

# Chemical Performance of Elastomers

## Abbreviations

S Satisfactory Resistance

L Limited Resistance

U Unsatisfactory Resistance

NR Natural Rubber

NBR Nitrile Rubber

CR Polychloropene (Neoprene)

SBR Styrene Butadiene Rubber

EPDM Ethylene Propylene Diene Monomer

dil.sol. dilute aqueous solution at a concentration equal to or less than 10%

sol. Aqueous solution at a concentration greater than 10% but not saturated

sat.sol. saturated aqueous solution prepared at 20°C

tg-g technical grade, gas

tg-l technical grade, liquid

tg-s technical grade, solid

work.sol. working solution of the concentration usually used in the industry concerned

susp. Suspension of solid in a saturated solution at 20°C

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Acetaldehyde	CH <sub>3</sub> CHO	20 60	40	L	U	U	U	S
Acetic acid	CH <sub>3</sub> COOH	20 60	up to 10	S	S	S	S	S
-glacial		20 60	>96	L	L	U	L	L
Acetic anhydride	(CH <sub>3</sub> CO) <sub>2</sub> O	20 60	100	L	U	S	L	L
Acetone	CH <sub>3</sub> COCH <sub>3</sub>	20 60	10	S	U	U	L	S
Acetonitrile		20 60		S	U	S	S	S
Acetophenone	CH <sub>3</sub> COC <sub>6</sub> H <sub>5</sub>	20 60	tg-s	U	U	U	U	S
Acetyl nitrile		20 60		U	U	U	U	U
Acrylic acid ethyl ester		20 60		L	U	L	U	S
Aluminium -chloride	AlCl <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
-sulphate	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Ammonium -hydroxide	NH <sub>4</sub> (OH)	20 60	35 m/v sol.	S	S	S	S	S
-sulphate	(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>	20 60	sat. sol.	S	S	S	S	S
Amyl acetate	CH <sub>3</sub> CO <sub>2</sub> CH <sub>2</sub> (CH <sub>2</sub> ) <sub>3</sub> CH <sub>3</sub>	20	tg-l	U	U	U	U	U

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Amyl alcohol	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>3</sub> CH <sub>2</sub> OH	20 60	tg-l	L	L	S	L	L
Aniline	C <sub>6</sub> H <sub>5</sub> NH <sub>2</sub>	20 60	sat. sol. or tg-l	L	U	L	S	S
Antimony chloride	SbCl <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Aqua regia	HCl + HNO <sub>3</sub>	20 60		U	U	U	U	U
Arsenic acid	H <sub>3</sub> AsO <sub>4</sub>	20 60	sat. sol. or weak conc.	S	S	S	S	S
Barium -chloride	BaCl <sub>2</sub>	20 60	sat. sol.	S	S	S	S	S
Benzaldehyde	C <sub>6</sub> H <sub>5</sub> CHO	20 60		U	U	U	U	S
Benzene	C <sub>6</sub> H <sub>6</sub>	20 60	tg-l	U	U	U	U	U
Benzoyl chloride		20	tg-l	U	U	U	U	U
Benzyl acetate		20 60		L	U	L	L	S
Boric acid	H <sub>3</sub> BO <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Bromine	Br <sub>2</sub>	20 60	tg-g	U	U	U	U	U
Butanols (butyl alcohols)	C <sub>4</sub> H <sub>9</sub> OH	20 60	tg-l	S	S	S	S	S
Butyl acetate	CH <sub>3</sub> CO <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>	20 60	tg-l	U	U	U	U	L
Butylene glycol	C <sub>4</sub> H <sub>6</sub> (OH) <sub>2</sub>	60	100	U	U	U	U	U
Butyl mercaptan		20 60		U	U	U	U	U
Butyric acid	C <sub>2</sub> H <sub>5</sub> CH <sub>2</sub> COOH	20 60	20	U	U	L	U	U
Calcium chloride	CaCl <sub>2</sub>	20 60	sat. sol.	S	S	S	S	S
Carbon disulphide	CS <sub>2</sub>	20 60	tg-l	U	U	U	U	U
Carbon tetrachloride Carbon tetrachloride	CCl <sub>4</sub>	20 60	tg-l	U	U	U	U	U
Castor oil		20 60		S	S	S	S	L
Cellosolve (2-ethoxyethanol)		20 60		L	L	L	U	L
Cellosolve acetate		20		U	U	U	U	S
Chlorine -dry gas	Cl <sub>2</sub>	20 60	10	U	U	U	U	U
		20 60	100	U	U	U	U	U
Chloroacetic acid	ClCH <sub>2</sub> COH	20 60	sol.	U	U	U	U	L
Chlorobenzene		20 60	tg-l	U	U	U	U	U

