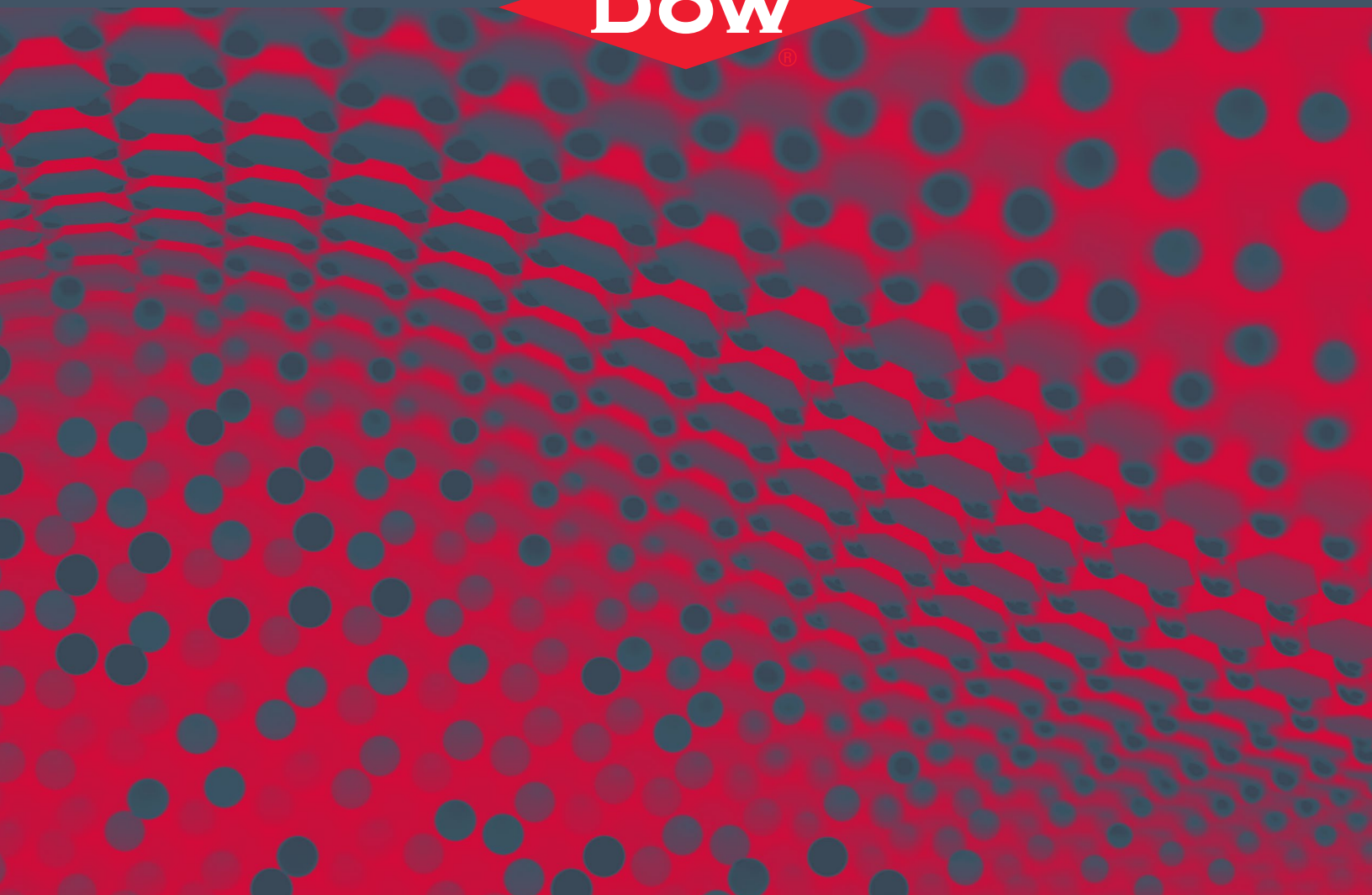
CONSUMER SOLUTIONS

Performance profiles for SILASTIC™ Silicone and Fluorosilicone Rubber and XIAMETER™ Silicone Rubber

Fluid resistance guide



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Introduction

This guide is intended to give you an idea of the performance profile of various classes of silicone rubbers when immersed in different fluids. It's our hope that the information will save you the time and cost of preliminary screening and feasibility tests. We recommend that you test specific materials prior to use. Keep in mind that service conditions are usually less severe than immersion tests. For instance, in actual service the rubber is often only partly exposed or is subjected only to spills or splashing. This means that a rubber that shows only fair results in a prolonged total immersion test will often perform quite adequately under actual conditions.

Types of SILASTIC™ and XIAMETER™ Silicone Rubbers

Immersion test results refer to types of silicone rubber by their ASTM designation. The polymer classification described in ASTM D 1418 is based on the organic group side chains attached to the silicon-oxygen chain. If other groups are present, their initials are listed prior to the MQ designation: MQ indicates methyl groups, V indicates phenyl groups. Where several types of rubber have been tested for resistance to one fluid, they are listed in this order in the tables:

SILASTIC™ and XIAMETER™ Silicone Rubbers

MQ, VMQ } General purpose stocks

PMQ, PVMQ } Extremely low-temperature stocks

SILASTIC™ and XIAMETER™ Fluorosilicone Rubbers

FVMQ Fuel-, oil-and solvent-resistant stocks

Effects of immersion

If a fluid affects a silicone rubber at all, after prolonged immersion and usually at elevated temperatures, the changes are evidenced as increases or decreases of several physical properties: hardness, tensile strength, elongation, and volume. The values that appear in the tables have been calculated as prescribed in ASTM D 471. The figures have been rounded and represent typical values.

The effects that have been tabulated often go hand in hand, but there is no quantitative correlation. For example, a silicone rubber in one fluid may swell 10 percent and lose 15 percent in tensile strength, whereas in another fluid the same rubber may also swell 10 percent but lose 30 percent in tensile strength.

The effects of solvent or fuel immersion often proceed until they reach a limit and then increase no more. This limit corresponds to the maximum amount of solvent or fuel that the rubber structure can absorb at the test temperature. While a fluid may produce little effect at room temperature, it may cause a noticeable change at 204°C (400°F).

Swelling caused by fluid penetration of rubber is usually the most obvious effect. However, this swelling does not necessarily indicate permanent deterioration. The rubber often regains most of its original properties after the fluid has evaporated.

Hardness changes are tabulated in durometer points on the Shore A-2 scale. Changes in tensile strength and elongation are expressed as percentages of the original values. These changes are usually losses that appear as negative values. Volume changes due to penetration of fluids between silicone polymer chains appear as positive values, that is, swelling. Negative volume changes indicate chemical degradation, such as the tables show for 20 percent sulfuric acid at 83°C (180°F) for seven days.

