High Performance Products for Technical Ceramics
The requirements of Technical Ceramics are very complex. By successfully using high-performance materials from Saint-Gobain Ceramics integrated ceramic systems can be developed for each application field.

Saint-Gobain Ceramics means:

- Creativity
- Know-how
- Service
- Quality
- Innovation
- Research & Development

Improve your profits by using our experience and expertise.
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High Performance Materials

High performance materials are destined for the wide ranging and innovative applications in the field of Technical Ceramics. Saint-Gobain Ceramics develops products which fulfill the existing requirements in accordance with lighter, thinner and mechanical superior materials. These high performance products have positive effects on the firing process and offer additional benefits like increasing capacity, faster cycle time, higher service life and reduced reworking costs to the customer.

**High performance silicon carbide (SiC) material properties:**

- Mechanical strength
- Temperature stability
- Wear resistance
- Chemical resistance
- Excellent thermal conductivity
- Very high thermal shock resistance
- Outstanding oxidation resistance
- Low thermal expansion
Catalytic converters
Diesel particle filters (DPF)
Electronic control devices
Lambda sensors
Spark plugs

Batts
Ground batts
Multi-lug systems
Pusher batts
Rollers
Square sagger
Stable substructures

Advancer®
AnnaMullit®
AnnaSicon® RT/RTH
Crystar® 2000/3000
Hexoloy®
Innovative ceramic systems are often used in the modern automotive market, because of temperature stability and strength. For producing spark plugs, lambda sensors, catalytic converters, antilock braking systems, electronic stability programs and diesel particle filters in the required quality and precision, kiln furniture from high performance materials are absolutely necessary because of their benefits.

**Benefits of Saint-Gobain Ceramics products:**

- Excellent thermal conductivity
- Shape stability and strength
- Outstanding thermal shock resistance
- Defined flatness and surface finish
Advancer® Lo-Mass® systems for firing catalytic converters and diesel particle filters

Crystar® 2000 and Crystar® 3000 batts for firing electronic control devices

AnnaMullit® square saggers and Hexoloy® high-strength substructure for firing spark plugs
Environmental Protection Technology

Flue gas desulphurization plants
Power stations

Concentric nozzles
Helix nozzles
Spiral nozzles
Tangential nozzles

Silit® SKG
Environmental Protection Technology

The protection of our environment requires precise product performance and forward-thinking technologies. Due to the excellent resistance to acids, particularly $\text{H}_2\text{SO}_4$ or HCL, Silit® SKG spray nozzles are used in current environment protection systems. Silit® SKG spiral nozzles are used for glue gas desulphurization in power stations.

Benefits of Saint-Gobain Ceramics spray nozzles:

- Hardness similar to diamond
- Outstanding chemical resistance
- Excellent wear resistance

Chemical stability of Silit® SKG

<table>
<thead>
<tr>
<th>Medium</th>
<th>Temperature</th>
<th>Resistance</th>
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</thead>
<tbody>
<tr>
<td>HCl 20 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>HCl 37 %</td>
<td>RT</td>
<td>1</td>
</tr>
<tr>
<td>$\text{HNO}_3$ 20 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>$\text{HNO}_3$ 100 %</td>
<td>RT</td>
<td>1</td>
</tr>
<tr>
<td>$\text{H}_2\text{SO}_4$ 95 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Oleum with 10 % free $\text{SO}_2$</td>
<td>RT</td>
<td>1</td>
</tr>
<tr>
<td>HF 20 %</td>
<td>RT</td>
<td>3</td>
</tr>
<tr>
<td>HF 40 %</td>
<td>RT</td>
<td>3</td>
</tr>
<tr>
<td>$\text{H}_3\text{PO}_4$ 85 %</td>
<td>RT / BP</td>
<td>2 / 2</td>
</tr>
<tr>
<td>$\text{H}_2\text{CrO}_4$ 20 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>NaCl 10 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>NaCl 30 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>KCl 10 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KCl 30 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>KMnO$_4$ 10 %</td>
<td>RT / BP</td>
<td>1 / 1</td>
</tr>
<tr>
<td>NaOH 10 %</td>
<td>RT / BP</td>
<td>2 / 3</td>
</tr>
<tr>
<td>NaOH 30 %</td>
<td>RT / BP</td>
<td>3 / 3</td>
</tr>
<tr>
<td>KOH 10 %</td>
<td>RT / BP</td>
<td>2 / 3</td>
</tr>
<tr>
<td>KOH 30 %</td>
<td>RT / BP</td>
<td>3 / 3</td>
</tr>
<tr>
<td>Sn Melting</td>
<td>300 °C</td>
<td>1 - 2</td>
</tr>
<tr>
<td>Pb Melting</td>
<td>450 °C</td>
<td>1 - 2</td>
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<tr>
<td>Zn Melting</td>
<td>550 °C</td>
<td>1 - 2</td>
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<tr>
<td>Al Melting</td>
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<td>2 - 3</td>
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<tr>
<td>Cu Melting</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Ni Melting</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Fe Melting</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>NH$_4$OH</td>
<td>RT / BP</td>
<td>2 / 2</td>
</tr>
</tbody>
</table>

