

# HEAT EXCHANGERS



Graphite tubes  
and blocks

Silicon carbide  
tubes and blocks

Services &  
Maintenance



Metallic shell  
and tubes



**MERSEN**

# WORLDWIDE HEAT EXCHANGER LEADER

**M**ERSEN DESIGNS AND MANUFACTURES ANTI CORROSION AND PROCESS EQUIPMENT, INCLUDING PRESSURE VESSELS, HEAT EXCHANGERS, COLUMNS, TURN-KEY SYSTEMS AND PIPING IN A WIDE RANGE OF MATERIALS. HEAT EXCHANGERS FORM A CORE PART OF MERSEN'S EQUIPMENT BUSINESS.

## DESIGN EXPERIENCE TO SERVE YOUR PROJECTS

**M**ersen has designed a comprehensive portfolio combining multiple heat exchanger technologies and materials of construction.

Mersen has over 50 years of thermal design experience and applications expertise. Our engineers have a successful history of designing thermal equipment based on our customers' applications in order to optimise thermal efficiency and easy maintenance.

Several design tools are used to provide thermally efficient heat exchangers that meet specified process constraints.

- Thermal design tools (In-house Programs, ASPEN B-JAC, X-Designer ...)
- Mechanical design tools

**50-years**

thermal and mechanical design experience

Proven design tools

**Unrivalled** comprehensive range of designs and solutions





## QUALITY COMMITMENT TO SERVE YOUR PROJECTS

**M**ersen manufactures all its heat exchangers in accordance with international standards: ASME, AS, ADM, JIS, CODAP, RTOD and international certifications : ISO9001, ISO 14001, OHSAS 18001, ASME U stamp, PED, SELO, KGS, GOST-R.



# WITH SOLUTION-ORIENTED APPROACH

## COMPREHENSIVE PORTFOLIO OF HEAT EXCHANGERS

	DESIGN	KEY FEATURES	MATERIALS	
<b>Blocks</b>	Cylindrical	Robustness Wide range of models Modular design	Graphite SiC	
	Cubic	Temperature cross application Compactness GMP design features	Graphite SiC	
<b>Tubes</b>	Shell and tube Coils Bayonets Tube-in-tube	Temperature and pressure resistance High exchange area application Easy maintenance	Graphite SiC Tantalum Zirconium Nickel Alloys Stainless steel Carbon steel	 

## WORLDWIDE PRODUCTION SITES AND LOCAL SERVICE CENTERS



Mersen manufactures heat exchangers in its worldwide first-class production sites representing more than 220,000 m<sup>2</sup> of factory area.

The production sites are all equipped with the latest technology machines and equipment to ensure performance, productivity and quality.

After-sales service is available in all our manufacturing sites (USA, Morocco, Germany, France, China, UK, India) and local repair-shops in South Africa, USA, Korea, Taiwan, Spain, Brazil, Argentina, Japan, Italy and the Netherlands. After-sales service consists of :

- Spare parts delivery.
- Repair and/or refurbishment services.
- On-site supervision of repair work to tube sheets, tubes, etc, available upon request.

After-sales service can be carried out at the Mersen sites as well as directly on the customer's site.

**220,000 m<sup>2</sup>**  
of factory area

**8** production sites with  
after-sales service

**10** local after-sales service

# GRAPHITE BLOCK

## HEAT EXCHANGERS

### DESIGN AND MANUFACTURE OF BLOCK HEAT EXCHANGERS FOR OVER 50 YEARS

**M**ERSEN HAS DESIGNED AND MANUFACTURED BLOCK HEAT EXCHANGERS FOR OVER 50 YEARS, WITH MORE THAN **10,000** UNITS IN SERVICE IN ALMOST **50** COUNTRIES.

### MATERIAL EXPERTISE GRAPHILOR® 3

The only impregnated graphite with ultra-fine grain isostatic graphite.

#### PROPERTIES :

- High resistance to corrosion
- Resistance to temperature and thermal shock
- The highest mechanical resistance certified by TÜV.