Service considerations

Duration of exposure may be very important in some applications. In the case of silicone rubber used as electrical insulation, this may mean that no permanent harm will result from short exposures to washing or rinsing, even with powerful solvents. After prolonged periods at high temperatures, hydrocarbon oils may slowly decompose. The breakdown products may have an entirely different solvent effect than that of the original oil. On the other hand, heating may sometimes have the favorable result of driving off volatile components of oils. Contamination in service may also produce changes in lubricating oils and their effect as immersion media. Swelling may be a limiting factor in service, even though a small amount may be desirable for certain applications. For example, o-rings often work better if they swell slightly in the fluid they seal; but if they swell too much, they may push themselves out of position and lose effectiveness. Also, swelling may produce tears in tightly restricted parts.

Selection recommendations

1. SILASTIC™ and XIAMETER™ fluorosilicone rubber shows superior resistance to many fluids; however, other types of rubber offer better resistance to acetone, certain other ketones, and some esters. The fluorosilicone polymer can be blended with other silicone polymers to obtain resistance intermediate between the two types.
2. The higher the aromatic or phenyl content of oils and fuels, the greater is their effect on most types of silicone rubber except fluorosilicone rubber. The stocks most affected are usually the types with ASTM designations including P (phenyl groups). This follows the common principle of organic to solvents that “like dissolves like.”
3. For high-temperature applications, parts should generally be cured at temperatures higher than anticipated service temperatures, no matter whether the parts will contact liquid or air. Property changes are usually less for fully cured parts than for as-vulcanized or partially cured parts.

Test conditions

The immersion tests tabulated were conducted according to ASTM D 471. Specimens were cut from slabs that were molded and oven-cured in accordance with recommended procedures for the individual stocks.

Many fluids were tested only for their effects on volume and hardness because these values are usually the most critical.

In regard to the limited correlation between test conditions and service conditions, the most widely used test, ASTM D 471, states:

“Owing to the wide variations often present in service conditions, no direct correlation between this accelerated test and service performance may be given or implied. However, the method yields comparative data on which to base judgment (as to service quality and is especially useful in research and development work).”

Test results refer to types of silicone rubber products by ASTM designation. Because tests were conducted over a period of several years, the specific products used may no longer be available. Test results, therefore, can be used to project general performance only. If more specific information is required, refer to individual data sheets or conduct new tests.

Fluids index

Classification of immersion media

Fluids for testing have often been submitted with only a trade name for identification. It has been difficult to classify some of these fluids for the tabular sections of this guide. The overall classification has been designed for easy reference by users in different industries.

A

Acetic Acid 29
Acetone 21
Acctonitrile 31
Aroclor 1254 19
Aerosafe 2300 15
Ammonia 31
Ammonium Hydroxide 30
AMOCO Super Permuable 10W-30 11
ANG 15 Industrial Grease 18
ANG 25 Diester Base 18
ANG 25 Glycerol Ester 18
Aniline 31
ANO No. 3 Grade M; Extreme Pressure 18
ANO No. 6 Oil 18
ANO No. 9 Oil 18
ANO No. 11 Oil 18
ANO No. 366 Oil 18
Aroclor 1254 19
Askerol Transformer Oil 17
ASTM No. 1 Oil 6
ASTM No. 2 Oil 6
ASTM No. 3 Oil 6
ASTM Reference Fuel A Isoctane 7
ASTM Reference Fuel B 8
ASTM Reference Fuel C 8
ASTM Test Fluid 101 7

B

Beer 26
Benzene 21
Brayco 880D Oil 10
Bromine (liquid) 31
Butter (liquid) 26
Butyl Acetate 22
Butyl Alcohol 22
Butylene Oxide 31

C

Calcium Oxide 30
Calcium Silicate 31
Caprolactam Monomer 31
Carbon Tetrachloride 22
Chlorobromomethane 22
1-Chlorodecane 32
Chloroform 22
Chlorothene Solvent 22
Coca -Cola Syrup 26
Coffee 26
Coolanol 35 18
Coolanol 45 18
Copper Sulfate 31
Cosmoline 2046 19
Crude Oil 7 API 19
Crude Oil 315 API 19
Cyclohexane 22

D

Delco No. 9 19
Delco No. 11 19
Delco Shock Absorber Fluid 13
Delco Supreme 550 Heavy-Duty Brake Fluid 13
Diacetone Alcohol 22
Dichloroisopropyl Ether 22
Diesel Fuel 14
Diethyl Ether 22
Di (2-Ethylhexyl) Sebacate 7
Dimethyl Formamide 32
Dioctyl Phthalate 32
DOWSIL™ Compound 25
DOWSIL™ and XIAMETER™ Fluids 24, 25
Dynaflow Automatic Transmission Fluid 12

E

Ethanol 15
Ethyl Alcohol 22
Ethylenedichloride 22
Ethylene Glycol 32
Ethylene Oxide 32
Exxon Turbo Oil No. 15 9
Exxon Univis J-43 Oil 9
Exxon WS2406 Fluid 15

F

FC-75 Fluorochemical Fluid 19
Ferric Chloride 31
Freon 32, 33

G

Gas Drip Oil 19
Gasohol 15
Gasoline 14
GE Transil Oil 19
GM Hydraniatic Fluid (Type A) 12
GM 14X Heavy Duty Oil 19
Gulf Synthetic Lube No. 2 Oil 10

H

Heptane 22
HMS 20-1083 33
Hydrazine 33
Hydrochloric Acid 29
Hydrofluoric Acid 29
Hydrogen Peroxide 13
Hydrolube H-2 Fluid 15
Hypoid EP Lubricant 13

I

Inerteen Transformer Oil 17
IRM 902 Oil 7
IRM 903 Oil 7
Isooctane 7
Isopropyl Alcohol 22
Isopropyl Nitrate 33

J

JP-4 Fuel 14
JP-5 Fuel 14
JP-8 Fuel 14

L

Lard 26
Lithium Hydroxide 30

M

Manufactured Gas 14
Mazola Oil 26
Methanol 8, 15
Methyl Alcohol 22
Methyl Chloride 22
Methylene Chloride 22

