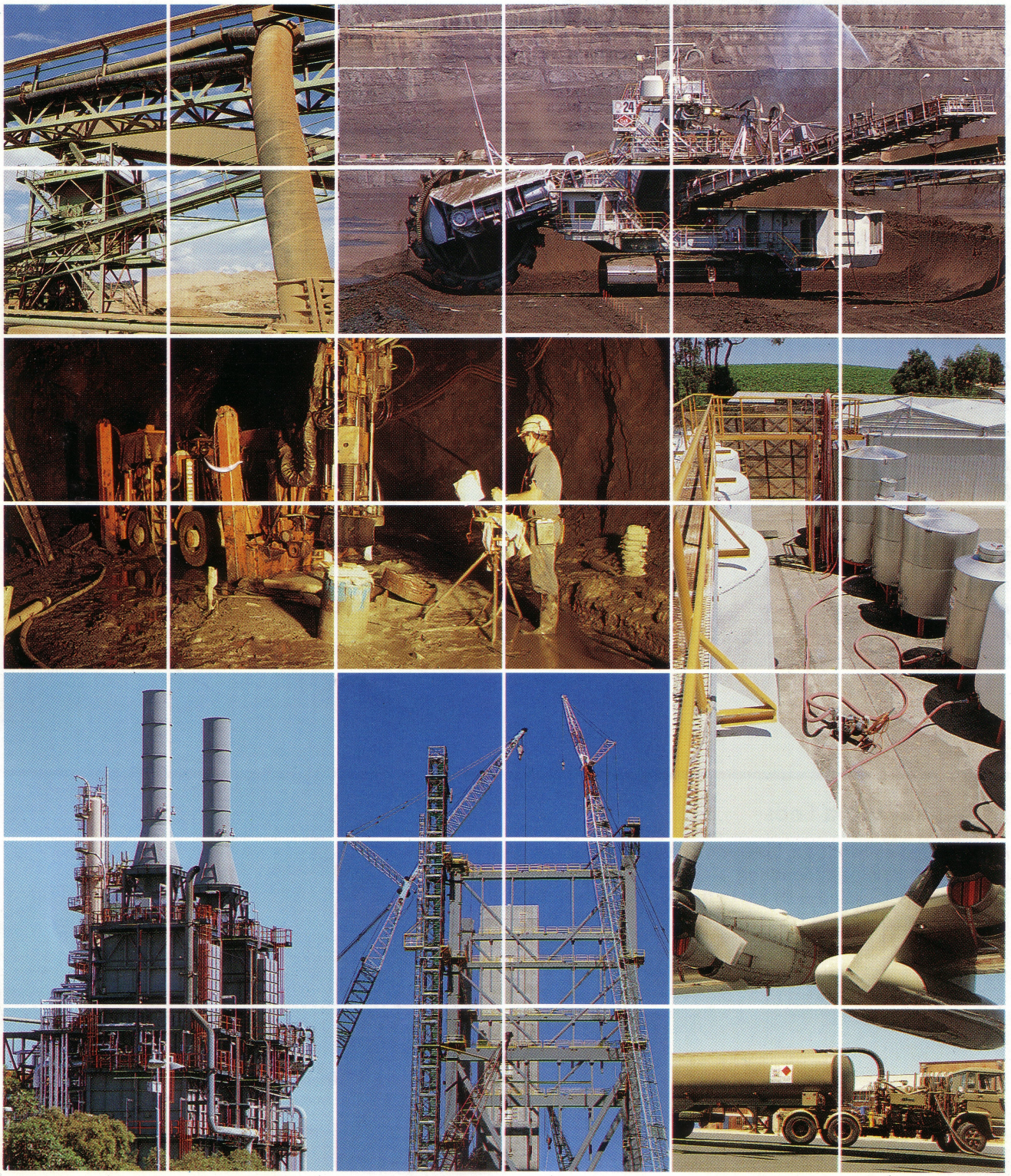
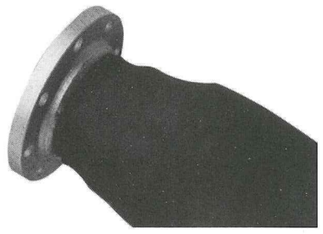
TECHNICAL INFORMATION



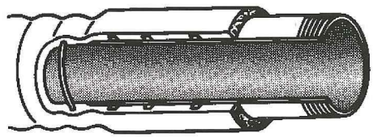
Hose Ends and Accessories

Inbuilt / Expanded Couplings



These type of couplings are built into the hose during manufacture. This is a high performance assembly with excellent reliability in dynamic applications. They are used mainly in the oil, mining and chemical industries.
A fully rubberised inbuilt expanded coupling is available in a beaded or flanged configuration. They are used mainly in dredging and high performance/pressure slurry applications.
The inbuilt tail piece is adaptable to various fittings including victaulic, rotating and fixed flanges and propriety couplings.

Inbuilt Nipple

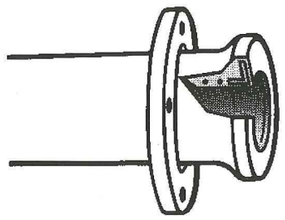


The hose end is built around, and rubber-to-metal bonded to the inbuilt nipple. Additionally, there are two or three bands around the OD of the nipple, which facilitate locking into position with heavy gauge wire, assuring a leak-proof end.
The nipple can be supplied with screwed thread for attachment of fittings, or can be shouldered or grooved to suit various clamp systems.

Flanged Ends

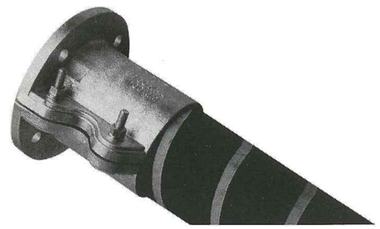
These ends are recommended especially where hoses carry acids, corrosives or abrasives; no metal is exposed to the fluid. Commonly supplied with Material Handling Hoses.
The rubber and fabric reinforcement of the hose body is extended to form a full face flange. This rubber and fabric flange is backed by a full circle or split ring metal backing plate. Bolt holes are drilled through the rubber and fabric flange and the metal backing plate.
This type of end is also available with a steel reinforcing for use where a towrope strain is applied to the hose. A flanged steel sleeve is built into the hose to give added strength to the end. The sleeve is totally encapsulated in rubber, thus exhibiting a metal free lining.

Beaded Ends



These are an alternative to flanged ends. Due to the ability to rotate the backing plate, beaded ends have the advantages of ease of alignment of bolt holes, and ease of rotation of the hose to evenly distribute wear in the lining of the hose in abrasive applications.
An angle iron hoop is built into the end of the hose to form the beaded end.

Muff Couplings

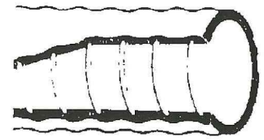


An externally fitted two piece coupling designed for the mining industry. Currently available with a flanged end in aluminium and cast iron, this fitting eliminates turbulance at the connection. Used mainly for conveying slurries and free flowing solids.

Swaged

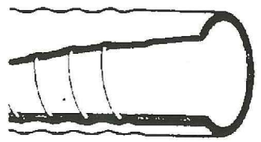
A permanent premium method of attachment, internal swaging is used in all industry types where a full flow, high pressure fitting is required. Special features can be customised for protecting the hose and fitting junction.

Plain Ends



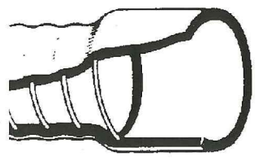
This type of end is the most common. It is the end usually supplied with stock hoses. The hose is simply cut to length, with no special treatment or finish to the cut end. The cross section of the hose is exposed, including wire if used in the reinforcing.

Cuffed Ends



The wire reinforcing is stopped at a pre-determined distance from the end of the hose to allow easier clamping. The length of the cuff is normally the same as the inside diameter of the hose, unless otherwise specified.
This type of end is also available capped, with rubber moulded over the end of the hose to protect the reinforcement from infiltration.
Cuffed and capped ends are steadily being replaced by specialised hose fittings, such as swaged couplings.

Raised Cuffed Ends

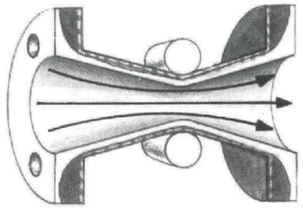


As for cuffed ends, but the hose ends are belled to allow unrestricted flow past the fitting. The inside diameter and length of raised cuffed ends are to be specified when the hose is ordered.

Reducers

For ease of connection between unequal pipe sizes and the ability to absorb noise and vibration emanating from pumps, compressors and other machinery.

Pinch Valves

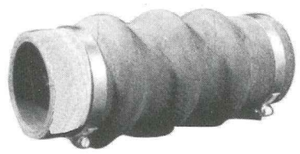


Designed for a variety of applications, in particular abrasive slurry services. Ideal for isolating or throttling flow.

Expansion Joints

Designed to alleviate stresses caused by, expansion and contraction in piping systems, noise and vibration. Dunlop expansion joints compensate for pipe misalignment.

Flexible Couplings



Simple to install, Dunlop flexible couplings are available in convoluted or plain finish, depending on the expansion or contraction needed. Will reduce noise caused by pipe misalignment.

