



Graphilor® 3

The isostatic impregnated graphite

www.serviceprocess.net

Service Process Equipment, Inc.

PO Box 850908

Mobile AL 36685-0908

251.342.1313 Fax

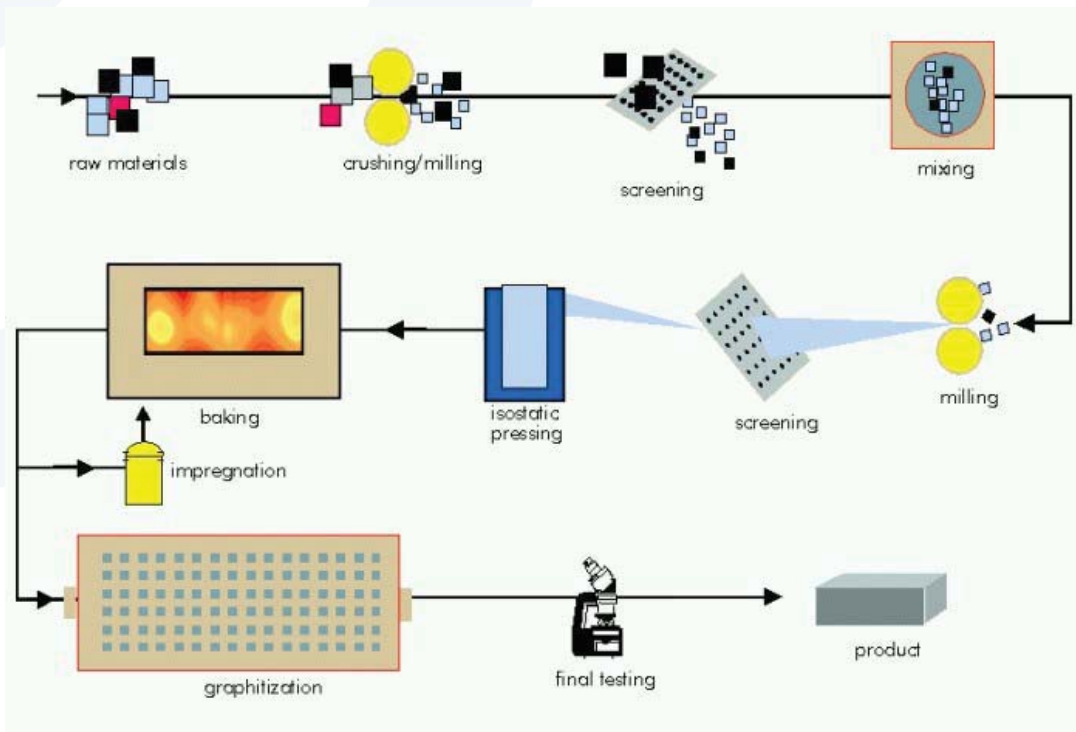
251.342.1377

Email msellers@serviceprocess.net

1. Graphilor® 3 - impregnated isostatic graphite with ultra-fine grain structure

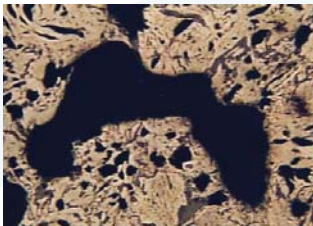
- Mersen produces an ultra-pure grade of graphite providing optimum resilience to extreme temperatures (up to 3,000° C).
- Graphilor® 3 is Mersen's trade mark for impregnated graphite, resulting from the combination between ultra-fine grain graphite and its proprietary resin impregnant
- Key advantages of Graphilor® 3:
 - High resistance to corrosion
 - Resistance to temperature and thermal shock
 - High mechanical resistance
- Mersen is using 2 different processes:
 - Isostatic pressing for blocks and tubesheets
 - Extrusion for tubes

2. Graphite manufacturing process: Ultra-fine grain graphite Manufacturing Process



Extrusion, the alternative process for graphite manufacture

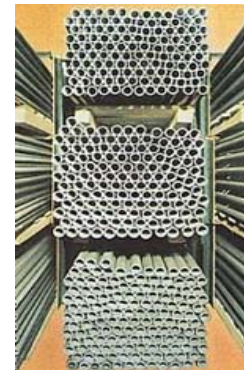
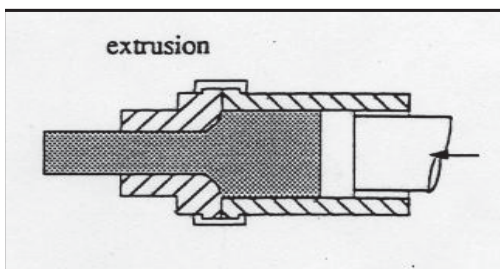
- Most applications that use extruded graphite (block & cylinder manufacturing) do not require high mechanical properties and low porosity (see below picture), unlike isostatic graphite.
- Extruded graphite is generally used for producing electrodes for metallurgy.