Methyl Methacrylate 33
MIL-A-8243 Deicer Fluid 10
MIL-H-5606 9
MIL-H-5606 Oil 9
MIL-J-5624F-14 14
MIL-L4600 Oil Bis 11
MIL-L-7808D Oil 9
MIL-L-7808E Oil 10
MIL-L-7808E, F, and G Oil 10
MIL-L-7808F Oil 10
MIL-L-7808G Oil 10
MIL-7808J Jet Engine Oil 11
MIL-L-23699 Oil 10
MIL-O-6085 Oil 9
Mineral Oil 19
Mineral Oil (Shell No. 5) 19
Mineral Spirits 22
Mobil 5W-30HP Engine oil 11
Mobil Jet II Oil 11
Mobil Oil No. 20 Oil 11
Mobilube GX-90 General Lubricant 13
Mobil XRM-139A Oil 10
Molybdenum Disulfide 33
MOLYKOTE Compounds 25
MOLYKOTE Greases 25
Monochlorobenzene 22
Monoethanolamine 33
Motor Oil - 10W-30 11

N

Naphtha 23
Navy Crankcase Oil No. 2135 20
Navy Crankcase Oil No. 9250 20
N-43 Fluorocarbon Capacitor Fluid 17
Nitric Acid 29, 30
Nitrocellulose Solvent 23
No Lead Gasolines 15

O

1-Chlorodecane 32
Oil 26, 27
Orange Peel Oil 26
Orange Syrup 26
Oronite Fluids 15, 16
Ortho-Chloroethylbenzene 23
Ortho-Chlorotoluene 23
Oxylene Solvent 23

P

Pacemaker Fluid 100T 20
Pentachlorophenol 33
Perchloroethylene 23
Phenol 33
Phosphoric Acid 30
Phthalic Acid Anhydride 33
Phthalic Anhydride 33
Polyglycol 34
Polystyrene 34
Potassium Hydroxide 30
PQ 4226 9
PQ 8365 10
PRL 3313 20
Propylenedichloride 23
Propylene Oxide 34
Pydraul Fluids 16
Pyranol Transformer Oil 17

R

RCA-Gulf Instrument Oil A 17
Royco 808GF Oil 10
RX-1099 (Vinyl Plastisol) 34

S

SAE No. 10 Oil 11
SAE No. 20 Oil 11
Salicylanilide 34
Santicizer 141 34
Scotch Whisky 27
SG 4766 Glycol Ester Base Grease 20
Shell Aircraft Turbine Lubricants 20
Shell B & B Grease 20
Skydrol Fluids 16, 17
Socony Mobil RL 147-A No. 7 20
Socony Mobil Transmission Fluid (Type A) 12
Sodium Carbonate 31
Sodium Chloride 31
Sodium Hydroxide 31
Solvatone Solvent 23
Spry Shortening 27
Standard Oil Shock Absorber Fluid 13
Staufferjet II Oil 10
Steam 28, 29
Stoddard Solvent 23
Styrene Monomer 34
Sulfur 34
Sulfur Dioxide 34
Sullur Hexafluoride 34
Sulfuric Acid 30
Sun Oil No. 8 X2513-I L 20
Sun 5W-3 Auto Engine Oil 11
Sun 109 Transmission Fluid 12
SUNOCO HD 11
Swan Finch EP90 Lubricant 13

T

Tab Concentrate 27
Tar 34
Tectyl 502C Rust Inhibitor 20
Tectyl 511-M Rust Inhibitor 20
Tetrahydrofuran 34
Texaco 10W 30 Motor Oil 11
Texaco Regal Starfak Special Grease 18
Texaco TG-749 18
Texamatic A Transmission Fluid 12
Texamatic C Transmission Fluid 12
Texamatic TL 3528 Transmission Fluid 12
Texas 1500 Oil (HD Concentrate) 20
Tia Maria Liquor 27
TL 3450 Lubricant 13
Toluene 23
Toluene Vapor 23
TTS-735 Type VII 9
Trichloroethylene 34
Tricresyl Phosphate 21
Trifluorochloroethylene 34
Turbo Oil No. 35 21
Turpentine 23

U

Ucon Lubricants 21
Univolt 35 Transformer Oil 17
Unsymmetrical Dimethyl Hydrazine 15

V

Vegetable Oil 27
Vinegar 27

W

Wagner 21B Brake Fluid 13
Water 28
Wemco C Transformer Oil 18
White Gasoline Vapors 14

X

XIAMETER™ PMX-200 Silicone Fluid 23, 24
Xylene 23

ASTM and IRM oils, fuels and fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
ASTM No. 1 oil	VMQ PVMQ	3 days/25°C (77°F)	nil -5	- -	- -	nil 5
	MQ VMQ PVMQ	3 days/100°C (212°F)	-5 -5 -10	-5 -10 -10	-5 -5 -10	5 5 10
	MQ VMQ PVMQ	1 day/150°C (302°F)	-10 -5 -10	-10 -10 -15	5 -10 -10	5 10 10
	MQ VMQ PVMQ FVMQ	3 days/150°C (302°F)	-10 -10 -10 -5	-10 -5 -20 nil	nil -5 -15 -5	5 10 10 nil
	MQ VMQ PVMQ	7 days/150°C (302°F)	-10 -10 -10	-10 -10 -20	-10 -10 -10	10 10 10
	VMQ	30 days/150°C (302°F)	-10	-35	-25	10
	MQ VMQ PVMQ	3 days/177°C (350°F)	-10 -5 -15	-10 -10 -20	-10 -10 -10	5 10 10
	VMQ	7 days/177°C (350°F) 14 days/177°C (350°F)	-20 -20	-50 -50	-30 -30	10 10
ASTM No. 2 oil	VMQ FVMQ	70 hr/150°C (302°F)	-6 nil	4 nil	-2 -14	1 1
	VMQ FVMQ	7 days/150°C (302°F)	-6 -2	8 1	nil -13	8 1
ASTM No. 3 oil	MQ PVMQ	3 days/24°C (75°F)	-5 -10	- -	- -	15 25
	MQ PVMQ	3 days/100°C (212°F)	-10 -15	- -	- -	20 35
	PVMQ FVMQ	7 days/110°C (230°F)	-30 -5	-75 -5	-60 -5	60 5
	MQ VMQ PVMQ FVMQ	1 day/150°C (302°F)	-20 -15 -25 -5	-50 -35 -40 -10	-20 -20 -20 10	50 45 50 5
	MQ VMQ PVMQ FVMQ	3 days/150°C (302°F)	-25 -20 -35 -25 -5	-50 -42 -50 - -25	-25 -25 -30 - -10	35 35 55 85 5
	VMQ FVMQ	7 days/150°C (302°F)	-25 -5	-45 -17	nil -15	40 5
	FVMQ	14 days/150°C (302°F) 21 days/150°C (302°F) 28 days/150°C (302°F)	-5 -10 -10	-25 -60 -85	5 5 -20	5 5 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups**