FLANGE DRILLINGS

The holes in the flanges are drilled to pipe industry dimensions and standards. The most common drillings are AS 2129 Tables C, D, E and F; and ANSI B16.5 (also referred to as ASA) 150 and 300. The most common material for flanges is mild steel (galvanised or ungalvanised), but gun-metal bronze, stainless steel, aluminium and other materials are available.

Table C and Table D

Nominal Size mm	Outside Diameter of Flange mm	Bolt Circle Diameter mm	Number of Bolts	Bolt Size and Thread *	Bolt Hole Diameter mm
32	120	87	4	M12	14
40	135	98	4	M12	14
50	150	114	4	M16	18
65	165	127	4	M16	18
80	185	146	4	M16	18
100	215	178	4	M16	18
125	255	210	8	M16	18
150	280	235	8	M16	18
200	335	292	8	M16	18
250	405	356	8	M20	22
300	455	406	12	M20	22

Table E

Nominal Size mm	Outside Diameter of Flange mm	Bolt Circle Diameter mm	Number of Bolts	Bolt Size and Thread *	Bolt Hole Diameter mm
32	120	87	4	M12	14
40	135	98	4	M12	14
50	150	114	4	M16	18
65	165	127	4	M16	18
80	185	146	4	M16	18
100	215	178	8	M16	18
125	255	210	8	M16	18
150	280	235	8	M20	22
200	335	292	8	M20	22
250	405	356	12	M20	22
300	455	406	12	M24	26

Table F

Nominal Size mm	Outside Diameter of Flange mm	Bolt Circle Diameter mm	Number of Bolts	Bolt Size and Thread *	Bolt Hole Diameter mm
32	135	98	4	M16	18
40	140	105	4	M16	18
50	165	127	4	M16	18
65	185	146	8	M16	18
80	205	165	8	M16	18
100	230	191	8	M16	18
125	280	235	8	M20	22
150	305	260	12	M20	22
200	370	324	12	M20	22
250	430	381	12	M24	26
300	490	438	16	M24	26

*Inch series bolts are interchangeable as follows: 1/2/M12, 5/8/M16, 3/4/M20, 7/8/M24.

FLANGE DRILLINGS

ANSI SERIES 150

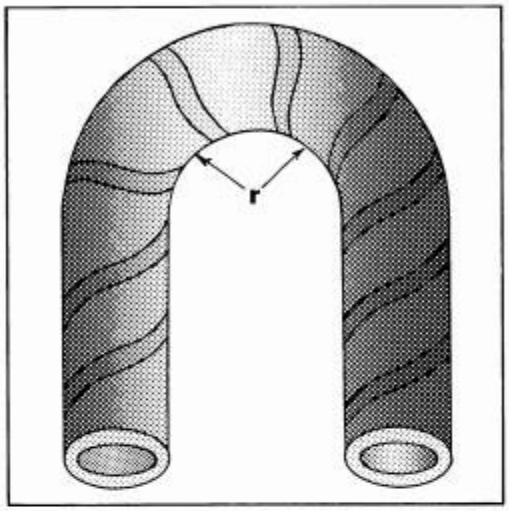
Size in.	Flange O.D. in.	P.C.D. in.	Bolt Hole Diameter in.	No. of Bolts	Bolt Diameter in.
2	6	4.3/4	3/4	4	5/8
2.1/2	7	5.1/2	3/4	4	5/8
3	7.1/2	6	3/4	4	5/8
4	9	7.1/2	3/4	8	5/8
6	11	9.1/2	7/8	8	3/4
8	13.1/2	11.3/4	7/8	8	3/4
10	16	14.1/4	1	12	7/8
12	19	17	1	12	7/8
16	23.1/2	21.1/4	1.1/8	16	1
20	27.1/2	25	1.1/4	20	1.1/8
24	32	29.1/2	1.3/8	20	1.1/4

ANSI SERIES 300

Size in.	Flange O.D. in.	P.C.D. in.	Bolt Hole Diameter in.	No. of Bolts	Bolt Diameter in.
2	6.1/2	5	3/4	8	5/8
2.1/2	7.1/2	5.7/8	7/8	8	3/4
3	8.1/4	6.5/8	7/8	8	3/4
4	10	7.7/8	7/8	8	3/4
6	12.1/2	10.5/8	7/8	8	3/4
8	15	13	1	12	7/8
10	17.1/2	15.1/4	1.1/8	16	1
12	20.1/2	17.3/4	1.1/4	16	1.1/8
16	25.1/2	22.1/2	1.3/8	20	1.1/4
20	30.1/2	27	1.3/8	24	1.1/4
24	36	32	1.5/8	24	1.1/2

MINIMUM BEND RADIUS RECOMMENDATIONS

The bend radius (r) is the radius of the arc through which a hose is bent. The minimum bend radius is the tightest arc in which a hose can be bent without kinking or otherwise damaging the hose.



Bending a hose to a tight radius imposes stresses on the structure of the hose which may cause a reduction in the performance, or in extreme cases cause permanent damage to the hose.

The minimum bend radius that a hose will withstand depends upon many factors including the wall thickness, the presence of a wire helix, the type of reinforcing material and the loss of performance that can be tolerated.

Hose up to 50mm I.D. — 6 times the inside diameter.
Hose over 50mm I.D. — 8 times the inside diameter.

e.g. A hose 50mm I.D. would have an MBR of 300mm. Thus 300mm of hose would be required to make a 90⁰ bend.

* For non wire reinforced hose recommend that a figure of 12 times the inside diameter of the hose be used to calculate the MBR.

These figures should be taken as a general guide only and if specific data be required.

Temperature Limits of Rubber Compounds

Rubber Type	Maximum Temperature Limits (Water)
Natural (NR)	70⁰C
Styrene Butadiene (SBR)	70⁰C
Nitrile (NBR)	90⁰C
Neoprene (CR)	90⁰C
* Ethylene Propylene (EPDM)	110⁰C
Hypalon (CSM)	120⁰C
Butyl (IIR)	90⁰C
Cross Linked Polyethylene (XLPE)	65⁰C

* Note that steam hoses are designed to perform at higher temperatures than shown here.

CHEMICAL RESISTANCE OF RUBBERS

The information contained in this table is based upon current knowledge and practice. The resistance as listed should be checked with a sample of the intended product as compounds and additives frequently vary. The resistance tabulated is an indication only and we accept no liability to its accuracy.

The data given relates to concentrated and saturated solutions at 20°C unless otherwise stated.

The table does not indicate what effect the rubber may have on the chemical.

RESISTANCE RATING

A — Recommended, little or no effect.
The material is unlikely to be destroyed by the indicated chemical.

B — Minor to moderate effect.
The material will probably give satisfactory results but will sooner or later be destroyed by the indicated chemical.

C — Moderate to severe effect.
The material may be used to a certain extent in conjunction with the indicated chemical if the contact period is short. Continuous contact will destroy the material.

U — Unsuitable and not recommended.
For some materials no data is available and thus no value has been entered.

ABBREVIATIONS/RUBBER MATERIALS

NR	=	Natural Rubber
IR	=	Isoprene Rubber
SBR	=	Styrene Rubber
BR	=	Butadiene Rubber
IIR	=	Butyl Rubber
EPDM EPM	=	Ethylene Propylene Rubber
ECO CO	=	Epichlorohydrin Rubber
NBR	=	Nitrile Rubber
EU	=	Urethane Rubber (Polyeter)
CR	=	Chloroprene Rubber (Neoprene)
CSM	=	Chlorosulphonylpolyethylene (Hypalon)
AU	=	Urethane Rubber (Polyester)
T	=	Polysulphide Rubber (Thiokol)
Si	=	Silicone Rubber
FSi	=	Fluorosilicone Rubber
FPM	=	Fluorinated Rubber (Viton)
ACM	=	Acrylate Rubber
XLPE	=	Cross Linked Polyethylene

PROPERTIES OF RUBBER COMPOUNDS

This table is provided as a general guide to the properties of compounds containing natural and synthetic rubbers.

Most compounds used in the manufacture of rubber hose contain about 60% by weight of rubber, the balance is made up of chemicals each contributing something to the physical properties of the finished product, or as an aid in processing. The selection of these components is very much a matter of compromise since the full achievement of one property is usually at the expense of another.

Common Name	ASTM Designation	Composition	General Properties
Neoprene	CR	Chloroprene	Good weather resistance. Flame retarding. Moderate resistance to petroleum based fluids. Good physical properties.
Natural	NR	Isoprene, natural	Excellent physical properties including abrasion and low temperature resistance. Poor resistance to petroleum based fluids.
Polyisoprene	IR	Isoprene, synthetic	Same properties as natural rubber.
Butyl	IIR	Isobutene-isoprene	Very good weathering resistance. Low permeability to air. Good physical properties. Poor resistance to petroleum based fluids.
Nitrile	NBR	Nitrile-butadiene	Excellent resistance to petroleum based fluids. Moderate resistance to aromatics. Good physical properties.
SBR	SBR	Styrene-butadiene	Good physical properties including abrasion resistance. Poor resistance to petroleum based fluids.
Hypalon	CSM	Chloro-sulfonyl-polyethylene	Excellent ozone, weathering and acid resistance. Good abrasion and heat resistance. Fair resistance to petroleum based fluids.
Ethylene Propylene Rubber	EPDM	Ethylene-propylene-diene-terpolymer	Excellent ozone, chemical and ageing characteristics. Poor resistance to petroleum based fluids.
Chlorobutyl	CIIR	Chloro-isobutene-isoprene	Very good weathering resistance. Low permeability to air. Good physical properties. Poor resistance to petroleum based fluids.
	XLPE	Cross Linked Polyethylene	Excellent Resistance to chemicals and petroleum based fluids.

CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Bromine — Anhydrous															
Bromine Trifluoride	U	U	U	U	U	U	U	U	U	U	U	U	U	U	
Bromine Water							B	A		B		B	A		
Bromobenzene	U	U	U	U	U	U	U	U	U	C	U	A	A	U	
Bunker Oil					A				B	A	B	A	A	A	B
Butadiene	U	U	C	C	U	U	B	B	U			B	B		A
Butane							Use D305 or D306 Hose only								
Butter	U	U	B	A	A	A	B	B	A	U	A	A	A	A	
Butyl Acetate			B	B		U	U	U		C	U	U	U	U	B
Butyl Acetyl Ricinoleate			A	A			B	B				B	A		
Butyl Acrylate		U	U	U						B			U		
Butyl Alcohol	A	A	B	B	A		A	A	U	B	B	A	A	U	A
Butyl Amine	U	U	U	U	C		U	U	U	U	B	U	U	U	A
Butyl Benzoate			A	A			U	U				A	A		
Butyl Carbitol			A	A	A		B	B					A		A
Butyl Cellosolve			A	A	C		B	B				U	U		
Butyl Oleate	U	U	B	B			U	U				B	A		
Butyl Stearate	U	U	B	B	B					A		B	A		A
Butylene	U	U	U	U	B		C	C		B		B	A		
Butyraldehyde	C	C	B	B	C		C	C		B	C	U	U	U	B
Calcium Acetate	A		A	A	B		B	B				U	U		A
Calcium Bisulfite	U	U	U	U	A		A	A	A	U	A	A	A		A
Calcium Chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Calcium Hydroxide	A	A	A	A	A	A	A	A	A	U	A	A	A	U	A
Calcium Hypochlorite	U	U	A	A	C	B	C	A			B	A	A		B
Calcium Nitrate	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A
Calcium Sulfide	B	B	A	A	B	B	A	A	A	U	B	A	A	U	A
Cane Sugar Liquors	A	A	A	A	A	A	A	A	U	U	A	A	A	U	A
Carbamate	U	U	B	B	C		B	B	U	B		A	A	U	A
Carbitol	B	B	B	B	B		B	B	U	B	B	B	B	U	
Carbolic Acid	U	U	B	B	U		C	C		U	U	A	A		B
Carbon Bisulfide			U	U	C	U	U	U		C		A	A		
Carbon Dioxide	B	B	B	B	A	A	B	A	A	A	A	A	A	B	A
Carbon Acid	A	B	A	A	A	A	A	A	A	A	A	A	A	A	
Carbon Monoxide	B	B	A	A	A	A	A	A	A	U	A	B	A		B
Carbon Tetrachloride	U	U	U	U	C	B	U	U	C	C	U	A	A		B
Castor Oil	A	A	B	B	A	A	A	A	A	C	A	A	A	A	A
Caustic Soda	A	A	A	A	B	B	A	A	B	U	B	B	B	A	B
Cellosolve	U	U	B	B				B		B			C		B
Cellosolve Acetate	U	U	B	B	U				U	B		U	U		A
Chlorine (Dry)															
Chlorine (Wet)															
Chlorine Dioxide			C	C	U		U	C				B	A		
Chlorine Trifluoride	U	U	U	U	U	U	U	U	U	U	U	B	U		
Chloroacetone	B		B	A	U		B	B				U	U		
Chloroacetic Acid			B	B											A
Chlorobenzene	U	U	U	U	U	U	U	U	C	U	U	B	A	U	A
Chlorobromomethane	U	U	B	B			U	U			U	B	A		B
Chlorobutadiene	U	U	U	U	U		U					B	A		
Chlorododecane	U	U	U	U	U		U					A	A		
Chloroform	U	U	U	U	U		U	U			U	B	A		B
0-Chloronapthalene	U	U	U	U	U		U				U	B	A		U
1-Chloro 1-Nitro Ethane	U	U	U	U	U		U	U	U	U	U		C	U	
Chlorosulfonic Acid															
Chlorotoluene	U	U	U	U	U		U	U	U			B	A		U
Chrome Plating Solutions	U	U	U	U	U		U	C	U	U	B	B	A		
Chromic Acid	U	U	C	C	U		U	B	U		C	C	A		
Citric Acid	A	A	A	A	A	A	A	A	A	U	A	A	A		A
Cobalt Chloride	A	A	A	A	A		A		U	B	A	A		U	
Coconut Oil	U	U	A	A	A		B	B	A		A	A		A	A
Cod Liver Oil	U	U	A	A	A		B	B	A		B	A	A	A	A
Coke Oven Gas	U	U									B	B	A		A
Copper Acetate			A	A	B		B	B							
Copper Chloride	A	A	A	A	A		A	A	A		A	A	A	A	A
Copper Cyanide	A	A	A	A	A		A	A	A		A	A	A	A	A

A = Recommended — little or no effect **B** = Minor to moderate effect **C** = Moderate to severe effect **U** = Not recommended

CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Acetaldehyde	C	U	A	A	U		C	C	U	C	A	U	U	U	A
Acetamide	C	C	A	A	A		B	B	U	U	B	A	B	U	A
Acetic Acid Glacial	B	C	B	A	C	U	C	C	U	B	B	C	C	U	B
Acetic Acid 30%	B	B	B	A	B	B	A	A	C	B	A	B	B	U	B
Acetic Anhydride	B	B	B	B	C	U	A	A	U	B	C	U	U	U	B
Acetone	B	B	A	A	U	U	B	B	U	C	B	U	U	U	B
Actodhenone, Actodphene	C	U	A	A	U	U	U	U	U	U		U	U	U	B
Acetyl Chloride							U	U				A	A		
Acetylene	Use D301 or D307 Hose Only														
Acrylonitrile	U	C	U	U	U		C	C		U	U	U	U		B
Adipic Acid					A							A			
Alkazene				U			U		B			B	B		
Aluminium Acetate	A	B	A	A	B	B	B	A		U	U	U		U	A
Aluminium Chloride	A	A	A	A	A	A	A	A		U	B	A	A	A	A
Aluminium Fluoride	B	A	A	A	A	A	A	A		U	B	A	A		A
Aluminium Nitrate	A	A	A	A	A	A	A	A		B					A
Aluminium Phosphate	A	A	A	A	A	A	A	A			A		A		
Aluminium Sulfate	A	B	A	A	A		A	A		U	A	A	A	U	A
Ammonia Anhydrous															
Ammonia Gas (Cold)	A	A	A	A	A		A	A		A	A	A			
Ammonia Gas (Hot)			B	B			B	B		U	A	U	U		
Ammonium Carbonate	A	A	A	A	U	B	A								A
Ammonium Chloride	A	A	A	A	A	A	A	A		A					A
Ammonium Hydroxide	U	U	A	A	U	B	A	A	A	U	A	B	B	U	A
Ammonium Nitrate	C	A	A	A	A	A	B	A	U					A	A
Ammonium Persulfate	A	U	A	A	U		A	A	U					U	
Ammonium Phosphate	B	A	A	A	A		A	A		A	A				A
Ammonium Sulfate	A	B	A	A	A		A	A		U				U	A
Amyl Acetate	B	C	A	A	U	U	U	U	U	U	U	U	U	U	A
Amyl Alcohol	B	B	A	A	B	A	A	A	U	B	U	A	B	U	A
Amyl Borate	U	U	U	U	A		A	A		A			A		A
Amyl Chloronaphtalene	U	U	U	U			U	U	U	C	U	B	A	U	A
Amyl Naphtalene	U	U	U	U	U		U	U	U	C	U	A	A	B	A
Aniline	U	U	B	B	U	U	C	C	U	C		C	C	U	B
Aniline Dyes	B	B	B	B	U		B	B	U	B		B	B	U	A
Aniline Hydrochloride	B	C	B	B	B		U	U	U	B	U	B	B	U	A
Animal Fats	U	U	B	B	A	A	B	B	A	U	B	A	A	A	A
Ansul Ether	U	U	C	C	C		U	U	B	A	U	C	U	U	
Aqua Regia	U	U	U	C			U	C	U	U	U	C	B		B
Arochlor (S)	U	U	C	C	C		U			U	B	B	A	U	
Arsenic Acid	B	A	A	A	A	A	A	A	C	A	A	A	A	C	A
Arsenic Trichloride					A		A			U	B	B	A	U	
Asphalt	U	U	U	U	B	A	C	C	B	A	U	B	A	B	B
Astm Oil No 1	U	U	U	U	A	A	A	A	A	A	C	A	A	A	A
Astm Oil No 2	U	U	U	U	A	A	B	B	B	A	C	A	A	A	A
Astm Oil No 3	U	U	U	U	A	A	B	B	B	A	C	A	A	A	A
Barium Chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Barium Hydroxide	A	A	A	A	A	A	A	A	A	A	A	A	A	U	A
Barium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A	A		A
Barium Sulfide	A	B	A	A	A	A	A	A	A	B	A	A	A	U	A
Beer	A	A	A	A	A	A	A	A			A	A	A	U	
Beet Sugar Liquors	A	A	A	A	A		A	A		U	A	A	A	U	A
Benzene	U	U	U	U	U	U	U	U	U	C	U	A	A	U	B
Benzenesulfonic Acid							A	A				B	A		A
Benzaldehyde	U	U	A	A	U	U	U	U	U	U	U	U	U	U	A
Benzyl Alcohol			B	B	U	U	A	B				B	A		A
Benzyl Benzoate			B	B								A	A		A
Benzyl Chloride					U		U					A	A		A
Benzoic Acid											B	B	A		
Blast Furnace Gas	U	U			U		U				A	B	A		A
Bleach Solutions	U	U	A	A			C	A			B	B	A		
Borax	B	B	A	A	B		A	A	A		B	B	A	B	A
Bordeaux Mixture	B	B	A	A			A	A			B	B	A		A
Boric Acid	A	A	A	A	A	A	A	A	A	U	A	A	A	U	A
Brine			A	A	A		A	A							

