DIABON®
Block Heat Exchangers

Process Technology
SGL Group – The Carbon Company – is one of the world’s leading manufacturers of carbon-based products. We have a comprehensive portfolio ranging from carbon and graphite products to carbon fibers and composites.

Our core competencies include a wide knowledge of raw materials, specialized production expertise and in-depth application and engineering know-how. As a result, we have built up a comprehensive technology and product portfolio. We operate on a global scale and are close to our customers anywhere at any time. Supported by this broad base, we offer our customers the best solutions. That is what SGL Excellence stands for.
Our Business Line Process Technology is focused on supporting the technical processes of our globally operating customers in the chemical industry, metal manufacturing and environmental protection technology. A maximum degree of know-how and expertise in corrosion protection, a global presence and full-package systems from a single source: that’s what our customers need – and get from us:

- Long-standing experience and a high level of expertise in process technology
- Comprehensive process, material and design know-how on graphite and PTFE
- Closeness to customers: cost-effective manufacturing to international and local standards at our production sites in Europe, America and Asia and worldwide customer service
- A consistently high standard of quality

Our comprehensive range of products and services extends from process equipment and components made from DIABON® graphite and POLYFLURON® virginal, paste-extruded PTFE, through LICUFLON® skived PTFE sheet-lined equipment, FLUROFLEX® bellows, FLUROPIPE® pipe systems, FLUROSIC® silicon carbide heat exchangers and DIABON® graphite or exotic metal pumps, to the planning and assembly of complex systems.
DIABON® Block Heat Exchangers

Product Line

DIABON graphite block heat exchangers are flexible in use. They are suitable for all heat exchange and mass transfer processes involving corrosive media. SGL Group’s block heat exchangers are used in all branches of the organic and inorganic chemical industry.

Our range of DIABON block heat exchangers includes:

**Cylindrical Block Heat Exchangers**
- CK
- CM (new design)

**Cubic Block Heat Exchangers**
- NEC
- EC

**Monoblock Heat Exchangers**
- KU

**All our block heat exchanger series combine the following advantages:**
- Suitability for corrosive media on both service and product sides, depending on the design
- High thermal efficiency even with low mass flows
- Easy servicing (easy cleaning and block replacement)
- Increase of block heat exchanger transfer area by adding block elements
- Modularity

**They can be used:**
- For cooling and heating of corrosive media
- For heat exchange between two corrosive media
- As forced and natural circulation evaporators
- For full and partial condensation (extended bottom header for phase separation on request)
- For absorption with simultaneous cooling

**Due to their compactness and modularity our block heat exchangers can be used as:**
- Pickling line heaters
- Reactor coolers
- Vent condensers and sump coolers
- Circulation coolers for quenchers
- Preheaters for evaporators
- Reboilers
- Steam heaters
- Condensers
Characteristic Features and Applications of DIABON® Graphite

**DIABON® NS1**

**Properties**
DIABON NS1 is an impervious, synthetic resin-impregnated process equipment graphite with a homogenous material structure. The maximum permissible material temperature is 200°C.

**Application**
Standard material for the production of heat exchangers and HCl synthesis plants as well as for all other pressure- and temperature-stressed components.

**DIABON® NS2**

**Properties**
Graphite material for superior demands. DIABON NS2 is characterized by higher strength, better corrosion resistance and lower sensitivity to swelling than DIABON NS1 graphite. The homogenous material structure has small pore sizes and a uniform pore size distribution. The maximum permissible material temperature is 200°C.

**Application**
Tube sheets, blocks and tubes for heat exchangers in case of higher mechanical stress and/or extremely corrosive media and solvents.

**DIABON® CT**

**Properties**
DIABON CT is an impervious, PTFE-impregnated process equipment graphite with a very homogenous material structure. The maximum material temperature is 200°C. DIABON CT is suitable for oxidizing or basic environments and has anti-adhesive properties.

**Application**
Blocks for block heat exchangers, especially for stainless steel pickling and pharmaceutical industries.
Carbon Fiber-Reinforced DIABON® Blocks
for Improved Reliability

Highly pretensioned carbon fibers are wrapped around the DIABON blocks. The high modulus of elasticity of the carbon fiber ensures that the tension on the reinforcement is retained even under sharply fluctuating load or stress surges—no fatigue is experienced.

The DIABON HF carbon fiber reinforcement does not impair resistance to corrosion because its chemical resistance is identical to that of synthetic resin-impregnated graphite.

Due to the carbon fiber’s negative coefficient of thermal expansion (volume increase in diameter), the tension on the reinforcement is further increased when the temperature rises. As a result, the bursting pressure and maximum leakage resistance pressure are improved at higher temperatures than room temperature.

The reinforcement with carbon fibers markedly improves the mechanical properties of graphite components. Today, many DIABON graphite heat exchangers subject to special stresses are fitted with carbon fiber-reinforced blocks and headers.
DIABON® Block Heat Exchangers
Cylindrical Design

DIABON block heat exchangers of this design consist of DIABON graphite blocks that incorporate horizontal and vertical passages. The blocks are stacked on a baseplate with corrosion-resistant gaskets between each.