ASTM and IRM oils, fuels and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
ASTM No. 3 oil (cont.)	VMQ	4 hr/177°C (350°F)	-25	-35	-25	45
	MQ VMQ PVMQ FVMQ	3 days/177°C (350°F)	-35 -40 -40 -10	-85 -60 -65 -25	-25 -15 5 5	55 60 70 5
	VMQ FVMQ	7 days/177°C (350°F)	-50 -10	-80 -40	-30 5	70 5
	VMQ	3 days/200°C (392°F)	-15	-45	nil	5
	FVMQ	14 days/200°C (392°F)	-25	-40	-10	nil
IRM-902 Oil	VMQ PVMQ FVMQ	3 days/23°C (73°F)	-5 -8 -6	-12 -12 -7	-14 -12 -1	5 7 1
	VMQ PVMQ FVMQ	3 days at 150°C (302°F)	-6 -16 0	-7 -7 -7	-17 -21 -8	10 19 1
IRM-903 Oil	VMQ PVMQ FVMQ	3 days/23°C (73°F)	-12 -21 -4	-7 -31 -7	-11 -23 -3	18 33 1
	VMQ PVMQ FVMQ	3 days/150°C (302°F)	-26 -33 -2	-23 -68 -11	-28 -62 -15	40 84 2
	FVMQ (70 durometer)	70 hours/150°C (302°F) 7 days/150°C (302°F)	-4 -3	-8 -9	4 6	2 2
ASTM Test Fluid 101 **Di** (2-Ethylhexyl) **Sebacate** **+0.5% Phenothiozine** **Di** (2-Ethylhexyl) **Sebacate** (Plexol-201)	FVMQ MQ VMQ	7 days/135°C (275°F) 48 hr/150°C (302°F) 7 days/100°C (212°F)	-4 -10 -15 -10	-7 -25 - -	-11 -25 - -	5 10 20 20
	FVMQ	4 days/232°C (450°F)	DT	DT	DT	DT
ASTM Reference Fuel A - **Isooctane** (also TTS-735 Type I)	VMQ PVMQ FVMQ	5 min/-54°C (-65°F)	- - -	- - -	- - -	10 10 10
	VMQ PVMQ FVMQ	10 min/-54°C (-65°F)	- - -	- - -	- - -	20 20 15
	VMQ PVMQ FVMQ	30 min/-54°C (-65°F)	- - -	- - -	- - -	30 35 30
	VMQ PVMQ FVMQ	5 min/24°C (75°F)	- - -	- - -	- - -	25 30 25
	VMQ PVMQ FVMQ	10 min/24°C (75°F)	- - -	- - -	- - -	35 50 40
	VMQ PVMQ FVMQ	30 min/24°C (75°F)	- - -	- - -	- - -	90 85 75
	FVMQ	7 days/24°C (75°F) 3 days/150°C (302°F)	-5 -20	-40 -60	-30 -30	15 25

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

ASTM and IRM oils, fuels and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
ASTM Reference Fuel B (70% Isooctane, 30% Toluence by Volume) (also TTS-735 Type III)	FVMQ	1 day/-54°C (-65°F) 3 days/24°C (75°F) 7 days/24°C (75°F) 14 days/24°C (75°F)	-5 -5 -5 -10	-20 -55 -40 nil	-20 -35 -30 -30	10 20 20 15
	VMQ FVMQ	3 days/65°C (150°F)	-5	-50	-40	215 15
	FVMQ	3 days/150°C (302°F) 3 days/232°C (450°F)	-20 DT	-60 DT	-35 DT	30 DT

MIL specification oils, fuels and fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
ASTM Reference C (M0)	FVMQ (60 durometer)	1 day/23°C (73°F) 1 week/23°C (73°F) 3 months/23°C (73°F) 1 year/23°C (73°F) 1 day/60°C (140°F) 1 week/60°C (140°F) 3 months/60°C (140 F) 6 months/60°C (140°F)	-15 -14 -14 -13 -14 -14 -17 -14	-25 -20 -23 -22 -30 -36 -37 -33	-23 -19 -20 -18 -15 -32 -28 -35	18 19 19 19 21 21 22 21
85% ASTM Reference Fuel C 15% Methanol (M15)	FVMQ (60 durometer)	1 day/23°C (73°F) 1 week/23°C (73°F) 3 months/23°C (73°F) 1 year/23°C (73°F) 1 day/60°C (140°F) 1 week/60°C (140°F) 3 months/60°C (140 F)	-24 -18 -18 -14 -21 -21 -24	-52 -56 -50 -53 -57 -64 -64	-29 -42 -38 -38 -41 -48 -45	26 24 25 24 29 31 31
75% ASTM Reference Fuel C 25% Methanol (M25)	FVMQ (60 durometer)	1 day/23°C (73°F) 1 week/23°C (73°F) 3 months/23°C (73°F) 1 year/23°C (73°F) 1 day/60°C (140°F) 1 week/60°C (140°F) 3 months/60°C (140 F) 6 months/60°C (140°F)	-19 -19 -18 -13 -20 -23 -26 -27	-53 -54 -50 -51 -63 -62 -68 -64	-43 -40 -39 -36 -51 -48 -48 -45	26 25 25 24 32 33 33 28
50% ASTM Reference Fuel C 50% Methanol (M50)	FVMQ (60 durometer)	1 day/23°C (73°F) 1 week/23°C (73°F) 3 months/23°C (73°F) 1 year/23°C (73°F) 1 day/60°C (140°F) 1 week/60°C (140°F) 3 months/60°C (140 F)	-18 -18 -19 -17 -21 -22 -24	-52 -48 -49 -50 -60 -59 -64	-41 -37 -39 -33 -47 -46 -43	25 24 23 22 29 30 28
15% ASTM Reference Fuel C 85% Methanol (M85)	FVMQ (60 durometer)	1 day/23°C (73°F) 1 week/23°C (73°F) 3 months/23°C (73°F) 1 year/23°C (73°F) 1 day/60°C (140°F) 1 week/60°C (140°F) 3 months/60°C (140 F) 6 months/60°C (140°F)	-15 -14 -11 -11 -17 -18 -17 -15	-36 -37 -32 -38 -38 -42 -49 -50	-27 -19 -21 -30 -24 -20 -25 -31	14 13 11 11 15 14 12 8
60% ASTM Reference Fuel C 40% Methanol by volume (M45)	FVMQ (75 durometer)	24 hours/110°C (230°F)	-30	-66	-50	46

