



Bearing and Seal Technology

Chemical Resistance



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Preface

Carbon and graphite materials exhibit high chemical resistance and belong to the standard materials in machine and apparatus construction of the chemical industry.

Although insoluble and unmeltable, carbon and graphite materials may be attacked by several chemical substances. Nevertheless, there is multitude of possible applications for these materials.

The data of our carbon and graphite materials presented in this brochure are to help deciding the suitability for use regarding the chemical resistance. Separate other brochures available will give you information on fabrication and physical properties of our carbon and graphite materials.

The data presented in the following tables are not binding and should help to select the suitable material.

Summary of the experimental procedure

Practical tests show whether carbon and graphites are suitable as work materials, as only we have performed corrosion tests since 1952.

The data listed in the following were determined in meticulous tests by our chemical laboratory.

Up to now, our carbon and graphite materials have been tested with more than 140 chemical reagents, and testing will be continued with further substances. Regarding the selection of chemical substances, we do appreciate suggestions of our clients.

The test conditions can be described as follows: The majority of the durability tests last 2160 hours (appr. 3 months). For all tests stationary samples with preferred dimensions of 70 x 10 x 10 mm were used. During the tests special attention was paid to the samples being fully covered by the test medium and to maintaining the composition of the medium by often exchanging it.

Changes in dimensions, weight and hardness as well as general conditions and micrographs were the basis to evaluate the durability properties of the materials.

The chemical resistance is indicated by the following symbols

+ resistant

O partially resistant

— not resistant

which to a large extent are based on the Dechema Materials Table. If for some reason or other, you should intend to use a “partially resistant” material, please contact us first.

The chemical resistance given in each case refers only to the present concentration and temperature of the medium but allows conclusions to different conditions. Metals are attacked more strongly by moving than by stationary liquids. This is to be considered with metal impregnated carbon and graphite materials.

It may not be completely excluded that the chemical attack is stronger on a sliding surface out of carbon and graphite materials which are not impregnated, resin impregnated or resin bonded, but due to the other properties of carbon and graphite this is not probable. This has been confirmed in practical applications.

Summary of the Experimental Procedure

Additional Advice

The most common terms are listed alphabetically in the Chemical Index (pp. 18 – 30) and refer to the medium which is to be found in the tables, listed below the corresponding categories (pp. 6 – 16).

Moreover, there are materials in this index which we have not tested but which are expected to have properties similar to those listed in column 2.

The chemical formulae of the test media are indicated, if available. Technical grades are trademarks.

The test conditions (weight %, volume %, g/l), pressure (bar; no indication of pressure always means normal pressure), and temperature (°C) are indicated in the tables on pp. 6 – 16. The ratios 1 : 1 or 3 : 1 are volume parts of concentrated substances.

The tables do not contain names of Schunk material grades. Instead, materials are collected in groups according to their similar chemical behaviour.

- 1 carbon graphite not impregnated
- 2 graphite not impregnated
- 3 carbon graphite resin impregnated
- 4 graphite resin impregnated
- 5 resin bonded carbon
- 6 carbon graphite and graphite antimony impregnated
- 7 carbon graphite and graphite lead impregnated
- 8 carbon graphite and graphite copper impregnated

Examples

1	2	3	4	5	6	7	8
FH27S	FE45S	FH42Z2/Z5	FE45Z2	FF521	FE45A	FH42B	FE45C
FH42	FE45Y2	FH42ZH2/ZH5		FF541	FH42A	FH44B	FH44C
FH44Y2	FE679	FH44Z2/Z5		FF46	FH82A	FH82B	FH42C
FH82		FH82Z2/Z5					
		FH82ZH2/ZH5					