#### IMPREGNATION

- BS : Phenolic highly cross-linked resin
- C : high-temperature treated carbon → Mersen exclusive
- TH : PTFE → Mersen exclusive

#### EXCEPTIONAL TÜV HOMOLOGATION

- XBS : up to 220°C : G20-00-200 for blocks  
up to 220°C : G30-00-220 for tubes
- XC : up to 430°C : G18-00-400
- XTH : up to 250°C : G15-00-250

**10,000 units**  
in service in almost  
**50 countries**

**430°C**

maximum temperature  
resistance of Graphilor® 3

In-house supplied  
isostatic graphite

High corrosion resistance  
with exclusive carbon (XC)  
and PTFE (XTH) impregnation

Multi-applications design



### GRAPHITE POLYBLOC® HEAT EXCHANGERS

#### LARGE AND MODULAR DESIGN

- Large exchange surface areas (up to 300 m<sup>2</sup>) and high thermal transfer
- Headers – available in Graphilor®, stainless steel and reactive metals, PTFE or rubber lined steel
- Large range of block size from 140 to 1,800 mm diameter
- Design for high pressure up to 16 barG (service) and 12 barG (process)
- PTFE Bellows - fitted to graphite nozzles to remove pipework stresses
- Drilling adapted to process constraints with large diameter holes for fouling process
- Multi-pass arrangements possible for both process and service sides

#### MATERIAL EXPERTISE

- Rigilor® consisting of a layer of carbon fiber which reinforces the graphite and improves the erosion and abrasion resistance

**EASY MAINTENANCE** - easily dismantled for overhaul, cleaning and validation

#### EXTENSIVE REFERENCE LIST

available upon request for main market such as pickling baths, coolers, evaporators, absorbers, condensers.



## GRAPHITE CUBIC BLOCK HEAT EXCHANGERS

**COMPACTNESS** - slots or double drilling on process side effectively doubling the process side surface area making units ideal for condensing duties

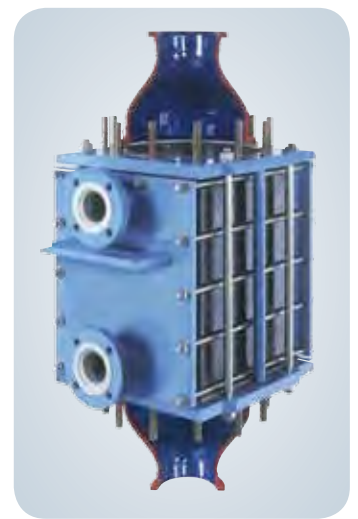
**SPECIAL GMP DESIGN FEATURES** - fully draining and no process to service gaskets

### LARGE AND MODULAR DESIGN

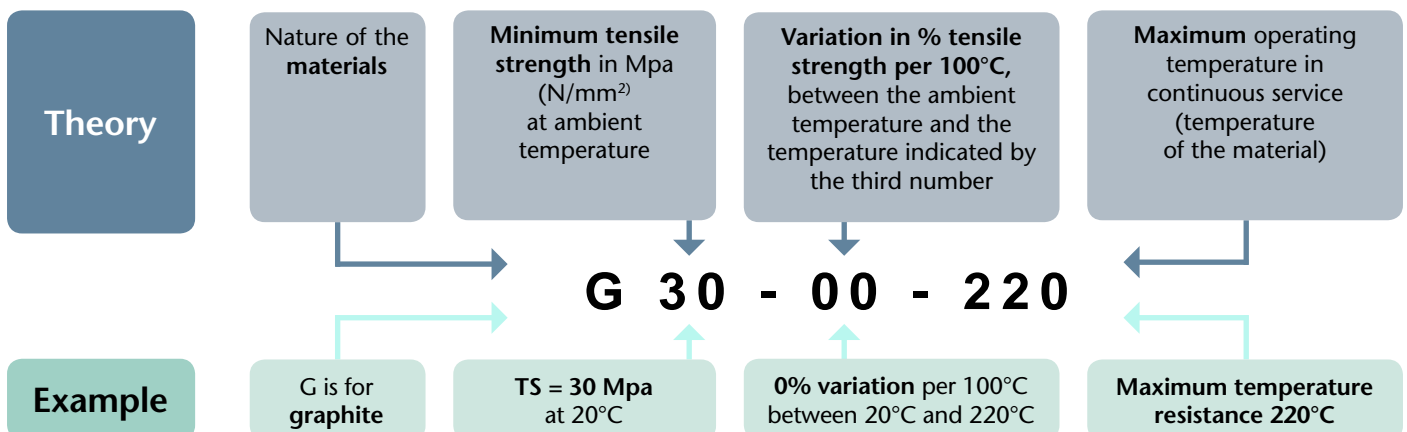
- Headers – available in Graphilor®, carbon and stainless steel, PTFE or rubber lined steel
- No hidden gaskets – single piece core blocks (250mm, 400mm, 500mm and 600mm square and up to 1600mm long)
- Heat exchange areas – from 1m<sup>2</sup> to 100m<sup>2</sup>
- Drilling – adapted to process requirements (6.5mm, 9.5mm and 16mm holes in single or double drilling patterns)
- Design pressure – up to 10 Bar.G on process and service side
- PTFE Bellows – fitted to graphite nozzles to remove pipework stresses
- Interchanger – optimum solution for corrosive fluids on both process and service side
- Multi pass arrangement - on both process and service side gives the most efficient thermal design using true counter-current flow; a large advantage for applications with temperature cross