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

MIL specification oils, fuels and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
TTS-735 Type VII (30% Toluene,10% Isooctane, 59% Cyclohexane, 1.0%n-Butyl Disulfide)	FVMQ	3 days/24°C (75°F) 3 days/100°C (212°F)	-10 -10	-40 -40	-25 -35	20 20
MIL-H-5606 Oil (Exxon Univis J-43)	VMQ FVMQ	14 days/24°C (75°F)	- -	- -	- -	65 95
	MQ PMQ FVMQ	1 day/71°C (160°F)	-20 -30 -5	-75 -65 -30	-18 -18 -19	18 18 19
	FVMQ	3 days/71°C (160°F)	-10	-30	-27	14
	VMQ FVMQ	14 days/71°C (160°F)	- -	- -	- -	80 110
	FVMQ	19 days/121°C (250°F) 3 days/150°C (302°F) 3 days/177°C (350°F) 7 days/177°C (350°F) 3 days/200°C (392°F)	-10 -10 -20 -20 -35	-10 -35 -50 -55 -85	-15 -10 -10 5 15	5 10 10 10 15
MIL-H-5606 (American Oil PQ 4226)	FVMQ	70 hr/150°C (302°F)	-6	-8	-16	6
MIL-O-6085 Oil	FVMQ	14 days/177°C (350°F)	-20	-70	-15	10
MIL-L-7808D Oil (Exxon Turbo Oil No. 15)	FVMQ	1 day/-54°C (-65°F)	-5	-15	nil	nil
	MQ VMQ PMQ	3 days/24°C (75°F)	-5 -10 -10	-10 -10 -25	nil -5 -15	10 10 20
	PVMQ	3 days/24°C (75°F) 7 days/24°C (75°F)	-15 -25	-10 -55	-5 -40	20 30
	VMQ PMQ	3 days/71°C (160°F)	-15 -15	-10 -45	-10 -40	15 30
	MQ VMQ PMQ PVMQ	7 days/71°C (160°F)	-10 -10 -20 -25	- - - -65	- - - -50	15 15 30 35
	MQ VMQ PMQ	1 day/121°C (250°F)	-10 -10 -10	- - -	- - -	20 20 40
	VMQ FVMQ	3 days/121°C (250°F)	-10 -5	-25 nil	-20 nil	20 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups**

MIL specification oils, fuels and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
MIL-L-7808D Oil (Exxon Turbo Oil No. 15)	MQ VMQ PMQ	1 day/150°C (302°F)	-10 -5 -10	 - -	 - -	15 10 20
	VMQ PVMQ FVMQ	3 days/150°C (302°F)	-15 -25 -5	-40 -45 -15	-10 5 nil	25 40 10
	MQ	1 hr/177°C (350°F)	-10	-	-	10
	FVMQ	1 day/177°C (350°F)	-10	-35	-10	10
	MQ VMQ PMQ PVMQ FVMQ	3 days/177°C (350°F)	-30 -35 -25 -35 -15	-65 - -50 -55 -40	-5 - -15 -15 -10	35 30 45 50 5
	FVMQ	7 days/177°C (350°F) 14 days/177°C (350°F) 1 day/200°C (392°F)	-20 DT -30	-60 DT -70	nil DT -15	10 DT 15
	VMQ FVMQ	3 days/200°C (392°F)	-35 -45	- -95	- -45	30 15
MIL-L-7808E Oil (Brayco 880D)	VMQ FVMQ	70 hr/150°C (302°F)	-20 -5	-35 -80	-10 -60	25 5
	VMQ FVMQ	70 hr/177°C (350°F)	-35 -5	-75 -95	-30 -90	25 -5
MIL-L-7808E, F, and G Oil (StaufferJet I)	VMQ FVMQ	70 hr/150°C (302°F)	-20 -10	-25 -25	-10 -25	25 10
	VMQ FVMQ	70 hr/177°C (350°F)	-35 -15	-65 -60	-10 -35	35 10
MIL-L-7808F Oil (Gulf Synthetic Lube No. 2)	FVMQ	70 hr/150°C (302°F)	-10	-30	-15	15
MIL-L-7808F Oil (Royco 808GF)	FVMQ	70 hr/150°C (302°F) 70 hr/177°C (350°F)	-10 -20	-45 -60	-15 -20	10 15
MIL-L-7808F Oil (Brayco 880G)	FVMQ	70 hr/150°C (302°F)	-15	-30	-20	10
MIL-L-7808G (Amendment 2) PQ8365	VMQ FVMQ	70 hr/150°C (302°F)	-14 -8	-21 -9	-19 -24	25 8
MIL-A-8243 Deicer Fluid	PVMQ	70 hr/71°C (160°F)	-5	-15	-10	nil
MIL-L-23699 Oil (Mobil XRM-139A)	FVMQ	96 hr/177°C (350°F)	-15	-	-	10
StaufferJet II Oil	FVMQ	70 hr/177°C (350°F)	-8	-25	-21	12
	VMQ FVMQ	100 hr/177°C (350°F)	-9 -9	2 -19	42 -36	11 12
	VMQ FVMQ	300 hr/177°C (350°F)	-8 -15	-3 -73	50 -33	7 9

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

MIL specification oils, fuels and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Mobil Jet II Oil	VMQ FVMQ	22 hr/25°C (77°F)	- -	- -	- -	4 3
	VMQ FVMQ	70 hr/150°C (302°F)	-10 nil	10 20	15 -35	10 10
	VMQ FVMQ	7 days/150°C (302°F)	-10 nil	10 5	25 -35	10 10
MIL-L-4600 Oil Bis (2-Ethylhexyl) **Sebacate**	PVMQ	3 days/25°C (77°F) 7 days/25°C (77°F)	-14 -14	- -	- -	28 30
MIL-L-7808JJet Engine Oil	75% FVMQ 25% VMQ Blend.	22 hours/24°C (75°F)	-6	-28	-22	4

Automotive oils and fluids

Motor oils

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
SAE No. 10 Oil (Sunoco HD)	FVMQ	3 days/150°C (302°F)	-5	-5	nil	nil
SAE No. 20 Oil (Mobil Oil)	MQ PMQ	1 day/100°C (212°F)	- -	- -	- -	10 20
	MQ PMQ	1 day/121°C (250°F)	- -	- -	- -	15 25
	MQ PMQ	1 day/150°C (302°F)	- -	- -	- -	15 25
10W-30 Motor Oil (Texaco)	FVMQ	15 days/177°C (350°F) 30 days/177°C (350°F)	-4 1	-33 -52	-8 -58	2 1
	50/50 VMQ/FVMQ	15 days/177°C (350°F) 30 days/177°C (350°F)	-16 -9	-35 -76	10 -80	9 3
AMOCO Super Permalube 10W-30	VMQ	250 hr/150°C (302°F)	-18	-21	5	23
Sun 5W-30 SJ Auto Engine Oil	FVMQ (70 durometer)	70 hours/150°C (302°F) 7 days/150°C (302°F)	-1 1	1 -3	0 -6	0 0
Mobil 5W-30 HP Engine Oil	75% FVMQ 25% VMQ Blend	3 days/150°C (302°F) 7 days/150°C (302°F)	-9 -9	-21 -26	-15 -22	12 12

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups**

Automotive oils and fluids (cont.)