Inorganic Compounds

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
1. Acids												
Boric acid, aqueous	H ₃ BO ₃	15	80	-	+	+	+	+	+	+	o	o
Chromic acid, aqueous	CrO ₃ + H ₂ O	20	20	-	+	+	+	+	+	+	+	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	20	80	-	-	-	-	-	-	-	-	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	40	20	-	+	+	+	+	+	+	+	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	50	20	-	-	+	+	+	+	+	+	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	50	40	-	-	+	-	+	-	-	+	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	50	60	-	-	-	-	-	-	-	o	-
Chromic acid, aqueous	CrO ₃ + H ₂ O	60	20	-	-	o	o	o	-	-	o	-
Hydrofluoric acid, diluted	HF	20	20	-	+	+	+	+	+	-	-	o
Hydrofluoric acid, concentrated	HF	40	20	-	+	+	+	+	o	-	-	o
Aqua regia	HCl/HNO ₃ 3:1	100	20	-	+	+	+	+	+	-	-	-
Mixed acid	HNO ₃ /H ₂ SO ₄ 2:3	100	20	-	-	-	-	-	-	-	-	-
Perchloric acid, aqueous	HClO ₂	approx. 70	20	-	+	+	+	+	+	+	o	o
Phosphoric acid, ortho, concentrated	H ₃ PO ₄	85	130	-	+	+	+	+	+	+	-	-
Nitric acid, diluted	HNO ₃	38	20	-	+	+	+	+	-	-	-	-
Nitric acid, diluted	HNO ₃	7	80	-	+	+	o	o	-	-	-	-
Nitric acid, concentrated	HNO ₃	65	20	-	+	+	+	+	-	-	-	-
Nitric acid, concentrated	HNO ₃	65	80	-	-	+	-	-	-	-	-	-
Nitric acid, red fumins	HNO ₃ + N-Oxide	100	20	-	-	-	-	-	-	-	-	-
Nitric acid, vapors	NO ₂	100	20	-	-	-	-	-	-	-	-	-
Hydrochloric acid, diluted	HCl	20	20	-	+	+	+	+	+	+	-	o
Hydrochloric acid, diluted	HCl	20	50	-	+	+	+	+	+	-	-	o
Hydrochloric acid, diluted	HCl	20	80	-	+	+	+	+	+	-	-	-
Hydrochloric acid, concentrated	HCl	32	20	-	+	+	+	+	+	+	-	o
Hydrochloric acid, concentrated	HCl	32	50	-	+	+	+	+	+	-	-	-
Hydrochloric acid, concentrated	HCl	32	80	-	+	+	+	+	+	-	-	-
Hydrochloric acid, gas	HCl	100	20	-	+	+	+	+	-	+	-	+

+ resistant · o partially resistant · - not resistant

Test Medium	Chemical Formula	Concentration %			temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
1. Acids (continuation)														
Hydrochl. acid, concentr. + chlorine	HCl + Cl ₂	40 g Cl ₂ / l	20	-			+	+	+	+	+	o	-	o
Sulphur dioxide, concentr., liquid	SO ₂	99.7	10	approx. 3.35			+	+	+	+	+	+	+	+
Sulphurous acid, aqueous	H ₂ SO ₃	50 g SO ₂ / l	20	-			+	+	+	+	+	+	+	+
Sulphuric acid, diluted	H ₂ SO ₄	25	20	-			+	+	+	+	+	+	+	+
Sulphuric acid, diluted	H ₂ SO ₄	25	80	-			+	+	+	+	+	o	+	-
Sulphuric acid, diluted	H ₂ SO ₄	50	20	-			+	+	+	+	+	+	+	+
Sulphuric acid, diluted	H ₂ SO ₄	50	80	-			+	+	+	+	+	o	o	-
Sulphuric acid, diluted	H ₂ SO ₄	62	20	-			+	+	+	+	+	+	+	+
Sulphuric acid, concentrated	H ₂ SO ₄	96	20	-			+	+	+	+	+	+	+	+
Sulphuric acid, concentrated	H ₂ SO ₄	96	50	-			+	+	+	+	+	+	+	+
Sulphuric acid, concentrated	H ₂ SO ₄	96	80	-			+	+	+	+	-	-	o	-
Sulphuric acid, concentrated	H ₂ SO ₄	96	120	-			+	+	+	+	-	-	-	-
Sulphuric acid, concentrated	H ₂ SO ₄	96	160	-			+	+	-	-	-	-	-	-
Sulphuric acid, concentrated	H ₂ SO ₄	96	200	-			o	o	-	-	-	-	-	-
Sulphuric acid, fumins (oleum)	H ₂ SO ₄ + SO ₃	H ₂ SO ₄ (100) + 60% SO ₃	20	-			-	-	-	-	-	-	-	-
Hydrogen sulfide water, cold, saturated	H ₂ S + H ₂ O	-	20	-			+	+	+	+	+	+	+	o

