

# SIGRAFLEX® HOCHDRUCK PRO

TA Luft-Compliant Sealing Sheet Made from  
Natural Graphite with High-Integrity Stainless Steel  
Foil Reinforcement for Extreme Conditions

## Expanded Graphite



**Broad Base. Best Solutions.**

# SIGRAFLEX® HOCHDRUCK PRO

## Our Contribution to Environmental Protection

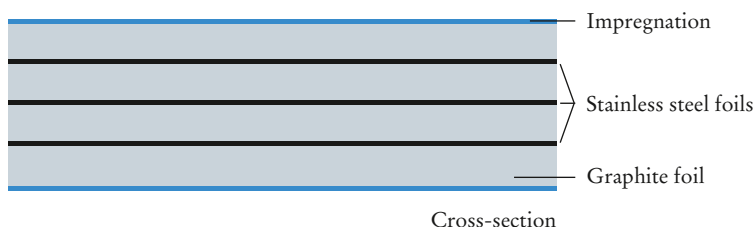
### SIGRAFLEX® HOCHDRUCK PRO

is a multilayer high-strength graphite sealing sheet comprising 0.5 mm thick layers of high-purity graphite foil and 0.05 mm thick stainless steel foils. Depending on the sheet thickness required, several layers of graphite and stainless steel foil are joined together in a patented adhesive-free process. As a result, the sheets have outstanding mechanical properties. The sealing sheet is impregnated to reduce leakage and improve handling.

SIGRAFLEX HOCHDRUCK PRO allows end users in the process industry to cover almost their entire gasket application range with a reliable and safe product.

### Applications

- ▶ For difficult and mechanically highly stressed sealed joints (in tongue-and-groove and special-dimension flanges, process equipment, heat exchangers); also suitable for all common pipework and vessel flange designs
- ▶ Recommended for one-piece gaskets up to 1500 mm outside diameter; for diameters over 1500 mm as two-layer structures with segmented sections and staggered joints, for instance
- ▶ For high internal pressures of up to 250 bar
- ▶ For corrosive media
- ▶ Suitable for a broad range of temperatures from -250 °C to approx. 550 °C under consideration of the chemical resistance; for applications at more than 450 °C, users should request our advice
- ▶ Gaskets for the chemical, petrochemical and nuclear industry as well as refineries
- ▶ Steam pipework and boilers in power stations
- ▶ Heat transfer oil and heating facilities
- ▶ Inspection glasses, pumps, fittings
- ▶ Existing plants



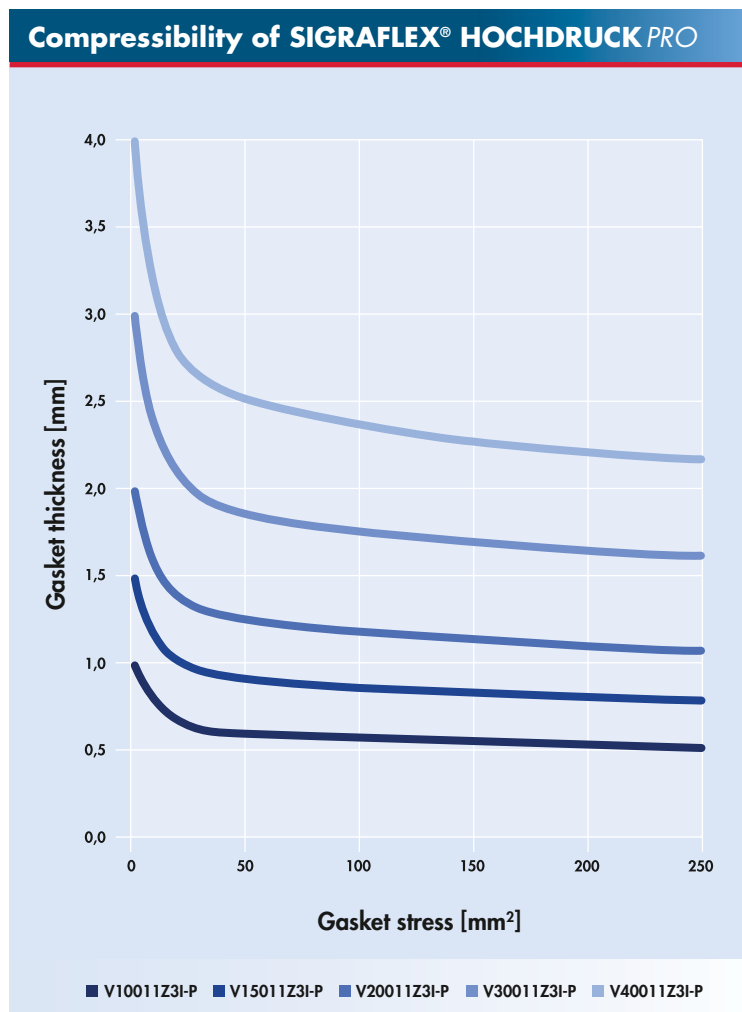
### Properties

- ▶ Reduction in fugitive emissions due to very high leak-tightness
- ▶ Complies with the TA Luft leakage requirements for all sheet thicknesses
- ▶ Very high maximum permissible gasket stress
- ▶ High operational reliability and excellent oxidation resistance
- ▶ High blow-out resistance and very high mechanical strength
- ▶ Very high fault tolerance during assembly and operation
- ▶ Good chemical resistance
- ▶ Long-term stability of compressibility and recovery, even under fluctuating temperatures
- ▶ Good scratch resistance; antistick finish due to special impregnation
- ▶ No measurable cold or warm flow characteristics up to the maximum permissible gasket stress
- ▶ No aging or embrittlement, owing to the absence of adhesives or binders
- ▶ Ease of processing
- ▶ Asbestos-free, no associated health risks



