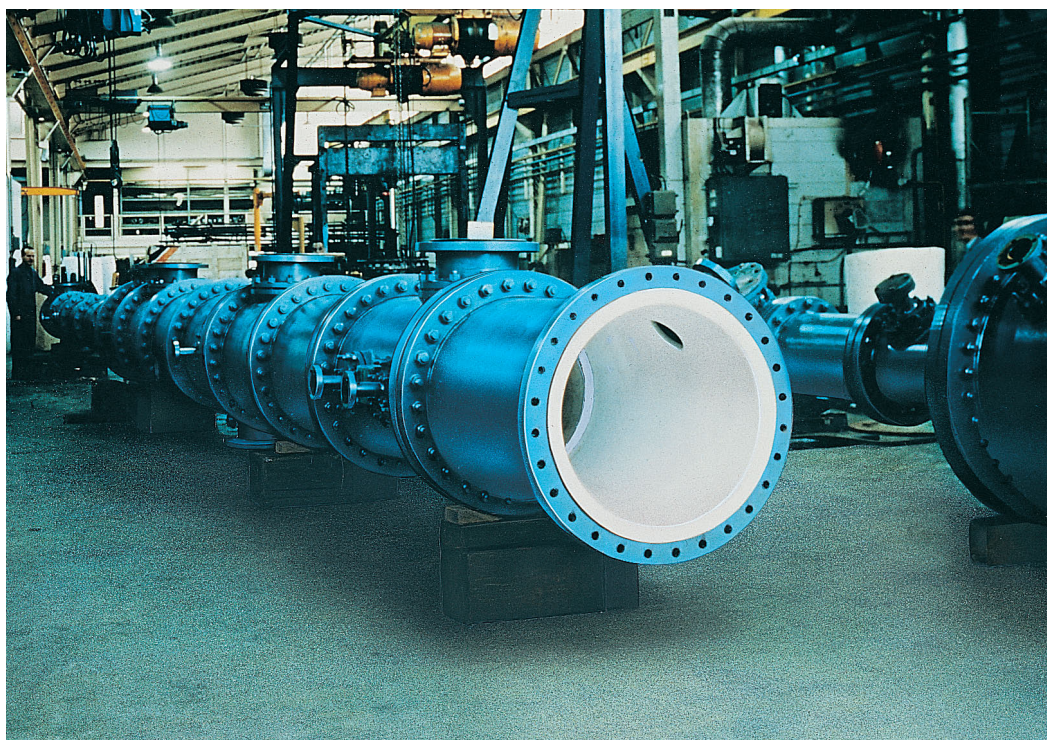


ISO 9001

VESSELS and COLUMNS

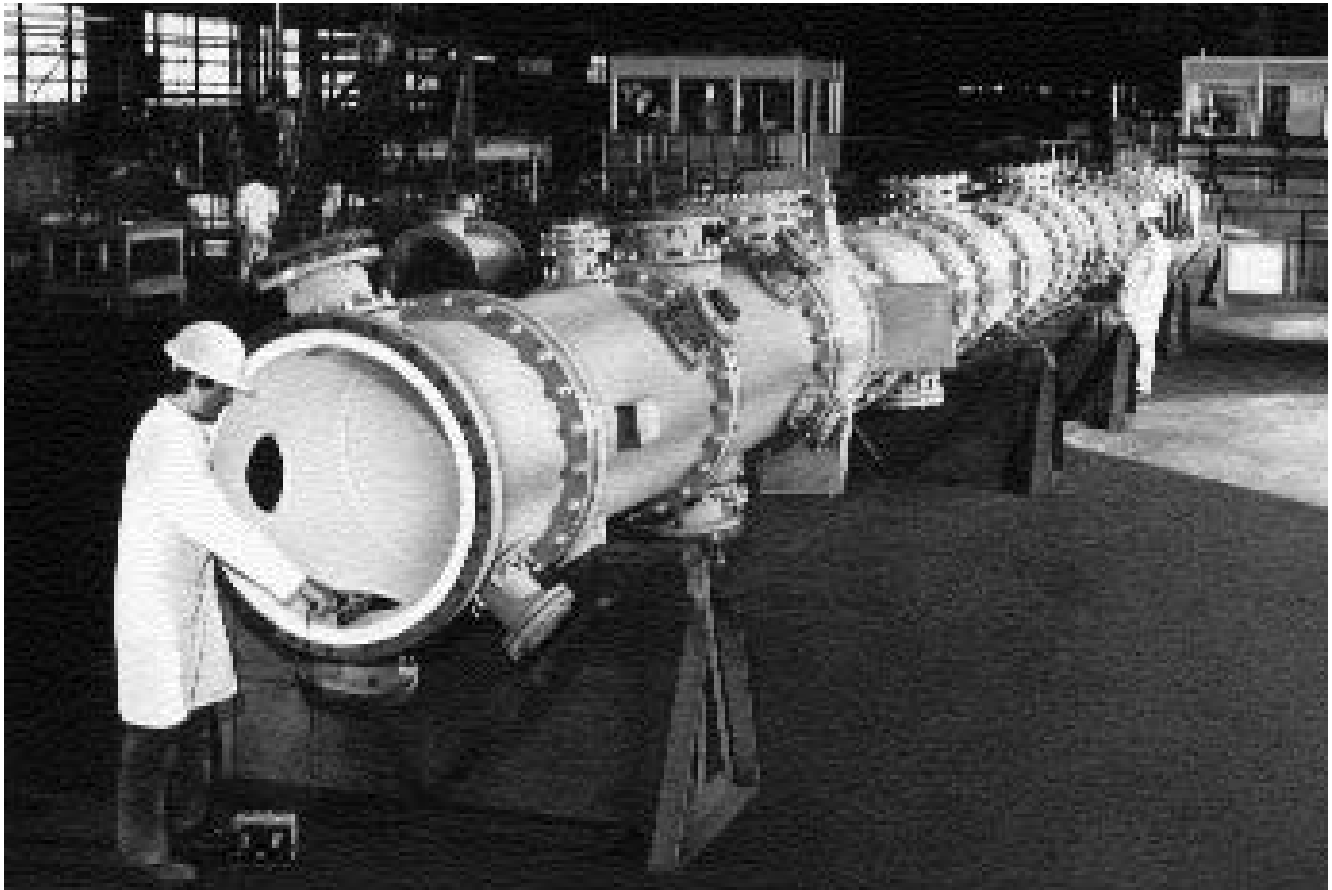
ARMYLOR®
GRAPHILOR®
RIGILOR



VESSELS and COLUMNS

Summary

- Applications
- Types of equipment
- Construction materials:
 - ARMYLOR®
 - GRAPHILOR®
 - carbon fibre RIGILOR composites
- Design:
 - Characteristics
 - Codes of construction
 - Certificates
