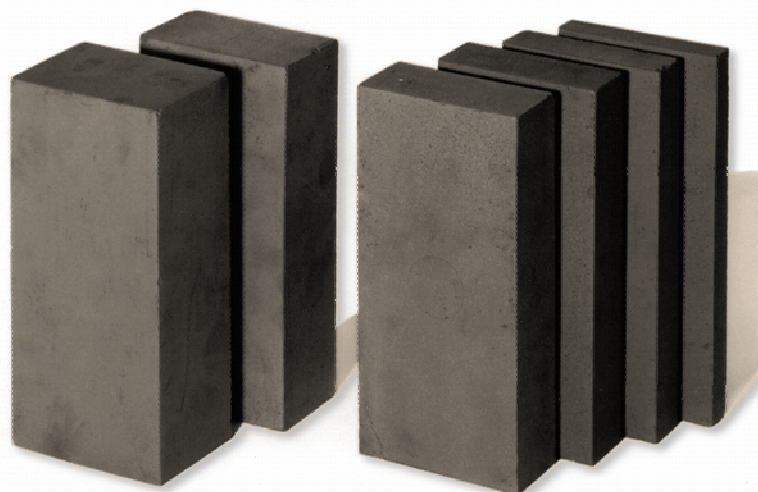


# CARBON AND GRAPHITE PRODUCTS

## FOR CHEMICAL RESISTANT LINING

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### STANDARD BRICKS



### SHAPES

# CARBON PRODUCTS FOR APPARATUS AND REACTION VESSEL LININGS IN THE CHEMICAL INDUSTRY

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## INTRODUCTION

In many chemical processes, the apparatus and reaction vessels must be protected against the acidic and caustic materials used in the processes. Apparatus linings made from ceramic or synthetic plastic type materials are often unsuitable, since they may not withstand chemical attack, high temperatures or sudden temperature changes. Alkaline solutions and hydrofluoric acid are of great importance in chemical technology, but they rapidly destroy equipment linings not made of carbon-containing materials.

The carbon and graphite products which have been developed in cooperation with the chemical and acid protection industries, have special characteristics which over many years have proved outstanding in numerous areas of chemical application for the lining of e.g. baths, reaction vessels, boilers etc., and as corrosion resistant floor coverings.

Carbon and graphite linings have a high mechanical strength, good heat resistance and excellent stability to temperature changes. Of special importance is the universal chemical resistance. In the food processing industries, tasteless and odourless carbon materials are very valuable.

Particularly under difficult chemical and technical conditions in which other materials have been lacking, the special combination of suitable physical and chemical properties of CECOLIT bricks has been extremely successful.

## GRADE TYPES OF CARBON LININGS (TYPES OF CECOLIT)

A Standard grade is available which for special applications can be modified by impregnation.

CECOLIT A: Standard grade

CECOLIT AX: Standard grade, pitch impregnated

CECOLIT AF: Standard grade, impregnated with phenol formaldehyde resin

## PROPERTIES

CECOLIT bricks are characterised by their high cold and hot compressive strength and hardness. CECOLIT brickwork is thus exceptionally resistant to the mechanical demands made e.g. in numerous chemical processes due to the presence of erosive solid materials.

An important characteristic of CECOLIT is its excellent stability to temperature changes which results from the good heat conductivity, high elasticity and very low, reversible thermal expansion behaviour. Thus, for example, high temperature sulphite boilers lined with CECOLIT carbon bricks can be readily sprayed out with cold water without danger of cracking or splitting as occurs with other ceramic linings.

The density of non-impregnated CECOLIT A is approximately 1,50 to 1,60 g/cm<sup>3</sup>. The total weight of a carbon lining is thus significantly lighter than one made of other brick materials, this is often most advantageous with respect to the construction and the statics of industrial plants. When using CECOLIT bricks in apparatus and construction units used for processes involving heat, attention should be given to the maximum withstandable temperatures given below:

- 350 °C for non-impregnated bricks in the presence of air/oxygen (A, AX)
- >350 °C for non-impregnated bricks in oxygen-free atmospheres (A, AX)
- 180 °C for material impregnated with phenolformaldehyde resin (AF).

