

We Combat Corrosion –
from Process Equipment and Components
to Complex Systems

Process Technology



Broad Base. Best Solutions.



Carbon is Future.

SGL Group – The Carbon Company.

Carbon has unique properties. It is indispensable in the production of steel, aluminum and solar energy systems. Carbon increases the performance of wind turbines and reduces the weight of airplanes, cars and sports equipment.



Carbon substitutes other materials and contributes to a reduction in CO₂ emissions.



SGL Group is one of the leading manufacturers of carbon-based products and has the broadest product and technology portfolio, a global sales network and state-of-the-art production sites in Europe, North America and Asia.

Process Technology

The Business Unit Process Technology is a premium technology provider for chemical and related industry process systems, equipment and after sales services. Our focus are high-tech materials for demanding chemical applications. With smart and sustainable solutions for an increasing number of industry we give proof of our strong innovation culture.

Broad Base

Our range of materials:

- ▶ graphite
- ▶ SiC
- ▶ PTFE
- ▶ reactive metals
- ▶ steel

Our range of services:

- ▶ process design
- ▶ engineering
- ▶ project management
- ▶ production and assembly
- ▶ commissioning
- ▶ after sales services.

With 9 manufacturing sites in 8 countries and a continually growing worldwide sales and service network, we are always close to our customers.

**RELIABILITY.
EFFICIENCY.
SUSTAINABILITY.**



Powered by our **Broad Base** of competencies, products and services, we offer **Best Solutions** to our customers. For the Business Unit Process Technology, those solutions are characterized by reliability, efficiency and sustainability.

Best Solutions

► Reliability

In a business that strongly depends on reliability we never compromise on quality and safety. Our products deliver dependable results; our services are fast and competent. The long-standing loyalty of our customers proves that we keep our promises – on-time, on-spec, on-budget.

► Efficiency

Tailor made, innovative solutions and an integrated approach on chemistry, materials, technology and design, ensure outstanding efficiency and improved customer value: higher yields, lower operating cost, lower service and maintenance cost, longer service intervals and less downtimes, and the extended product lifetime sum up to significant lower total cost of ownership and to a higher return on investment for our customers.

► Sustainability

In all industries that deal with resource- and energy- consuming processes sustainability is of crucial importance. Based on innovative solutions, more than 60 % of our sales contribute to the saving of resources and energy and to the reduction of greenhouse gases.

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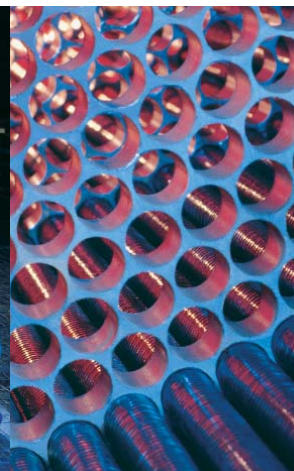
DIABON® tube bundle



DIABON® shell and tube heat exchangers



DIABON® multi-tube bundle heat exchanger



Baffle cage fitted with carbon fiber-reinforced tubes

DIABON® Heat Exchangers – Customized Solutions

DIABON® heat exchangers: highly efficient and cost-effective

Resistant to acids, alkalis and other corrosive media, our heat exchangers are used for heat exchange and mass transfer processes in the organic and inorganic chemical industry. To match their different operating requirements (medium, tendency to fouling, temperature differential, volume flow, available space), we draw on our wide range of products to work out optimum solutions. Designs available include shell and tube heat exchangers, multi-tube bundle heat exchangers, block heat exchangers, plate heat exchangers and modular heat exchangers, as well as economizers. A solution can be found whether our equipment is used as a heater, evaporator, condenser or absorber.

