SIGRAFLEX® HOCHDRUCK

Graphite Sealing Sheet with
High-Integrity Stainless Steel Foil Reinforcement for Extreme Conditions
SIGRAFLEX® HOCHDRUCK

is a multilayer high-strength sheet material comprising 0.5 mm thick layers of high-quality graphite foil (type Z) and 0.05 mm thick stainless steel foil.

Depending on the sheet thickness required, several layers of graphite and stainless steel foil are joined together in a special process.

SIGRAFLEX HOCHDRUCK is a sealing material with excellent mechanical properties.

Applications

For gaskets meeting increased demands for operational reliability and sealability, notably:

- Requirements of the German Clean Air Act/TA Luft (gaskets with modified inner eyelet; for high gasket pressures without eyelet)
- Blow-out resistance
- Fire safety

For mechanically highly stressed sealed joints exposed to:

- Very high gasket pressures of over 300 N/mm² (see material data)
- Very high internal pressures of up to 250 bar.

For gaskets in tongue-and-groove flanges meeting DIN and ANSI standards:

- Recommended as one-piece gaskets up to 1500 mm outside diameter; over 1500 mm diameter as two-layer structures in segments
- It is recommended that the bolts be tightened up to the permitted limit.

Examples of Application

Gaskets for:

- Chemical and petrochemical pipework and equipment with hot and/or corrosive media
- Steam pipework in power stations
- Heat transfer oil and heating facilities
- Inspection glasses, pumps, fittings and vessels
- Existing plants (after extended service)

How a SIGRAFLEX HOCHDRUCK gasket with eyelet works

Gaskets in this material with stainless steel eyehlets make for much better sealability (see sketch).
Properties

- Very high maximum permissible gasket pressure (no gasket destruction)
- Meets German Clean Air Act (VDI 2440) requirements on gaskets with modified inner eyelet (for tongue-and-groove gaskets without eyelet)
- Suitability for use at temperatures ranging from -250°C up to approx. 500°C. For applications at more than 400°C, users should request our advice
- High blow-out resistance
- High rigidity, resistance to buckling
- Long-term stability of compressibility and recovery over a wide temperature range
- No ageing or embrittlement, owing to absence of adhesives or binders
- No measurable cold or warm flow characteristics up to maximum permissible compressive stress
- Good scratch resistance, antistick finish due to impregnation
- Very good chemical resistance
- Excellent resistance to thermal shock
- Ease of handling and processing
- Absence of health hazard; asbestos-free

For details of the recovery behavior of gaskets, see brochure SIGRAFLEX® Products Manufactured from Flexible Graphite Foil.
## Material Data

<table>
<thead>
<tr>
<th>Material type</th>
<th>V10011Z3I</th>
<th>V15011Z3I</th>
<th>V20011Z3I</th>
<th>V30011Z3I</th>
<th>V40011Z3I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.0</td>
<td>1.5</td>
<td>2.0</td>
<td>3.0</td>
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<tr>
<td>Bulk density of graphite</td>
<td>g/cm³</td>
<td>1.1</td>
<td></td>
<td></td>
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<tr>
<td>Ash content of graphite (DIN 51903)</td>
<td>%</td>
<td>≤ 0.15</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total chloride content</td>
<td>ppm</td>
<td>≤ 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stainless steel foil details</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ASTM material number</td>
<td></td>
<td></td>
<td>316 (L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>mm</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of foils</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Residual stress (DIN 52913)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>σD: 16 h, 300°C, 50 N/mm²</td>
<td>N/mm²</td>
<td>&gt; 48</td>
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<tr>
<td>Gasket factors¹ [DIN E 2505 / DIN 28090-1]</td>
<td></td>
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</tr>
<tr>
<td>Gasket width b₀=20 mm at an internal pressure of</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>σᵥU/₀.1</td>
<td>bar</td>
<td>N/mm²</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>σᵥD</td>
<td>N/mm²</td>
<td>10</td>
<td>12</td>
<td>14</td>
<td>17</td>
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<tr>
<td>σᵥ₂₀</td>
<td>N/mm²</td>
<td>10</td>
<td>14</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>σᵥ₄₀</td>
<td>N/mm²</td>
<td>13</td>
<td>16</td>
<td>18</td>
<td>25</td>
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<tr>
<td>m</td>
<td></td>
<td>1.3</td>
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</tr>
<tr>
<td>σᵥ₀</td>
<td>N/mm²</td>
<td>305</td>
<td>290</td>
<td>270</td>
<td>240</td>
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<tr>
<td>σᵥ₀ at 300°C</td>
<td>N/mm²</td>
<td>250</td>
<td>230</td>
<td>210</td>
<td>180</td>
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<tr>
<td>ASTM ²</td>
<td>&quot;m&quot; factor</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>&quot;y&quot; factor</td>
<td>psi</td>
<td>3000</td>
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<td></td>
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<tr>
<td>Compression factors¹ [DIN 28090-2]</td>
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<td></td>
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<tr>
<td>Compressibility at 20°C</td>
<td>εᵥSW</td>
<td>%</td>
<td>30 – 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recovery at 20°C</td>
<td>εᵥRW</td>
<td>%</td>
<td>4 – 5</td>
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<td></td>
</tr>
<tr>
<td>Hot creep during operation</td>
<td>εᵥWSW</td>
<td>%</td>
<td>&lt; 4</td>
<td></td>
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</tr>
<tr>
<td>Recovery at 300°C</td>
<td>εᵥWRW</td>
<td>%</td>
<td>3 – 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) Definitions:

σᵥU/₀.1 Minimum gasket assembly pressure needed to comply with leakage class L 0.1 (according to DIN 28090-1)
Recommended gasket pressure for installation: ≥ 20 N/mm² up to σᵥ₀

σᵥU Minimum gasket pressure under service conditions, where σᵥU is the product of internal pressure p and gasket factor m for test and service conditions (σᵥU = p · m)

σᵥ₀ Maximum permissible gasket pressure at 20°C

σᵥ₀ Maximum permissible gasket pressure under service conditions

m σᵥU/p

"m" factor Similar to m, but defined according to ASTM, hence different value

"y" factor Minimum gasket pressure in psi

εᵥSW Compression set under a pressure of 35 N/mm²

εᵥRW Gasket recovery after reduction in pressure from 35 N/mm² to 1 N/mm²

εᵥWSW Gasket creep compression under a pressure of 50 N/mm² at 300°C after 16 h

εᵥWRW Recovery after reduction in pressure from 50 N/mm² to 1 N/mm².

The percentage changes in thickness of εᵥSW, εᵥRW, εᵥWSW and εᵥWRW are relative to the initial thickness of the gasket.
**Forms Supplied**

SIGRAFLEX HOCHDRUCK sheets are available in the following dimensions and type designations. The sheets can also be supplied in dimensions of 1000 x 1000 mm.

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 x 1500 x 1.0 mm</td>
<td>V10011Z3I</td>
</tr>
<tr>
<td>1500 x 1500 x 1.5 mm</td>
<td>V15011Z3I</td>
</tr>
<tr>
<td>1500 x 1500 x 2.0 mm</td>
<td>V20011Z3I</td>
</tr>
<tr>
<td>1500 x 1500 x 3.0 mm</td>
<td>V30011Z3I</td>
</tr>
<tr>
<td>1500 x 1500 x 4.0 mm</td>
<td>V40011Z3I</td>
</tr>
</tbody>
</table>

### Dimensions

**HOCHDRUCK**
- 1500 x 1500 x 1.0 mm
- 1500 x 1500 x 1.5 mm
- 1500 x 1500 x 2.0 mm

**HOCHDRUCK AP**
- 1500 x 1500 x 3.0 mm
- 1500 x 1500 x 4.0 mm

### Packaging

Depending on the quantity ordered, the sheets are supplied in cartons or on pallets with stackable frames and top cover. The sheets are protected against damage by inserted corrugated cardboard or foam rubber strips. The carton can take up to 50 kg, the pallet up to 1200 kg. The height of the frame structure is adjustable. The consignments can be arranged on the pallets to customers’ individual wishes.

**Carton:**
- 1180 x 1180 x 60 mm

**Pallet with stackable frames:**
- 1090 x 1090 mm
- 1590 x 1590 mm

### Typical Order

- **Ash content:** ≤ 0.15 %
- **Bulk density of graphite:** 1.1 g/cm³
- **Thickness:** 2.0 mm
- **Length:** 1500 mm
- **Width:** 1500 mm

**1500 x 1500 x 2.0 mm** V20011Z3I

### Approvals

- BAM
- Blow-out resistance (TÜV)
- DVGW
- Fire safety (BS 6755-2 and API 607)
- Germanischer Lloyd
- TA Luft (VDI 2440) (with modified inner eyelet; for tongue-and-groove without eyelet)
- US Coastguard

### Assembly Instructions

Use dry and undamaged gaskets.

The sealing faces must be clean, dry and free from grease. Do not use release agents.