+ resistant · o partially resistant · - not resistant

Inorganic Compounds

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
2. Acid halogens												
Chlorosulfonic acid	SO ₂ · OH · Cl	100	20	-	-	o	o	o	-	-	-	o
Chlorosulfonic acid	SO ₂ · OH · Cl	100	100	-	-	-	-	-	-	-	-	-
Phosphorus oxychloride	POCl ₃	100	20	-	+	+	+	+	+	-	-	+
Sulphuryl chloride	SO ₂ Cl ₂	100	20	-	+	+	o	o	-	-	-	o
Thionyl chloride	SOCl ₂	100	20	-	+	+	+	+	+	-	-	+
3. Bases												
Ammonia, concentrated, liquid	NH ₃	100	20	approx. 9.8	+	+	+	+	-	+	+	+
Ammonia solution, aqueous	NH ₄ OH	approx. 25	20	-	+	+	+	+	+	+	+	-
Sodium hydroxide, aqueous	NaOH	10 - 30	20	-	+	+	+	+	-	+	+	+
Sodium hydroxide, aqueous	NaOH	35 - 50	20	-	+	+	+	+	-	+	+	+
Sodium hydroxide, aqueous	NaOH	40	80	-	+	+	+	+	-	+	+	+
Sodium hydroxide, aqueous	NaOH	50	80	-	+	+	+	+	-	+	+	+
Sodium hydroxide, concentr., aqueous	NaOH	62	100	-	+	+	+	+	-	+	-	-
4. Halogens												
Bromine, liquid	Br ₂	approx. 99.6	20	-	o	-	-	-	-	-	-	-
Chlorine, liquid	Cl ₂	99.9	20	approx. 7.6	+	+	+	+	-	-	-	o
Chlorine water	H ₂ O + Cl ₂	3.7 g Cl ₂ / l	25	-	+	+	+	+	+	+	+	+
Chlorine water	H ₂ O + Cl ₂	1.73 g Cl ₂ / l	50	-	o	+	+	+	o	o	-	o
Chlorine water	H ₂ O + Cl ₂	1.73 g Cl ₂ / l	80	-	o	o	+	+	o	o	-	-

+ resistant · o partially resistant · - not resistant

Test Medium	Chemical Formula	Concentration %										
			temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
5. Oxidizing agents												
Ammonium peroxy disulfate, solution, aqueous	$(\text{NH}_4)_2\text{S}_2\text{O}_8$	20	20	-	+	+	+	+	+	+	+	-
Calcium hypochloride, aqueous	$\text{Ca}(\text{OCl})_2$	20	20	-	o	o	o	o	o	o	-	-
Calcium hypochloride, aqueous	$\text{Ca}(\text{OCl})_2$	20	100	-	o	o	o	o	o	o	-	-
Chlorine containing chloride-brine	NaCl-Lösung + Cl_2	approx. 312 g NaCl/l + approx. 0,2 g Cl_2 /l	75	-	+	+	+	+	+	+	+	+
Potassium chlorate, aqueous	KClO_3	5	20	-	o	o	+	+	o	o	o	o
Potassium chlorate, aqueous	KClO_3	5	100	-	o	o	+	+	o	o	o	o
Potassium permanganate, aqueous	K Mn O_4	10	50	-	+	+	+	+	+	+	+	+
Sodium chlorite, aqueous	NaClO_2	2% = 8 g Cl_2 /l	85	-	-	+	-	+	-	+	+	+
Sodium chlorite, aqueous	NaClO_2	20% = 80 g Cl_2 /l	90	-	-	-	-	-	-	-	o	+
Sodium hypochloride, concentrated	NaOCl	148 - 160 g Cl_2 /l 12 - 13% akt. Cl_2	20	-	-	o	-	o	-	o	-	+
Sodium hypochloride, concentrated	NaOCl	148 - 160 g Cl_2 /l 12 - 13% akt. Cl_2	40	-	-	o	-	o	-	o	-	o
Sodium hypochloride, concentrated	NaOCl	148 - 160 g Cl_2 /l 12 - 13% akt. Cl_2	60	-	-	o	-	o	-	o	-	o
Hydrogen peroxide, aqueous	H_2O_2	30	20	-	+	+	+	+	-	+	+	+
6. Water, salts, salt solutions												
Aluminum chloride, aqueous	AlCl_3	approx. 32	20	-	+	+	+	+	+	+	+	+
Ammonium iron (III) sulfate, aqueous	$\text{NH}_4\text{Fe}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$	50	20	-	+	+	+	+	+	+	+	-
Ammonium nitrate, aqueous	NH_4NO_3	85	108	-	+	+	+	+	+	+	+	+
Ammonium sulfide solution, aqueous	$(\text{NH}_4)_2\text{S} + \text{H}_2\text{O}$	10	20	-	+	+	+	+	+	o	+	-
Iron (II) sulfate, aqueous	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	20	20	-	+	+	+	+	+	+	+	+
Hydrazine hydrate, aqueous	N_2H_4	0.1 - 100	100	-	+	+	+	+	+	+	+	+
Potassium bromide, aqueous	KBr	30	20	-	+	+	+	+	+	+	o	o
Potassium bromide, aqueous	KBr	30	100	-	o	o	o	o	o	-	-	-
Potassium iodide, aqueous	KI	30	20	-	+	+	+	+	+	+	+	o
Potassium iodide, aqueous	KI	30	100	-	+	+	+	+	+	+	+	-
Potassium nitrate, aqueous	KNO_3	20	20	-	+	+	+	+	+	+	+	+