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CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	SI	FSI	FPM	ACM	XLPE
Ethyl Formate	U	U	B	B	U	U	B	B				A	A		
Ethyl Mercaptan	U	U	U	U	U	U				U			A		A
Ethyl Oxalate	A	A	A	A	U	U	C		A	A			A		A
Ethyl Pentochlorobenzene	U	U	U	U	C	C	U	U	C	B		B	A		A
Ethyl Silicate	B	B	A	A	A	A	A	A				A	A		A
Ethylene					A							A	A		
Ethylene Chloride			C	C								C	A		B
Ethylene Chlorohydrin	B	B			U		B	B		B	C	B	A		A
Ethylene Diamine	B	B	A	A	A	A	A	A			A	U	U		A
Ethylene Dichloride	U	U	C	C	U	U	U	U	U	U	C	C	A		B
Ethylene Glycol	A	A	A	A	A	A	A	A	B	C	A	A	A	U	A
Ethylene Oxide			C	C	U		U	U			C	U	U		
Ethylene Trichloride			C	C	U		U	U			C	C	A		
Fatty Acids	C	C	U	U	B		B	B		U	C		A		B
Ferric Chloride	A	A	A	A	A	A	A	A	A		A		A		A
Ferric Nitrate	A	A	A	A	A	A	A	A		A	C	A	A	A	A
Ferric Sulfate	A	A	A	A	A	A	A	A		A	B	A	A	A	A
Fish Oil					A						A	A	A		
Fluroboric Acid	A	A	A	A	A		A	A							A
Fluorine (Liquid)															
Fluorobenzene	U	U	U	U	U		U	U			U	B	A		
Fluorocarbon Oils			A	A											
Fluorinated Cyclic Ethers			A	A											
Fluorosilic Acid	A				A		A	A							A
Formaldehyde			A	A	B	B	A	A	U				A		B
Formic Acid	A	A	A	A	B	B	A	A	U		B	C	C		A
Freon 11	U	U	U	U	A		B	A	U	A	U	B	A		
Freon 12															
Freon 13	A	A	A	A	A	A	A	A		A			A		
Freon 21	U		U	U	U	B	B	U		U	U		U		
Freon 22	A	A	A	A	U	A	A	A	U	A	U	U	U		
Freon 31	B	B	A	A	U		A	B		B			U		
Freon 32	A	A	A	A	A		A	A		A			C		
Freon 112	U		U	U	B		B	B		A			A		
Freon 113	C	B	U	U	A	A	A	A	B	A	U	U	B		
Freon 114															
Freon 115	A	A	A	A	A		A	A		A			B		
Freon 142 b	A	A	A	A	A		A	A		A			U		
Freon 152 a	A	A	A	A	A		A	C		A			U		
Freon 218	A	A	A	A	A		A	A		A			A		
Freon C 316	A	A	A	A	A		A	A							
Freon C 318	A	A	A	A	A		A	A		A			A		
Freon 13 B 1	A	A	A	A	A		A	A	A	A	U		A		
Freon 114 B 2	U	C	U	U	B		A	A		A			B		
Freon 502	A	A			B		A						B		
Freon TF	C	B	U	U	A	A	A	A	A	A	U		A		
Freon T-WD 602	C	B	A	B	B		B	B	A	A	U		A		
Freon TMC	B	C	B	B	B		B	B	B	A	C		A		
Freon T-P35	A	A	A	A	A		A	A	A	A	A		A		
Freon TA	A	A	A	A	A		A	A	A	A	A		C		
Freon TC	U	B	A	B	A		A	A	A	A	U		A		
Freon MF	U	B	U		A		C	U	C	A					
Freon BF	U	U	U		B		B	B		A					
Fuel Oil	U	U	U	U	A	A	B	B	B	A	U	A	A	A	A
Fumaric Acid	A	A	U		A		B	B			B	A	A	U	A
Furan, Furfuran	U	U	C	C	U		U	U		B					A
Fufural	C	C	B	B	U	U	B	B		C			U		A
Gallic Acid	A	B	B	B	B		B	B	U			A	A	U	A
Gasoline	U	U	U	U	A	A	B	B	A	A	U	A	A		A
Gelatin	A	A	A	A	A	A	A	A	A	U	A	A	A	U	
Glaubers Salt		U	B	B						U		A	A	U	U
Glucose	A	A	A	A	A	A	A	A	A	U	A	A	A		A
Glue	A	A	A	A	A	A	A	A	A	U	A	A	A		A
Glycerin	A	A	A	A	A	A	A	A	A	B	A	A	A	U	A
Glycols	A	A	A	A	A	A	A	A	B	A	A	A	A	U	A

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CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Copper Sulfate	B	B	A	A	A		A	A	A	U	A	A	A	U	A
Corn Oil	U	U	B	C	A	A	B	B	A	U	A	A	A	A	A
Cottonseed Oil	U	U	C	A	A	A	B	B	A	U	A	A	A	A	A
Creosote	U	U	U	U	B	U	C	C	B	C	U	A	A	A	B
Cresol	U	U	U	U	C		C	C	U			B	A		B
Cresylic Acid	U	U	U	U	C		C	C	U			B	A		B
Cumene							U	U		B		B	A		A
Cyclohexane	U	U	U	U	A		U	U	B	A	U	A	A	B	A
Cyclohexanol	B	U	U	U	B		A	A		B		A	A		
Cyclohexanone			B	B	U	U	U	U		B		U	U		A
P-Cymene							U	U		B		B	A		B
Decalin	U	U					U	U		B		A	A		A
Decane	U	U			B		U	U	B		B	A	A	A	
Denatured Alcohol	A	A	A	A	A	A	A	A	C	A	A	A	A	U	A
Detergent Solutions	B	B	A	A	A	A	A	A	U		A	A	A	U	A
Developing Fluids	A	B	B	B	A		A	A		A	A	A	A		A
Diacetone			A	A					B			U	U		A
Diacetone Alcohol	U	U	A	A	U	U	A	A	B		A				A
Dibenzyl Ether	U	U	B	B	U	U	B		B	B					A
Dibenzyl Sebacate			B	B			U		B	B	C	C	B		A
Dibutyl Amine	U	U	U	U	U		U	U			C	U	U		
Dibutyl Ether	U	U	C	C	C		C	C	B	A	U	C	C	C	A
Dibutyl Phtalate	C	U	B	A	U	B	U	U	C	A	B	B	B		A
Dibutyl Sebacate	U	U	B	B	U		U	U	U	B	B	B	B	U	A
0-Dichlorobenzene	U	U	U	U	U		U	U	U	A	U	B	A		B
Dichloro-Isopropyl Ether	U	U	C	C	U		U	U	B	A	U	C	C	B	
Dicyclohexylamine	U	U			C					C					
Diesel Oil	U	U	U	U	A	A	B	B	B	A	U	A	A	A	A
Diethylamine	B	B	B	B	C		C	C	C	B	B	U	U	U	A
Diethyl Benzene	U	U	U	U	U		U	U	U	B	U	A	A		A
Diethyl Ether	U	U	U	U	U		C	C	A	A	U	C	U	C	
Diethylene Glycol	A	A	A	A	A	A	A	A	U	U	B	A	A	U	A
Diethyl Sebacate			B	B	U		U	U		B	B	B	B		A
Diisobutylene					B		C	C		A	U	C	A		A
Diisopropyl Benzene	U	U	U	U	U		U	U		B		B	A		
Diisopropyl Ketone			A	A	U		U	U		B		U	U		A
Dimethyl Aniline	U	U	U	B			U					U	U		A
Dimethyl Formamide					B		C	C			B		U		B
Dimethyl Phtalate	U	U	B	B	U		U	U		B		B	B		A
Dinitrotoluene	U	U	U	U	U		U	U					C		
Dioctyl Phtalate			B	B		B	U	U		B	C	B	B		A
Dioctyl Sebacate	U	U	B	B	U	C	U	U	B	C	C	C	B	U	A
Dioxane			B	B								C			A
Dioxalane	U	U	C	B	U										
Dipentene					B					A		C	A		A
Diphenyl										B		B	A		
Dipgenyl Oxides				A							C	B	A		
Dry Cleaning Fluids	U	U	U	U	C		U	U				B	A		
Epichlorohydrin	U	U	B	B								U	U		B
Ethane	U	U	U	U	A		B	B	B	A	U	A	A	A	
Ethanolamine	B	B	B	B	B	B	B	B	C	B	B	U	U	U	A
Ethyl Acetate	U	U	B	B	U	U	C	C	U	B	B	U	U		A
Ethyl Acetoacetate	C	C	B	B	U		C			B	B	U	U		A
Ethyl Acrylate			B	B		U				B	B	U	U		B
Ethyl Alcohol — Ethanol	A	A	A	A	B	A	A	A	B	A	A	A	A	U	A
Ethyl Benzene	U	U	U	U	U	U	U	U	U	C		A	A		B
Ethyl Benzoate			B	B						B		A	A		
Ethyl Cellosolve			B	B						B		U	U		
Ethyl Cellulose	B	B	B	B			B	B	B	U	C	U	U	U	A
Ethyl Chlorine	B	B	A	A	A	B	B	C	B	U	U	A	A	C	
Ethyl Chlorocarbonate	U	U					C	C				B	A		
Ethyl Chloroformate	U						C	C				B	A		
Ethyl Ether			C	C	C	B	U	U	B	A		C	U	U	B