**EASY MAINTENANCE** - easily dismantled for overhaul, cleaning and validation

**EXTENSIVE REFERENCE LIST** – available on request for main markets such as fine chemical and pharmaceutical, H<sub>2</sub>SO<sub>4</sub> dilution, interchanger for 2 corrosive fluids



## TÜV HOMOLOGATION EXPLANATION

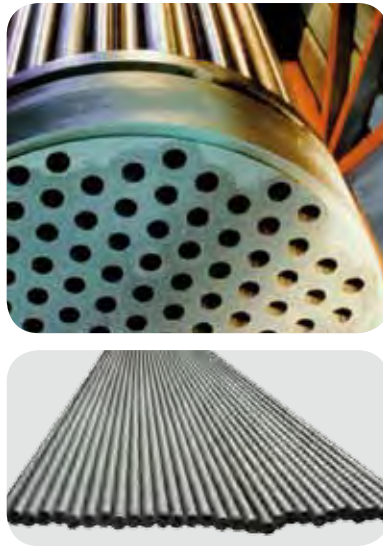


# GRAPHITE SHELL & TUBE

## HEAT EXCHANGERS

### WORLDWIDE LEADER IN THE MANUFACTURE OF GRAPHITE TUBES FOR OVER 50 YEARS

**M**ERSEN HAS DESIGNED AND MANUFACTURED GRAPHITE SHELL AND TUBE HEAT EXCHANGERS FOR OVER 50 YEARS WITH UNITS IN SERVICE IN THE MOST DEMANDING PROCESSES, ESPECIALLY IN THE PHOSPHORIC ACID INDUSTRY. POLYTUBE®, THE GRAPHITE SHELL AND TUBE HEAT EXCHANGER DESIGN IS BASED ON GRAPHILOR® 3, THE UNIQUE IMPREGNATED GRAPHITE WITH ULTRA-FINE GRAIN ISOSTATIC GRAPHITE. THREE TYPES OF IMPREGNATION ARE AVAILABLE (PAGE 8).



OUR GRAPHITE TUBES ARE MANUFACTURED IN FRANCE BY AN EXTRUSION PROCESS WHICH PRODUCES UP TO 6 METER LONG TUBES WITHOUT A JOINT. THE TUBES HAVE THE HIGHEST MECHANICAL RESISTANCE (G30-00-220) CERTIFIED BY TÜV.

THE GRAPHITE SHELL AND TUBE HEAT EXCHANGERS CAN BE ASSEMBLED IN ALL OUR WORLDWIDE WORKSHOPS.

### GRAPHITE POLYTUBE® HEAT EXCHANGERS

#### LARGE DESIGN AVAILABLE

- High exchange surface (up to 1,000 m<sup>2</sup>) and high thermal transfer
- Tubes up to 6 meter without joint with reinforced fiber as an option
- Designed for high pressure: 10 barG (service) and 6 barG (process)
- Special shell designs adapted to corrosive service fluids

#### GRAPHILOR® 3 MATERIAL EXPERTISE

- High corrosion resistance of Graphilor®
- High temperature resistance up to 220°C protection by Rigilor®, the carbon reinforced fiber homologated by TÜV
- Erosion and abrasion resistance

#### GLOBAL MANUFACTURER (6 SITES) AND QUICK MAINTENANCE SERVICE ALL OVER THE WORLD

**EXTENSIVE REFERENCE LIST** upon request for main markets (phosphoric acid evaporators, sulfuric acid heaters, hydrochloric acid re-boilers)

### TESTS AND CONTROLS ARE REALISED AT EACH STAGE OF PRODUCTION TO GUARANTEE THE BEST QUALITY

#### INTERMEDIARY TESTS

- Tube-sheets: pneumatic tests for tightness
- Tubes: 20 bar air under water for mechanical and 9 bar air under water for tightness
- Cemented tubes: pneumatic tests at joint to verify perfect cementing

#### FINAL TESTS

- Air in the service side to verify tube cement joints
- Hydraulic pressure test on process and service sides

#### VISUAL AND DIMENSIONAL

inspections by our quality control and third party if required.