- Column internals

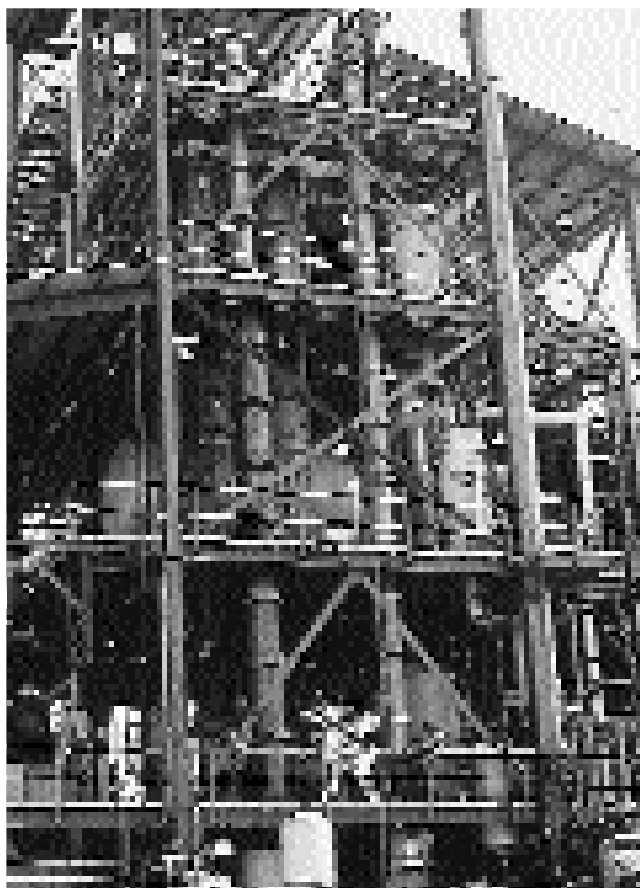


ARMYLOR® GRAPHILOR® RIGILOR

ARMYLOR, GRAPHILOR and carbon fibre RIGILOR composites offer reliable and profitable solutions to corrosion problems for reactors, columns and vessels used in the processes of the organic and inorganic chemical industries as well as in the pharmaceutical and food industries.