DIABON® shell and tube heat exchangers

are best suited for:

- ▶ high volume flows
- ▶ low pressure drops
- ▶ media with a tendency to fouling → ease of cleaning

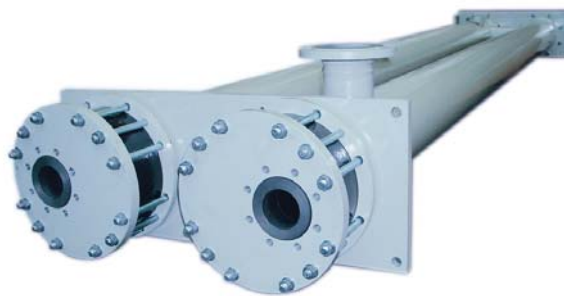


DIABON® shell and tube heat exchanger

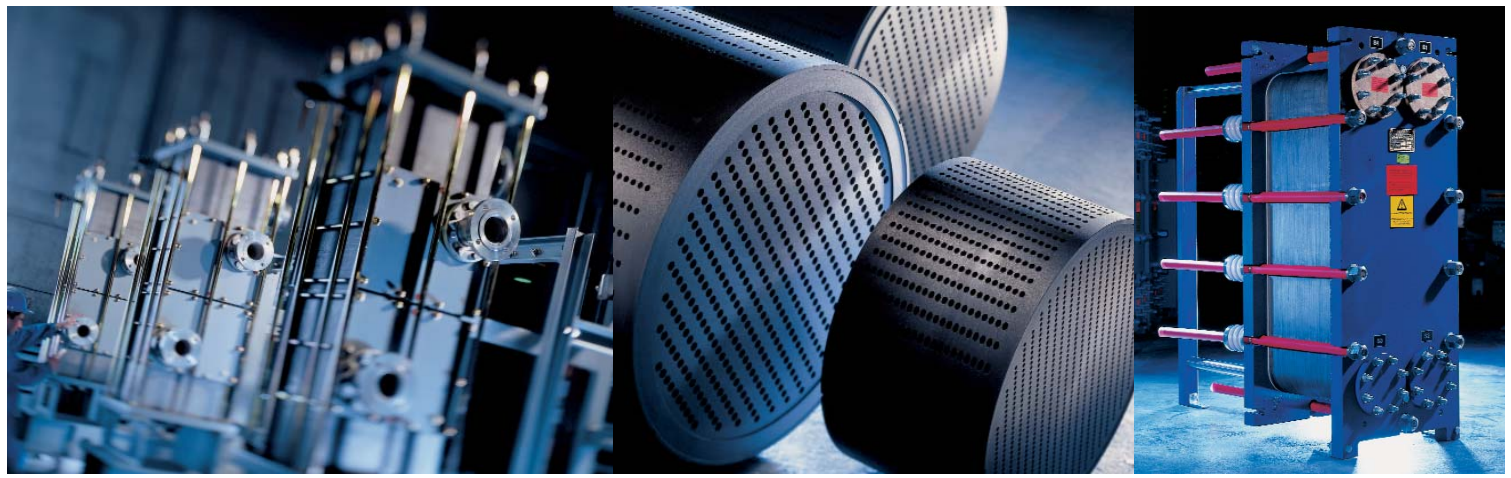
DIABON® multi-tube bundle heat exchangers

are best suited for:

- ▶ medium volume flows
- ▶ process control by optional inspection ports
- ▶ quick replacement of tube bundles and cleaning on both product and service sides
- ▶ low temperature differentials due to pure counter-current flow



DIABON® multi-tube bundle heat exchanger



DIABON® block heat exchangers

DIABON® blocks

DIABON® plate heat exchanger

DIABON® block heat exchangers

are recommended for:

- ▶ medium volume flows
- ▶ clean media
- ▶ modular design



DIABON® plates

DIABON® plate heat exchangers

are best suited for:

- ▶ heat exchange between two liquids
- ▶ corrosive media on both service and product sides
- ▶ confined spaces – an advantage of their compact design



DIABON® block column



DIABON® modular heat exchanger

DIABON® modular heat exchangers

are used for:

- ▶ heat recovery from corrosive waste gases
- ▶ high waste gas volumes in power stations and large industrial plants
- ▶ cooling below dew point

DIABON® economizers

are used for:

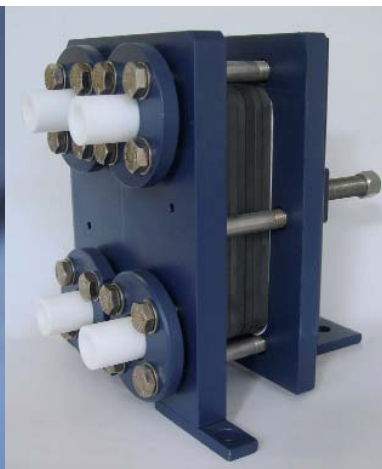
- ▶ heat recovery from medium to small heating systems (apartment complexes, industrial plants)
- ▶ firing of crude oil, gas, renewable fuels (e.g. wood)
- ▶ cooling below dew point if corrosive gases evolve



DIABON® economizer



FLUROSIC® shell and tube heat exchanger



FLUROSIC® plate heat exchanger



SiC block heat exchanger

FLUROSIC® Heat Exchangers – for Specific Heat Exchanger Applications

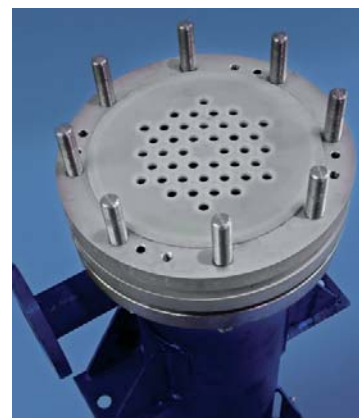
FLUROSIC® heat exchangers

Owing to the almost universal chemical resistance of the silicon carbide material used, FLUROSIC heat exchangers permit long-term operation even with highly corrosive media. What's more, the excellent heat transfer efficiency provided by the silicon carbide material results in compact equipment dimensions. This range of excellent physical properties is complemented by the advantages of the heat exchangers' patented sealing systems. Our SiC block heat exchangers can now be operated efficiently even under extreme conditions of up to 16 bar.

FLUROSIC® shell and tube heat exchangers

are ideal for:

- ▶ universal use as preheaters (economizers), heaters, evaporators, condensers, coolers or absorbers
- ▶ medium volume flows
- ▶ highly aggressive media
- ▶ media that tend to cause fouling -> ease of cleaning
- ▶ high-purity applications (GMP)



FLUROSIC®
shell and tube heat exchanger

Our latest innovations:

FLUROSIC® plate heat exchangers

are ideal for:

- ▶ low volume flows with high thermal output
- ▶ highly aggressive and abrasive media
- ▶ confined spaces

SiC block heat exchangers

are recommended for:

- ▶ low to medium volume flows
- ▶ highly aggressive and abrasive media
- ▶ extreme service conditions, pressures up to 16 bar
- ▶ high-purity applications (GMP)



DIABON® support plate

DIABON® support plate

DIABON® tunnel cap tray, DN 1800

DIABON® Columns and Column Internals

High Operational Reliability and Safety

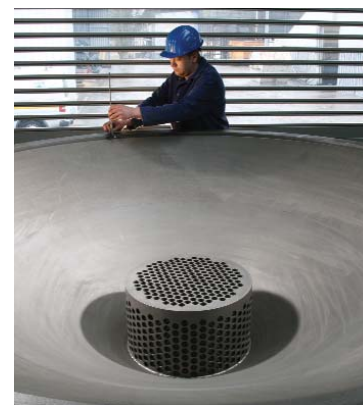
Ideal for mass transfer processes

Columns and column internals by SGL Group are manufactured from DIABON process equipment graphite. They are designed using well-tried methods of process engineering calculation. This lets customers benefit from our specialized know-how on the mass transfer of corrosive media.



DIABON® column bottom section

Our columns and column internals meet exacting demands for corrosion resistance and ensure a high level of operational reliability and safety. Used in chemical process engineering and environmental protection technology, they provide highly cost-effective solutions to problems.