Automobile transmission fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Dynaflow Automatic Transmission Fluid	MQ VMQ PMQ	70 hr/93°C (200°F)	-15 -15 -10	- -	- -	15 25 35
GM Hydramatic Fluid (Type A)	VMQ FVMQ	3 days/150°C (302°F)	-35 -5	-40 -10	-5 -5	35 5
Socony Mobil Transmission Fluid (Type A)	MQ PMQ	1 day/121°C (250°F)	-10 -10	- -	- -	35 40
	MQ	7 days/121°C (250°F)	-10	-	-	35
Sun 109 Transmission Fluid	VMQ	100 hr/177°C (350°F)	-25	-40	nil	30
Texamatic A Transmission Fluid (Texaco)	VMQ	70 hr/65°C (150°F)	-10	-	-	10
	VMQ PVMQ FVMQ	70 hr/150°C (302°F)	-20 -30 nil	-30 -85 -25	-10 -65 -15	25 65 nil
	VMQ	70 hr/177°C (350°F)	DT	DT	DT	DT
Texamatic C Transmission Fluid (Texaco)	MQ PMQ	1 day/121°C (250°F)	-10 -10	- -	- -	35 45
	MQ VMQ	7 days/121°C (250°F) 70 hr/150°C (302°F)	-20 -25	- -60	- -25	40 25
Texamatic TL 3528 Transmission Fluid (Texaco)	VMQ	70 hr/121°C (250°F)	-15	5	nil	25

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Automotive oils and fluids (cont.)

Transmission and differential lubricants

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Hypoid EP Lubricant	FVMQ	14 days/149°C (300°F)	-20	nil	-10	nil
Mobilube GX-90 General Lubricant	VMQ FVMQ	3 days/149°C (300°F)	DT DT	DT DT	DT DT	DT DT
Swan Finch EP90 Lubricant	FVMQ	3 days/121°C (250°F) 3 days/150°C (302°F)	-10 DT	-70 DT	nil DT	-10 DT
TL 3450 Lubricant	VMQ	3 days/100°C (212°F)	-10	-	-	15
	VMQ FVMQ	3 days/121°C (250°F)	-10 5	-60 -5	-45 -5	10 5
	VMQ FVMQ	3 days/150°C (302°F)	DT DT	DT DT	DT DT	DT DT

Shock absorber fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Delco Shock Absorber Fluid	PMQ	3 days/71°C (160°F)	-	-	-	65
Standard Oil Shock Absorber Fluid	MQ VMQ	1 hr/150°C (302°F)	-15 -20	- -	- -	25 35
	MQ VMQ	1 hr/177°C (350°F)	-15 -20	- -	- -	30 45

Brake fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Dynaflow Automatic Transmission Fluid	MQ VMQ PMQ	70 hr/93°C (200°F)	-15 -15 -10	- -	- -	15 25 35
	MQ PMQ	1 day/121°C (250°F)	-10 -10	- -	- -	35 45
	MQ VMQ	7 days/121°C (250°F) 70 hr/150°C (302°F)	-20 -25	- -60	- -25	40 25
Texamatic TL 3528 Transmission Fluid (Texaco)	VMQ	70 hr/121°C (250°F)	-15	5	nil	25

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Fuels

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Diesel Fuel	MQ VMQ PVMQ	7 days/24°C (75°F)	-25 -25 -35	- - -	- - -	85 100 130
	MQ VMQ PVMQ	7 days/54°C (130°F)	-25 -30 -40	- - -	- - -	90 105 140
Gasoline	VMQ PVMQ	5 min/24°C (75°F)	- -	- -	- -	25 20
	VMQ PVMQ	30 min/24°C (75°F)	- -	- -	- -	60 75
	MQ	18 hr/24°C (75°F)	-25	-	-	245
Gasoline - Regular	FVMQ	24 hr/25°C (77°F)	-12	-39	-30	21
Gasoline - Low lead	FVMQ	24 hr/25°C (77°F)	-12	-41	-30	20
White Gasoline Vapors	PMQ	14 days/24°C (75°F)	-10	-	-	50
	VMQ	7 days/24°C (75°F)	-20	-	-	165
JP-4 Fuel (MIL-J-5624F)	FVMQ	1 day/-54°C (-65°F)	-5	-10	nil	nil
	PVMQ	10 min/24°C (75°F)	-10	-	-	30
	PVMQ FVMQ	1 day/24°C (75°F)	- -5	- -20	- -50	105 10
	FVMQ	3 days/24°C (75°F)	-5	-35	-20	10
	PVMQ FVMQ	7 days/24°C (75°F)	-25 -5	-75 -20	-60 -50	330 10
	FVMQ	14 days/24°C (75°F) 21 days/24°C (75°F) 30 days/24°C (75°F) 3 days/115°C (240°F) 15 days/121°C (250°F) 3 days/177°C (350°F) 3 days/200°C (392°F) 3 days/232°C (450°F)	-5 -5 -5 -5 -20 -25 -35 -45	-20 -30 -30 -55 -65 -65 -80 -90	-50 -55 -55 -40 -40 -20 -10 -20	10 10 10 15 20 25 30 20
JP-5 Fuel (MIL-J-5624F)	FVMQ	7 days/24°C (75°F)	-5	-15	nil	5
JP-5 Fuel Jet Engine Oil	75% FVMQ 25% VMQ blend	22 hours/24°C (75°F)	-11	-45	-37	21
JP-8 Fuel	FVMQ	1 day/24°C (75°F) 7 days/24°C (75°F)	-9 -9	-8 -13	0 -6	3.7 4.6
JP-8 Jet Engine Fuel	FVMQ (75 durometer)	7 days/163°C (325°F) 28 days/163°C (325°F)	-11 -18	0 -73	-8 -38	12 14
Manufactured Gas (24% Methane, 3% Ethane, 18% Carbon Monoxide, 55% Hydrogen)	FVMQ	2 mo/121°C (250°F)	GR	GR	GR	GR

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **GR – good resistance**

Fuels (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Gasohol 10%; Methanol/90%; No Lead Gasoline	FVMQ	1 day/24°C (75°F) 7 days/24°C (75°F) 14 days/24°C (75°F) 28 days/24°C (75°F)	-19 -19 -20 -21	-47 -19 -48 -50	-35 -26 -26 -26	27.5 25.9 26.6 24.4
Gasohol 10%; Ethanol/90%;	FVMQ	1 day/24°C (75°F) 7 days/24°C (75°F)	-18 -18	-37 -37	-19 -16	21.5 21.3
Unsymmetrical Dimethyl Hydrazine	VMQ FVMQ	4 days/24°C (75°F)	nil DT	-25 DT	-50 DT	60 DT