### HEADERS

- Graphilor® 3 XBS standard header with concentric nozzle
- Other materials are available : stainless steel, carbon steel, CL-Clad® or reactive metals (tantalum, zirconium, titanium), rubber lined, PTFE lined..
- Fast dismantling design option for an easy re-tubing.
- Special design according to the process (falling film, multi-pass process, kettle, phosphoric or sulfuric acids)

### TUBE-SHEET

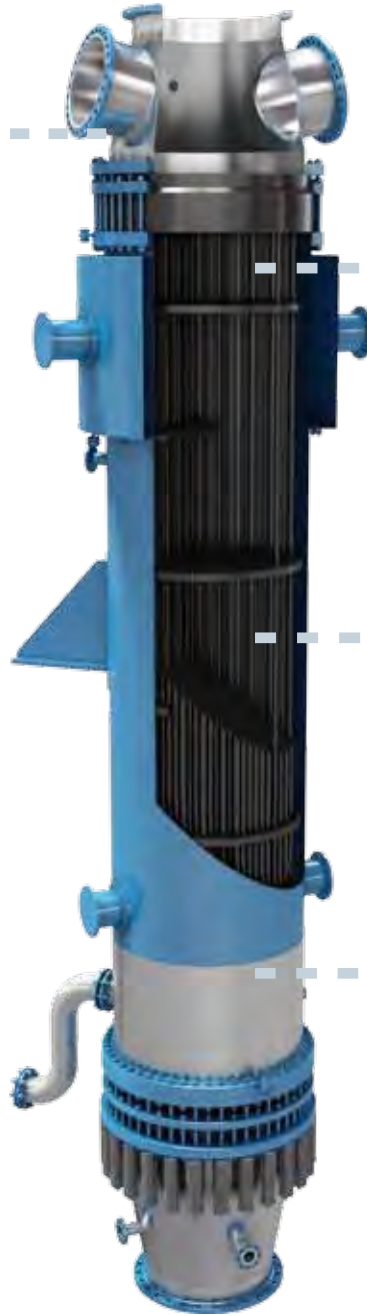
- TÜV homologation G20-00-220
- Alternative ML technology
- Rigilor® option to increase abrasion resistance
- Amorphous carbon sleeves to increase erosion resistance
- Graphilor® 3 XC option for severe applications (up to 430°C)

### GRAPHILOR® 3 TUBE BUNDLE

- Tubes in Graphilor® 3 XBS
- TÜV homologation G30-00-220
- Diameters: 25/16, 32/22, 37/25 and 51/38 mm.

### SHELL

- Diameter 10" – 82"
- Carbon steel shell as a standard
- Other materials are available : stainless steel, rubber lined, high nickel alloys, CL-Clad® or reactive metals (tantalum, zirconium, titanium)



**50-years**  
of experience

**N°1 worldwide  
producer**  
of graphite tubes

Exclusivity  
**6-meter**  
jointless graphite tubes

Option: fiber tubes

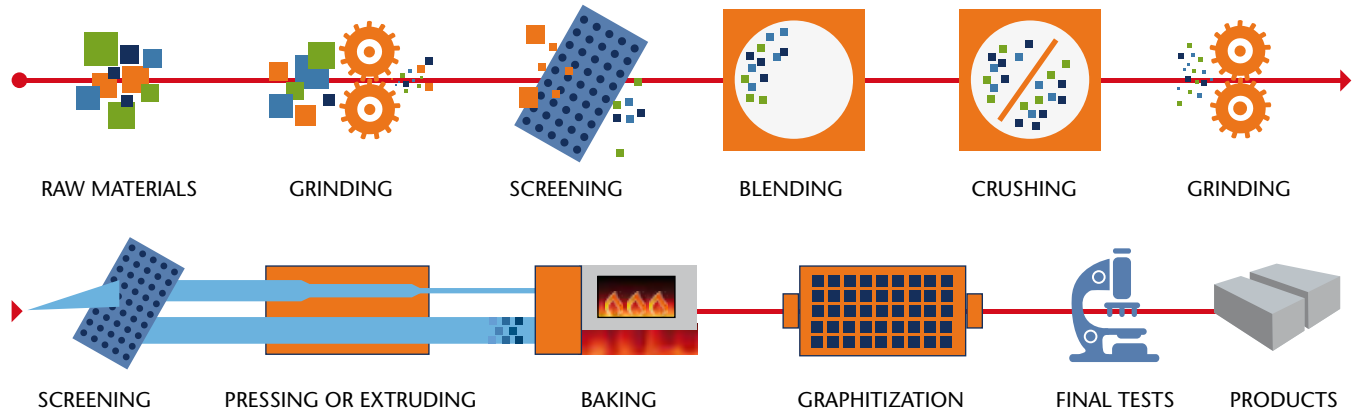
Highest mechanical resistance  
for tubes and tubesheet  
certified by TÜV

# GRAPHITE EXCLUSIVE SOLUTIONS

## GRAPHITE HEAT EXCHANGERS

### GRAPHILOR® 3

THE ONLY IMPREGNATED GRAPHITE WITH ULTRA-FINE GRAIN ISOSTATIC GRAPHITE.