DIABON® column bottom section with baffle

DIABON® columns

are ideal for:

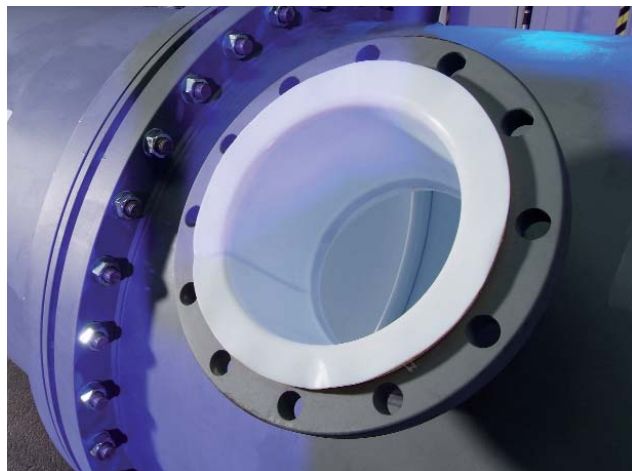
- ▶ operation under vacuum
- ▶ temperatures up to 200°C
- ▶ pressures up to 3 bar (depending on diameter)
- ▶ nominal widths up to 2500 mm
- ▶ adiabatic absorption of hydrogen halides
- ▶ absorption and desorption of hydrogen chlorides
- ▶ separation of acid mixtures by distillation
- ▶ purification of highly aggressive flue gases



DIABON® bubble cap tray, DN 2200



DIABON® hollow cylinder



LICUFLON® column



POLYFLURON® column

Dr. Schnabel **POLYFLURON® and LICUFLON®** Columns and Column Internals

Optimum column lining materials for mass transfer processes involving corrosive media

Equipment lined with these two PTFE variants can meet nearly all customer requirements entailing special designs, large lining thicknesses, electrical conductivity, etc. in mass transfer processes involving highly corrosive media.

Vessels and process equipment can also be provided with these special PTFE linings. LICUFLON and POLYFLURON columns are used mainly in the chemical and pharmaceutical industries.

LICUFLON® columns

are used:

- ▶ at temperatures up to 220°C
- ▶ at pressures up to 16 bar
- ▶ in nominal widths of 700 to 3000 mm
- ▶ in special designs

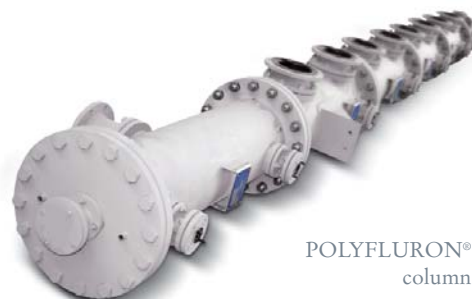


LICUFLON® column

POLYFLURON® columns

are used:

- ▶ at temperatures up to 220°C
- ▶ at pressures up to 16 bar
- ▶ in nominal widths of 100 to 3000 mm
- ▶ with large lining wall thicknesses up to 8 mm
- ▶ with white or black (conductive) PTFE linings