A steel shell fits over the block column and is bolted to the baseplate. The block column is secured by a top pressure plate bolted to the steel shell. The joint between the steel shell and top header is sealed with an O-ring to allow free movement of the shell. The difference in thermal expansion between graphite and steel is compensated for by helical compression springs.

As a rule, the corrosive medium flows through the vertical passages of the DIABON blocks. Fluid enters the heat exchanger through a DIABON header, flows through all the blocks and is collected on the opposite side in another DIABON header before leaving the equipment.

The service medium, usually in the shell space, passes through the horizontal passages of the DIABON blocks. A baffle cage optimizes the flow through the horizontal passages on the service side.

When two corrosive fluids are involved, a suitable anti-corrosion coating or lining can be offered on the shell side (e.g. in rubber, PTFE, special metal).
Our Cylindrical Design

Advantages and Design

Advantages
- Monolithic blocks
- 200 to 1500 mm diameter
- Modular design
- Outstanding corrosion resistance of DIABON
- High heat transfer efficiency
- Multipass operation

Field of application
- Condensers
- Coolers
- Heaters
- Evaporators
- Falling-film absorbers

Designs
- Maximum pressure on product and service side: 7 bar
- Maximum material temperature: 200°C
- Number of blocks: up to 15
- Product passage diameter: 8 or 16 mm
- Heat exchange area:
  - CKS: 0.91 to 600 m²
  - CKDS: 1 to 850 m²
  - CKL: 0.72 to 500 m²
  - CKDL: 1 to 660 m²
  - CM: 1.1 to 171 m²
  - CM: 1.1 to 246 m²
- Block material brands:
  - DIABON® NS1
  - DIABON® NS2
  - DIABON® NS+
  - DIABON® HF1
  - DIABON® HF2
  - DIABON® CT
  - DIABON® CT+
- Seals:
  - PTFE
  - SIGRAFLEX®
- Installation options:
  - vertical
  - horizontal
  - tilted
- Inspections according to:
  - AD 2000 specification
  - ASME
  - Stoomwezen
  - CODAP
- Main options:
  - Graphite header for gas-liquid separation
  - Distribution header for falling-film absorbers
  - Detachable header for in-situ cleaning of blocks
  - Steel shell lining (rubber, PTFE, etc.) for processes involving corrosive fluids on the service side
  - DURABON plate to minimize erosion by abrasive fluids containing solids, for instance
Our Cylindrical Design
Series CK / CM

Series CKS
Features
- Product passage diameter 8 mm
- Suitable mostly for clean media
- Suitable for evaporation and condensation stage
- Suitable for low product flows

Series CKDS
Features
- Double-row drilling on process side
- Product passage diameter 8 mm
- Suitable mostly for clean media
- Suitable for evaporation and condensation stage
- Suitable for low product flows
- Suitable for applications requiring a large flow cross-section on the product side

Series CKL
Features
- Product passage diameter 16 mm
- Suitable for contaminated media
- Easy to clean
- Condensation under vacuum
- Reflux condensation
- Falling-film absorption

Series CKDL
Features
- Double-row drilling on process side
- Product passage diameter 16 mm
- Suitable for contaminated media
- Easy to clean
- Suitable for applications requiring a large flow cross-section on the product side
- Condensation under vacuum
- Reflux condensation

Series CM
Features
- Modular design
- Outstanding corrosion resistance
- Low weight
- Carbon fiber reinforcement is possible
- Short lead time
- Corrosive fluids on both sides
- No external corrosion
- Steel shell-free design
- No risk of cross contamination

Block heat exchanger, series CM
DIABON® Block Heat Exchangers
Cubic Design

Advantages
- Modular design
- Outstanding corrosion resistance of DIABON
- High heat transfer efficiency
- Easy servicing and repair
- Vertical, horizontal or tilted design
- Multipassing and multiple adaptation features (e.g. cooling water and brine)
- Suitable for pharmaceutical and fine-chemical industries
- No risk of cross-contamination

Field of application
- Coolers
- Condensers
- Heaters
- Interchangers

Cubic block heat exchanger, series NEC
Base plate and bottom header, series NEC
Base plate, bottom header and one element, series NEC
Cubic block heat exchanger, series NEC
Series NEC

Features
- Lateral distribution chambers are machined within the graphite block
- Lateral plates are manufactured in carbon steel

Series EC

Features
- The service medium in this heat exchanger series is distributed by machined carbon steel plates