Applications

- Treatment of active carbons polluted with acid products.
- Desorption of halogenated acids.
- Absorption of halogenated acids.
- Distillation and purification of halogenated organic products.
- Washing gases or corrosive effluents.
- Drying with sulfuric acid synthesised ethanol and viscose.
- Neutralisation and treatment of corrosive effluents.
- Manufacture of bisphenol.
- Chlorine absorption/desorption in the manufacture of carbon tetrachloride.
- Reactors for the manufacture of artificial emeralds.
- Purification of rare earths.
- Distillation, purification, rectification of chemical intermediates for the pharmaceutical industry...



Types of equipment

ARMYLOR, GRAPHILOR and carbon fibre RIGILOR composites are used in the manufacture of:

- Tray or packed columns,
- Pulverization or cascade columns,
- Trays for brick or glass lined columns,
- Distributors, recentering plates, heating or cooling elements, condensers,...
- Reactors with agitators and heat exchange elements,
- Separators, accumulators, storage vessels, intermediate or plug vessels,
- Shells, heat exchange chambers and headers,
- Static decanters,
- Filters for treatment of active carbons,...

Construction materials

CARBONE LORRAINE uses three main types of materials in the construction of vessels and columns:

ARMYLOR
GRAPHILOR
carbon fibre RIGILOR composites

ARMYLOR®

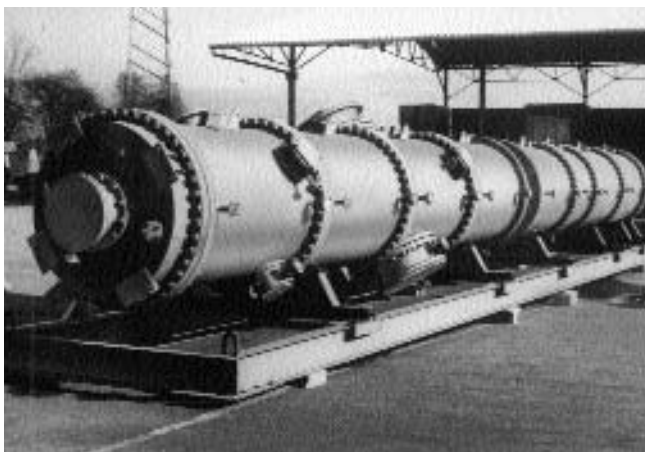
ARMYLOR combines a steel shell with a loose, **thick, non-welded PTFE* lining**. ARMYLOR has been manufactured by CARBONE LORRAINE since 1964; its proficiency is supported by a list of references which can be supplied on request.

ARMYLOR REACTORS, VESSELS and COLUMNS are manufactured in diameters up to 1,050 mm (42") they can be used between

- 50°C and + 230°C,
up to 8 barg

and offer the following characteristics:

- **Total corrosion resistance** to all known chemical agents except molten alkaline metals, amidures and high temperature fluorine,
- **Excellent mechanical resistance** to shocks, fatigue wear and thermal shocks.



Exceptional reliability and life time resulting from:

- **The material design which associates the resistance of steel** to that of **thick PTFE** (up to 5 mm),
- The manufacturing process which uses **non-welded PTFE** made from fine powders (paste extrusion),

- **Very strict inspection control** on PTFE and steel (physical, chemical and mechanical characteristics are checked during processing, as is the finished product):
 - on raw materials: purity, extrusion properties and shelf life,...
 - on the lining: thickness, elongation, rupture strength, density, permeability, flexural strength,
 - on steel: dimensional inspection, hydraulic test, radiography, magnetoscopy, etc. are optional,
 - on lined elements: dimensional inspection, electrostatic test at 15 kV, pressure test, permeability to helium, cyclic test (air) high temperature steam test.



* PTFE is marketed under different registered trade names: Algaflon (MONTECATINI), Fluon (I.C.I.), Hostaflon TF (FARBWERKE HOECHST), Teflon (DU PONT DE NEMOURS).