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CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Halowax Oil	U	U	U	U	U		U	U		A	U	A	A		U
n-Hexaldehyde	U	U	B	A	U		A		B		B				A
Hexane	U	U	U	U	A	A	B	B	B	A	U	A	A	A	A
Hexyl Alcohol	A	A	C	C	A		B	B	U	A	B	A	A	U	A
Hydrazine			A	A	B		B	B	U		C				U
Hydraulic Oil (Petroleum)	U	U	U	U	A	A	B	B	A	A	C	A	A	A	A
Hydrobromic Acid	A	C	A	A	U		A	A	U		U	C	A	U	A
Hydrochloric Acid (Hot) 37%	U	U	C	C	U	U	U	C	U	U	U	U	A	U	A
Hydrochloric Acid (Cold) 37%	B	B	A	A	B	U	B	A	U	U	B	B	A	U	A
Hydrocyanic Acid															
Hydrofluoric Acid (Conc) Hot	U	U	U	U	U		U	C	U	U	U	U	B	U	A
Hydrofluoric Acid (Conc) Cold	U	U	B	B	U		B	A	U	U	U	U	A	U	A
Hydrofluoric Acid (Anhydrous)	U	U	B	B				A			U				
Hydrofluorosilic Acid	A	B	A	A	B		B	A		U	U		A		
Hydrogen Gas															
Hydrogen Peroxide (90%)	U	U	C	C	U			C		U	A	B	B		U
Hydrogen Sulfide Wet Cold	U	U	A	A	U	B	A	B		A	C	C	U	U	
Hydrogen Sulfide Wet Hot	U	U	A	A	U	B	B	C		A	C	C	U	U	
Hydroquinone	B	B			C					C		B	U		A
Hypochlorus Acid	B	B	B	B	U	B							A		A
Iodine Pentafluoride	U	U	U	U	U	U	U	U	U	U	U	U	U	U	
Iodoform			A	A											
Isobutyl Alcohol	A	B	A	A	B		A	A	U		A	B	A	U	A
Isooctane	U	U	U	U	A	A	B	B	B	A	U	A	A	A	A
Isopropyl Acetate			A	A	U		U	U	A				U	U	A
Isopropyl Alcohol	A	B	A	A	B	A	A	A		A	A	B	A	U	A
Isopropyl Chloride	U	U	U	U	U					U		B	A		
Isopropyl Ether	U	U	U	U	B		B	B	B	A			U	C	A
Kerosene	U	U	U	U	A	A	C	C	B	B	U	A	A	A	A
Lacquers	U	U	U	U	U	U	U	U	U	A	U	U	U	U	A
Lacquer Solvents	U	U	U	U	U	U	U	U	U	A	U	U	U	U	A
Lactic Acid	A	A	A	A	A		A	A		U	A	A	A		A
Lard	U	U	U	U	A	A	C	C	A	U	B	A	A	A	A
Lavender Oil	U	U	U	U	B		C			B		B	A	B	
Lead Acetate	A		A	A	B	B	B			U	U				A
Lead Nitrate	A	A	A	A	A		A	A			B	A			A
Lead Sulfamate	B	B	A	A	B		A	A		U	B	A	A	U	A
Lime Bleach	A	A	A	A	A		B	B		U	B	A	A	U	A
Lime Sulfur	U	U	A	A	U		A	A		U	A	A	A	U	
Lindol			A	A			C	C			C	C	B		
Linoleic Acid			U	U	B		U				B		B		A
Linseed Oil	U	U	B	B	A		B	B	B	A		A	A	A	A
Liquefied Petroleum Gas							Use D305 or D306 Hose only								
Lubricating Oils (Petroleum)	U	U	U	U	A	A	B	B	B	C	U	A	A	A	A
Lye	B	B	A	A	B		B	A	B	C	B	A	B	U	
Magnesium Chloride	A	A	A	A	A	A	A	A	A	C	A	A	A		A
Magnesium Hydroxide	B	B	A	A	B	A	A	A	A	C			A	U	A
Magnesium Sulfate	B	B	A	A	A	A	A	A		B	A	A	A	U	A
Maleic Acid	B	B	C	C						B			A		
Maleic Anhydride	B	B	C	C									A		
Malic Acid		B	U	U	A		B	B			B	A	A	U	A
Mercuric Chloride	A	A	A	A	A	A	A	A					A		A
Mercury	A	A	A	A	A	A	A	A	A				A		A
Mesityl Oxide	U	U	B	B	U		U	U		B	U	U	U		A
Methane	U	U	U	U	A	A	B	B	B	A	U	B	A	A	

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CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Methyl Acetate	U	U	B	B	U	U	B					U	U		B
Methyl Acrylate	U	U	B	B	U		B					U	U	U	B
Methylacrylic Acid	U	U	B	B			B					U	B	U	
Methyl Alcohol	A	A	A	A	A	B	A	A	U	B	A	A	C	U	A
Methyl Bromide					B		U	U				A	A		A
Methyl Butyl Ketone	U	U	A	A	U		U	U		A	B	U	U		A
Methyl Cellosolve	U	U	B	B			B	B					U		A
Methyl Chloride	U	U	C	C	U		U	U			U	B	A	U	B
Methyl Cyclopentane	U	U	U	U			C			B		B	A		
Methylene Chloride	U	U	U	B	U		U	U	U			B	B		A
Methyl Ethyl Ketone	U	U	A	A	U	U	U	U	U	A		U	U	U	B
Methyl Formate	U	U	B	B	U	U	B	B		B	B				A
Methyl Isobutyl Ketone	U	U	C	B	U	U	U	U		B	C	U	U	U	B
Methyl Methacrylate	U	U	U	U	U	U	U			B	C	U	U	U	B
Methyl Oleate	U	U	B	B	U		U					B	A		
Methyl Salicylate			B	B			U								A
Milk	A	A	A	A	A		A	A	U	B	A	A	A	U	
Mineral Oil	U	U	U	U	A	A	B	B	A	B	B	A	A	A	A
Monochlorobenzene	U	U	U	U	U	U	U	U		B	U	B	A		B
Monomethyl Aniline	U	U			U		U	U					B		
Monoethanolamine	B	B	B	B	U		U	U			B	U	U		B
Monomethylether	B	B	A	A	A		A			B					
Monovinyl Acetylene	B	B	A	A	A		B	B		C	B		A		
Mustard Gas	A		A	A			A	A			A				
Naphta	U	U	U	U	C	A	C	U	C	B	U	B	A	B	A
Naphtalene	U	U	U	U	U		U	U	B	B	U	A	A		B
Naptenic Acid	U	U	U	U	B					B		A	A		
Natural Gas	Use D305 or D306 Hose only														
Nickel Acetate	A		A	A	B		B					U	U		A
Nickel Chloride	A	A	A	A	A		A	A		A	A	A	A		A
Nickel Sulfate	B	B	A	A	A		A	A	A		A	A	A	U	A
Nitric Acid Conc.	U	U	C	C	U	U	C	B	U	U	U	U	A	U	B
Nitric Acid Dilute	U	U	B	B	U	U	A	A	C	U	B	B	A	U	A
Nitric Acid Red Fuming	U	U	U	U	U	U	U	U	U	U	U	U	C	U	C
Nitrobenzene	U	U	U	B	U	U	U	U	U	U	U	U	B	U	B
Nitrobenzine			C	C			U	U				A	A		
Nitroethane	B	B	B	B	U		C	C			U	U	U	U	A
Nitromethane	B	B	B	B	U		C	C			U	U	U	U	A
Nitrogen	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Nitrogentetroxide															
Octadecane	U	U	U	U	A		B	B	A	A	U	A	A	B	
n-Octane	U	U	U	U						B	U	B	A		B
Octyl Alcohol	B	B	A	A	B		A	A	U	B	B	B	A	U	A
Oleic Acid	C	C	B	B	C		C	C	B				B		A
Oleum Spirits					B		C	B	C			B	A		U
Olive Oil	U	U	B	B	A	B	B	B	A		U		A	A	A
0-Dichlorobenzene					U		U	U		B		B	A		B
Oxalic Acid	B	B	A	A	B	C	B	B		U	B	A	A		B
Oxygen - cold	B	B	A	A	B	B	B	B	A	B	A	A	A	A	U
Oxygen - 100-200°C	U	U	U	U	U	U	U	U	U	U	B	U	B		
Ozone	U	U	B	A	U	A	B	A	A	A	A	U	A	B	B
Paint Thinner (Duco)	U	U	U	U						B		B	B		
Palmitic Acid	B	B	B	B	A	B	B	B	A	U		A	A		A
Peanut Oil	U	U	C	C	A	A	B	B	B	U	A	A	A	A	A
Perchloric Acid			B	B		C	A	A		A	U	A	A		B
Perchloroethylene	U	U	U	U	C	B	U	U	U	A	B	B	A		A
Petroleum - Below 250	U	U	U	U	A	A	B	B	B	U	B	B	A	A	
Petroleum - Above 250	U	U	U	U	C	B	U	U	U	U	U	U	B	C	
Phenol	C	C	B	B	U		C	C	U		C	B	A		B
Phenylbenzene	U	U	U	U	U		U	U		B		B	A		
Phenyl Ethyl Ether	U	U	U	U	U		U	U		B					

