

AEROSPACE

Materials and solutions for high
temperatures and space optics

Electrical solutions for
motors and generators

Power electronics
cooling systems



MeRSeN

MERSEN

In the aerospace industry



A leading manufacturer of aerospace products

- As a worldwide supplier in the forefront of electric systems and high-performance materials, Mersen helps to improve a number of aerospace systems. We deliver solutions to the leading aircraft manufacturers, such as Airbus, Boeing and Embraer, and to the main subcontractors in the aerospace sector.

Expertise, Know-how and Experience

- These are the reasons why our customers come to us. They know that we deliver solutions that are controlled throughout the product's life cycle (development, manufacture of the materials, product design, quality control, distribution and technical expertise). We propose reliable solutions that have been tried and tested in the civil and military aerospace sector for many years.

Research and development policy

- We work hand-in-hand with our suppliers to develop innovative solutions in order to improve the performance of our customers' applications. Our research teams use sophisticated test benches to work on a number of development priorities in the aerospace sector in order to meet the demands of the market of the future.
- On all five continents, our technical staff proposes a global offer that includes technical support for the design of parts. We have local production capacity in the Mersen workshops all over the world and can guarantee on-site technical assistance.

Quality and the environment

- All our production sites all over the world are ISO-certified for quality and environment. In Europe, we also have EN9100-certified work-shops dedicated to the aerospace sector. This means that our customers are sure to receive products that are built to meet the strictest quality criteria, also in accordance with the applicable environmental standards.

Energy performance

- All our solutions contribute to the improvement of the efficiency of our customers' applications, by reducing weight, saving energy, cutting consumption and increasing reliability.



OUR HIGH-PERFORMANCE SOLUTIONS FOR THE AEROSPACE INDUSTRY

● Severe safety demands and extreme environments demand components and materials that are both reliable and resistant. Our solutions benefit from 100 years of experience with materials. We can rely on our knowledge to optimize the performance of applications, even under the most extreme conditions.

Resistance to extreme conditions of abrasion and temperature :

● Mersen's materials (carbon, graphite, composite, silicon carbide) can withstand the conditions in nozzles, rockets, turbojets and aircraft brakes.

Reliable components that meet extreme safety demands :

● Our EN 9100-certified design offices and workshops have acquired a unique know-how in the field of the mechanical components that guide, seal or hydraulically or electro-mechanically actuate aerospace systems.

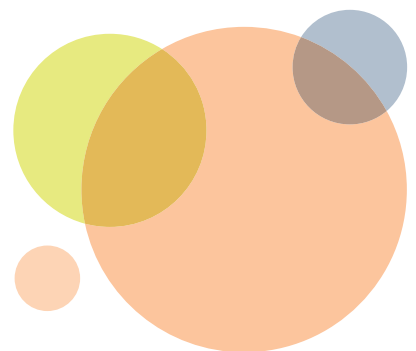
Mersen designs carbon brushes, brush-holders and slip ring assemblies that guarantee the optimal performance of aerospace applications, especially at high altitudes. Mersen's graphite grades are treated by impregnating resins and metal salts, or are enriched with molybdenum disulfide in order to behave optimally in rarefied atmospheres.

Weight savings

● It is essential to cut the weight of aerospace systems in order to save energy. Mersen can propose innovative solutions in the fields of composite materials, power electronics cooling systems and mechanical solutions to reduce friction, to all the major players in the aerospace sector.

Extreme precision for space optics

● In cooperation with EADS Astrium, Mersen is designing the new instruments to observe the Earth and the universe. The Boostec® silicon carbide offers outstanding dimensional stability for optical instruments in the space vacuum, thanks to its high rigidity, isotropic properties and low thermal expansion coefficient.



MERSEN IN THE AEROSPACE INDUSTRY

Carbon & Graphite SHAFT SEALS / DYNAMIC SEALS

- Works at high speeds without seizure
- Reduced operation gap / leaks under high temperature conditions
- Possible metal housing for easier integration into the system
- Self-lubricating properties
- No blocking when starting or stopping the system
- No seizing, even after long periods without use
- Possible on-demand design
- Reduced leaks thanks to the optimized design (overlaps, etc.)

Carbon & Graphite GUIDES / BUSHES (Pumps, jet engine blades)

- Self-lubricating properties to reduce friction torques
- Reduced wear
- No seizing, even after long periods without use
- Operates at temperatures of up to 650°C
- Compatible with most aerospace fluids
- Can be impregnated for increased service life
- Can be shrunk-fit for easier integration into the system

C/C Composite BRAKES / TORQUE LIMITERS

- Stable friction coefficient
- Reduced wear thanks to the use of composite materials
- High friction coefficient
- Dry or lubricated operation
- Low- and high-energy braking

CARBON PUMP VANES

- Self-lubricating properties
- No blocking when starting or stopping the system
- Can be impregnated for increased service life
- Dry or lubricated operation at high speeds

CARBON BRUSHES

- Four types of graphite grades
 - > Impregnated electro graphite (resins/metal salts)
 - > Electrographite with MoS₂ cores
 - > Carbon graphite enriched with MoS₂
 - > Copper graphite enriched with MoS₂
- Tried and trusted riveting techniques
- Wear detection system

