SEPCARB®
3D CARBON/CARBON COMPOSITE

HEAT TREATMENT FIXTURES

PRODUCTS EQUIPMENTS & SERVICES
Airbus Safran Launchers was created from the desire of the Airbus and Safran Group to take the European space industry to the highest possible level.

Airbus Safran Launchers develops and supplies innovative and competitive solutions for civil and military space launchers. Prime contractor for the Ariane 5 and Ariane 6 launcher families, as well as for the missiles in the French oceanic deterrent force, the company’s expertise encompasses state-of-the-art launch and propulsion system technologies.

Leveraging its core business technologies and competences, Airbus Safran Launchers also offers a wide range of derived products, equipments and services for numerous sectors, such as automobile, aerospace, defense and nuclear engineering.

Airbus Safran Launchers is a joint venture equally owned by Airbus Defence and Space and Safran.

For more than 40 years, Airbus Safran Launchers has developed and manufactured a broad range of high-temperature composite materials for the aerospace, energy, automotive and other industries.

Sepcarb® is our high-performance 3D carbon/carbon composite material. Sepcarb® tooling is used for high-temperature processing of aerospace and automotive components. Over 1,000 tons of Sepcarb® are produced annually in European and North American plants.

Sepcarb® is the ideal tooling material for brazing, annealing, carburizing and quenching of high-performance metals in vacuum or inert atmosphere furnaces.

Airbus Safran Launchers is your partner in the design and fabrication of tooling and equipment for high-temperature applications.

Choose Sepcarb® to improve your productivity.
The exceptional characteristics of Sepcarb® carbon/carbon composite make it the ideal material for tooling used in heat treatment, low-pressure carburizing, annealing and brazing applications of metals. Sepcarb® significantly outperforms graphite and refractory alloys in these very demanding thermal processes.

SEPCARB® EQUIPMENT PROVIDES THESE MAJOR BENEFITS:

- Higher-efficiency and more secure processing
- Reduction of rejected parts and production quality improvements
- No tooling deformation, allowing robotic automation
- Zero creep, providing extended service life
- High temperature capability, allowing higher processing temperatures and shorter cycle times
- Reduced maintenance costs
- High resistance to fatigue and to mechanical and thermal shock
- Low mass for easier handling
- Low thermal inertia, reducing power consumption and cycle duration, and decreasing production costs
- High resistance to corrosive chemicals
- Large range of dimensions available

One-piece plate up to Ø 2300mm/90°
Sepcarb® is a composite of carbon fibers and a carbon matrix which bonds the fibers together and distributes the load evenly. Both the carbon fibers and the carbon matrix are resistant to extremely high temperatures. The precise distribution and combination of these components provides Sepcarb® with exceptional lightness, outstanding resistance to thermal shock, and stability of mechanical properties at temperatures up to 2700°C. The result is perfectly consistent operational behavior, unmatched reliability and extended service life. These properties make Sepcarb® the ideal tooling material for a very wide range of applications.

In contrast with 2-dimensional (2D) carbon/carbon products, Sepcarb® H01 is highly delamination-resistant. This results from its patented 3D architecture, combined with the chemical vapor infiltration (CVI) process used in its manufacture. The CVI process enables the formation of an extremely pure and homogeneous carbon matrix within the fiber architecture. This process yields an optimal matrix-to-fiber cohesion, providing excellent mechanical properties and thermal stability. Materials and parts are manufactured using proven industrial processes. Manufacturing capabilities exceed 2 meters x 3 meters (80” x 120”). A wide variety of geometries can be fabricated including (but not limited to) plates, cylinders, tubes, discs, cones and beams, as well as complex shapes with thicknesses of less than one millimeter to several centimeters.

With an average density of 1.5, Sepcarb® is the ideal material for heat treatment fixturing to be used in vacuum and inert atmosphere furnaces operating up to 1300°C (2370°F) or higher.
The main properties of Sepcarb® include its exceptionally low density, outstanding resistance to thermal shock and corrosion, stability of mechanical properties at temperatures up to 2700°C (4890°F), high resistance to fatigue and total absence of creep.

The following tables compare the mechanical properties of Sepcarb® with those of graphite and refractory alloy.