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Chloroform	CHCl <sub>3</sub>	20 60	tg-l	U	U	U	U	U
Chlorosulphonic acid	ClHSO <sub>3</sub>	20 60	tg-s	U	U	U	U	U
Chromic acid (plating soln)	CrO <sub>3</sub> + H <sub>2</sub> O	20 60	10	U	U	L	U	U
Citric acid	C <sub>3</sub> H <sub>4</sub> (OH)(CO <sub>2</sub> H) <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Copper sulphate	CuSO <sub>4</sub>	20 60	sat. sol.	S	S	S	L	S
Cottonseed oil		20 60	work sol.	S	S	S	U	S
Cresol	CH <sub>3</sub> C <sub>6</sub> H <sub>4</sub> OH	20 60	≤90	U	U	L	U	U
Cyclanone		20 60		U	U	U	U	L
Cyclohexane	C <sub>6</sub> H <sub>12</sub>	20 60		U	L	L	U	U
Cyclohexanol		20 60	sat. sol. or tg-s	U	L	L	U	L
Dichloroethylene	ClCH <sub>2</sub> Cl	20 60	tg-l	U	S	L	U	U
Diesel fuels		20 60		U	U	L	U	U
Diethyl ether	C <sub>2</sub> H <sub>5</sub> OC <sub>2</sub> H <sub>5</sub>	20 60		S	S	S	S	S
Dimethylamine	(CH <sub>3</sub> ) <sub>2</sub> NH	20 60	100	L	S	L	U	U
Dimethylhydrazine		20 60		U	U	U	U	S
Diocetyl phthalate		20 60	tg-l	U	L	U	U	S
Dioxane		20 60	tg-l	U	U	U	U	L
Ethanol (ethyl alcohol)	CH <sub>3</sub> CH <sub>2</sub> OH	20 60	tg-l	S	S	S	S	S
Ethyl chloride	CH <sub>3</sub> CH <sub>2</sub> Cl	20 60	tg-g	U	U	U	U	L
Ethylene -dibromide		20 60		U U	U U	U U	U U	U L
-glycol (ethanediol)	HOCH <sub>2</sub> CH <sub>2</sub> OH	20 60	tg-l	S	S	S	S	S
Ferric chloride	FeCl <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Fluoboric acid		20 60		S	S	S	S	S
Fluorine	F <sub>2</sub>	20 60	tg-g wet or dry	U	U	U	U	U
Fluosilic acid	HSiF <sub>6</sub>	20 60	sat. sol.	S	S	S	L	S

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Formaldehyde	HCOH	20 60	30-40%	S	U	L	L	S
Formic acid	HCOOH	20 60	10	L	L	L	S	S
Furfuraldehyde (furfural)		20 60		U	U	U	U	S
Hexane	C <sub>6</sub> H <sub>14</sub>	20 60		U	S	L	L	U
Hydrazine		20 60	97	S	L	L	S	S
Hydrobromic acid	HBr	20 60	up to 20	S	U	L	U	S
Hydrochloric acid	HCl	20 60	≤25	L	S	S	S	S
		20 60	≤37	L	S	S	L	L
Hydrofluoric acid	HF	20 60	up to 10	L	U	S	S	S
Hydrogen peroxide	H <sub>2</sub> O <sub>2</sub>	20 60	12	S	S	S	S	S
		20 60	30	U	U	U	U	S
Hydrogen sulphide	H <sub>2</sub> S	20 60	tg-g	U	U	S	U	S
Iso-octane (2,2,4-trimethylpentane)	C <sub>8</sub> H <sub>18</sub>	20 60		U	S	L	U	U
Isopropylalcohol	(CH <sub>3</sub> ) <sub>2</sub> CHOH	20 60	tg-l	S	S	S	S	S
Lactic acid	CH <sub>3</sub> CHOHCOOH	20 60	10	S	L	S	S	S
Lead acetate	Pb(CH <sub>3</sub> COO) <sub>2</sub>	20 60	dil. or sat. sol.	S	S	S	S	S
Linseed oil		20 60	work sol.	U	S	L	U	S
Lithium bromide		20 60		U	S	S	U	U
Magnesium carbonate	MgCO <sub>3</sub>	20 60	susp.	S	S	S	S	S
Manganese sulphate		20 60	10/20 or sat.	S	S	S	S	S
Mercuric chloride	HgCl <sub>2</sub>	20 60	sat. sol.	S	S	S	S	S
Methyl alcohol (methanol)	CH <sub>3</sub> OH	20 60	5	S	S	S	S	S
Methyl bromide (bromomethane)	CH <sub>3</sub> Br	20 60		U	U	U	U	U
Methyl ethyl ketone	CH <sub>3</sub> COCH <sub>2</sub> CH <sub>3</sub>	20 60	tg-l	U	U	U	U	S
Methylene chloride	CH <sub>2</sub> Cl <sub>2</sub>	20 60	tg-l	U	U	U	U	U