Most other suppliers (competitors) of graphite equipment used to make equipment in the chemical industry use extruded graphite as their raw materials

Mersen Graphite extruded tubes

- Mersen graphite tubes are manufactured by an extrusion process, up to 6 meters without a splice (joint), thus making the longest, strongest tube on the market
- Mersen graphite tubes have the same properties as ultra-fine grain isostatic rods
- To enhance higher performance material, Mersen has mastered in-house all the production stages specifically :
 - Baking
 - Graphitization



3. Graphite transformation into Graphilor®3:

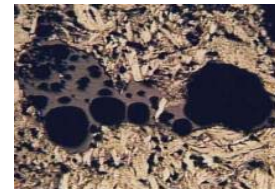
Isostatic
graphite



+ *Specific resin
impregnant*

(*Impregnation
process*)

= Graphilor® 3



Graphite Strengths

- Excellent thermal conductivity
- Excellent corrosion resistance
- Good Mechanical resistance

Graphite Weaknesses

- Porosity



Graphilor® 3 Strengths

- Excellent conductivity
- Corrosion resistance depending on the selection of impregnant
- Air tightness
- Reinforced mechanically

End Machining after impregnation

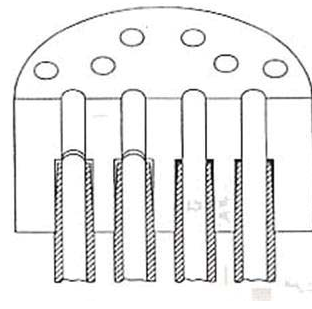
Blocks

- End machining to the final dimensions
- Gasket Sealing area machining
- Graphite baffle cementing



Tubes

- Cut to the dimension.
- Bond together with AN cement if the required length of the tube is more than 6 meters
- Machining of tubes ends before cementing to the tube sheet



New development : cleaning for tubes

- Mersen carried out tests early in 2009 on existing machinery to clean the tubes both internally and externally.
- Mersen has now a new fully automatic brushing machine and can now propose the cleaning step as a standard for all tubes.
- **Features** : better visual aspect & improvement to the thermal conductivity.



Tests on impervious graphite

Tightness tests 100% control

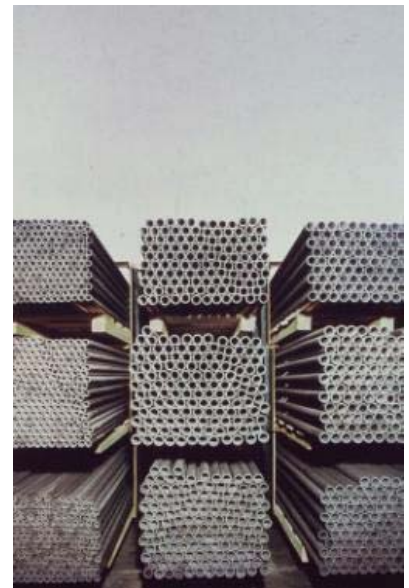
- **Blocks BS, XBS & XC and XBS Tubes are controlled 9barG air under water**
→ highest control level
- **Blocks XTH are controlled 6barG air under water**
 - Full tightness is guaranteed by Mersen
- **Tubes XBS are controlled 20barG air under water (mechanical) and 9barG water (tightness)**