## Approvals

- ▶ TA Luft (VDI 2440/VDI 2200)  
for all thicknesses
- ▶ Fire safety according to API 607
- ▶ Blow-out resistance (TÜV at 2.5 times  
the nominal pressure)
- ▶ BAM oxygen
- ▶ DVGW (DIN 3535-6)



Compressibility of  
SIGRAFLEX HOCHDRUCK PRO  
depending on gasket thickness  
and gasket stress under service  
conditions





Our patented, overlap-free laser welding process allows sheets of up to 1500 mm width without leakage channels



### Assembly instructions

For assembly, use dry and undamaged gaskets only. Wet graphite gaskets must not be fitted unless first dried completely. The sealing faces must be clean, dry and free from grease. Do not use release agents! Position the gasket centrally and avoid mechanical stresses during assembly. An assembly aid can be used if necessary. To facilitate assembly in difficult positions, the gasket may be fixed by using a commercially available adhesive. However, the adhesive should be applied sparingly at a few points only.

Align the flanges as plane-parallel as possible. First hand-tighten the bolts and then tighten the bolts in a crosswise order to about 50% of the maximum torque value, in the second stage to about 80% and to the full value in the third stage. All bolts must be tightened to the specified bolt load, so the torque must be checked repeatedly. Our detailed assembly instructions are available on request.

### Forms supplied

SIGRAFLEX HOCHDRUCK *PRO* sheets are available in the following dimensions and type designations:

#### Dimensions in mm

1500 x 1500 x 1.0  
1500 x 1500 x 1.5  
1500 x 1500 x 2.0  
1500 x 1500 x 3.0  
1500 x 1500 x 4.0

#### Types

V10011Z3I-P  
V15011Z3I-P  
V20011Z3I-P  
V30011Z3I-P  
V40011Z3I-P

The sheets can also be supplied in dimensions of 1000 x 1000 mm.

## Material data of SIGRAFLEX® HOCHDRUCK PRO

Material type		V10011Z3I-P	V15011Z3I-P	V20011Z3I-P	V30011Z3I-P	V40011Z3I-P
Thickness	mm	1.0	1.5	2.0	3.0	4.0
Dimensions	m	1.5 x 1.5 / 1.0 x 1.0				
Bulk density of graphite	g/cm <sup>3</sup>	1.1				
Ash content of graphite (DIN 51903)	%	≤ 0.15				
Total chloride content	ppm	≤ 10				
Reinforcing steel foil details		Flat stainless steel foil				
ASTM material number		316 (L)				
Thickness	mm	0.05				
Number of foils		1	2	3	5	7
Residual stress (DIN 52913) $\sigma_D$ 16 h, 300°C, 50 N/mm <sup>2</sup>	N/mm <sup>2</sup>	≥ 48				
Gasket factors (DIN E 2505/DIN 28090-1)						
Gasket width $b_D = 20$ mm						
at an internal pressure of						
$\sigma_{VU/0.1}$ 10 bar	N/mm <sup>2</sup>	10	10	10	10	11
16 bar	N/mm <sup>2</sup>	10	10	12	13	14
25 bar	N/mm <sup>2</sup>	10	12	14	15	17
40 bar	N/mm <sup>2</sup>	12	14	16	18	20
$m$		1.3	1.3	1.3	1.3	1.3
$\sigma_{VO}$	N/mm <sup>2</sup>	305	290	270	240	200
$\sigma_{BO}$ at 300°C	N/mm <sup>2</sup>	250	230	210	180	160
Gasket factors according to DIN EN 13555		see <a href="http://www.gasketdata.org">www.gasketdata.org</a>				
Compression factors (DIN 28090-2)						
Compressibility $\epsilon_{KSW}$	%	30 – 40				
Recovery at 20 °C $\epsilon_{KRW}$	%	4 – 6				
Hot creep $\epsilon_{WSW}$	%	< 3				
Recovery at 300 °C $\epsilon_{WRW}$	%	3 – 5				
Young's modulus at 20 N/mm <sup>2</sup> (DIN 28090-1)	N/mm <sup>2</sup>	750				
ASTM "m" factor		2.5				
"y" factor	psi	2000				
Compressibility		30 – 40				
Recovery		20 – 30				
The gasket factor conversion formulas as per AD Merkblatt B7 are as follows:		$k_0 \cdot K_D = \sigma_{VU} \cdot b_D$ $k_1 = m \cdot b_D$				