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Molasses		20 60	work sol.	S	S	S	S	S
Nickel chloride	NiCl <sub>2</sub>	20 60	sat. sol.	S	S	S	S	S
Nitric acid	HNO <sub>3</sub>	20 60	up to 45%	L	L	L	L	S
		20 60	>50%	U	U	U	U	U
Nitrobenzene	C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	20 60	tg-l	U	U	U	U	S
Nitroglycol		20 60		L	L	S	L	L
Nitropropane		20 60		L	U	L	L	S
Oleic acid	C <sub>8</sub> H <sub>17</sub> CHCH(CH <sub>2</sub> ) <sub>7</sub> CO <sub>2</sub> H	20 60	tg-l	U	S	L	U	L
Oxalic acid	HO <sub>2</sub> CCO <sub>2</sub> H	20 60	sat. sol.	S	L	S	L	S
Ozone	O <sub>3</sub>	20 60	sat. sol.	U	U	L	U	S
Paraffin		20 60		U	S	L	U	U
Petrol -refined		20 60		U	S	U	L	U
Petrol/benzene (mixture)		20 60	80:20					
Phenol	C <sub>6</sub> H <sub>5</sub> OH	20	1	L	U	L	L	S
Phosphoric -acid	H <sub>3</sub> PO <sub>4</sub>	20 60	10	S	U	S	S	S
Picric acid:	HO <sub>6</sub> H <sub>2</sub> (NO <sub>2</sub> ) <sub>3</sub>	20 60	1	L	L	L	L	S
Potassium cyanide	KCN	20 60	sat. sol.	S	S	S	S	S
Potassium fluoride	KF	20 60	sat. sol.	S	S	S	S	S
Potassium hydroxide	KOH	20 60	10	S	S	S	L	S
Potassium sulphate	K <sub>2</sub> SO <sub>4</sub>	20 60	sat. sol.	S	S	S	S	S
Propylene oxide		20 60		L	U	L	U	L
Pyridine	CH(CHCH) <sub>2</sub> N	20 60		U	U	U	U	L
Sea Water		20 60		S	S	S	S	S
Silver nitrate	AgNO <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
Sodium -carbonate	Na <sub>2</sub> CO <sub>3</sub>	20 60	sat. sol.	S	S	S	S	S
-chloride	NaCl	20 60	sat. sol.	S	S	S	S	S

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
Sodium -cyanide -hydroxide  -hypochlorite -nitrite	NaCN	20 60	sat. sol.	S	S	S	S	S
	NaOH	20 60	1 w/v	L	S	S	S	S
		20 60	10 w/v	S	S	S	S	S
	NaOCl	20 60	13% Cl	S	S	S	L	S
	NaNO <sub>2</sub>	20 60	sat. sol.	S	S	S	S	S
Stannic chloride (Tin (IV) chloride)	SnCl <sub>4</sub>	20 60	sol.	S	S	S	S	S
Sulphamic acid		20	sol.	S	S	S	S	S
Sulphur dioxide (dry)	SO <sub>2</sub>	20 60		U	L	L	U	S
Sulphuric acid	H <sub>2</sub> SO <sub>4</sub>	20 60	up to 10	S	S	S	S	S
		20 60	15	U	U	L	U	S
		20 60	10 to 50	U	U	U	U	U
		20 60	50 to 90	U	U	U	U	U
Tetrachloroethane	CHCl <sub>2</sub> CHCl <sub>2</sub>	20 60		U	U	U	U	U
Tetrahydrofuran	C <sub>4</sub> H <sub>8</sub> O	20 60	tg-l	U	U	U	U	U
Thionyl chloride	SOCl <sub>2</sub>	20 60	tg-l	U	U	U	U	L
Titanium tetrachloride		20 60		U	L	U	U	U
Toluene	C <sub>6</sub> H <sub>5</sub> CH <sub>3</sub>	20 60	tg-l	U	U	U	U	U
Trichloroacetic acid	CCl <sub>3</sub> COOH	20 60	≤50	L	L	U	L	L
Trichlorobenzene		20 60	work. sol.	U	U	U	U	U
Trichloroethylene	Cl <sub>2</sub> CCHCl	20 60	tg-l	U	U	U	U	U
Triethanolamine	N(CH <sub>2</sub> CH <sub>2</sub> OH) <sub>2</sub>	20 60	100	L	S	S	L	S
Triethylamine		20 60		U	L	U	U	U
Turpentine		20 60		U	S	U	U	U
Vegetable oils		20		U	S	S	U	L
Vinyl acetate	CH <sub>3</sub> CO <sub>2</sub> CHCH <sub>2</sub>	20 60	tg-l	U	L	S	U	U
Water	H <sub>2</sub> O	20 60		S	S	S	S	S

Chemical	Formula	Temp. (°C)	Conc. (%)	NR	NBR	CR	SBR	EPDM
<b>Xylene</b>	C <sub>8</sub> H <sub>10</sub>	20 60	tg-l	U	U	U	U	U
<b>Zinc chloride</b>	ZnCl <sub>2</sub>	20 60	dil. or sat. sol.	S	S	S	S	S

#### **Sources for Chemical Resistances of Rubbers**

1. Chemical Resistance Data Sheets, Volume 2-Rubbers, Rapra Technology Limited, 1993
2. Handbook of PVC Pipe Design and Construction, Third Edition, Uni-Bell PVC Pipe Association, 1993