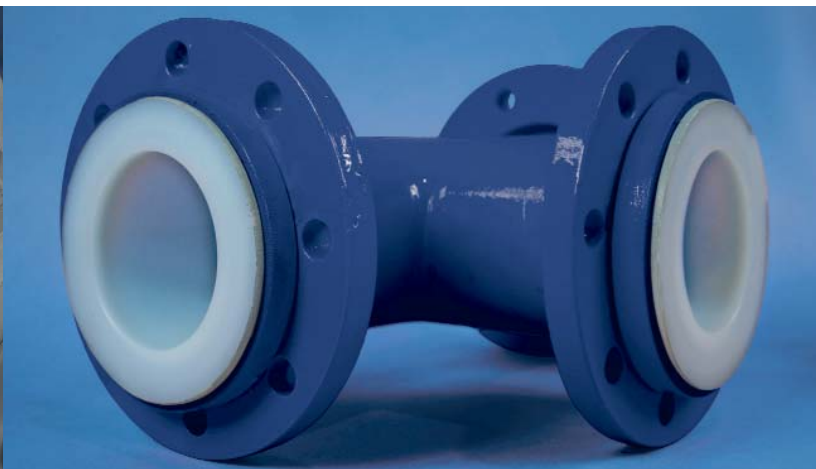
POLYFLURON®
column

LICUFLON® is our PTFE-lined steel equipment

POLYFLURON® is our virginial, paste-extruded PTFE



FLUROPIPE® distributor pipe in electrically conductive design



FLUROPIPE® pipe component

Dr. Schnabel FLUROPIPE® Pipe Systems

Robust and Durable

Optimum lining materials based on more than half a century's experience

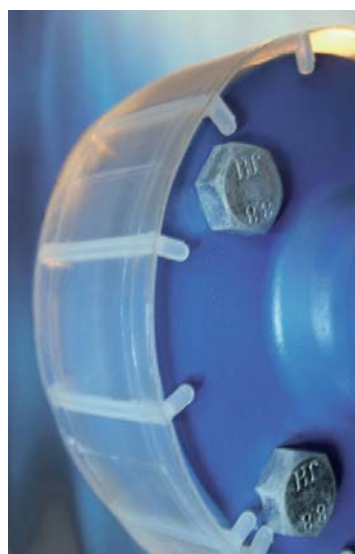
For more than 50 years now, we have been supplying pipes and fittings for connecting columns and process equipment used for highly corrosive applications in the chemical and pharmaceutical industries. FLUROPIPE steel pipes with POLYFLURON PTFE linings are also used successfully in the production of high-purity acids in the electronics industry. Our special PTFE linings with wall thicknesses of up to 10 mm permit long operating times, even in highly demanding applications. Special pipe components ensure an optimized pipe arrangement and reduce the number of flanged joints.

FLUROPIPE® pipes with POLYFLURON® lining

are used:

- ▶ at temperatures up to 220°C
- ▶ at pressures up to 25 bar
- ▶ in nominal widths of 15 to 600 mm
- ▶ with carbon steel or stainless steel jackets
- ▶ with white or black (conductive) PTFE linings
- ▶ with DIN or ANSI flanges
- ▶ with DIN or ANSI standard-length fittings
- ▶ as dip and inlet pipes for transferring media to vessels

POLYFLURON® is our virginal, paste-extruded PTFE



ANJA tape
Safety shield for flanges



FLUROFLEX® bellows



Robust tie rod



Cut-away model of FLUROFLEX® bellows

Dr. Schnabel **FLUROFLEX® Bellows** Flexible Systems of Any Size



Bellows with safety shield

Latest production technologies provide uniform wall thickness of our POLYFLURON® material

FLUROFLEX bellows made of POLYFLURON PTFE are used in pipe systems to absorb any vibrations due to rotating equipment (e.g. pumps or compressors), and to compensate for any thermal expansion and contraction of the pipe system. They are also suitable for protecting any process equipment components susceptible to stress. FLUROFLEX bellows are used mainly in pipe systems in contact with highly corrosive media.



FLUROFLEX® bellows with metal jacket for elevated pressures

FLUROFLEX® bellows in POLYFLURON® PTFE

are used:

- ▶ at temperatures up to 230°C
- ▶ at pressures up to 25 bar
- ▶ for highly corrosive media
- ▶ in nominal widths of 25 to 2500 mm
- ▶ with a metal jacket or in POLYFLURON PTFE only
- ▶ with white or black (conductive) POLYFLURON PTFE
- ▶ with DIN, ANSI, JIS or special-design flanges
- ▶ in combination with steel components with various linings; also with components in glass, plastics, graphite, etc.



FLUROFLEX® bellows in various designs



Pump casing



Pump impeller



Inside view of a pump

DIABON® Graphite and Exotic Metal Pumps for Continuous Use

Our pumps are the solution for moving corrosive fluids

Our expertise in graphite process equipment construction has also been put to good use in our pump products sector.