Position the gasket correctly to avoid mechanical stresses during assembly. Make sure that the gasket is properly fitted in tongue-and-groove flanges.

Align the flanges as plane-parallel as possible. Tighten the bolts in cross-wise order, first to about 50 % of the maximum torque value, in the second stage to about 80 % and to the full value in the third stage but not before. All bolts must be tightened to the specified value; hence, the torque should be checked repeatedly.

### Other Relevant Publications

- SIGRAFLEX®, Products Manufactured from Flexible Graphite Foil
- Data sheets:
  - SIGRAFLEX® FOIL
  - SIGRAFLEX® STANDARD
  - SIGRAFLEX® ECONOMY
  - SIGRAFLEX® UNIVERSAL
  - SIGRAFLEX® UNIVERSAL.PRO
  - SIGRAFLEX® SELECT
  - SIGRAFLEX® HOCHDRUCK.PRO
  - SIGRAFLEX® MF
  - SIGRAFLEX® EMAIL
- SIGRAFLON® H, High-Quality Sealing Sheet Made from Reinforced PTFE
- SIGRAFLEX®, Graphite Foils and Laminated Sheets for Thermal Insulation and Electric Heating Elements
### Product Overview

<table>
<thead>
<tr>
<th>Product</th>
<th>Characteristics</th>
<th>Recommended applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIGRAFLEX® FOIL F.....C / Z / APX</td>
<td>▲ Flexible, continuous</td>
<td>-250°C to approx. 500°C; for compressed packings, spiral-wound and kammpfcle gaskets</td>
</tr>
<tr>
<td>SIGRAFLEX® STANDARD L.....C1</td>
<td>■ Unreinforced, impregnated</td>
<td>Large segmented gaskets; enamel or glass flanges; highly corrosive media</td>
</tr>
<tr>
<td>SIGRAFLEX® ECONOMY V.....C4</td>
<td>■ Reinforced with bonded s/s foil</td>
<td>Pumps; fittings; gas; offshore; waste gas pipelines</td>
</tr>
<tr>
<td>SIGRAFLEX® UNIVERSAL V.....C2I</td>
<td>■ Reinforced with perforated s/s sheet, impregnated</td>
<td>Pipework and vessels in the chemical and petrochemical industries and in power stations</td>
</tr>
<tr>
<td>SIGRAFLEX® UNIVERSAL PRO V.....C2I-P</td>
<td>■ Reinforced with perforated s/s sheet, impregnated</td>
<td>For applications subject to the German TA Luft (Clean Air Act); for pipework and vessels in the chemical and petrochemical industries and in power stations</td>
</tr>
<tr>
<td>SIGRAFLEX® SELECT V16010C3I</td>
<td>● High-integrity s/s foil reinforcement, impregnated</td>
<td>For applications subject to the German TA Luft (Clean Air Act); raised-face flanges; pipework in the chemical and petrochemical industries</td>
</tr>
<tr>
<td>SIGRAFLEX® HOCHDRUCK V.....Z3I</td>
<td>■ High-integrity multilayer laminate, impregnated</td>
<td>Universal gasket for solving sealing problems in pipework, process equipment, tongue-and-groove flanges and special-dimension sealed joints in the chemical and petrochemical industries and in power stations</td>
</tr>
<tr>
<td>SIGRAFLEX® HOCHDRUCK PRO V.....Z3I-P</td>
<td>■ High-integrity multilayer laminate, impregnated</td>
<td>Universal gasket sheet for applications subject to the German TA Luft (Clean Air Act) and solving sealing problems in pipework, process equipment, tongue-and-groove flanges and special-dimension sealed joints in the chemical and petrochemical industries and in power stations</td>
</tr>
<tr>
<td>SIGRAFLEX® MF V.....Z2MF</td>
<td>■ High-integrity laminate made of graphite, s/s and PTFE</td>
<td>Maximum requirements for sealability (German TA Luft), safety, chemical resistance and process hygiene; sealed joints in the chemical, petrochemical, pharmaceutical and food industries</td>
</tr>
<tr>
<td>SIGRAFLEX® EMAIL V.....Z3E</td>
<td>■ High-integrity s/s foil reinforcement</td>
<td>PTFE-envelope gaskets in enameled pipework, vessels, stub connections, etc.</td>
</tr>
</tbody>
</table>

Forms supplied: ▲ roll or tape ■ sheet material ● gasket with inner eyelet, for applications subject to the German Clean Air Act

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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”.

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Expanded Graphite

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