Hydraulic fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Aerosafe 2300 (Stauffer)	VMQ	70 hr/25°C (77°F)	-12	-26	-17	21
	VMQ FVMQ	70 hr/70°C (158°F)	-15 -49	-36 -97	-5 -62	22 18
Exxon WS2406 Fluid	MQ VMQ PMQ	7 days/71°C (160°F)	-15 -10 -20	- - -	- - -	15 20 35
	MQ VMQ PMQ	1 day/121°C (250°F)	-5 -10 -5	- - -	- - -	20 35 45
	MQ VMQ PMQ	1 hr/177°C (350°F)	-10 -10 -15	- - -	- - -	15 20 30
Hydrolube H-2 Fluid	MQ VMQ PVMQ	70 hr/24°C (75°F)	-5 -5 -5	-15 NIL -15	10 15 -10	5 5 5
	MQ PMQ	5 days/24°C (75°F)	-5 -10	- -	- -	5 10
	MQ PMQ	14 days/24°C (75°F)	-5 -10	- -	- -	10 15
	MQ PMQ	27 days/24°C (75°F)	-5 -10	- -	- -	10 15
	MQ PMQ	5 days/65°C (150°F)	-10 -10	- -	- -	10 20
	MQ PMQ	24 days/65°C (150°F)	-5 -10	- -	- -	15 20
	MQ VMQ PMQ	7 days/70°C (158°F)	-10 -10 -5	-10 - -15	20 - -10	5 5 5
Oronite M2V (Chevron)	VMQ FVMQ	7 days/100°C (212°F)	-19 -3	-57 nil	-62 -16	73 2
	VMQ FVMQ	7 days/150°C (302°F)	-24 nil	-70 -22	-63 -12	96 4
	VMQ FVMQ	7 days/177°C (350°F)	-35 -4	-86 -34	-77 -38	130 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Hydraulic fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Oronite 8200 Fluid (Chevron)	FVMQ	3 days/177°C (350°F)	-15	-10	-10	5
Oronite 8515 Fluid (Chevron)	FVMQ	1 day/-54°C (-65°F)	nil	5	5	nil
	MQ VMQ PVMQ	3 days/24°C (75°F)	-15 -20 -15	- - -	- - -	40 45 40
	MQ VMQ PVMQ	3 days/130°C (265°F)	-20 -30 -25	- - -	- - -	60 80 115
	FVMQ	3 days/150°C (302°F) 3 days/177°C (350°F) 3 days/200°C (392°F)	-5 -10 -45	-10 -40 -95	-10 -5 -40	5 10 15
Oronite Hyjet (Chevron)	FVMQ VMQ	70 hr/70°C (158°F)	-25 -10	-79 -4	59 9	24 9
Pydraul 60 Fluid	VMQ PVMQ FVMQ	3 days/24°C (75°F)	-5 -10 -5	- - -	- - -	5 5 5
	VMQ PVMQ FVMQ	3 days/121°C (250°F)	-10 -25 -15	- - -	- - -	10 10 5
Pydraul A-200 Fluid	VMQ PVMQ FVMQ	3 days/24°C (75°F)	-5 -10 -5	- - -	- - -	5 5 nil
	VMQ PVMQ FVMQ	3 days/121°C (250°F)	-10 -10 -5	- - -	- - -	10 15 5
	VMQ PVMQ FVMQ	1 day/177°C (350°F)	-5 -10 -5	- - -	- - -	15 120 5
Pydraul F9 Fluid	MQ VMQ PMQ PVMQ	3 days/24°C (75°F)	-5 -5 -10 -10	-15 - - nil	nil - - 5	5 5 10 5
	MQ VMQ PMQ PVMQ FVMQ	3 days/150°C (302°F)	-5 -5 -10 -10 -5	-15 nil - nil -5	-5 10 - -5 5	10 10 15 15 5
	FVMQ	3 days/177°C (350°F)	-10	-60	-15	-10
Pydraul 150	FVMQ	7 days/150°C (302°F)	DT	DT	DT	DT
Skydrol 500B (Monsanto)	VMQ PVMQ	70 hr/70°C (158°F)	-9 -15	-17 -24	3 -11	10 19
Skydrol HT (Monsanto)	VMQ PVMQ	70 hr/70°C (158°F)	-13 -24	-23 -50	-8 -32	20 40

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Hydraulic fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Skydrol LD (Monsanto)	VMQ FVMQ	70 hr/70°C (158°F)	-16 -37	-22 -87	-3 -71	26 108
Skydrol LD-4 (Monsanto)	FVMQ	1 day/24°C (75°F) 1 day/70°C (158°F)	-24 -29	-82 -85	-68 -73	68 67
Skydrol 7000 Fluid (Monsanto)	MQ VMQ PVMQ	3 days/24°C (75°F)	-5 nil -10	-10 -5 -10	-5 -5 -5	5 5 10
	MQ PMQ	14 days/24°C (75°F)	nil -10	- -	- -	5 5
	MQ VMQ PVMQ	3 days/93°C (200°F)	-5 -5 -10	-10 -10 -15	nil -10 -10	5 5 10

Transformer and instrument oils

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Askerol Transformer Oil (Monsanto) - **Chlorinated**	VMQ	35 days/24°C (75°F) 44 days/24°C (75°F) 60 days/24°C (75°F) 7 days/70°C (158°F) 14 days/70°C (158°F) 28 days/70°C (158°F) 38 days/70°C (158°F) 1 day/121°C (250°F) 3 days/121°C (250°F) 7 days/121°C (250°F) 14 days/121°C (250°F)	nil -5 -5 -5 -5 -5 -5 -5 -5 -10 -5	-20 -10 -10 -10 -20 -15 -15 -15 -15 -11 -10	-15 -15 -15 -20 -20 -15 -15 -15 -15 -15 -15	10 10 10 10 15 10 15 20 20 15 20
Inerteen Transformer Oil (Westinghouse) - **Chlorinated**	MQ VMQ PVMQ	3 days/24°C (75°F)	-5 -5 -10	-10 -10 -15	-5 -5 -15	10 10 5
	MQ PVMQ FVMQ	3 days/115°C (240°F)	-10 -10 nil	-25 -25 -15	-5 -10 nil	15 15 5
	VMQ	3 days/177°C (350°F)	-15	-25	-15	30
N-43 Fluorocarbon Capacitor Fluid	VMQ PVMQ	3 days/150°C (302°F)	-5 nil	- -	- -	5 5
Pyranol Transformer Oil (General Electric) - **Chlorinated**	PMQ	7 days/100°C (212°F)	-10	-	-	25
RCA-Gulf Instrument Oil A	VMQ PVMQ	3 days/93°C (200°F)	-20 -30	- -	- -	70 5
Univolt 35 Transformer Oil	MQ VMQ PVMQ FVMQ	3 days/150°C (302°F)	-15 -15 -30 nil	-25 -45 -30 -10	-20 -45 -15 nil	40 50 55 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing group**