Standard chemical pump in graphite

Our range of pump products

includes the following pump types:

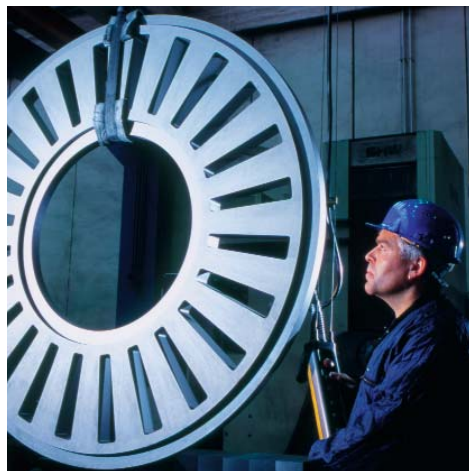
- ▶ centrifugal pumps
- ▶ axial pumps
- ▶ vertical pumps

Their advantages over plastic pumps are:

- ▶ higher operating temperatures
- ▶ longer service lives
- ▶ higher mechanical load-bearing capacity
- ▶ resistance to highly corrosive media
- ▶ absence of diffusivity
- ▶ low expansion coefficient of the pump material
- ▶ capacities up to 3000 m³/h



Standard chemical pump in graphite



DIABON® support plate for a packed column



DIABON® safety disks



Carbon fiber-reinforced DIABON® tube sheet

DIABON® Components and Safety Disks

Convincing Solutions

Besides manufacturing complete equipment for a wide variety of operating conditions, we produce individual components from graphite to customer order. Our product range extends from standard components to complex parts and assemblies. This is another area where our customers stand to benefit – not only from our highly successful DIABON process equipment graphite but also from our detailed knowledge of designing and manufacturing graphite components.



Corrugated DIABON® NS1/NS2 plates for plate heat exchangers

We'll gladly respond to customers' specific requests by working with them on successful solutions ideally matched to whatever the application. All our skills and resources are available for the asking.