GRAPHILOR®

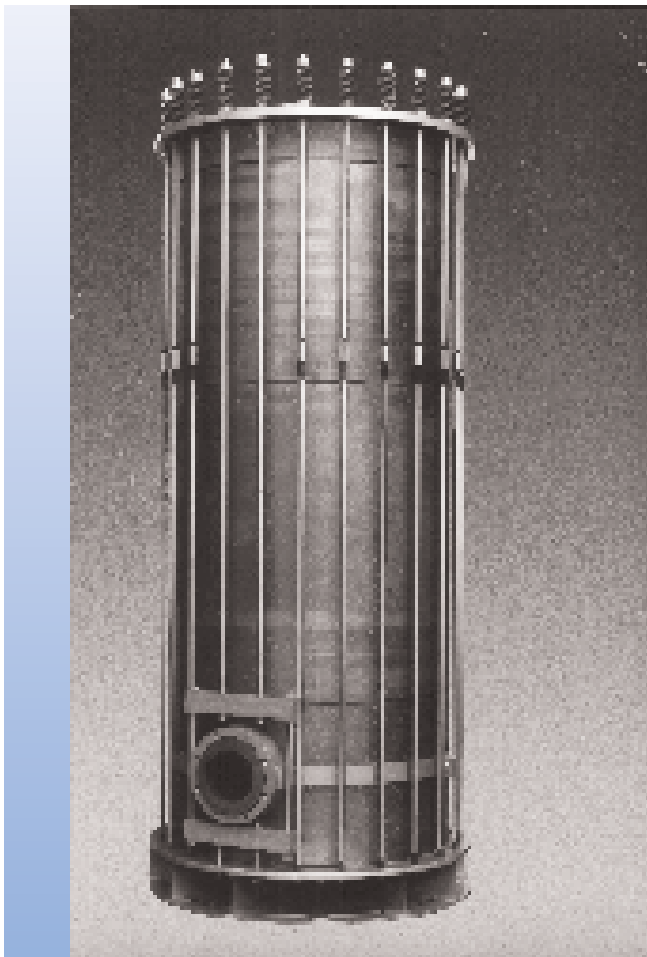
GRAPHILOR is the trade name for impregnated graphite manufactured by CARBONE LORRAINE since 1952 specifically for the chemical industry. Several grades are available, the choice depending on the application. For further information, our GRAPHILOR leaflet GCA 15 and corrosion chart GC 5 are available on request.

The characteristics of the different grades of GRAPHILOR include:

- excellent corrosion resistance to all acids (except very strong oxidizing acids) HCl, H₂SO₄, HF, H₂SiF₆, H₃PO₄, monochloroacetic acid HCOOH, ..., halogenated aromatic, aliphatic or sulphonated organics,...
- resistance to thermal shock,
- ability to withstand maximum temperatures ranging from 165°C to 185°C, according to the grade of GRAPHILOR.

Exceptional reliability and life result from:

- designing the equipment to take advantage of the excellent compression strength of the material,
- fabrication processes which take maximum advantage of the properties of the graphites, impregnation techniques and materials,



- strict inspection procedures for materials and finished products:
 - for graphite raw materials: density, resistivity, porosity, ash content, flexural strength, dimensions,
 - impregnated products: density, polymerisation index, flexural strength, tensile strength, dimensions, imperviousness.
 - on finished products: dimensional inspection, imperviousness.

Carbon fibre RIGILOR composites

CARBONE LORRAINE has been manufacturing carbon fibres since 1956 and has developed several carbon fibre composite materials for advanced technology applications, which are marketed under different trade marks.



Based on this experience, it has been possible to apply these composites to the chemical industry, associating the exceptional mechanical properties of fibres to the corrosion and temperature resistance of GRAPHILOR.

Column internals such as distributors, trays, recentering plates, grids and bubble caps are manufactured from these composites, offering unequalled lightness and mechanical resistance.

Derived from products used in the aerospace industry, these components are subjected to very strict inspection procedures:

- mechanical resistance,
- density,
- polymerisation,
- dimensional and functional characteristics according to the application,...