#### PROPERTIES :

- High resistance to corrosion
- Resistance to temperature and thermal shock
- The highest mechanical resistance certified by TÜV.

#### IMPREGNATION

- **BS:** Phenolic highly cross-linked resin
- **C:** highly-temperature treated carbon  
→ Mersen exclusive solution
- **TH:** PTFE  
→ Mersen exclusive solution

#### EXCEPTIONAL TÜV HOMOLOGATION

- **XBS:** up to 220°C: G20-00-200 for blocks / up to 220°C: G30-00-220 for tubes
- **XC:** up to 430°C: G18-00-400
- **XTH:** up to 250°C: G15-00-250

- **Particularly high resistance to corrosion**

- **Highest mechanical resistance, certified by TÜV**

- **Temperature resistance up to 230°C and 430°C**

### 6 METER TUBES IN GRAPHILOR® 3 WITHOUT A JOINT

The absence of a joint makes the tubes less fragile. Tubes can be optionally reinforced with carbon fiber.

- **Tubes are more mechanically resistant**

- **G30-00-220 TÜV certification**

### RIGILOR®

Treatment of graphite parts with a carbon fiber based layer. Rigilor® is used for large blocks and tube-sheets.

- **Mechanical resistance is doubled**

- **Erosion resistance is increased six times**

### ML TECHNOLOGY

Used to produce blocks with a diameter greater than 36".

- **Higher mechanical resistance than monolithic graphite in large diameters**

- **Similar to small diameter mechanical resistance properties**



# SERVICES & MAINTENANCE

**W**E DO NOT JUST DELIVER EQUIPMENT. WE CAN ALSO PROVIDE SUPPORT FOR ALL PRODUCTS WE DELIVER THROUGHOUT THEIR LIFE CYCLE AND OFFER A BROAD RANGE OF SERVICES :

- START-UP SERVICES
- PREVENTATIVE MAINTENANCE
- CORRECTIVE MAINTENANCE
- CONSULTING AND DIAGNOSTIC SERVICES



## START-UP SERVICES

Start-up is a critical phase and its success depends on many different factors specific to each item of equipment and each process. our vast experience in graphite equipment means that we are able to give you the right advice on how to start up equipment successfully.

With complex systems, we can support you from the beginning of the project through to the start-up phase.

Acid production systems need meticulous preparation in line with the safety standards. our team of system specialists can also provide you with support throughout this stage.



## PREVENTATIVE MAINTENANCE

Thanks to our know-how concerning our equipment and related materials, we can give you the best advice for your specific process.

We are able to suggest technical improvements to increase returns or extend the life of equipment. our R&D service and design office are able to develop made-to-measure solutions addressing the specific issues you face. We also deliver spare parts right around the world.

## CORRECTIVE MAINTENANCE

We are keenly aware that halting production has a serious impact on our customers' business. That is why we have a team of installation experts at our 16 after-sales centers around the globe on stand-by to repair defective equipment on site.

Thanks to their highly extensive product knowledge, they are able to make the right diagnosis and repair on site or in our local workshops.

## CONSULTING AND DIAGNOSTIC SERVICES

Standards are constantly changing and technical improvements are being made all the time. And so it is crucial for you to have a partner with the product and process know-how to be able to suggest adjustments in line with the latest market requirements. our team of process experts offer audits of our system installations and can recommend enhancements to keep production running as smoothly and efficiently as possible.



# SILICON CARBIDE SHELL & TUBES

## HEAT EXCHANGERS

**M**ERSEN DESIGNS AND MANUFACTURES BOTH SHELL AND TUBE AND BLOCK TYPE SILICON CARBIDE HEAT EXCHANGERS AT ITS AMERICAN AND EUROPEAN PRODUCTION SITES. SILICON CARBIDE IS ONE OF THE MOST CORROSION RESISTANT MATERIALS AVAILABLE FOR HEAT EXCHANGERS.

### SPECIALLY DESIGNED TO COMPLY WITH SEVERE PROCESSES

More than 300 units already in operation.