DIABON® safety disks

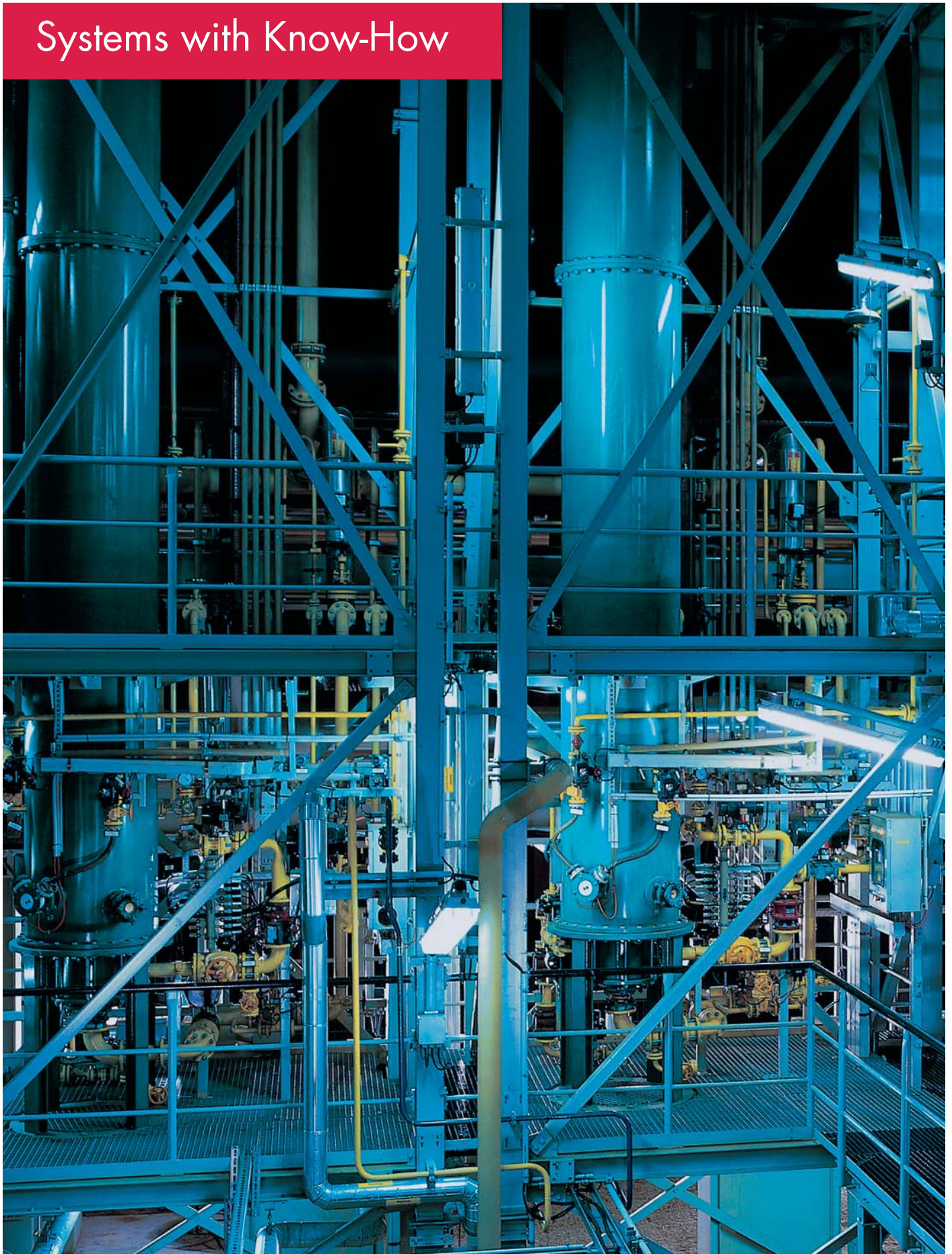
Graphite safety disks by SGL Group are manufactured from high-quality DIABON process equipment graphite. The highly homogeneous structure of this fine-grain material ensures constant strength values in the disks. In an emergency this means they burst at their actual rated bursting pressures.

We'll be glad to help our customers select the safety disks best matched to their particular application.



Vacuum support of a DIABON® safety disk

Systems with Know-How



HCl synthesis unit



HCl synthesis unit



Complete combustion of Cl_2 and H_2 in an HCl synthesis burner to produce HCl



DIABON® column incorporated in a chemical plant

Systems – Our Know-How

Cost-Effectiveness and Reliability

Our know-how on hydrochloric acid, sulfuric acid, phosphoric acid, various salt solutions and halogenated residual gases

Our entire expertise is put to good use in the design of our systems. We offer everything from a single source – from the optimum material for an individual equipment item to complete systems.

We develop individually tailored solutions that satisfy our customers' requirements in every respect. For this purpose, a team of experienced design engineers works with experts in plant construction, process engineering and every other field required for the execution of the project.

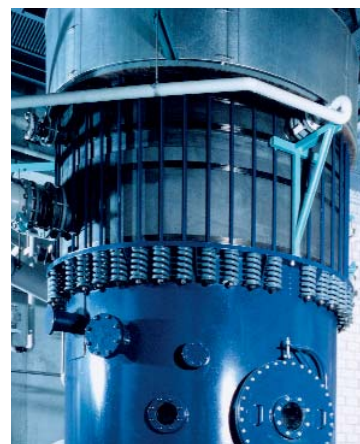
The resulting systems include heat exchangers, columns, vessels, pumps and piping that cover the complete spectrum of process engineering for corrosive media and harmonize with our environment. From the treatment of HCl by absorption, distillation, stripping or evaporation to the dilution and concentration of sulfuric acid, including the cleaning of flue gases and combustion of residual gases, we can find solutions to any materials and process engineering problem.