Legend:
1 = resistant
2 = limited resistance
3 = very limited resistance
RT = Room Temperature
BP = Boiling Point
Spray nozzles made from Silit® SKG

Emission of flue gas

User specified spiral nozzles

Spiral nozzles in use

Results:
- Clean air
- Reduce acid rain
- Plaster as a recycled product
Furnace construction
Metal forming
Plant construction
Pump technology
Wear resistant technology

Batts
Diverse single components
One-piece linings
Rail and shelf systems
Supports

Crystar® 2000/3000
Hexoloy®
Silit® SKD
Wear is the mechanical attack of a subject on a solid substance. In addition to wear effects caused by abrasion and erosion, further losses can be attributed to chemical corrosion of industrial equipment. Each year industry suffers high costs due to wear, maintenance operations and production losses.

Benefits of Saint-Gobain Ceramics products:
- Longer service life
- Increased productivity
- Improved production safety
- Improved quality and yield
- Outstanding chemical resistance
- Excellent wear resistance

Conventional lining with rectangular or hexagonal wear resistant batts

Silit® SKD one-piece lining
Diverse products made of Silit® SKD and Hexoloy® for wear resistance

Crystar® 2000 and Crystar® 3000 Lo-Mass® system for firing wear resistant products
BUILDING CERAMICS

- Chimney flues
- Clay bricks
- Floor tiles
- Roof tiles
- Split tiles
- Stoneware pipes

Batts
Beams
Bricks
Extrusion dies
Heavy load constructions
H-saggers
Monolithic support systems
Rollers
Supports

Advancer®
Alfrax®
Alundum®
AnnaCarbid® 94
AnnaCorit® 50/60
AnnaSicon® 25
AnnaSicon® RT
Mullfrax®
Silit® SK/SKD
Building Ceramics

For the production of roof tiles, wall bricks, split tiles, and floor tiles, the use of high performance materials offer the following advantages:

**Advantages of Saint-Gobain Ceramics products:**

- Reduced energy consumption
- Optimum rate of capacity utilization
- High flexibility
- Excellent product quality
- Very good creep resistance
- Outstanding shape stability

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Silit® SK rollers for firing floor tiles

Heavy-load constructions made of AnnaSicon® 25 for hang firing of rollers
Silit® SK stable substructures for firing wall bricks and split tiles

Monolithic support system for realization single level superstructures

Beams out of Silit® SK and AnnaSicon® RT for firing roof tiles
Capacitors
Electrically insulated devices
Ferrites
High-voltage insulators
Low-voltage insulators
Substrates
Varistors

Beams
Collar batts
Batts
Rollers
Heavy load constructions
Square saggars
Supports

Advancer®
Alundum®
AnnaCarbid® 42/94
AnnaMullit® 83/86/88
AnnaSicon® 25
Crystar® 2000/3000
Silit® SK
Insulators & Electroporcelain

Saint-Gobain provides kiln furniture for the firing of ferrites, capacitors, substrates, insulators, varistors, capacitors and several other electronical components.