#### SUITABLE MARKETS APPLICATIONS :

SiC heat exchangers are resistant in severe environments such as sulfuric acid, phosphoric acid, HF, NaOH, HCl ...

#### CUSTOMERS BENEFITS :

- Gasket design
- Proven technology
- Cost-effective solution
- 10-years experience

#### KEY FEATURES : LARGE DESIGN OPTIONS

- Single or double "O" ring design
- Single fixed tube-sheet design
- Floating tubesheet design
- Double tube-sheet design
- Materials for construction for shell and headers
- Multi-pass process flow

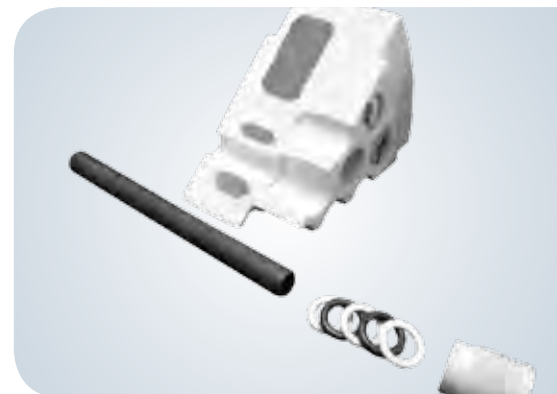
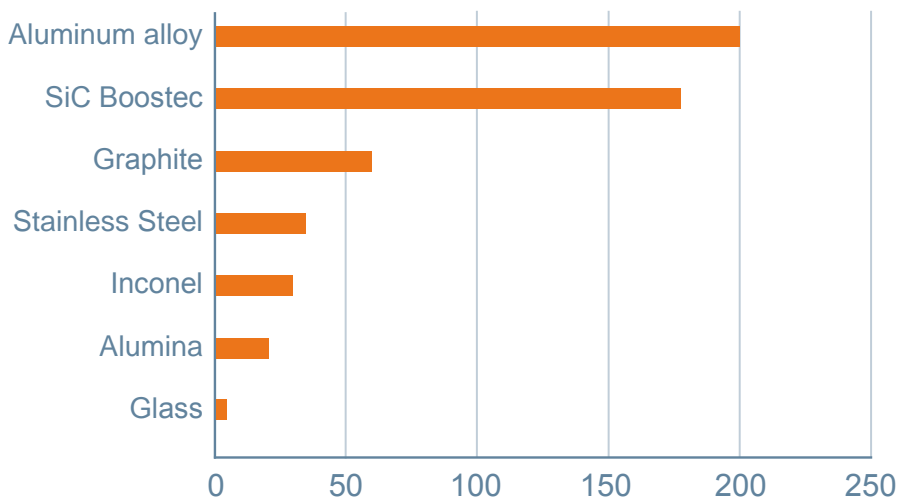
#### CONSTRUCTIONS

The Hexoloy® silicon carbide tubes are matched with Teflon® tubesheets for a combination of corrosion resistance and thermal performance that cannot be equaled by others materials in severe chemical applications.

#### SILICON CARBIDE : AN ADVANCED CERAMIC MATERIAL WHICH OFFERS THE FOLLOWING ADVANTAGES

- Chemicals resistance to strong acids, bases, oxidants and chlorinated organics
- Completely impervious without the use of any impregnants
- Non-contaminating for high purity applications
- Excellent thermal conductivity resulting in efficient heat transfer and immunity to thermal shock
- Excellent mechanical properties
- High erosion resistance allowing higher velocity and improved heat transfer

Thermal Conductivity (W. K-1. m-1)



# SILICON CARBIDE BLOCKS

## HEAT EXCHANGERS

**M**ERSEN BOOSTEC® IS MANUFACTURING SINTERED SILICON CARBIDE BLOCKS.  
SIC BLOCKS HEAT EXCHANGER IS THE BEST SOLUTION WHEN TANTALUM OR GRAPHITE XTH ARE NOT SUITABLE.