<table>
<thead>
<tr>
<th>Maximum permissible service data</th>
<th>EC</th>
<th>NEC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. service pressure</strong></td>
<td>Product side 5 bar</td>
<td>Product side 7 bar</td>
</tr>
<tr>
<td></td>
<td>Service side 5 bar</td>
<td>Service side 7 bar</td>
</tr>
<tr>
<td><strong>Max. service temperature</strong></td>
<td>200°C</td>
<td>200°C</td>
</tr>
<tr>
<td><strong>Heat exchange area</strong></td>
<td>0.5 to 259 m²</td>
<td>0.8 to 145 m²</td>
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<tr>
<td><strong>Block no. / heat exchanger</strong></td>
<td>max. 12 items</td>
<td>max. 12 items</td>
</tr>
<tr>
<td><strong>Product passage diameter</strong></td>
<td>10, 12, 18 and 20 mm</td>
<td>10 mm</td>
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</table>
DIABON® Block Heat Exchangers
Monoblock Design

Our KU design can be used successfully between two highly corrosive, pressurized media. This mono-block heat exchanger series is made from a single monolithic DIABON graphite block that includes integrated baffles on the product and service sides produced by milling. The graphite block is sealed on four faces with PTFE-lined steel plates that are braced together.

The heat exchange area varies from 0.5 to 110 m². The maximum product and service pressure is up to 10 bar, the maximum temperature is 200°C.

Series KU

Features
- Processes with low temperature differential and/or temperature cross
- Heat exchange between two corrosive fluids
- Outstanding corrosion resistance of DIABON
- Limited number of gaskets since it is produced out of one single monolithic block
- Very versatile design as far as the flow rates on both sides are concerned
- Rugged design

Field of application
- Interchanger
- Heater
- Cooler
Technical Specifications
for Block Design

The design calculations for DIABON graphite block heat exchangers are carried out by our experienced application engineers. The thermal design calculations are performed with a tried and tested program developed by ourselves or with the help of internationally proven and recognized software such as

- Aspen Tasc+
- HTRI

Heat and mass transfer processes are modeled using Aspen Plus and the equipment is then designed separately.

HTRI software is used to optimize the geometry of the DIABON graphite block heat exchangers and to calculate the necessary mechanical strength.

On request, we would be pleased to assist you in the selection of the most suitable heat exchanger for your application and provide a free quote.
Our continuing partnership with customers is based on the excellent services and system solutions we provide. These are a key part of our commitment.

All items of SGL Group’s DIABON process equipment are quality products manufactured in our own plants from high-grade materials using the latest technologies. If a product still fails to meet your requirements, SGL Group’s worldwide network of service centers will be on hand to help. We see every problem as a fresh opportunity. Give us the chance to prove it.

**Spare parts and repairs**

SGL Group’s responsibility for its products doesn’t end when customers take delivery of DIABON equipment. In fact, we give our customers systematic support all the time it’s in use. This support is a key part of our customer service.

The long service life of our graphite equipment depends crucially on its high quality and the servicing and/or cleaning it gets when in contact with highly corrosive and contaminated media.
Quality Management
by Process Technology

As a manufacturer of carbon and graphite products, process equipment and systems for the chemical industry and environmental protection technology, SGL Group maintains a targeted quality management system designed to attain and meet the product quality standards demanded by customers. Our quality management system meets the requirements of DIN EN ISO 9001:2000 and Pressure Equipment Directive 97/23/EC Annex III, Module H/H1 and has been certified by the approved associations of DQS and TÜV SÜD. In process equipment construction, Quality Management is responsible for the testing and approval of semi-finished graphite products, impregnating resin, cement components, outsourced parts, process equipment and components.

Synthetic resin impregnation, cementing and assembly are all subject to continuous monitoring. Appropriate marking of the semi-finished graphite products before and after synthetic resin impregnation, during machining and thereafter until assembly of the complete equipment or plant provides comprehensive evidence of the semi-finished products employed. Consequently, they meet the traceability requirement of specification AD 2000-Merkblatt N2 for pressure vessels made from electrographite and hard burned carbon. The conditions for synthetic resin impregnation of the semi-finished graphite products and those for cementing of the components are stipulated, monitored and checked.

Evidence of the quality characteristics of the material grades employed, as required by specification AD 2000-Merkblatt N2, is provided in a report issued by the testing laboratory of TÜV SÜD Industrie Service GmbH.
Process Technology Brochures

- Process Technology – We Combat Corrosion – from Process Equipment and Components to Complex Systems
- DIABON® Graphite for Engineered Process Equipment
- DIABON® Shell and Tube Heat Exchangers
- DIABON® Block Heat Exchangers
- DIABON® Plate Heat Exchangers
- DIABON® Economizers for Heat Recovery
- DIABON® and LICUFLON® Columns and Column Internals
- DIABON® Hydrogen Chloride Synthesis Plants
- DIABON® and Exotic Metal Pumps
- DIABON® Safety Disks
- Systems – Solutions for Corrosive Processes
- ECOPOR® Porous Burners

The data contained herein represent the current state of our product knowledge and are intended to provide general information on our products and their application spectra. In view of the variety and large number of application possibilities, these data should be regarded merely as general information that gives no guarantee of any specific properties and/or suitability of those products for any particular application. Consequently, when ordering a product, please contact us for specific information on the properties required for the application concerned. On request, our technical service will supply a profile of characteristics for your specific application requirements without delay.