## TECHNICAL DATA FOR CECOLIT GRADES OF CARBON BRICKS

	PROPERTY	CECOLIT A	CECOLIT AX	CECOLIT AF	UNIT
1.	Density	1.50-1.60	1.60-1.65	1.65-1.70	g/cm <sup>3</sup>
2.	Porosity (open)	18-25	10-15	5-10	%
3.	Compressive strength	approx. 40	approx. 65	approx. 75	N/mm <sup>2</sup>
4.	Bending strength	approx. 12	approx. 20	approx. 25	N/mm <sup>2</sup>
5.	Modulus of elasticity	approx. 1.2 x 10 <sup>4</sup>	approx. 1.8 x 10 <sup>4</sup>	approx. 2 x 10 <sup>4</sup>	N/mm <sup>2</sup>
6.	Tensile strength	approx. 6	approx. 8	approx. 10	N/mm <sup>2</sup>
7.	Linear coefficient of thermal expansion	approx. 3.5 x 10 <sup>-6</sup> (293-573 K)	approx. 4 x 10 <sup>-6</sup> (293-573 K)	approx. 5 x 10 <sup>-6</sup> (293-423 K)	K <sup>-1</sup>
8.	Heat conductivity	4-6	6-8	4-6	W/mK
9.	Temperature stability in air	350	350	170	°C
10.	Ash content	<1	<1	<1	%
11.	Specific electrical resistance	50-80	50-70	50-80	Ωmm <sup>2</sup> /m
12.	Stability to temp changes	very good	very good	good	
13.	Chemical stability	See stability table for more detail			

The above values are average values.

## DIMENSIONS

Standard dimensions for grades A/AX/AF:

240 x 114 x 20, 30, 40, 50, 65, 80, 100 mm (stock sizes)

250 x 124 x 20, 30, 40, 50, 65, 80, 100 mm (on request)

Other thicknesses to 100 mm max. on request.

All other dimensions can be made and supplied under contract. These include bends, wedges, small plates, hand moulded bricks, support beams and tubes up to an external diameter of 600 mm.

## TOLERANCES *(UNLESS OTHERWISE SPECIALLY AGREED)*

- a. Machined pieces e.g. tubes are manufactured in accordance with: DIN 7168 rough.
- b. For special dimensions, e.g. hand moulded bricks no tolerances can be quoted and have to be agreed upon.

Besides the CECOLIT A, AX and AF grades, other grades of carbon and graphite in the form of beams or tubes etc., for special chemical construction applications can be supplied. The technical data of these other grades are available on request. On principle, any size and shape can be produced. Moulding methods can be block pressing, extrusion pressing, vibrating and ramming. Hand moulded bricks, both complicated and simple in form are made in the CECOLIT A, AX, and AF grades. It is recommended to contact us when projects in this field are being planned.

Special sizes and bricks with convex radii can also be made in suitable quantities. To allow us to check the feasibility of manufacture, both quantity requirements and dimensioned drawings should be supplied.

## CHEMICAL STABILITY

CECOLIT A carbon bricks are extremely insensitive to all acids, provided they have no strongly oxidising properties. CECOLIT materials also show the same excellent resistance to attack by highest concentrations of alkaline solutions. Alternating acid and alkali conditions are withstood by this carbon material and they are also unaffected by corrosive salt solutions. CECOLIT A carbon brick linings are thus particularly suitable for chemical processes which involve various temperature and concentration cycles.

The stability of CECOLIT A, AX and AF to various chemicals is given in the following table. It is pointed out that there is no difference in stability between CECOLIT A and AX. Because of its higher density and lower porosity CECOLIT AX is recommended in surroundings where erosion and oxidation occur. CECOLIT AF is impregnated with phenolic resin, and is resistant to oxidising acids up to 170° C. CECOLIT AF is unsuitable for strongly alkaline media.

## THE USE OF ACID RESISTANT CEMENTS

In acid protection and apparatus construction the use of suitable cement is of the utmost importance. This is also important when using our CECOLIT bricks. In many cases the stability of our carbon and graphite material is greater than that of the cement used. Thus, when checking the stability and suitability of the possible carbon or graphite materials, the stability of the cement to be used in the particular application should also be checked so that full advantage can be obtained from the properties of our products.

In the choice of suitable cement, e.g. phenolic or furan resin based, we will gladly give our experience and advise on suppliers of cements, which we do not produce ourselves.

## GRAPHITE COVA GRADES

Resistant       Non-Resistant  
 Conditionally Resistant       Use must be checked from case to case

MEDIUM CECOLIT	A	AX	AF
Acetaldehyde			
Acetic acid			
Acetic acid anhydride			
Acetic acid butyl ester			
Acetic acid ethyl ester			
Acetic acid methyl ester			
Acetone			
Alum - S			
Aluminium acetate - S			
Aluminium Chloride - S			
Aluminium sulphate - S			
Ammonia in aqueous solution			
Ammonia liquid			N
Ammonium Chloride - S			
Ammonium diphosphate - S			?
Ammonium fluoride - S			
Ammonium nitrate - S			
Ammonium phosphate - S			?
Ammonium sulphate - S			
Ammonium sulphite - S			
Ammonium thiocyanate - S			
Amyl alcohol = pentanol			
Aniline			
Arsenic acid - S			
Arsenic trichloride			
Asphalt			
Barium Chloride - S			
Benzene			
Bleaching lye	C	C	C
Bleaching powder	C	C	C
Borax - S			C
Boric acid - S			
Boron oil			
Bromine, bromine water	C	C	C
Butadiene			?
Butane			
Butanol			
Butylacetate = Acetic acid butyl ester			
Butyl alcohol = Butanol			
Butylcellulose			
Butyric acid			
Caesium chloride - S			
Caesium chlorite - S	C	C	C
Caesium hydrogen sulphite - S (upto 50%)			
Caesium hydroxide - S			C
Caesium hypochlorite - S	C	C	C
Carbolic acid = Phenol			
Carbon disulphide	C	C	C
Carbon tetrachloride			
Chestnut extract			
Chloric acid	?	?	N
Chlorine (gaseous, dry)			C
Chlorine (liquid)	C	C	N
Chlorine (wet), chlorine water	N	N	N
Chlorobenzene			
Chloroform			
Chromate (Na, K) - S	?	?	?
Chromic acid - S	N	N	N
Chromium sulphate - S			
Citric acid			
Coal tar oil			
Copper(II) Chloride - S			
Copper (11) sulphate - S			
Cresol			
Developer - S (photographic)			
Dichlorobenzene, P-			
Dichloroethylene			