### MARKETS APPLICATIONS

- Condensers and evaporators for API and chemicals
- Acid recovery units
- Organic solvents
- Bromine

### CUSTOMERS BENEFITS

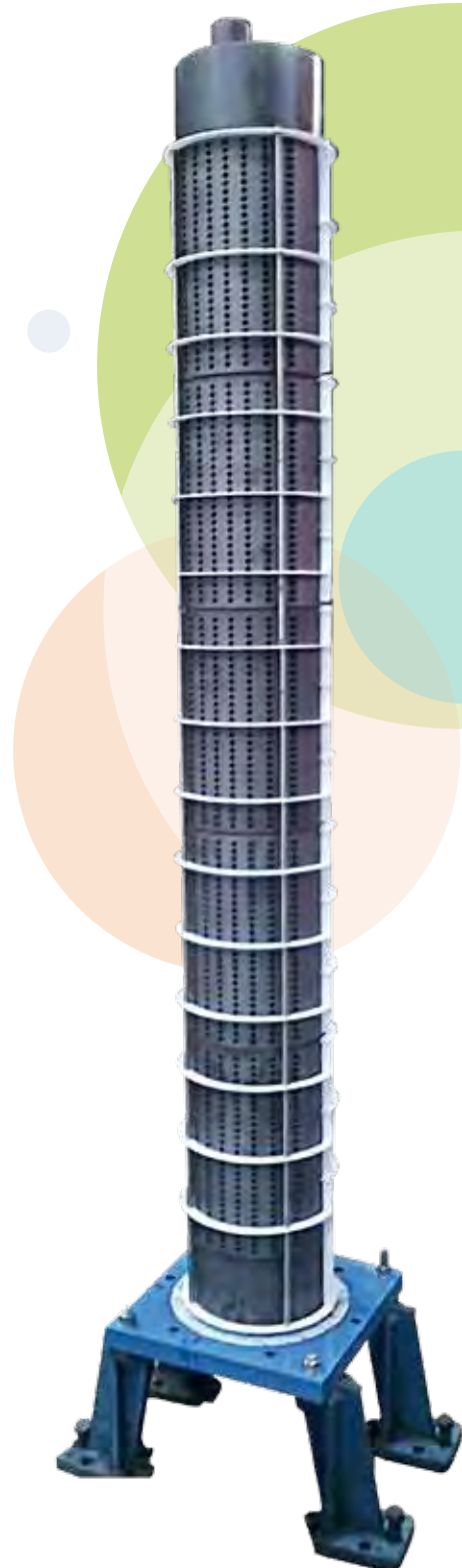
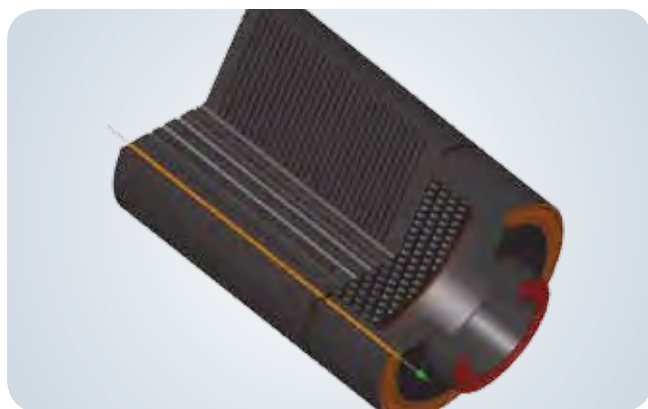
- Surface up to 35 m<sup>2</sup>
- No product contamination => suitable for API and cGMP requirements
- Universal corrosion resistance
- SiC high abrasion resistance allows higher fluid velocity
- Low fouling => low maintenance
- Low heat area => compact unit
- Raw materials produced within Mersen facilities
- Overall dimension of block heat exchangers compatible with existing graphite unit
- Block design validated.

### KEY FEATURES

- No free particles
- Block diameter up to 350 mm
- 1.8 mm < width between holes < 20 mm
- Design pressure / temperature : up to 25 bars
- Low roughness – Ra < 0.8 µm

### OPTIONS : TELL-TALE TO ENSURE SAFETY AND EASY CLEANING

- Preventing communication between streams : safety option in case of leakage.
- 2 FEP or Kalrez O'ring surrendering a 6 mm hole, this one is in direct contact with atmosphere
- Cleaning blocks allowing fast and easy cleaning



# METALLIC SHELL & TUBE

## HEAT EXCHANGERS

### HEAT EXCHANGER EXPERTISE SUPPORTED BY ENGINEERING CAPACITY

- Engineering capacity for thermal and mechanical design
- ASPEN, TASC+ software FEA
- New design or rerating of existing equipment
- Process know-how for many designs : straight tubes, U-bundle, kettle, coils, double tubes, smooth or corrugated tubes...