Characteristics

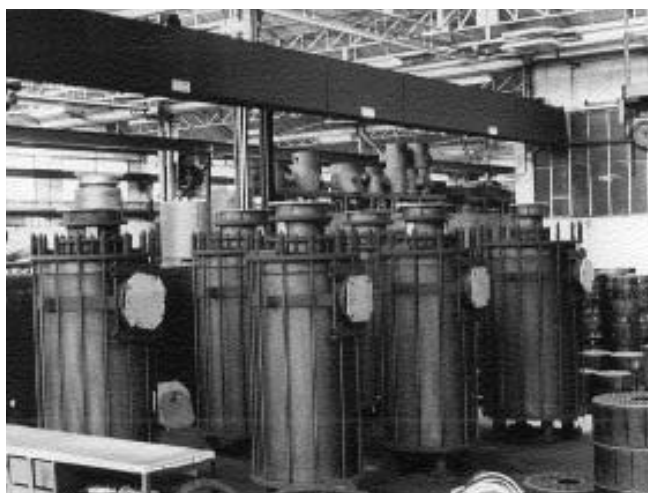
CHARACTERISTICS \ TYPE	ARMYLOR	GRAPHILOR
Maximum diameter (mm)	1,050	≤ 1,000 monolithic > 1,000 jointed elements
Maximum length of sections	varies according to diameter	
Maximum operating temperature (°C)	230	165 to 185 according to material
Maximum operating pressure (barg)	varies according to diameter: up to 8	varies according to diameter
Internals	PTFE GRAPHILOR RIGILOR	PTFE GRAPHILOR RIGILOR
Gaskets	impervious without gasket	raw PTFE
Ends	flats and bolted	flat with gaskets or cemented joints

Construction codes

ARMYLOR or GRAPHILOR vessels and columns can be manufactured to conform to various codes (ASME, TÜV, SNCT, ANCC,...)... However it should be noted that some construction codes limit the use of impregnated graphite with reference to operating pressure, volume of equipment and operating conditions.

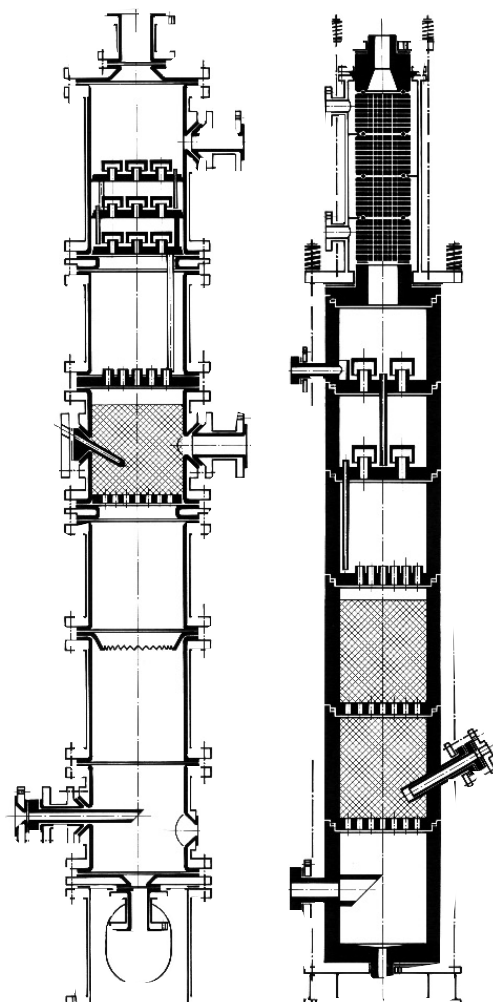
Certificates

CARBONE LORRAINE can supply material, test and control certificates if requested when the order is placed.