BRUSH-HOLDER / SLIP RING ASSEMBLIES

- Customized solutions
- Good mechanical stability
- Optimal guidance of the brush
- Optimized distribution of the electric current
- A selection of quality materials

POWER ELECTRONICS COOLING SYSTEMS

Air Heatsink

- Optimized fin assembly technology (Swaging process)
- High cooling performances
- Weight saving benefit

Liquid-cooled heatsink

- Tailor-made optimized solution using aluminum vacuum-brazing process
- High thermal performances
- High pressure withstanding
- High reliability and lifetime

Auxiliary motors : pumps, fans, seats, de-icing, APUs



Pump carbon brush



Brush-holder

Electrical power generation and distribution

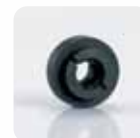


Air heatsink



Liquid-cooled heatsink

Bearing / Guide



Pump vanes



Dynamic seal



Fluid controls : aviation fuel, oil, etc.



Shaft seal

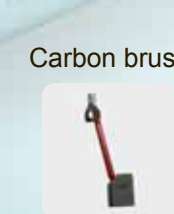


Dynamic seal

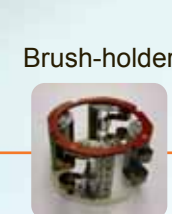


Bearing / Guide

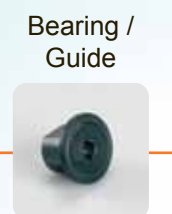
Air conditioning



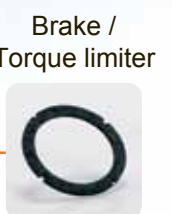
Carbon brush



Brush-holder



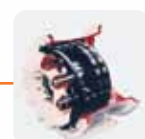
Bearing / Guide



Brake / Torque limiter

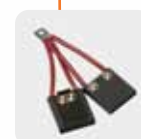
Actuation

Brakes

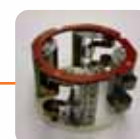


Braking system with C/C composite discs

Starter / Generator



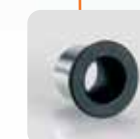
Starter carbon brushes



Brush-holder



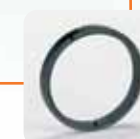
Slip ring assembly



Vane guide

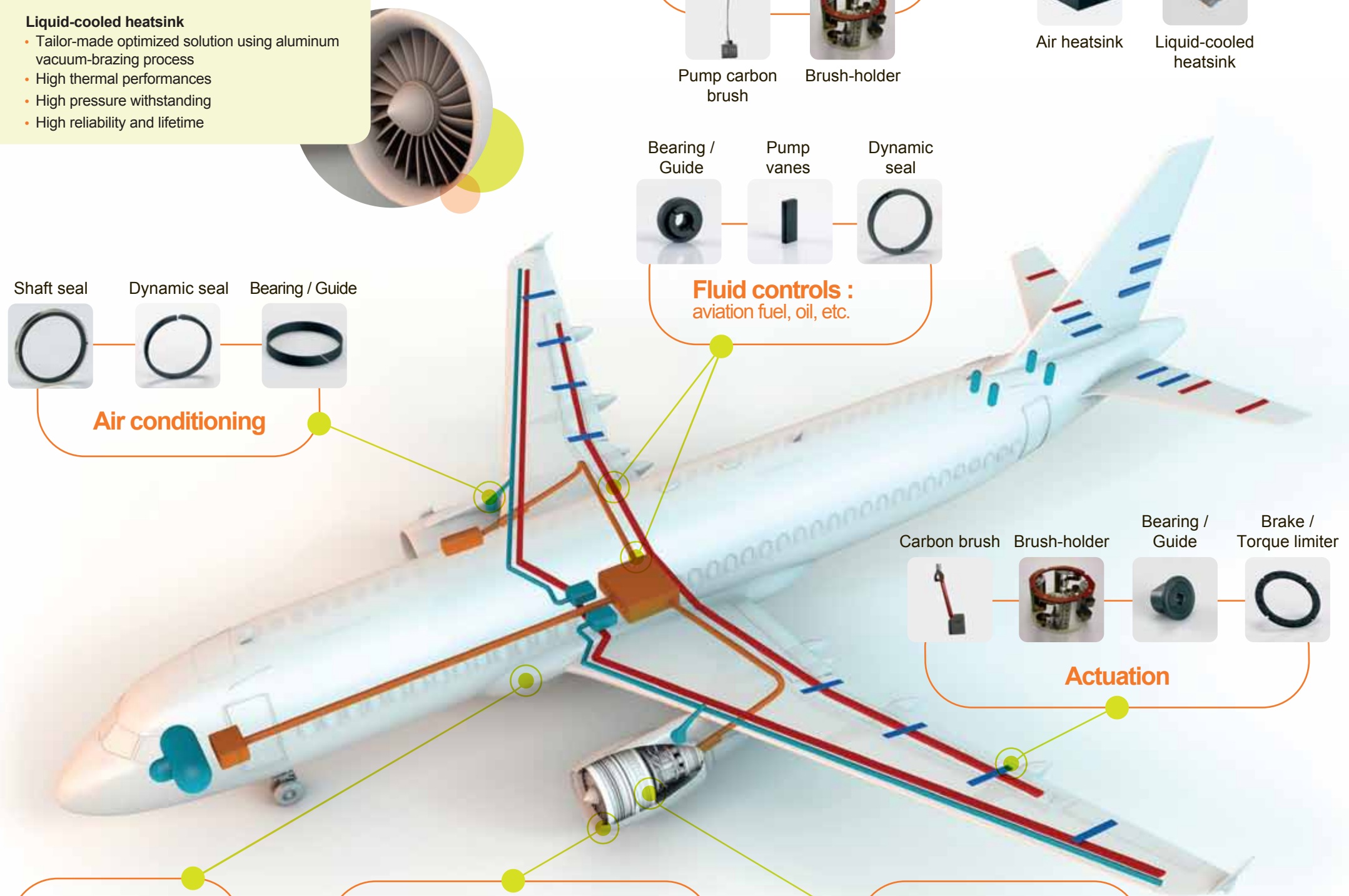


Shaft seal



Dynamic seal

Engine components

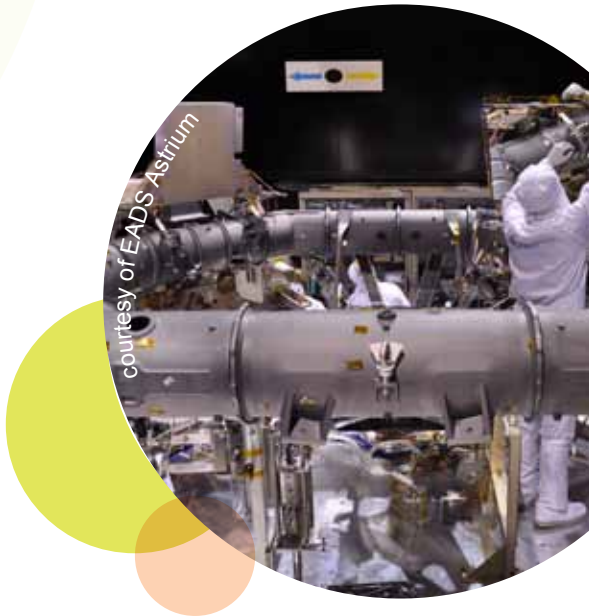




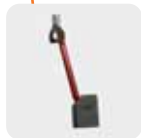
Space optics instrumentation

SPACE OPTICS INSTRUMENTATION

Boostec® silicon carbide is used in the EADS Astrium observation satellite projects to design ultra high-performance optical systems. This material thermal and mechanical stability is exceptional in the space vacuum. The mirrors on the Herschel observation satellite are made entirely of this material. The annular structure (diameter of 3 meters) of the GAIA observation satellite (launching in 2012 to map one billion stars in the Milky Way) is based on a unique assembly technique.