+ resistant · o partially resistant · - not resistant

Inorganic Compounds

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
6. Water, salts, salt solutions (continuation)												
Potassium nitrate, aqueous	KNO ₃	20	100	-	+	+	+	+	o	o	o	o
Tap water, 348 ppm CaCO ₃	H ₂ O	-	20	-	+	+	+	+	+	+	+	+
Monozinc phosphate, aqueous	Zn (H ₂ PO ₄) ₂	50	20	-	+	+	+	+	+	+	+	+
Monozinc phosphate, aqueous	Zn (H ₂ PO ₄) ₂	50	100	-	+	+	+	+	+	+	o	+
Sodium carbonate, purest, aqueous	Na ₂ CO ₃	20	100	-	+	+	+	+	+	+	+	+
Sodium chloride, aqueous	NaCl	25	20	-	+	+	+	+	+	+	+	+
Sodium chloride, aqueous	NaCl	25	80	-	+	+	+	+	+	+	+	+
Sodium nitrite, aqueous	NaNO ₂	40	20	-	+	+	+	+	+	o	o	o
Sodium nitrite, aqueous	NaNO ₂	40	100	-	+	+	+	+	-	o	-	-
Tri-sodium phosphate, aqueous	Na ₃ PO ₄ · 12 H ₂ O	50	100	-	+	+	+	+	+	+	+	+
Sodium sulfite solution, aqueous	Na ₂ SO ₃	20	100	-	+	+	+	+	+	+	+	+
Nickel sulfate, aqueous	NiSO ₄ · 7H ₂ O	approx. 28	20	-	+	+	+	+	+	+	+	+
Sea water		27.3 g NaCl, 3.3 g MgCl ₂ 2.2 g MgSO ₂ 0.2 gKBr } /1	20	-	+	+	+	+	+	+	+	+
Silicon tetrachloride, technical	SiCl ₄	-	20	-	+	+	+	+	+	+	-	+
Titanium tetrachloride	TiCl ₄	100	20	-	+	o	+	+	+	o	-	o