Statistic tests

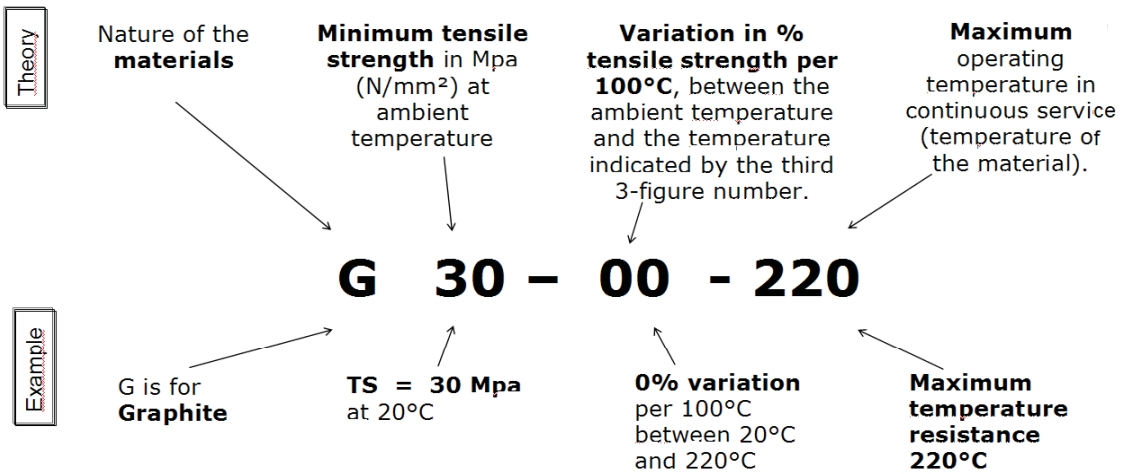
- **Blocks**
 - Mechanical control through graphite samples (tensile strength)
 - Graphite properties control : density with and without impregnation
- **Tubes : Resistivity and Flexural strength**

Graphilor® 3 for tubes

- Tubes are made with Graphilor® 3 XBS
 - Graphite grade X – ultra-fine grain
 - Resin Phenolic
- Temperature : 220° C
- High mechanical strength : all our tubes are homologated G30-00-220 which is the highest available in the market
- Single proprietary manufacturing center for tubes with tight QC



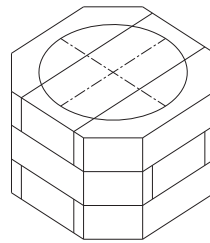
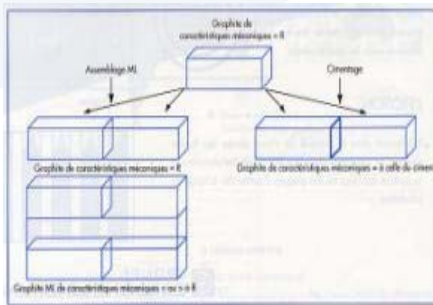
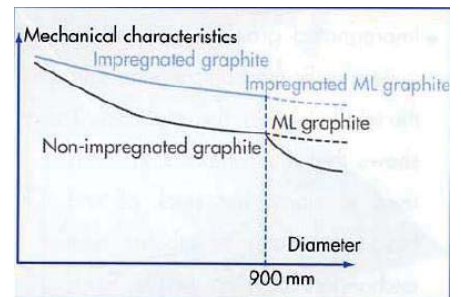
TUV Homologation



Option - Graphilor® ML

Graphilor® ML suitable for large diameters up to 82”

- High mechanical resistance
 - Much better than monolithic graphite in large diameter
 - Similar to small diameter properties
- Low resin content → no cementing



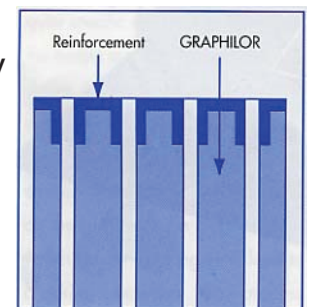
Option – Rigilor®

Rigilor® is used for large blocks and tubesheets

Main feature

Abrasion resistance x 6

- Strengthening of graphite parts by means of a carbon fiber based layer
- Impregnation after applying the Rigilor® coating provides excellent homogeneity of the material with the same properties as graphite
- Mechanical resistance x 2
- Phosphoric acid evaporator : tubesheets are reinforced by Rigilor® fibers and amorphous carbon sleeves to increase the lifetime.



Option : tubes reinforced with carbon fibres

- Mersen developed wrapped tubes to enlarge its portfolio
- External brushing before wrapping to improve adherence of fibre.
- Pre-impregnation of the carbon fibre Phenolic resin (same used for tube impregnation).
- Automatic polymerization by catalyst.
- Tubes available up to 6 meters without a splice