Satellite actuation : solar panels



carbon brush



Brush-holder



Brake / Torque limiter

Fuel supply



Pump carbon brush



Brush-holder

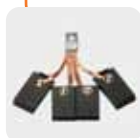


Bearing / Guide



Shaft seal

Engine components



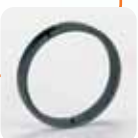
Start carbon brushes



Brush-holder



Shaft seal



Dynamic seal

The properties of Boostec® material

Density	3.15 g/cm ³
Young's modulus	420 GPa
Resistance to bending / Weibull modulus	400 MPa / 11
Breaking strength	3.5 MPa.m ^{1/2}
Coefficient of thermal expansion	2.2 . 10 ⁻⁶ /K
Thermal conductivity	180 W.m/K

REFRACTORY COMPONENTS FOR NOZZLES

- Resistance to abrasion of the carbon/carbon composite
- High density of the isomolded graphite
- Can withstand temperatures up to 3,000°C

CARBON BRUSH / BRUSH-HOLDER SYSTEMS

- Carbon brushes**
- Specific carbon-silver grades with solid lubricant cores
 - Tried and tested riveting techniques
 - Wear detection system

- Brush-holders**
- Customized solutions
 - Good mechanical stability
 - Optimal guidance of the brush
 - Optimized distribution of the electric current

Carbon & Graphite GUIDES

- Self-lubricating properties
- Stable behaviour at high temperatures and in cryogenic environments
- Possible impregnation to extend the service life and/or reduce wear

C/C Composite BRAKES / TORQUE LIMITERS

- Stable friction coefficient at high temperatures and in cryogenic environments
- Reduced wear thanks to the use of composite materials
- Wide range of friction coefficient
- Dry or lubricated operation

Carbon & Graphite SHAFT SEALS / DYNAMIC SEALS

- Work at high speeds without seizure
- Reduced operation gaps and leaks at high temperature
- Possible metal housing for easier integration into the system
- Self-lubricating properties
- No blocking when starting or stopping the system
- No seizing, even after long periods without use
- Possible on-demand design
- Reduced leaks thanks to the optimized design (overlaps, etc.)



MERSEN
Expertise, our source of energy



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