+ resistant · o partially resistant · - not resistant

Organic Compounds

Test Medium	Chemical Formula	Concentration %											
			temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated	
1. Hydrocarbons													
Gasoline-benzene	-	1 : 1	95	-	+	+	+	+	+	+	+	+	+
Cyclohexane, pure	(CH ₂) ₆	-	80.8	-	+	+	+	+	+	+	+	+	+
Fuel oil (light) DIN 51603, colored, 10% of preservation oil V-9447, Shell	-	100	20	-	+	+	+	+	+	+	+	+	+
Fuel oil (light) DIN 51603, colored, 10% of preservation oil V-9447, Shell	-	100	80	-	+	+	+	+	+	+	+	+	+
Fuel oil (med. heavy), 20°E/20°C	-	100	120 - 125	-	+	+	+	+	+	+	+	+	+
Fuel oil (heavy), 78°E/20°C	-	100	120 - 125	-	+	+	+	+	+	+	+	+	+
Mineral oil, technical, appr. 150 cP	-	100	20	-	+	+	+	+	+	+	+	+	+
Terphenyl, technical	(C ₆ H ₅) ₂ C ₆ H ₄	95,9	300	-	+	+	-	-	-	+	-	+	+
Toluene-xylene	C ₆ H ₅ CH ₃ -C ₆ H ₄ (CH ₃) ₂	1 : 1	115	-	+	+	+	+	+	+	+	+	+
2. Halogenated hydrocarbons													
Allyl chloride, analytically pure	CH ₂ =CH · CH ₂ Cl	-	20	-	+	+	+	+	+	+	-	-	-
1,2-dibromethane	BrH ₂ C-CH ₂ Br	-	100	-	+	+	+	+	+	+	-	+	+
Methyl chloride	CH ₃ Cl	-	10 - 15	4.5 - 5.0	+	+	+	+	+	+	+	+	+
Monochlorobenzene, purest	C ₆ H ₅ Cl	-	20	-	+	+	+	+	+	+	+	+	+
Carbon tetrachloride	CCl ₄	-	20	-	+	+	+	+	+	+	+	+	+
Carbon tetrachloride	CCl ₄	-	70	-	+	+	+	+	+	+	+	+	+
Carbon tetrachloride/trichloroethylene	CCl ₄ /CIHC = CCl ₂	1 : 1	83	-	+	+	+	+	+	+	-	+	+
1,1,1-trichloroethane	CH ₃ -CCl ₃	-	20	-	+	+	+	+	+	+	+	+	+
Trichloroethylene, technical	CIHC = CCl ₂	-	20	-	+	+	+	+	+	+	+	+	+
Trichloroethylene	CIHC = CCl ₂	-	87	-	+	+	+	+	+	+	+	+	+

+ resistant · o partially resistant · - not resistant

Organic Compounds

Test Medium	Chemical Formula	Concentration %			temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
3. Alcohols and phenols														
Ethanol, absolute	C ₂ H ₅ OH	-	78	-	+	+	+	+	+	+	+	+	+	+
Glycerin, double distilled	C ₃ H ₈ O ₃	100	20	-	+	+	+	+	+	+	+	+	+	+
Glycerin, double distilled	C ₃ H ₈ O ₃	100	100	-	+	+	+	+	o	+	o	+	+	
Glycol	C ₂ H ₆ O ₂	100	100	-	+	+	+	+	o	o	-	+	+	
Methanol, analytically pure	CH ₃ OH	min. 99.5	65	-	+	+	+	+	o	+	+	+	+	
Phenol, purest	C ₆ H ₅ OH	-	100	-	+	+	+	+	+	+	+	+	+	
4. Esters														
N-butyl acetate	CH ₃ COO · C ₄ H ₉	100	20	-	+	+	+	+	+	+	+	+	+	
N-butyl acetate	CH ₃ COO · C ₄ H ₉	100	80	-	+	+	+	+	o	+	o	o	o	
Dimethyl phthalate	C ₆ H ₄ (COOCH ₃) ₂	100	20	-	+	+	+	+	+	+	+	+	+	
Dimethyl phthalate	C ₆ H ₄ (COOCH ₃) ₂	100	80	-	+	+	+	+	+	+	+	+	+	
Tri-n-butyl phosphate, technical	(C ₄ H ₉) ₃ PO ₄	-	20	-	+	+	+	+	+	+	+	+	+	
5. Ethers														
Diethyl ether	(C ₂ H ₅) ₂ O	100	20	-	+	+	+	+	+	+	+	+	+	
6. Amines														
Aniline, purest	C ₆ H ₅ NH ₂	100	184	-	+	+	+	+	+	+	+	+	+	
Diethanol amine	(HOCH ₂ H ₄) ₂ NH	100	20	-	+	+	+	+	+	+	+	+	+	
Ethyl amine	C ₂ H ₅ NH ₂	99	20	2.02	+	+	+	+	+	+	+	+	+	
Isopropyl amine (mono), water-free	CH ₃ CH(NH ₂)CH ₃	98 - 100	20	-	+	+	+	+	+	+	+	+	+	