A = Recommended — little or no effect **B** = Minor to moderate effect **C** = Moderate to severe effect **U** = Not recommended

CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	Si	FSi	FPM	ACM	XLPE
Phelyn Hydrazine	A	B	C	C	U		C	C					A		
Phorone			B	B						C					A
Phosphoric Acid 20%	B	C	A	A	B		B	A	A	U		B	A		A
Phosphoric Acid 45%	U	U	B	B	U		B	B	A	U	U	B	A		A
Phosphorus Trichloride	U	U	A	A	U		U	U				A	A		
Pickling Solution			C	C		U		C					B		
Picric Acid	B	B	B	B	B		A	B	B		U	B	A		B
Pinene	U	U	U	U	B		B	B	B	B	U	B	A		A
Pine Oil	U	U	U	U	B		U	U		B		A	A		A
Piperidine	U	U	U	U	U		U	U				U	U		
Plating Solution - Chrome	U	U	A	A				C			U		A		A
Plating Solution - Others			A	A	A			A			U		A		
Polyvinylacetate Emulsion			A	A			B	B							
Potassium Acetate	A		A	A	B		B	B				U	U		A
Potassium Chloride	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Cupro Cyanide	A	A	A	A	A		A	A	A	A	A	A	A	A	
Potassium Cyanide	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B
Potassium Carbonate	B	B	B	B	B		B								A
Potassium Dicromate	B	B	A	A	A		A	A	A	A	A	A	A	A	A
Potassium Hydroxide	B	B	A	A	B	A	A	A	B	B	C	C	B	U	A
Potassium Nitrate	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Sulfate	B	B	A	A	A	A	A	A	A	B	A	A	A	U	A
Producer Gas	U	U	U	U	A		B	B	A	U	B	B	A	B	
Propane	Use D305 or D306 Hose only														
Propyl Acetate	U	U	B	B	U	U	U	U		B		U	U		A
Propyl Alcohol	A	A	A	A	A	A	A	A	U	A	A	A	A	U	A
Propyl Nitrate			B	B							C	U	U		
Propylene	Use D305 or D306 Hose only														
Propylene Oxide			B	B			U	U			U				
Pyridine	U	U	B	B	U	U	U	U					U		B
Pyroligeneuos Acid			B	B			B	B		B					
Pyrrole	C	C	C	C	U		U			U	B	B		U	
Radiation	B	B	U	B	B		B	B	A	U	C	U	U	B	
Rapeseed Oil	U	U	A	A	B	A	B	B	B	U	U	A	A	B	A
Sal Ammoniac	A	A	A	A	A		A	A	A	A	B	A	A	A	
Salicylic Acid	A	B	A	A	A							A	A		A
Salt Water	A	A	A	A	A		A	A		C		A	A		A
Sewage	B	B	B	B	A		A	A	U	U	B	A	A	U	A
Silicate Esters	U	U	U	U	B		A	A	A		U	A	A		
Silicone Greases	A	A	A	A	A	A	A	A	A	A	C	A	A	A	B
Silicone Oils	A	A	A	A	A	A	A	A	A	A	C	A	A	A	B
Silver Nitrate	A	A	A	A	B		A	A	A	B	A	A	A	A	A
Skydrol 500	U	U	B	A	U	U	U	U	U		C	C	U	U	A
Skydrol 7000	U	U	A	A	U	U	U	U	U	U	B	C	B	U	A
Soap Solutions	B	B	A	A	A	A	A	A	A	U	A	A	A	U	A
Soda Ash	A	A	A	A	A	A	A	A		U	A	A	A		A
Sodium Acetate	A	C	A	A	B		B	B	U	U		U	U	U	A
Sodium Bicarbonate	A	A	A	A	A	A	A	A		C	A	A	A		A
Sodium Bisulfite	A	B	A	A	A	A	A	A		C	A	A	A	U	A
Sodium Borate	A	A	A	A	A	A	A	A		A	A	A	A		A
Sodium Chloride	A	A	A	A	A	A	A	A	A	C	A	A	A		A
Sodium Cyanide	A	A	A	A	A	A	A	A		A	A	A	A		A
Sodium Hydroxide	A	A	A	A	B	B	A	A	B	U	B	B	B	A	A
Sodium Hypochlorite	C	C	B	B	B	A	B	B	U	U	B	B	A	U	B
Sodium Metaphosphate	A	A	A	A	A		B	B				A	A		A
Sodium Nitrate	B	B	A	A	B	A	A	A			U				A
Sodium Perborate	B	B	A	A	B		B	B		B	B	A	A		A
Sodium Peroxide	B	B	A	A	B		B	B	U		U	A	A	U	A
Sodium Phosphate	A	A	A	A	A		A	A	A		U		A	A	A
Sodium Silicate	A	A	A	A	A		A	A					A		
Sodium Sulfate	B	B	A	A	A	A	A	A	A	B	A	A	A	U	
Sodium Thiosulfate	B	B	A	A	B		A	A	A	B	A	A	A	U	A
Soybean Oil	U	U	C	C	A	A	B	B	B	U	A	A	A	A	A
Stannicous Chloride	A	A	B	B	A		A	A			B	A	A		A

A = Recommended — little or no effect **B** = Minor to moderate effect **C** = Moderate to severe effect **U** = Not recommended

CHEMICAL RESISTANCE OF RUBBERS (Cont'd)

CHEMICAL	NR IR	SBR BR	IIR	EPDM EPM	NBR	CO ECO	CR	CSM	AU EU	T	SI	FSI	FPM	ACM	XLPE
Steam under 150°C	Use D503, D508 or D511 Hose only														
Steam over 150°C	Use D508 Hose only														
Stearic Acid	B	B	B	B	B	B	B	B	A		A				A
Styrene	U	U	U	U	U		U	U			U	C	B		B
Sucrose Solution	A	A	A	A	A		A	A		U					A
Sulfite Liquors	B	B	B	B	B	B	B	B		U	U	B	A	U	
Sulphur	U	U	A	A	U	C	A	A		U	A	A	A	U	
Sulphur Chloride	U	U	U	U	C		C	B				A	A		B
Sulphur Dioxide	C	C	B	A	U		C	C		U	A	B	A	U	B
Sulphur Hexafluoride		A	A	A	A	A	A	A			A	A	A		
Sulphur Trioxide	B	U	B	B	U		U	U		U	B	B	A	U	A
Sulphuric Acid (Dilute)	C	C	B	B	U	B	B	A	B	U	U	C	A	U	A
Sulphuric Acid (Conc)	U	U	B	B	U	U	U	B	U	U	U	U	A	U	B
Sulphuric Acid (20% oleum)	U	U	U	U	U	U	U	U	U	U	U	U	A	U	
Sulfurous Acid	B	B	B	B	B		B	A	U	U	U		A	U	A
Tannic Acid	A	B	A	A	A		A	A	A	A	B		A	U	A
Tar - Bituminous	U	U	U	U	B	B	C	C			B	A	A	U	A
Tartaric Acid	A	B	B	B	A	B	B	A	A	U	A	A	A		A
Terpineol	U	U	C	C	B		U	U	B	A		A	A		A
Tertiary Butyl Alcohol	B	B	B	B	B		B	B	U	B	B	B	A	U	
Tertiary Butyl Catechol	U	C	B	B	U		B	B	U	U		A	A	U	
Tertiary Butyl Mercaptan	U	U	U	U	U		U	U	U				A		
Tetrabromomethane	U	U	U	U	U							B	A		
Tetrachloroethylene	U	U	U	U	U				B	U		B	A	U	
Tetraethyl Lead	U	U	U	U	B		C	C				B	A		B
Tetrahydrofuran	U	U	B	B						A			U		A
Tetralin	U	U	U	U	U		U	U				A	A		
Thionyl Chloride	U	U	U	U			U						A		
Titanium Tetrachloride	U	U	U	U	C		U	U		C		B	A		U
Toluene	U	U	U	U	U	U	U	U	C	U	U	B	A		A
Toluene Diisocyanate	C	C	A	A			U	U							A
Transformer Oil	U	U	U	U	A		B	B			B	A	A	B	A
Transmission Fluid Type A	U	U	U	U	A	A	B	B	A	A	B	A	A	A	A
Triacetin	B	C	A	A	B		B	B	U	B		U	U	U	
Tributoxy Ethyl Phosphate	B	B	A	A	U		U	U	U	A		B	A		A
Tributyl Phosphate	B	U	A	A	U		U	C	U	A		U	U	U	A
Tributyl Merkaptan	U	U	U	U	U		U	U					A		
Trichloroethane	U	U	U	U	U		U	U	U	U	U	B	A	U	
Trichloroacetic Acid	C	B	B	B	B		B	B					C	U	
Trichloroethylene	U	U	U	U	C	B	U	U	U		B	B	A		A
Tricresyl Phosphate	U	U	A	A	U	U	C	C	C	B	C	B	B		U
Triethanol Amine	B	B	B	B	C		A	A	U	U		U	U	U	A
Triethyl Aluminium													B		
Triethyl Borane													A		
Trinitrotoluene	U	U	U	U	U		B	B		B		B	B		
Trioctyl Phosphate	U	U	A	A	U		U	U		B	C	B	B	U	
Triaryl Phosphate	U	U	A	A	U		C	C	B	B	C	B	A	U	
Tung Oil	U	U	C	U	A		B	B	B	B		B	A		B
Turbine Oil	U	U	U	U	B	A	B	B		A		B	A	B	
Turpentine	U	U	U	U	A	A	U	U	U	B	U	B	A	A	U
Urea Solution	A	A	B	A	B										A
Varnish													B		B
Vinegar	B	B	B			U	B						U		A
Vinyl Chloride (Monomer)	U	U	U	U	U	U	U	U	U	U	U	U	B	U	B
Vinyl Flouride													A		A
Water	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Xylene	U	U	U	U	U			U					B		A
Zinc Acetate	B	B	B	B	U		U	U					U		A
Zinc Chloride Solutions	B	B	B		A		A		A				A		A
Zinc Chromate								A							A
Zinc Sulfate Solutions	U	U	B	B	B			B	B						A