Benefits of Saint-Gobain Ceramics products:

- High stability and strength
- Excellent thermal shock resistance
- Outstanding thermal conductivity
- High productivity
- Excellent oxidation resistance

Heavy-load construction out of AnnaSicon® 25 for hang firing of insulators

Square saggers made of AnnaCarbid® for firing electronical components

Batts with covers made of Crystar® 2000 for sintering bulk solids
Batts out of silicon carbide and mullite for firing electronic devices

Construction for firing electronic components consisting of AnnaMullit® 83 square saggars and batts made of Advancer®

AnnaMullit® 86 batts for firing ferrites
ABRASIVES & GRINDING MEDIA

Grinding balls
Grinding wheels

Batts
Beams
Pusher batts
Square saggers
Supports
Triangle batts

Advancer®
AnnaCarbid® 42/94
AnnaMullit® 83/88
AnnaSicon® 25
AnnaSicon® RTH
Crystar® 2000
Crystolon®
Cryston®
Abrasives & Grinding Media

For the production of grinding wheels and grinding balls Saint-Gobain Ceramics provides complete constructions as well as firing saggers and frames.

Benefits of Saint-Gobain Ceramics products:
- High shape stability and creep resistance
- Very good thermal conductivity
- Excellent thermal shock resistance
- High oxidation resistance

Constructions for firing grinding wheels

Kiln furniture for sintering grinding media
POWDERS

Coloured pigments
Phosphorous powders

Hearth plates
Pusher batts
Saggers
Square saggers

AnnaSicon® 25
AnnaSicon® RTH
Crystar® 2000
Silit® SKD
Powders

Silicon carbide saggers and bowls for the firing, sintering, heat treating and analysis of pulverized materials, e.g. phosphorous and fluorescent powders. The often neutral chemical reaction and the thermal shock resistance of silicon carbide allows extremely high temperature profiles, which will be fulfilled by another material in addition with a long service life.

Benefits of Saint-Gobain Ceramics products:
- High stability and strength
- Excellent thermal conductivity
- Very good chemical resistance
- Outstanding thermal shock resistance

Bowls and saggers made of Silit® SKD and AnnaSicon® RTH

Stackable square saggers with lids made of Silit® SKD
Large roller kilns are used for the horizontal tempering of large glass plates for flat screens or glass ceramic cooktops. In the high temperature zone these roller kilns are predominantly equipped with black silicon carbide rollers.

Benefits of Saint-Gobain Ceramics products:

- Slight bending over the whole temperature range
- Outstanding temperature stability
- Excellent thermal conductivity
- High strength and shape stability

Silicon carbide rollers for horizontal tempering of glass plates

Silicon carbide multiple construction for vertical tempering of glass plates
HEAT TREATMENT

Heat treatment
Surface refinement

Batts
Beams
Bricks
Hearth plates
Muffles
Muffle systems

Alundum®
Crystolon®
Crystar® 2000
Hexoloy®
Silit® SK/SKD
Heat Treatment

Heat treatment processes are frequently running in mesh belt kilns in atmosphere. Here SiC high performance materials are convincing by the use of muffle channels as well as kiln furniture for hardening razor blades or carpet knives.

Benefits of Saint-Gobain Ceramics products:

- Very good temperature stability up to max. application temperature
- Excellent chemical resistance
- Outstanding strength

Silit® SKD ceramic muffle system for the heat treatment of razor blades

Silit® SK one-piece muffle beam for the heat treatment of carpet cutters
## Material Properties

Products from Saint-Gobain Ceramics are manufactured out of multitude refractory raw materials. However main part is silicon carbide (SiC), predominantly made from one of the hardest of all raw materials existing on the ceramic market. The specific chemical composition, purity and ceramic structure of this material fulfill all the conditions for an all-round industrial application.

### Material Properties

<table>
<thead>
<tr>
<th>Typical material properties</th>
<th>Unit</th>
<th>AnnaCorit®</th>
<th>AnnaMullit®</th>
<th>Mullfrax®</th>
<th>Alundum®</th>
<th>Alfrax®</th>
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</thead>
<tbody>
<tr>
<td>Al₂O₃-content 1)</td>
<td>%</td>
<td>37 58 75 86</td>
<td>75 5,5 82 89</td>
<td>89 91.3 88.4</td>
<td></td>
<td></td>
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<tr>
<td>Max. service temperature 2)</td>
<td>ºC</td>
<td>1280 1350 1550 1500</td>
<td>1450 1750 1750 1750</td>
<td>1750 1750 1815</td>
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<td></td>
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<tr>
<td>Bulk density</td>
<td>kg/dm³</td>
<td>1.9 2.1 2.5 2.6</td>
<td>2.4 2.75 2.8</td>
<td>2.9 1.7</td>
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<tr>
<td>Open porosity</td>
<td>%</td>
<td>27 26 21 23</td>
<td>22.5 16 19</td>
<td>20 54</td>
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<td></td>
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<tr>
<td>Hot bending strength</td>
<td>N/mm²</td>
<td>1.3³ 1.3³ 10 11</td>
<td>7 10 4.5</td>
<td>- 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(at 1400°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal expansion</td>
<td>K⁻¹·10⁶</td>
<td>2.9 2.9 5.5 6.0</td>
<td>5.3 5.3 6.0</td>
<td>- 7.3</td>
<td></td>
<td></td>
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<tr>
<td>(20°C…1100°C)</td>
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</table>