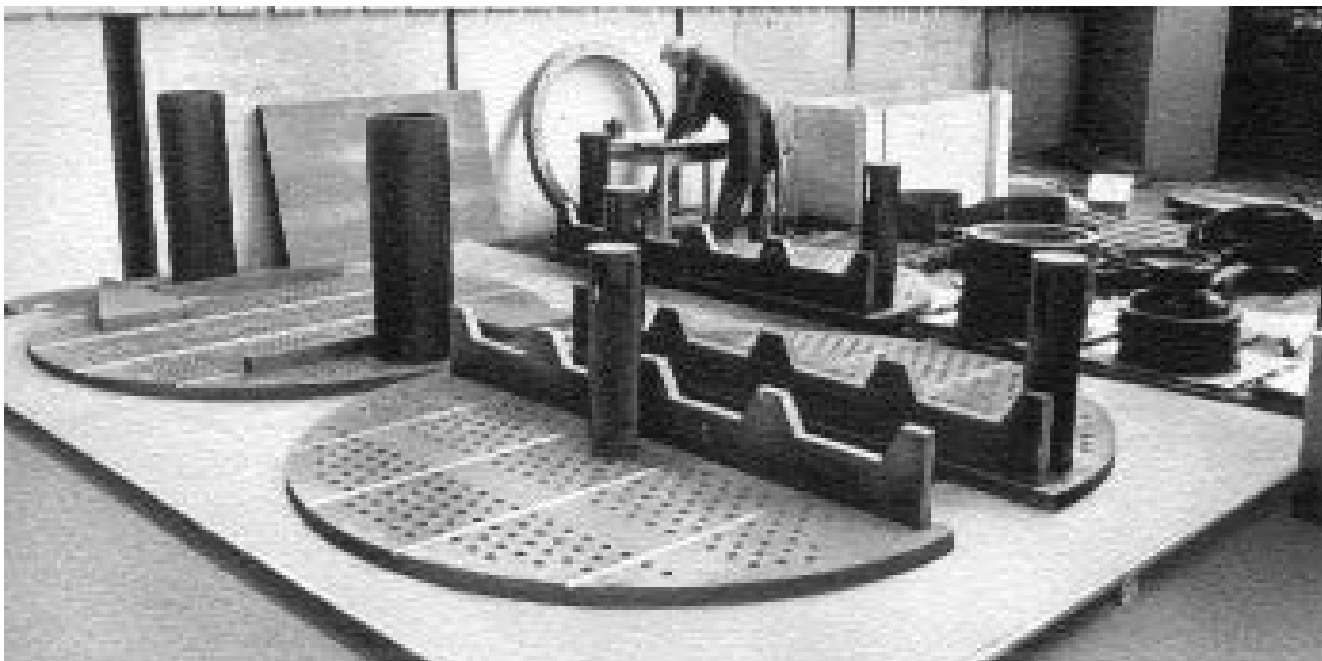
ARMYLOR column

GRAPHILOR column



Column internals

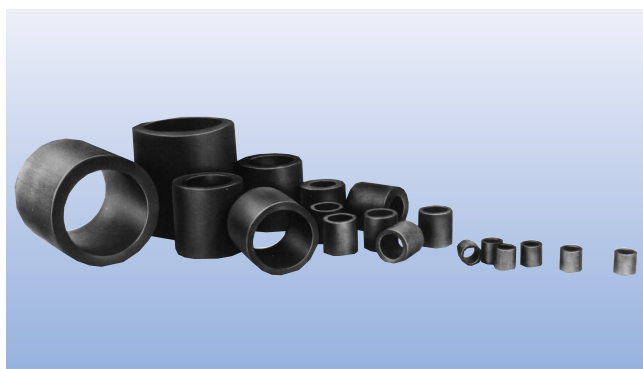
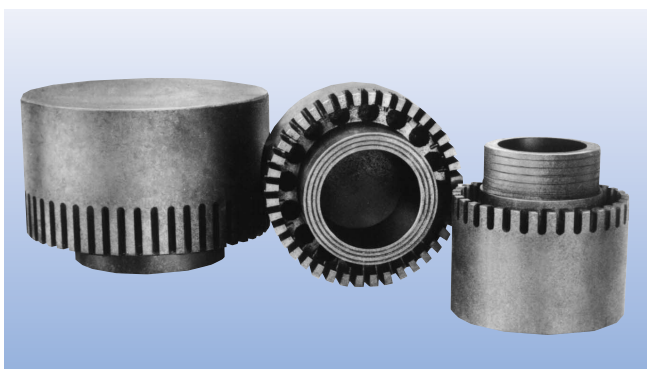
CARBONE LORRAINE also supplies internals in GRAPHILOR, ARMYLOR, or carbon fibre RIGILOR composites for columns constructed with other materials (glass-lined or brick-lined steel,...). These components are designed and fabricated to order.



Most internals can be manufactured in GRAPHILOR, ARMYLOR or RIGILOR composites:

- distributors,
- distribution trays,
- demisters,
- trays with slotted bubble caps,
- weirs, barrages, tap-off units,
- grids, Raschig rings,
- antivortex rings,...