+ resistant · o partially resistant · - not resistant

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
7. Nitriles and isonitriles												
Acrylonitrile	CH ₂ = CHCN	100	20	-	+	+	+	+	+	+	+	+
8. Aldehydes												
N-butyraldehyde	C ₃ H ₇ CHO	100	20	-	+	+	+	+	+	+	+	+
9. Ketones												
Acetone, purest	(CH ₃) ₂ CO	-	56	-	+	+	+	+	+	+	+	+
10. Acids												
Formic acid	HCOOH	98 - 100	20	-	+	+	+	+	+	+	-	+
Benzoic acid, alcoholic	C ₆ H ₅ COOH	40	20	-	+	+	+	+	+	+	+	+
Benzoic acid, aqueous	C ₆ H ₅ COOH	approx. 2	80	-	+	+	+	+	+	+	+	+
Butyric acid	C ₃ H ₇ COOH	98 - 100	20	-	+	+	+	+	+	+	o	+
Acetic acid	CH ₃ COOH	98 - 100	20	-	+	+	+	+	+	+	+	+
Lauric acid	C ₁₁ H ₂₃ -COOH	-	160 - 165	-	+	+	+	+	+	+	+	+
Myristic acid	C ₁₃ H ₂₇ -COOH	-	160 - 165	-	+	+	+	+	+	+	+	+
Oxalic acid, alcoholic	(COOH) ₂	50	20	-	+	+	+	+	+	+	+	+
Palmitic acid	C ₁₅ H ₃₁ -COOH	-	160 - 165	-	+	+	+	+	+	+	+	+
O-phthalic acid, aqueous	C ₆ H ₄ (COOH) ₂	15	100	-	+	+	+	+	+	+	o	-
Stearic acid	C ₁₇ H ₃₅ -COOH	-	160 - 165	-	+	+	+	+	+	+	+	+
Trichloroacetic acid, aqueous	CCl ₃ COOH	50	81	-	+	+	+	+	+	+	+	+
Undecanoic acid	C ₁₀ H ₂₁ -COOH	-	180 - 185	-	+	+	+	+	+	+	+	+
Tartaric acid, technical, aqueous	C ₄ H ₆ O ₆	50	103	-	+	+	+	+	+	+	+	+
Citric acid, aqueous, saturated	C ₆ H ₈ O ₇	62.1	100	-	+	+	+	+	+	+	-	+

+ resistant · o partially resistant · - not resistant

Organic Compounds

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
11. Acid halogens												
Acetyl chloride, pure	CH ₃ COCl	-	20	-	+	+	+	+	+	+	-	+
12. Heterocyclics												
ε-caprolactam, concentrated	CO(CH ₂) ₅ NH	-	90	-	+	+	+	+	+	+	+	+
Quinoline	C ₉ H ₇ N	-	20	-	+	+	+	+	+	+	+	+
Furan	C ₄ H ₄ O	-	20	-	+	+	+	+	+	+	+	+
N-methyl pyrrolidone	C ₅ H ₉ NO	-	20	-	+	+	+	+	+	+	+	+
N-methyl pyrrolidone	C ₅ H ₉ NO	-	100	-	+	+	+	+	+	+	+	+
N-methyl pyrrolidone	C ₅ H ₉ NO	-	206	-	+	+	+	+	-	+	+	+
Pyridine, crude	C ₅ H ₅ N	-	115	-	+	+	+	+	+	+	+	+