A = Recommended — little or no effect **B** = Minor to moderate effect **C** = Moderate to severe effect **U** = Not recommended

UHMW PE

Ultra High Molecular Weight Polyethylene

UHMW PE Chemical Properties

Chemical Resistance	UHMW-PE		UHMW-PE
Acetaldehyde	+	Glycerine	+
Acetic acid	+	Hydrochloric acid	+
Acetone	+	Hydrogen peroxide	+
Acrylonitrile	+	Hydrogen sulphide	+
Allyl alcohol	96+	Lactic acid	+
Aluminum chloride	A+	Magnesium chloride	A+
Ammonia	A+	Mercury	+
Ammonium chloride	A+	Methanol	+
Aniline	+	Methyl ethyl ketone	+
Benzaldehyde	+	Methylene chloride	/
Benzene	/	Mineral oil	+
Benzyl alcohol	+	Motor oil	+
Bleach (Chlorine)	-	Nitric acid	+to/
Boric acid	A+	Nitobenzene	+
Butanol	+	Oleic acid	+
Butyl acetate	+	Ozone	/
Calcium chloride	+	Perchloric acid	50+
Carbon disulphide	/	Petroleum	+
Carbon tetrachloride	/M-	Phenol	+
Chlorine gas	/	Phosphoric acid	+
Chlorobenzene	/	Potassium chromate	40+
Chloroform	/M-	Potassium hydroxide	30+
Chromic acid	10+	Potassium nitrate	+
Citric acid	+	Potassium permanganate	+
Cyclohexanol	+	Pyridine	+
Cyclohexanone	+	Sea water	+
Dekalin	+	Sodium carbonate	10+
Dibutyl phthalate	+	Sodium chloride	10+
Diesel fuel	+	Sodium hydroxide	60+
Diethyl ether	+to/	Sulphuric acid	75+
Dioxane	+	Tallow	+
Ethanol	96+	Tetrahydrofurane	+M-
Ethyl acetate	+	Tetralin	+
Ethylene chloride	/	Thionyl chloride	-
Ethylene diamine	+	Toluene	/
Ferric chloride	A+	Transformer oil	+
Fluorine	-	Trichlorethylene	+M-
Formaldehyde	40+	Urea, aqueous	33+
Formic acid	+	Water	+
Furfurol	+	Zinc chloride	A+

Values obtained at room temperature. Call for high or low temperature applications. Number indicates concentration if < 100%. M= Values may change under mechanical stress G=Gaseous state. A=Aqueous solution. S=Soluble.

+= Specimen is resistant.....Swelling <3% or weight loss <0.5%. Break elongation not significantly altered.
/= Specimen has limited resistance...Swelling 3-8% or weight loss 0.5-5% and/or break elongation decreased by <50%
-= Specimen is not resistant.....Swelling > 8% or weight loss > 5% and/or break elongation decreased by >50%

PRESSURE DROP IN HOSES

The following tables of pressure drops and flow rates are based on experimental data and may be considered typical of most hoses. The data is based upon hoses laid out in a straight line and thus it must not be considered as an exact result that may be obtained at a given pressure. Variables such as hose fittings and bends increase the frictional losses and an estimate of their effect may be determined by adding an "equivalent length" to the hose length.

Values of the equivalent length (Le) may be determined using the inside diameter (D) of the hose in the following relationships:

90° swept elbow — Le = 20D

90° square elbow — Le = 50D

45° square elbow — Le = 16D

Hose coupling — Le = 5D

NOTE:

(1) Pressure drop is directly proportioned to the length of hose.

(2) Friction is independant of pressure and proportional to velocity.

PRESSURE DROP (kPa/100m) WATER AT 20°C THROUGH HOSE

Flowrate	Hose Internal Diameter												
l/m	12.5	16	19	25	32	38	40	50	64	75	80	100	125
25	1100	470	210	50									
50		2440	770	200	90	30							
100			2660	730	300	100	55	30					
200					1030	405	285	95	25				
300						900	650	210	65	20			
400							1200	370	110	40			
500								580	155	70	50		
1000									575	230	180	55	
2000										920	600	220	45
3000										2125	1400	490	100
4000												805	190
5000												1390	315

PRESSURE DROP OF AIR THROUGH RUBBER HOSE

Size	Cu./m of Free Air							
(mm)	0.5	1.0	1.25	1.5	2.0	2.75	3.5	4.25
12.5	249	855	1325	–	–	–	–	–
19	–	215	350	505	895	1725	2745	–
25	–	–	–	–	250	465	755	1100
32	–	–	–	–	80	100	175	285
38	–	–	–	–	–	45	75	135

Size	Cu./m of Free Air											
(mm)	15	20	30	40	50	60	70	80	90	100	125	150
50	385	680	1530	2690	4230	–	–	–	–	–	–	–
64	160	270	565	1020	1630	2350	3170	4185	5270	–	–	–
76	–	–	215	330	520	745	1020	1335	1675	2035	3190	4590

To obtain frictional pressure loss in kPa/100m divide above values by the ratio of compression listed below:

kPa W.P.	Ratio of Compression
400	3.9
500	4.9
600	5.9
700	6.9
800	7.85
900	8.85
1000	9.85

VOLUMETRIC FLOWRATE OF WATER THROUGH 100m HOSE (litre/min.)

Inlet Pressure	Hose Internal Diameter (mm)													
(kPa)	12.5	16	20	25	32	38	40	50	64	75	80	100	150	200
150	15.5	31	48	102	181	299	359	639	1145	1701	2079	3969	11482	24239
200	18.5	35	57	117	215	352	408	741	1342	2126	2457	4631	13466	28870
300	24	42	71	157	272	438	499	922	1663	2717	3071	5670	16727	35749
400	29.5	49	82	178	317	510	582	1081	1950	3189	3662	6710	19609	41675
500	33	56	93	200	355	575	658	1221	2200	3544	4064	7560	22047	46967
600	36	62	102	219	397	635	730	1349	2430	3936	4408	8269	24334	51739
700	38	69	111	238	427	688	801	1467	2646	4253	4772	9025	26413	56228
800	41	73	120	257	464	737	862	1576	2835	4631	5198	9686	28634	60480
900	43	77	127	272	491	783	919	1686	3013	4938	5576	10348	30335	64260
1000	45	82	134	291	522	828	972	1788	3187	5198	5906	11009	32036	67946
1250	52	93	149	333	586	937	1111	2015	3595	5826	6804	12521	36052	76592

PROPERTIES OF SATURATED STEAM

TEMPERATURE-PRESSURE EQUIVALENTS OF SATURATED STEAM
GAUGE PRESSURE AT SEA LEVEL

Temperature °F	Temperature °C	Lbs. per Sq. in.	MPa *
212	100.0	0.0	
214	101.1	0.6	0.004
216	102.2	1.2	0.008
218	103.3	1.8	0.012
220	104.4	2.5	0.017
222	105.6	3.2	0.022
224	106.7	3.9	0.027
226	107.8	4.6	0.032
228	108.9	5.3	0.037
230	110.0	6.1	0.042
232	111.1	6.9	0.048
234	112.2	7.7	0.053
236	113.3	8.5	0.059
238	114.4	9.4	0.065
240	115.6	10.3	0.071
242	116.7	11.2	0.077
244	117.8	12.1	0.083
246	118.9	13.1	0.090
248	120.0	14.1	0.097
250	121.1	15.1	0.104
252	122.2	16.2	0.112
254	123.3	17.3	0.119
256	124.4	18.4	0.127
258	125.6	19.6	0.135
260	126.7	20.7	0.143
261	127.2	21.4	0.147
262	127.8	22.0	0.152
263	128.3	22.6	0.156
264	128.9	23.2	0.160
265	129.4	23.9	0.165
266	130.0	24.5	0.169
267	130.6	25.2	0.174
268	131.1	25.8	0.178
269	131.7	26.5	0.183
270	132.2	27.2	0.187