The properties of standard-grade Sepcarb® 3D carbon/carbon material are provided below as indicative values.

<table>
<thead>
<tr>
<th>Density</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C</td>
<td>25</td>
</tr>
<tr>
<td>Tensile strength t,r (MPa)</td>
<td>100</td>
</tr>
<tr>
<td>t,r (%)</td>
<td>0.6</td>
</tr>
<tr>
<td>Eo (GPa)</td>
<td>30</td>
</tr>
<tr>
<td>Interlaminar shear strength Tl (MPa)</td>
<td>22</td>
</tr>
<tr>
<td>V (%)</td>
<td>1.3</td>
</tr>
<tr>
<td>G (GPa)</td>
<td>5</td>
</tr>
<tr>
<td>Thermal expansion (%)</td>
<td>0.2</td>
</tr>
<tr>
<td>Heat capacity (J Kg⁻¹ K⁻¹)</td>
<td>800</td>
</tr>
</tbody>
</table>
The following table provides a qualitative comparison of SepCarb® carbon/carbon, graphite, and refractory alloy. In addition to usage guidelines, the table illustrates the benefits and advantages of carbon/carbon.

<table>
<thead>
<tr>
<th></th>
<th>SepCarb® carbon/carbon</th>
<th>Graphite</th>
<th>Refractory metal</th>
<th>Carbon/carbon benefit</th>
</tr>
</thead>
</table>
| **Weight**               | Density 1.5            | Density 1.8 | Density 5 to 10 times higher than c/c | - Easy handling,  
- Increased worker safety,  
- Easier storage,  
- Lighter loads yield reduced maintenance costs, less down-time. |
| **Thermal resistance**   | Excellent              | Excellent (but mechanical strength is 4 times less than c/c) | Performance characteristics reduced at 1000°C (1832°F); completely lost above 1100°C (2012°F) | Permits a lighter, more robust design. |
| **Creep**                | Excellent              | Excellent | Poor             | No deformation – permits robotic automation of loading / unloading. |
| **Thermal shock resistance** | Excellent        | Fair     | Poor             | Stands up to shorter heat/quench cycles; increases productivity. |
| **Mechanical shock resistance** | Very Good     | Very Poor | Excellent          | Due to its composite make-up, c/c is not brittle (as are graphite and ceramic). It is therefore very suitable for intensive use. |
| **Energy saving**        | Excellent              | Fair     | Poor             | Carbon/carbon fixturing has much less thermal inertia than graphite and metal. Up to 3 times less energy is required for heating. Heating and cooling cycles are shortened. |
| **Safety**               | Excellent              | Fair to Poor | Fair to Poor | Lighter carbon/carbon fixturing makes handling easier, faster and safer. |
| **Protecting the environment** | Excellent | Poor     | Poor             | Less energy used = reduced environmental impact. |
HEAT TREATMENT FIXTURES

Additional applications, designs, geometries and dimensions upon request
CARBURIZING FIXTURES

600 x 450 x 600 mm³
24" x 18" x 24"

900 x 600 x 600 mm³
36" x 24" x 24"

1000 x 600 x 600 mm³
40" x 24" x 24"

Ø 500 mm - H 900 mm
Ø 20" - H 36"

Ø 500 mm - H 900 mm
Ø 20" - H 36"

500 x 600 x 600 mm³
20" x 24" x 24"

1000 x 600 x 600 mm³
40" x 24" x 24"

Additional applications, designs, geometries and dimensions upon request
FURNACE BASES

Additional applications, designs, geometries and dimensions upon request

SPECIALIZED HARDWARE

Additional applications, designs, geometries and dimensions upon request
DISCLAIMERS

1 - BROCHURE CONTENTS DISCLAIMER

All information in this brochure is based on Airbus Safran Launchers data that were currently available at the time of production. The brochure provides general information on Airbus Safran Launchers products and product applications.

The product data given in this brochure are typical values and are not guaranteed.

The product applications in this brochure are examples only. In addition to using your own discretion and judgment, please consult with Airbus Safran Launchers in order to establish the appropriateness of our products for your applications before use, and follow up with an assessment of product performance, behavior and safety.

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