DIABON® absorber block



Decomposition unit for processing fluorinated hydrocarbons



Flue gas scrubber with pipe quencher

Production Sites and Sales and Service Network

Business Line Process Technology

Our sales centers are always within easy reach

Understanding our customers' needs and processes is one of our key concerns. This helps us offer customers optimum solutions or collaborate with them to develop new ones. The sales network of SGL Group's Process Technology Business Line spans the globe and enables customers to contact us direct in their own particular region.

Always at our customers' service

We offer our customers a global network of flexible and specific services. Our service staff makes sure that our customers are given direct and prompt support, and supplied with high-quality and product-specific spare parts in a minimum of time.

Production sites in three continents

The three pillars of our production system are high quality, adherence to deadlines and our highly motivated and competent workforce. We demonstrate this claim in three continents (Europe, the Americas and Asia) to get maximum benefit from both cost-effectiveness and close customer contact.

SGL Group Head Office

Wiesbaden, Deutschland

Business Line Process Technology

Meitingen, Germany

Technology and Innovation

Meitingen, Germany

Asia / Oceania

Production and Service

Kyunggi-Do, South Korea
Pune, India
Shanghai, China
Yamanashi, Japan

Local Sales Offices

Kyunggi-Do, South Korea
Pune, India
Shanghai, China
Yamanashi, Japan





The Americas

Production and Service

Strongsville (Ohio), USA

Local Sales Offices

São Paulo, Brazil

Strongsville (Ohio), USA

Europe / Africa

Production and Service

Grenoble, France

Limburg, Germany

Meitingen, Germany

Narni, Italy

Schachty, Russia

Vereeniging, South Africa

Local Sales Offices

Grenoble, France

Limburg, Germany

Meitingen, Germany

Milan, Italy

Moscow, Russia

Ripponden, United Kingdom

Vereeniging, South Africa

Quality Management

and After Sales Service



Quality Management

Continuous quality assurance is an integral part of the SGL Group corporate philosophy.

Our quality management system is certified in accordance with ISO 9001:2008. In order to guarantee consistently high quality to our customers, we work according to a key performance indicator orientated quality management system.

Depending on specifications we are able to meet specific requirements like the Pressure Equipment Directive 97/23/EC Annex III, Module H/H1, AD 2000 Merkblatt N2 as well as ASME "U" Stamp, Section VIII, Part UIG.



After Sales Services – Anytime and Everywhere

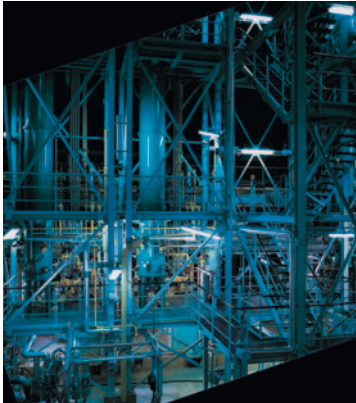
We take care of our products during the entire operational lifetime. We aim to provide the best customer service anytime and everywhere.

- Maintenance – genuine spare parts supply, failure analysis, repair, field service
- Fast emergency support
- Start-up assistance
- Consulting for continuous improvement

Our service specialists as well as our service centers work in a global network to support you best.

Process Technology

Our Products



System Solutions

- ▶ Syntheses
- ▶ Distillation and concentration
- ▶ Purification
- ▶ Dilution
- ▶ Absorption
- ▶ Desorption
- ▶ Thermal destruction and recycling
- ▶ Reactors and converters
- ▶ Heat storage
- ▶ ...



Equipment Solutions

- ▶ Graphite and SiC heat exchangers – shell & tube, block and plate type
- ▶ Columns and internals
- ▶ Vessels
- ▶ Quenchers
- ▶ Pumps
- ▶ Rupture discs
- ▶ PTFE piping and bellows
- ▶ PTFE hoses
- ▶ ...



After Sales Services

- ▶ Maintenance
- ▶ Emergency support
- ▶ Start-up assistance
- ▶ Consulting
- ▶ ...

Regional Sales & Service Center

Central and East Europe

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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.

Process Technology

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SGL GROUP
THE CARBON COMPANY