Temperature °F	Temperature °C	Lbs. per Sq. in.	MPa *
271	132.8	27.9	0.192
272	133.3	28.6	0.197
273	133.9	29.3	0.202
274	134.4	30.0	0.207
275	135.0	30.8	0.212
276	135.6	31.5	0.217
277	136.1	32.3	0.223
278	136.7	33.0	0.227
279	137.2	33.8	0.233
280	137.8	34.5	0.238
281	138.3	35.3	0.243
282	138.9	36.1	0.249
283	139.4	36.9	0.254
284	140.0	37.7	0.260
285	140.6	38.6	0.266
286	141.1	39.4	0.272
287	141.7	40.3	0.278
288	142.2	41.1	0.283
289	142.8	42.0	0.289
290	143.3	42.9	0.296
291	143.9	43.8	0.302
292	144.4	44.7	0.308
293	145.0	45.6	0.314
294	145.6	46.5	0.321
295	146.1	47.5	0.328
296	146.7	48.4	0.334
297	147.2	49.4	0.341
298	147.8	50.3	0.347
299	148.3	51.3	0.354
300	148.9	52.3	0.361
301	149.4	53.4	0.368
302	150.0	54.4	0.376
303	150.6	55.4	0.382
304	151.1	56.4	0.389
305	151.7	57.5	0.396

*PSI x .006895 = Megapascals (MPa) = Meganewton/meter^2
Degrees Celsius = 5/9 (Degrees F -32)

TEMPERATURE-PRESSURE EQUIVALENTS OF SATURATED STEAM GAUGE PRESSURE AT SEA LEVEL

Temperature °F	Temperature °C	Lbs. per Sq. in.	MPa *
306	152.2	58.6	0.404
307	152.8	59.7	0.412
308	153.3	60.7	0.419
309	153.9	61.9	0.427
310	154.4	63.0	0.434
311	155.0	64.2	0.443
312	155.6	65.3	0.450
313	156.1	66.5	0.459
314	156.7	67.6	0.466
315	157.2	68.8	0.474
316	157.8	70.0	0.483
317	158.3	71.3	0.492
318	158.9	72.5	0.500
319	159.4	73.7	0.508
320	160.0	75.0	0.517
321	160.6	76.3	0.526
322	161.1	77.5	0.534
323	161.7	78.8	0.543
324	162.2	80.1	0.552
325	162.8	81.5	0.562
326	163.3	82.8	0.571
327	163.9	84.2	0.581
328	164.4	85.6	0.590
329	165.0	87.0	0.600
330	165.6	88.4	0.610
331	166.1	89.8	0.619
332	166.7	91.2	0.629
333	167.2	92.7	0.639
334	167.8	94.1	0.649
335	168.3	95.6	0.659
336	168.9	97.1	0.670
337	169.4	98.7	0.681
338	170.0	100.2	0.691
339	170.6	101.8	0.702
340	171.1	103.3	0.712
341	171.7	105.0	0.724
342	172.2	106.5	0.734
343	172.8	108.2	0.746
344	173.3	109.8	0.757
345	173.9	111.5	0.769

Temperature °F	Temperature °C	Lbs. per Sq. in.	MPa *
346	174.4	113.1	0.780
347	175.0	114.8	0.792
348	175.6	116.5	0.803
349	176.1	118.2	0.815
350	176.7	119.9	0.827
352	177.8	123.5	.852
354	178.9	127.1	.876
356	180.0	130.8	.902
358	181.1	134.5	.927
360	182.2	138.3	.954
362	183.3	142.3	.981
364	184.4	146.2	1.008
366	185.6	150.3	1.036
368	186.7	154.4	1.065
370	187.8	158.7	1.094
372	188.9	163.0	1.124
374	190.0	167.4	1.154
376	191.1	171.9	1.185
378	192.2	176.4	1.216
380	193.3	181.1	1.249
382	194.4	185.8	1.281
384	195.6	190.6	1.314
386	196.7	195.6	1.349
388	197.8	200.6	1.383
390	198.9	205.7	1.418
392	200.0	210.9	1.454
394	201.1	216.2	1.491
396	202.2	221.5	1.527
398	203.3	227.0	1.565
400	204.4	232.6	1.604
402	205.5	238	1.641
404	206.7	244	1.682
406	207.8	250	1.724
408	208.9	256	1.765
410	210	262	1.806
412	211.1	268	1.848
414	212.2	275	1.896
416	213.3	281	1.937
418	214.4	288	1.986
420	215.6	294	2.027

*PSI x 006895 = Megapascals (MPa) = Meganewton/meter^2
Degree Celsius = 5/9 (Degrees F -32)

TEMPERATURE CONVERSION CHART

Fahrenheit - Centigrade

°C	C to F / F to C	°F	°C	C to F / F to C	°F	°C	C to F / F to C	°F
−46	**−50**	−58	21	**70**	158	138	**280**	536
−43	**−45**	−49	24	**75**	167	143	**290**	554
−40	**−40**	−40	27	**80**	176	149	**300**	572
−35	**−30**	−22	29	**85**	185	154	**310**	590
−32	**−25**	−13	32	**90**	194	160	**320**	608
−29	**−20**	− 4	35	**95**	203	166	**330**	626
−26	**−15**	+ 5	38	**100**	212	171	**340**	644
−23	**−10**	14	43	**110**	230	177	**350**	662
−21	**− 5**	23	49	**120**	248	182	**360**	680
−18	**0**	32	54	**130**	266	188	**370**	698
−15	**+ 5**	41	60	**140**	284	193	**380**	716
−12	**10**	50	66	**150**	302	199	**390**	735
−10	**15**	59	71	**160**	320	204	**400**	752
− 7	**20**	68	77	**170**	338	210	**410**	770
− 4	**25**	77	82	**180**	356	216	**420**	788
− 1	**30**	86	88	**190**	374	221	**430**	806
0	**32**	90	99	**210**	410	227	**440**	824
+ 2	**35**	95	100	**212**	414	232	**450**	842
5	**40**	104	104	**220**	428	238	**460**	860
7	**45**	113	110	**230**	446	243	**470**	878
10	**50**	122	116	**240**	464	249	**480**	896
13	**55**	131	121	**250**	482	254	**490**	914
16	**60**	140	127	**260**	500	260	**500**	932
18	**65**	149	132	**270**	518			

HOW TO USE THE TABLE

Locate the temperature in the middle column and read the equivalent °F in the right hand column and the equivalent °C in the left hand column.

EXAMPLE

1. °C to °F: You wish to convert 40°C to °F. Locate 40 in the bold typeface column and read the appropriate temperature in the °F column to the right. The answer is 104°F.

2. °F to °C: To convert 40°F to °C, locate 40 in the bold typeface column, and the °C column to the left will show that the answer is 5°C.

PRESSURE CONVERSION CHART
(MPa to p.s.i.)

MPa	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0		14.50	29.01	43.51	58.02	72.52	87.02	101.53	116.03	130.53
1	145.04	159.54	174.05	188.55	203.05	239.31	217.56	246.57	261.07	275.57
2	290.08	304.80	319.08	333.59	348.09	362.60	377.10	391.60	406.11	420.61
3	435.11	449.62	464.12	478.63	493.13	507.63	522.14	536.64	551.14	565.65
4	580.15	594.66	609.16	623.66	638.17	652.67	667.18	681.68	696.18	710.69
5	725.19	739.70	754.20	768.70	783.21	797.71	812.21	826.72	841.22	855.72
6	870.23	884.73	899.24	913.74	928.24	942.75	957.25	971.76	986.26	1000.76
7	1015.27	1029.77	1044.27	1058.78	1073.28	1087.76	1102.29	1116.79	1131.30	1145.80
8	1160.30	1174.81	1189.31	1203.82	1218.32	1232.82	1247.33	1261.83	1276.33	1290.84
9	1305.34	1319.85	1334.35	1348.85	1363.36	1377.86	1392.37	1406.87	1421.37	1435.88
10	1450.38	1464.88	1479.39	1493.89	1508.40	1522.90	1537.40	1551.91	1566.41	1580.91
11	1595.42	1609.92	1624.43	1638.93	1653.43	1667.94	1682.44	1696.95	1711.45	1725.95
12	1740.46	1754.96	1769.46	1783.97	1798.47	1812.98	1827.48	1841.98	1856.49	1870.99
13	1885.49	1900.00	1914.50	1929.01	1943.51	1958.01	1972.52	1987.02	2001.52	2016.03
14	2030.53	2045.04	2059.54	2074.04	2088.55	2103.05	2117.56	2132.06	2146.56	2161.07
15	2175.57	2190.07	2204.58	2219.08	2233.59	2248.09	2262.59	2277.10	2291.60	2306.10
16	2320.61	2335.11	2349.62	2364.12	2378.62	2393.13	2407.63	2422.14	2436.64	2451.14
17	2465.66	2480.15	2494.65	2509.16	2523.66	2538.17	2552.67	2567.17	2581.68	2596.18
18	2610.68	2625.19	2639.69	2654.20	2668.70	2683.20	2697.71	2712.21	2726.71	2741.22
19	2755.72	2770.23	2784.73	2799.23	2813.74	2828.24	2842.75	2857.25	2871.75	2886.26

1 MPa = 145 p.s.i.