<table>
<thead>
<tr>
<th>Typical material properties</th>
<th>Unit</th>
<th>AnnaCarbid®</th>
<th>AnnaSicon®</th>
<th>Crystolon®</th>
<th>Cryston®</th>
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<tbody>
<tr>
<td>SiC-content 1)</td>
<td>%</td>
<td>40 &gt;90 75 88</td>
<td>88 80 80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. service temperature 2)</td>
<td>ºC</td>
<td>1430 1500 1550</td>
<td>1550 1550 1550</td>
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<tr>
<td>Bulk density</td>
<td>kg/dm³</td>
<td>2.5 2.5 2.6</td>
<td>2.6 2.6 2.6</td>
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<tr>
<td>Open porosity</td>
<td>%</td>
<td>20 18 18</td>
<td>18 18 15</td>
<td></td>
<td></td>
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<tr>
<td>Hot bending strength</td>
<td>N/mm²</td>
<td>10 20 40</td>
<td>20 20 55</td>
<td></td>
<td></td>
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<tr>
<td>(at 1400°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Thermal expansion</td>
<td>K⁻¹·10⁶</td>
<td>5.0 5.0 4.5</td>
<td>5.8 5.0 5.0</td>
<td></td>
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<tr>
<td>(20°C…1100°C)</td>
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<td></td>
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<table>
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<tr>
<th>Typical material properties</th>
<th>Unit</th>
<th>SK</th>
<th>Silit®</th>
<th>SKD</th>
<th>SK</th>
<th>AnnaSicon®</th>
<th>Advancer®</th>
<th>Crystar®</th>
<th>Hexoloy®</th>
</tr>
</thead>
<tbody>
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<td>SiC-content</td>
<td>%</td>
<td>81</td>
<td>81</td>
<td>88</td>
<td>88</td>
<td>66 66</td>
<td>68</td>
<td>&gt;99</td>
<td>&gt;99 &gt;99</td>
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<td>Max. service temperature 2)</td>
<td>ºC</td>
<td>1350</td>
<td>1320</td>
<td>1380</td>
<td></td>
<td>1200 1550</td>
<td>1550 1600</td>
<td>1600 1750</td>
<td>1750 1750</td>
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<tr>
<td>Bulk density</td>
<td>kg/dm³</td>
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<td>3.0</td>
<td>3.05</td>
<td></td>
<td>2.8 2.8 2.8</td>
<td>2.8 2.8 2.8</td>
<td>2.7 2.7</td>
<td>3.07</td>
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<td>Open porosity</td>
<td>Vol %</td>
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<td>0</td>
<td>0</td>
<td></td>
<td>&lt;1 &lt;1 &lt;1</td>
<td>&lt;1 &lt;1 &lt;1</td>
<td>15 15</td>
<td>0.6</td>
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<tr>
<td>Modulus of rupture 20°C</td>
<td>MPa</td>
<td>260</td>
<td>320</td>
<td>250</td>
<td></td>
<td>160 160 160</td>
<td>160 160 160</td>
<td>80 80</td>
<td>380</td>
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<tr>
<td>Modulus of rupture 1400°C</td>
<td>MPa</td>
<td>260</td>
<td>320</td>
<td>250</td>
<td></td>
<td>160 160 160</td>
<td>160 160 160</td>
<td>80 80</td>
<td>380</td>
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<tr>
<td>Modulus of elasticity 20°C</td>
<td>GPa</td>
<td>300</td>
<td>380</td>
<td>360</td>
<td></td>
<td>235 235 250</td>
<td>250 250 250</td>
<td>240 240</td>
<td>350</td>
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<tr>
<td>Thermal conductivity 1000°C</td>
<td>W/(m·K)</td>
<td>40</td>
<td>35</td>
<td>35</td>
<td></td>
<td>20 20 20</td>
<td>20 25 25</td>
<td>25 30</td>
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<tr>
<td>Thermal expansion 20°C</td>
<td>K⁻¹·10⁶</td>
<td>4.5</td>
<td>4.1</td>
<td>4.1</td>
<td></td>
<td>4.4 4.4 4.4</td>
<td>4.4 4.8 4.8</td>
<td>4.8 4.8</td>
<td>4.0</td>
</tr>
</tbody>
</table>