+ resistant · o partially resistant · - not resistant

Industrial Trade Products

Test Medium	Chemical Formula	Concentration %			temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
1. Aids for dye mills and textile industries														
Acramin®	-	-	20	-	+	+	+	+	+	+	+	+	+	+
Persistol®	-	100	20	-	+	+	+	+	+	+	+	+	+	+
2. Detergents														
Soaking and pre-wash detergents	-	3	60	-	+	+	+	+	+	+	+	+	+	+
Laundry detergent	-	3	20 - 100	-	+	+	+	+	+	+	+	+	+	+
Fine washables (silk and synthetics)	-	3	40	-	+	+	+	+	+	+	+	+	+	+
Wool detergent	-	3	20	-	+	+	+	+	+	+	+	+	+	+
3. Dish washing detergents														
Dish washing detergent, aqueous	-	0.4 - 0.8	20 - 65	-	+	+	+	+	+	+	+	+	+	+
4. Heat transfer materials														
Diphyl®	(C ₆ H ₅) ₂ O, (C ₆ H ₅) ₂	73 27	200	-	+	+	+	+	+	+	+	+	+	+
5. Refrigerants														
Freon 11®	CFCl ₃	-	0	1.4	+	+	+	+	+	+	+	+	+	+
Freon 12®	CF ₂ Cl ₂	-	-30	-	+	+	+	+	+	+	+	+	+	+
Freon 22®	CHF ₂ Cl	-	0	6.1	+	+	+	+	+	+	+	+	+	+
Freon 113®	C ₂ F ₃ Cl ₃	-	20	1.4	+	+	+	+	+	+	+	+	+	+
Freon 114®	C ₂ F ₄ Cl ₂	-	20	2.87	+	+	+	+	+	+	+	+	+	+

+ resistant · o partially resistant · - not resistant

Industrial Trade Products

Test Medium	Chemical Formula	Concentration %	temperature (°C)	Pressure (bar)	carbon graphite, not impregnated	graphite, not impregnated	carbon graphite, resin impregnated	graphite, resin impregnated	resin bonded carbon	carbon graphite and graphite, antimony impregnated	carbon graphite and graphite, lead impregnated	carbon graphite and graphite, copper impregnated
6. Anti-freeze												
Glycolen [®] , aqueous	-	50 Vol.	100	-	+	+	+	+	+	+	+	+
Glysantin [®] , aqueous	-	50 Vol.	107	-	+	+	+	+	+	+	+	+
7. Rust inhibit. and anti-freeze												
Shell Donax C, aqueous	-	0.5 - 1.0	95 - 100	-	+	+	+	+	+	+	+	+
8. Cooling lubricants												
Esso-Kutwell, aqueous	-	0.5 - 1.0	95 - 100	-	+	+	+	+	+	+	+	+
9. Motor fuels												
Gasoline, leaded	-	100	75	-	+	+	+	+	+	+	+	+
Gasoline, unleaded	-	100	20	-	+	+	+	+	+	+	+	+
Gasoline, leaded, super	-	100	20	-	+	+	+	+	+	+	+	+
Diesel	-	100	20	-	+	+	+	+	+	+	+	+
Diesel	-	100	80	-	+	+	+	+	+	+	+	+
10. Synthetic oils												
Silicon oil DC 200/100 cSt.	-	-	200	-	+	+	+	+	+	+	+	+

+ resistant · o partially resistant · - not resistant

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Stearic acid	1,1,1-trichloroethane	11
Strontium nitrate		13
Styrene	Ammonium nitrate, aqueous	9
Succinic acid	Gasoline-benzene	11
Sulphuric acid	Oxalic acid, alcoholic	13
Sulphuric acid, fumins		7
Sulphuric dioxide		7
Sulphurous acid		7
Sulphuryl chloride		7
Synthetic oil		8
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		10
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Tartaric acid, aqueous		10
Terphenyl		13
Tetra		11
Tetrabromoethane	Carbon tetrachloride	11
Tetrachloroethane	1,1,1-trichloroethane	11
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Tetrachloromethane	Trichloroethylene	11
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Toluene		10
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Tolyl acid		11
Tolyl phosphate	Benzoic acid	13
Trans-butene 1,4-diolic acid	Tri-n-butyl phosphate	12
Tri	Oxalic acid, alcoholic	13
Tri-n-butyl phosphate	Trichloroethylene	11
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Zinc phosphate	Ammonium nitrate, aqueous	9
Zinc stearate	Monozinc phosphate, aqueous	10
Zinc sulfate	Stearic acid	13
	Iron (II) sulfate, aqueous	9



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