### Definitions

$\sigma_{VU/0.1}$	Minimum gasket assembly stress needed to comply with leakage class L 0.1 (according to DIN 28090-1) Recommended gasket assembly stress: $\geq 20$ N/mm <sup>2</sup> up to $\sigma_{BO}$	$k_1$ $K_D$	In mm, factor for gasket stress in service In N/mm <sup>2</sup> , max. gasket stress-bearing capacity under assembly conditions
$\sigma_{BU}$	Minimum gasket assembly stress in service, where $\sigma_{BU}$ is the product of internal pressure p and gasket factor m for test and in service ( $\sigma_{BU} = p \cdot m$ )	$\epsilon_{KSW}$ $\epsilon_{KRW}$	Compression set under a gasket stress of 35 N/mm <sup>2</sup> Gasket recovery after reduction in gasket stress from 35 N/mm <sup>2</sup> to 1 N/mm <sup>2</sup>
$\sigma_{VO}$	Maximum permissible gasket stress at 20 °C	$\epsilon_{WSW}$	Gasket creep compression under a gasket stress of 50 N/mm <sup>2</sup> at 300 °C after 16 h
$\sigma_{BO, 300 °C}$	Maximum permissible gasket stress in service	$\epsilon_{WRW}$	Recovery after reduction in gasket stress from 50 N/mm <sup>2</sup> to 1 N/mm <sup>2</sup>
$m$	$\sigma_{BU}/p_i$		
"m" factor	Similar to m, but defined according to ASTM, hence different value		
"y" factor	Minimum gasket stress in psi		
$k_0$	In mm, factor for gasket assembly stress		

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

## Product overview

Product		Characteristics	Recommended applications
<b>SIGRAFLEX® FOIL</b> <b>F.....C/Z/APX</b>	▲	Flexible, continuous	–250°C to approx. 550°C; for compressed packings, spiral-wound and kammprofile gaskets
<b>SIGRAFLEX® STANDARD</b> <b>L.....CI</b>	■	Unreinforced, impregnated	Raised-face flanges; enamel or glass flanges; highly corrosive media
<b>SIGRAFLEX® ECONOMY</b> <b>V.....C4</b>	■ ▲	Reinforced with bonded s/s** foil	Pumps; fittings; gas supply; waste gas pipelines
<b>SIGRAFLEX® UNIVERSAL</b> <b>V.....C2I</b>	■	Reinforced with tanged s/s** foil, impregnated	Pipework and vessels in the petro-/chemical industries and in power stations
<b>SIGRAFLEX® UNIVERSAL PRO</b> <b>V.....C2I-P</b>	■	Reinforced with tanged s/s** foil, impregnated	For TA Luft* applications; for pipework and vessels in the petro-/chemical industries and in power stations
<b>SIGRAFLEX® SELECT</b> <b>V16010C3I</b>	●	High-integrity s/s** foil reinforcement, impregnated	For TA Luft* applications; raised-face flanges; pipework in the chemical and petrochemical industries
<b>SIGRAFLEX® HOCHDRUCK</b> <b>V.....Z3I</b>	■	High-integrity multilayer laminate, impregnated	Universal sealing sheet, also for solving sealing problems in pipework, process equipment, tongue-and-groove flanges and non-standard joints in the petro-/chemical industries and in power stations
<b>SIGRAFLEX® HOCHDRUCK PRO</b> <b>V.....Z3I-P</b>	■	High-integrity multilayer laminate, 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 petro-/chemical industries and in power stations
<b>SIGRAFLEX® MF</b> <b>V.....Z2MF</b>	●	High-integrity laminate made of graphite, s/s** and PTFE	Maximum requirements for sealability (TA Luft*), safety, chemical resistance and process hygiene; sealed joints in the chemical and petrochemical, pharmaceutical and food industries
<b>SIGRAFLEX® EMAIL</b> <b>V.....Z3E</b>	■	High-integrity s/s** foil reinforcement	PTFE-envelope gaskets in enameled pipework, vessels, stub connections, etc.
<b>SIGRAFLEX® HEXAGON</b> <b>V.....C8P</b>	■	s/s** foil with honeycomb pattern, without glue, impregnated	High requirements for sealability (TA Luft*), for pipework and vessels in the petro-/chemical industries and in power stations

Forms supplied: ▲ roll or tape ■ sheet material ● gasket with inner eyelet, for applications requiring TA Luft approval

\*TA Luft: German Clean Air Act \*\* s/s: stainless steel

® registered trademark of SGL Group companies

01 2011/0 4NÄ Printed in Germany

This information is based on our present state of knowledge and is intended to provide general notes on our products and their uses. It should therefore not be construed as guaranteeing specific properties of the products described or their suitability for a particular application. Any existing industrial property rights must be observed. The quality of our products is guaranteed under our "General Conditions of Sale".

## Graphite Specialties

### SGL CARBON GmbH

Werner-von-Siemens-Str. 18  
86405 Meitingen/Germany  
Phone +49 8271 83-2276  
Fax +49 8271 83-2419  
expandedgraphite@sglcarbon.de  
www.sigraflex.eu

[www.sglgroup.com](http://www.sglgroup.com)