1) in the mixture  2) dependant on the corresponding operation  3) measured at T=1200°C

The excellent deformation resistance of our SiC products in the different fields of Technical Ceramics leads to an even higher quality of customer’s end product. Its high thermal conductivity, combined with its extraordinary thermal shock resistance properties, allow excellent results. These advantages, coupled with the long service life of our SiC products, guarantee a high profitability.
Quality Assurance and Quality Control

In order to meet customer requirements at Saint-Gobain Ceramics, all of the single production steps are supervised and continuously improved. All products are checked carefully before shipment. The strong demands on quality and environmental protection are based on our management system, which fulfill the requirements of DIN EN ISO 9001 and DIN EN 14001.

Quality Control:

- Measurement of roller deflection
- Measurement of the maximum bending
- Strength and load capacity testing and control
- Control of tightness
- Checking of flatness and parallelism
- Determination of gas permeability
- Product dimensions meet blueprint specifications

In coordination with our customer corresponding certificates and inspection sheets will be drawn up and shipped with the goods.
Laser test equipment for rollers
(Deflection/Bending)

Numeric controlled measuring device for complex components

Simulation of stress distribution of a monolithic supporting system made of Silit® SKD

For the production of ceramic products, kiln furniture has to meet the current requirements in economical, ecological and ergonomic respects. Utilising the potential of modern ceramic materials development, combined with Computer Aided Design (CAD), special tailor-made high-temperature logistic systems have been developed for the firing process of any ceramic product. Special tailor-made logistic systems have been developed for the firing process of any ceramic product. Utilising the potential of modern utilising the potential of modern ceramic materials development, combined with Computer Aided Design (CAD), special tailor-made high-temperature logistic systems have been developed for the firing process of any ceramic product. Special tailor-made logistic systems have been developed for the firing process of any ceramic product.

Saint-Gobain Ceramics strives for innovation and leadership in the fast-paced and ever-advancing field of technical ceramics.

Saint-Gobain Ceramics strives for innovation and leadership in the fast-paced and ever-advancing field of technical ceramics.
## Standard Dimensions

### Feasible dimensions and tolerances of SILIT® SK beams and profiles*

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Tolerance X mm</th>
<th>Wall thickness s mm</th>
<th>Max. Length mm ± 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height H ± X mm</td>
<td>Width B ± X mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>± 1.0</td>
<td>6.0</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>± 1.0</td>
<td>6.0</td>
</tr>
<tr>
<td>30</td>
<td>20</td>
<td>± 1.0</td>
<td>6.0</td>
</tr>
<tr>
<td>35</td>
<td>35</td>
<td>± 1.0</td>
<td>6.0</td>
</tr>
<tr>
<td>40</td>
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<tr>
<td>50</td>
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<td>± 1.0</td>
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<td>50</td>
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<td>± 1.0</td>
<td>6.3</td>
</tr>
<tr>
<td>50.8</td>
<td>44.5</td>
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### Feasible dimensions and tolerances of Advancer® beams and profiles*

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*Technical data, right of modification reserved*
Saint-Gobain IndustrieKeramik Rödental

is a global business, integrated in the Compagnie de Saint-Gobain, Paris, France. Compagnie de Saint-Gobain is an international business group located in 46 countries. The company is one of the 100 largest industrial companies in the world and has a leading position in all its strategic business areas.

Saint-Gobain IndustrieKeramik Rödental

has more than 100 years of experience in the production of high performance materials and is world-wide respected in all well-known business fields with all its brand names.

Saint-Gobain IndustrieKeramik Rödental

has a strong customer-service orientation and operating philosophy. We pride ourselves on our ability to partner with our customer and to provide high performance materials.