### WORLDWIDE INDUSTRIAL SITES

- Oxnard (USA)
- Linsengericht ( Germany)
- El Jadida (Morocco)
- Shanghai (China)

### MULTI-CONSTRUCTION CODES EXPERIENCE

- International standards: ASME, AS ADM, JIS, CODAP, RTOD, RCCM
- International certifications: ASME U stamp, PED, ISO 9001, ISO14001, OHSAS18001, SELO, KGS, GHOS-R
- Materials according to ASTM, EN, AS, GB standards

**Mersen is y**

whenever high-end projects, large equip and heat exchange for a metallic shell and



## our partner

materials, international  
ment, global presence  
expertise are required  
tube heat exchanger.



### UNRIVALED MATERIALS CHOICE WITH KNOW-HOW AND WELDING COMPETENCE

- Reactive metals : tantalum, zirconium, titanium
- Nickel alloys, stainless steel
- Carbon steel

### INDUSTRIAL CAPACITIES ESPECIALLY FOR LARGE EQUIPMENT

- Welding expertise : GTAW, GMAW, SAW, PAW, FCAW, SMAW
- In-house NDT : X ray, PT, UT, MT, PMI, helium leak test
- Equipment up to 240 tons

### INTERNATIONAL PROJECTS MANAGEMENT

- Project management system with a dedicated project leader
- Global procurement
- Manufacturing reporting
- Total quality management program

# METALLIC SHELL & TUBE

## HEAT EXCHANGERS

### CARBON STEEL, STAINLESS STEEL AND NICKEL ALLOYS EQUIPMENT



**85,000 m<sup>2</sup>**  
workshop in China

High-level industrial  
capabilities

International project  
management



#### MERSEN XIANDA : FOCUS ON LARGE CAPACITIES

Since the acquisition of Xianda in 2009, Mersen has repeatedly invested to maintain its position of having a state-of-the-art workshop in China. The whole entity covers a total surface area of 150,000 m<sup>2</sup> ground space with 85,000 m<sup>2</sup> of workshop area. The new production center is equipped with the highest-level industrial capabilities, such as a thermal treatment furnace for equipment up to 25 meters, automatic welding machines, X-Ray rooms for 20-meter length and 5m-diameter equipment, rolling machines (one of which can handle 120 mm thick material) together with several cranes with an accumulated capacity of 400 tons.



For many years, both international and local customers have acknowledged Mersen Xianda as a leading manufacturer, particularly for the supply and project management of large contracts. The design

office, bringing together more than one hundred highly skilled experts in design, process and projects management, applies its experience to demanding projects.

### CARBON STEEL, STAINLESS STEEL AND NICKEL ALLOYS EQUIPMENT

#### MERSEN MOROCCO

- Design and manufacture of equipment in reactive metals (Titanium, Stainless...)
- Machining, welding, metal construction
- After-sales service

#### Mersen Morocco

Multi-activities subsidiary located at 100 Kilometers from Casablanca

Plant area : **2 500 m<sup>2</sup>**

Land including building : **6 000 m<sup>2</sup>**





**Mersen Oxnard (USA)**

**Mersen El Jadida (Morocco)**

**Mersen Xianda (China)**



## ZIRCONIUM AND TITANIUM EQUIPMENT



**M**ersen is recognized as the world's number one supplier of zirconium columns, shell and tube heat exchangers and pressure vessels for the major producers of acetic acid.

**T**itanium is suitable for wet chlorine and chlorinated compounds, sea water and oxidizing acids. A long expertise in design and fabrication of reactive metal equipment combined with an international material sourcing policy allows Mersen to bring quality and

cost-effective solutions. Mersen manufactures zirconium and titanium heat exchangers in plants on three continents.

## TANTALUM EQUIPMENT

**M**ersen produces Tantalum heat exchangers in USA and in its dedicated 3000 m<sup>2</sup> workshop in Germany. Mersen, the home of Tantalum, is deemed to be the worldwide leader for the manufacture of Tantalum equipment.

The unique chemical and physical properties of Tantalum require know-how, specific equipment and highly trained people. A long experience in design, forming and welding Tantalum equipment combined with an international material sourcing policy allows Mersen to bring quality and cost-effective solutions.

Mersen has many reference lists for Tantalum bayonet heaters, U-tube heat exchangers, heating coils for columns, clad tube-sheets that are currently used in fields such as

- Hydrochloric acid
- Sulfuric acid
- Acid concentration
- Nitric acid
- Phosphoric acid
- Strong organic acids
- Bromine
- Pharmaceuticals
- Pickling baths



**Worldwide leader**  
for the manufacture of Tantalum equipment

**Dedicated Tantalum workshop**  
in Germany and USA

**Highly skilled welders**

Many reference lists for severe applications





## A GLOBAL PLAYER

Mersen is a global expert in electrical specialties and graphite-based materials

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