CARBONE LORRAINE also supplies equipment and piping elements in GRAPHILOR or ARMYLOR, for connections between vessels and columns, or linking them to heat exchangers, pumps, pipelines, bellows, compensators, valves,...



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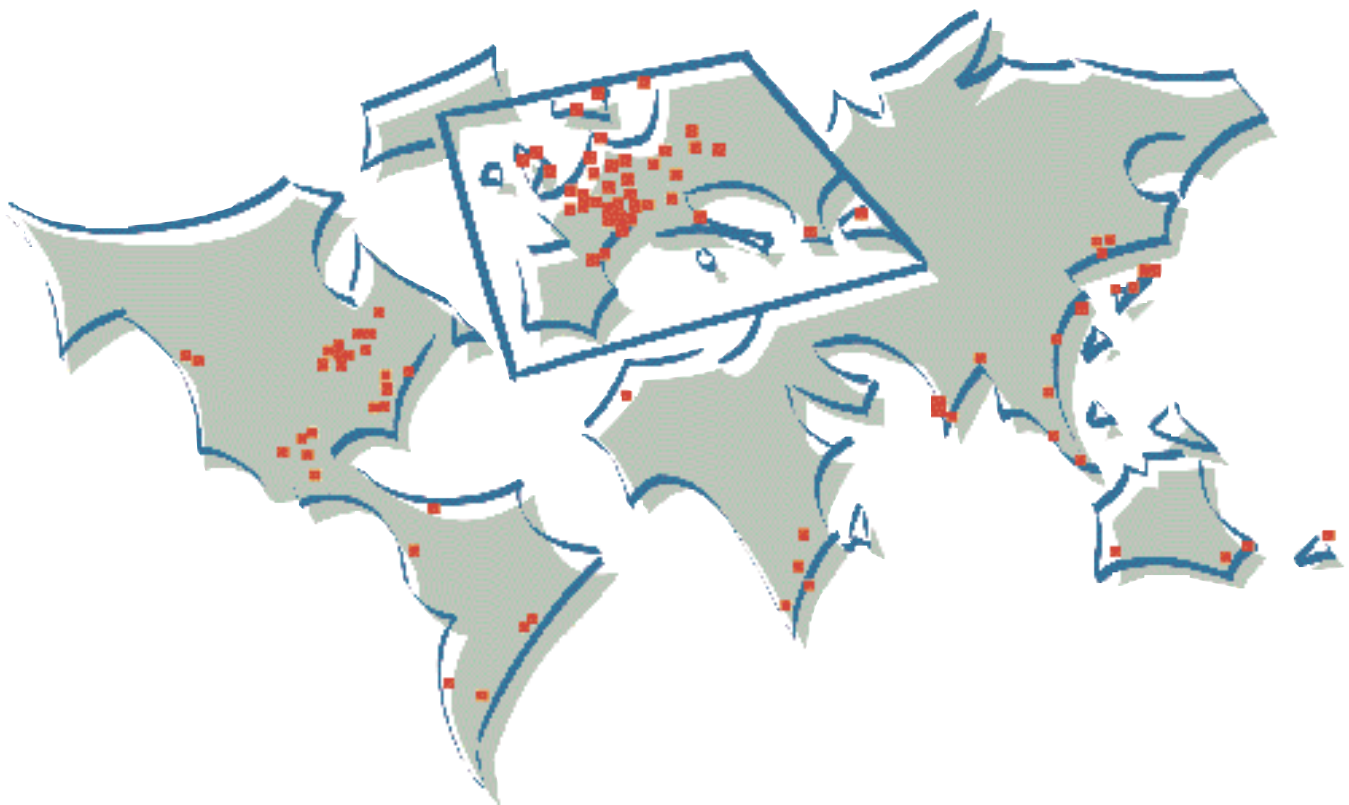
WORLDWIDE SPECIALIST in industrial components

Since its foundation in 1892, CARBONE LORRAINE has built up an international reputation by creating subsidiaries on all continents.

Today with industrial and commercial plants scattered in more than 30 countries, agencies and representatives in

more than 70 countries and 250 commercial contacts throughout the world, CARBONE LORRAINE offers its customers everywhere reliable high technology products and the service of its experienced technicians.

A global player



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