MEDIUM CECOLIT	A	AX	AF	
Diesel oil				
Dioxane			C	
Diphenyl (molten)				
Diphenyloxide (molten)				
Dowtherm				
Ether (diethyl-)				
Ethyl alcohol = Ethanol				
Ethylchloride				
Ethylene dichloride				
Fatty acids				
Fatty alcohols				
Fixing salt = S (sodium thiosulphate)				
Formaldehyde (Formalin - S)				
Formic acid				
Freon 11 and 12			C	
Frigen			C	
Fruit acids				
Fruit Juices				
Furfurole			C	
Furfuryl alcohol			C	
Gelantine				
Glycerine				
Glycol				
Grape sugar - S				
Grease, fat (molten)				
Heating oil				
Heavy gasoline				
Hexane				
HToils				
Hydrazine hydrate - S			N	
Hydrobromic acid				
Hydrochloric acid				
Hydrofluoric acid			C	
Hydrogen sulphide (gas and solution)				
Iodine (alcoholic solution)	?	?	N	
Iron (II, III) Chloride - S				
Iron (II) sulphate - S				
Isopropylacetic acid ester				
Isopropyl alcohol, Isopropanol				
Isopropylether				
Kerosene				
Lead Acetate - S				
Linseed oil				
Magnesium Chloride - S				
Magnesium sulphate - S				
Malic acid				
Manganese sulphate - S				
Methane (gas)				
Methanol				
Methyl acetate = acetic acid methyl ester				
Methyl ethyl ketone				
Methyl isobutyl ketone				
Milk, lactic acid, whey				
Mineral oils				
Monochloro-acetic acid				
Monochlorobenzene				
Nickel Chloride - S				
Nickel sulphate - S				
Nitric acid (upto 20 %)		C	C	C
Nitric acid (above 20 %)		N	N	N
Nitrobenzene				
Nitrogenous gases (damp)		N	N	N
Oleic acid				
Oleum		?	?	N
Oxalic acid				
Paraffin				
Pentane				

MEDIUM CECOLIT	A	AX	AF	
Pentanol				
Pentyl Chloride			?	
Petrol				
Petroleum				
Phenol, carbolic acid				
Phosphoric acid (all concentrations)				
Phosphorus trichloride				
Potassium bromide - S				
Potassium carbonate - S			C	
Potassium Chloride - S				
Potassium hexacyanoferrate (11 and 111)			?	
Potassium hydroxide - S			N	
Potassium nitrate - S				
Potassium sulphate - S				
Potassium sulphide - S		?	?	N
Potassium sulphite - S				
Propane				
Pyridine				?
Rapeseed oil				
Saccharin - S				
Salicylic acid (alcoholic solution)				
Sea water				
Silicic acid/anhydride, silica - S				
Soda = sodium carbonate				C
Sodium acetate - S				
Sodium carbonate - S				C
Sodium Chloride - S				
Sodium hydrogen sulphate - S				
Sodium hydrogen sulphite - S				
Sodium hydroxide - S (upto 60 %)				N
Sodium hypochlorite - S		C	C	C
Sodium nitrate - S				
Sodium nitrite - S				
Sodium perborate - S		C	C	C
Sodium phosphate - S (tri)				
Sodium silicate - S				C
Sodium sulphate - S				
Sodium sulphide-S, polysulphide-S		?	?	N
Sodium sulphite - S				
Sodium thiosulphate - S				
Soya bean oil				
Stearic acid				
Sugar - S				
Sulphur dioxide (gas, dry and damp)				
Sulphuric acid (upto 20 %)				
Sulphuric acid (20 % - 50 %)				
Sulphuric acid (above 50 %)		C	C	N
Sulphurous acid				
Tannic acid - S (Tannin)				?
Tartaric acid				
Tin (11) Chloride-S				
Toluene				
Trichloroethylene				
Turpentine				
Varnish				?
Vegetable oil				
Vinyl acetate				
Water glass				C
Water, steam				
Wine				
Xylene				
Zinc Chloride - S				
Zinc sulphate - S				