SIGRAFLEX® FOIL

Flexible Graphite Foil Manufactured from Expanded Natural Graphite

Expanded Graphite
SIGRAFLEX® FOIL
High Performance and Safety in Sealing Systems

SIGRAFLEX flexible graphite foil – manufactured from expanded natural graphite – is a homogeneous material without adhesives or binders. Even after long service periods, SIGRAFLEX displays no noticeable changes in its properties compared with other sealing materials. Inhibitors can be added to enhance the oxidation or corrosion resistance properties of the flexible graphite.

SIGRAFLEX graphite foil is also available with self-adhesive backing. For applications in stuffing box packings, a special PTFE-coated foil is supplied with markedly improved friction and leakage behavior. SIGRAFLEX APX foil offers maximum protection against oxidation and thus ensures greater reliability and longer service lives.

SIGRAFLEX graphite foil is available in various bulk densities, purity levels and dimensions (see Material data table).

Properties
- Flexible, soft
- Impermeable to gases and liquids
- Suitable for a broad range of temperatures from 250°C to approx. 550°C; for applications at more than 450°C, users should request our advice
- Excellent chemical resistance
- Asbestos-free, no associated health risks
- No aging or embrittlement, owing to absence of adhesives or binders
- Long-term stability of compressibility and recovery
- No measurable cold or warm flow characteristics up to the maximum permissible gasket stress
- Resistant to radiation
- High thermal shock resistance
- High residual stress
- Easily processable by cutting or punching
- Can be bonded using commercial adhesives

Applications

<table>
<thead>
<tr>
<th>Semi-finished products for gaskets and packings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static sealing</td>
</tr>
<tr>
<td>Gaskets, exhaust manifold and cylinder head gaskets</td>
</tr>
<tr>
<td>Graphite top layer for kammprofile gaskets</td>
</tr>
<tr>
<td>Spiral-wound graphite gaskets</td>
</tr>
<tr>
<td>Dynamic sealing</td>
</tr>
<tr>
<td>Stuffing box packings</td>
</tr>
</tbody>
</table>

Different types of SIGRAFLEX® foils

<table>
<thead>
<tr>
<th>Different types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APX</td>
<td>Outstanding oxidation resistance</td>
</tr>
<tr>
<td>D</td>
<td>Automotive quality</td>
</tr>
<tr>
<td>C</td>
<td>Industrial quality, ash content ≤ 2%</td>
</tr>
<tr>
<td>E</td>
<td>Foil with oxidation inhibitor</td>
</tr>
<tr>
<td>Z</td>
<td>Nuclear quality, ash content ≤ 0.15%</td>
</tr>
<tr>
<td>CS/ZS</td>
<td>Qualities with self-adhesive backing</td>
</tr>
<tr>
<td>ZX</td>
<td>Nuclear quality with corrosion inhibitor</td>
</tr>
<tr>
<td>TF</td>
<td>PTFE-coated for stuffing box packings</td>
</tr>
</tbody>
</table>

Approvals
- Drinking water
- Foodstuffs
- KTW
- BAM
### Material data SIGRAFLEX® FOIL

#### Foil grade

<table>
<thead>
<tr>
<th>Foil grade</th>
<th>APX</th>
<th>C</th>
<th>E</th>
<th>D</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard bulk density</td>
<td>g/cm³</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ash content (DIN 51903)</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total chloride content</td>
<td>ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foil thickness</td>
<td>mm</td>
<td>0.35 - 1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll width</td>
<td>mm</td>
<td>500 / 1000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tape width</td>
<td>mm</td>
<td>≥ 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roll length</td>
<td>m</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Typical material data of SIGRAFLEX® FOIL grade Z with bulk density of 1.0 g/cm³

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity at 20°C</td>
<td></td>
</tr>
<tr>
<td>in plane</td>
<td>180 - 200</td>
</tr>
<tr>
<td>through plane</td>
<td>4 - 6</td>
</tr>
<tr>
<td>Resistivity at 20°C</td>
<td></td>
</tr>
<tr>
<td>in plane</td>
<td>6 - 8</td>
</tr>
<tr>
<td>through plane</td>
<td>650 - 700</td>
</tr>
<tr>
<td>Coefficient of thermal expansion (20 - 1000°C)</td>
<td></td>
</tr>
<tr>
<td>in plane</td>
<td>10⁶/K</td>
</tr>
<tr>
<td>through plane</td>
<td>approx. 1</td>
</tr>
<tr>
<td>Permeability coefficient for air</td>
<td></td>
</tr>
<tr>
<td>through plane</td>
<td>&lt; 5 · 10⁻⁵</td>
</tr>
<tr>
<td>Shore hardness (D)</td>
<td>30</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
</tr>
<tr>
<td>Max. permissible compressive stress</td>
<td></td>
</tr>
<tr>
<td>Specimen: 20 mm x 20 mm x thickness</td>
<td></td>
</tr>
<tr>
<td>0.35 mm</td>
<td>N/mm²</td>
</tr>
<tr>
<td>0.50 mm</td>
<td>220</td>
</tr>
<tr>
<td>1.00 mm</td>
<td>200</td>
</tr>
<tr>
<td>Residual stress (DIN 52913)</td>
<td></td>
</tr>
<tr>
<td>σ₀ 10 h, 300°C, 50 N/mm²</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Coefficient of friction against steel, roughness ≤ 10 μm</td>
<td>0.1</td>
</tr>
<tr>
<td>The gasket factor conversion formulas as per AD Merkblatt B7 are as follows</td>
<td>k₀ · K₀ = σᵥ · b₀</td>
</tr>
<tr>
<td></td>
<td>k₁ = m · b₀</td>
</tr>
</tbody>
</table>

**Definitions**
- Other dimensions on request
- k₀ in mm, factor for gasket assembly stress
- k₁ in mm, factor for gasket stress in service
- K₀ in N/mm², max. gasket stress-bearing capacity under assembly conditions

**Packaging**

The foils are wound onto cardboard cores with an inner diameter of 105 mm. Stable flanges with handles ensure that the wound foil does not come into contact with the floor and is easy to handle. Rolls of this type are supplied in rigid cartons.
### 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. 550°C; for compressed packings, spiral-wound and kamprofile gaskets</td>
</tr>
<tr>
<td>SIGRAFLEX® STANDARD L.....Cl</td>
<td>■ Unreinforced, impregnated</td>
<td>Raised-face flanges; 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 supply; waste gas pipelines</td>
</tr>
<tr>
<td>SIGRAFLEX® UNIVERSAL V.....C2I</td>
<td>▲ Reinforced with tanged s/s” foil, 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 tanged s/s” foil, impregnated</td>
<td>For TA Luft* applications; 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 TA Luft* applications; 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 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</td>
</tr>
<tr>
<td>SIGRAFLEX® HOCHDRUCK PRO V.....Z3I-P</td>
<td>■ High-integrity multilayer laminate, impregnated</td>
<td>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 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 (TA Luft*), safety, chemical resistance and process hygiene; sealed joints in the chemical and 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 requiring TA Luft approval

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

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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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Expanding the frontiers of carbon technology