Transformer and instrument oils (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Wemco C Transformer Oil	MQ VMQ PVMQ	3 days/24°C (75°F)	-15 -20 -30	- - -	- - -	35 40 45
	VMQ	1 yr/79°C (175°F)	-35	-	-	40
	VMQ FVMQ	3 days/177°C (350°F)	-55 -5	- -20	- 5	140 10
Coolanol 35 (Monsanto)	VMQ FVMQ	3 days/121°C (250°F)	-21 1	-67 1	-68 -10	101 3
Coolanol 45 (Monsanto)	FVMQ	70 hr/177°C (350°F)	-3	-12	-14	4

Specialty oils, greases and fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
ANG 15 Industrial Grease (Texaco Regal Starfak Special)	MQ VMQ	3 days/24°C (75°F)	-5 -10	nil nil	nil nil	5 5
	MQ VMQ	3 days/150°C (302°F)	-10 -15	nil nil	nil nil	20 20
ANG 25 Diester Base (Texaco TG-749)	VMQ	3 days/25°C (77°F)	-5	-	-	15
ANG 25 Diester Base (Texaco TG-749)	PMQ	3 days/93°C (200°F) 1 day/150°C (302°F) 7 days/150°C (302°F)	-15 -20 TB	- - TB	- - TB	30 40 TB
ANG 25 Glycerol Ester (Texaco)	PMQ	1 day/71°C (160°F)	-10	-	-	10
ANO No. 3 Grade M; Extreme Pressure (GAF Corp.)	MQ PMQ	3 days/177°C (350°F)	- -	- -	- -	45 30
ANO No. 6 Oil (GAF Corp.)	MQ PMQ	1 day/24°C (75°F)	-10 -10	- -	- -	30 45
	MQ PMQ	7 days/24°C (75°F)	-15 -20	- -	- -	35 60
	MQ PMQ	1 day/150°C (302°F)	-25 -25	- -	- -	95 145
ANO No. 9 Oil (GAF Corp.)	MQ PMQ	1 day/121°C (250°F)	-10 -15	- -	- -	35 40
	MQ PMQ	3 days/121°C (250°F)	-15 -20	- -	- -	45 70
	MQ PMQ	7 days/121°C (250°F)	-15 -20	- -	- -	45 65
ANO No. 11 Oil (GAF Corp.)	MQ PMQ	1 day/121°C (250°F)	-5 -15	- -	- -	10 20
	MQ PMQ	3 days/121°C (250°F)	-10 -15	- -	- -	15 25
	MQ PMQ	7 days/121°C (250°F)	-10 -15	- -	- -	15 25
ANO No. 366 Oil (GAF Corp.)	MQ PMQ	3 days/93°C (200°F)	-20 -10	- -	- -	95 140

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing group**

Specialty oils, greases and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Aroclor 1254 (Monsanto)	VMQ	3 days/24°C (75°F) 3 days/150°C (302°F)	-5 -10	10 -5	5 nil	5 10
Cosmoline 2046 (Fritzsche, Dodge & Olcutt)	VMQ	4 days/24°C (75°F)	-35	-	-	55
Crude Oil 7 API	FVMQ	14 days/24°C (75°F)	-	-	-	5
	VMQ	3 days/83°C (180°F)	-10	-	-	25
	FVMQ	14 days/83°C (180°F) 14 days/135°C (275°F)	- -10	- -	- -	5 5
Crude Oil 315 API	VMQ	14 days/24°C (75°F) 3 days/83°C (180°F)	- -20	- -	- -	10 60
	FVMQ	14 days/83°C (180°F) 14 days/135°C (275°F)	- -5	-70	-45	5 -2
Delco No. 9	PVMQ	1 day/100°C (212°F)	-15	-15	15	10
	VMQ PVMQ	5 days/100°C (212°F)	-10 -15	- -	- -	10 10
Delco No. 11	MQ VMQ	5 days/100°C (212°F)	-5 -5	- -	- -	5 5
FC-75 Fluorochemical Fluid (3M)	VMQ PVMQ FVMQ VMQ PVMQ FVMQ	1 day/24°C (75°F) 7 days/65°C (150°F)	-5 -5 5 nil -5 nil	- - - - - -	- - - - - -	nil nil nil 5 5 5
Gas Drip Oil	VMQ PVMQ FVMQ	3 days/24°C (75°F)	-25 -30 -5	- - -	- - -	250 500 20
GE Transil Oil	VMQ	3 days/24°C (75°F) 3 days/93°C (200°F)	-20 -30	- -	- -	35 50
GM 14X Heavy Duty Oil	VMQ	5 days/100°C (212°F)	-5	-	-	5
Mineral Oil	VMQ PVMQ	3 days/24°C (75°F)	-10 -15	-30 -20	-10 -10	25 35
Mineral Oil (Shell No. 5)	VMQ PVMQ	3 days/121°C (250°F)	-20 -35	-55 -55	-35 -20	60 70
	MQ PMQ	1 day/100°C (212°F)	-10 -5	- -	- -	25 40
	MQ PMQ	1 day/121°C (250°F)	-15 -10	- -	- -	25 40
	MQ PMQ	1 day/149°C (300°F)	-15 -10	- -	- -	30 55

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing group**

Specialty oils, greases and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Navy Crankcase Oil No. 2135	VMQ	4 days/93°C (200°F)	-15	-	-	10
Navy Crankcase Oil No. 9250	VMQ	4 days/93°C (200°F)	-10	-	-	10
Pacemaker Fluid 100T	VMQ PVMQ	1 day/177°C (350°F)	-25 -35	- -	- -	50 60
	VMQ PVMQ FVMQ	3 days/177°C (350°F)	-30 -40 -5	- - -20	- - -10	55 65 5
SG 4766 Glycol Ester Base Grease (Standard Oil)	MQ PMQ	70 hr/24°C (75°F)	-10 -10	- -	- -	5 10
	MQ PMQ	3 days/24°C (75°F)	-10 -10	- -	- -	10 15
	PMQ	1 day/71°C (160°F) 3 days/71°C (160°F)	-10 -10	- -	- -	10 10
Shell Aircraft Turbine Lubricant A	FVMQ	70 hr/150°C (302°F) 140 hr/150°C (302°F)	-5 -11	-9 -24	-25 -32	8 10
Shell Aircraft Turbine Lubricant B	FVMQ	70 hr/150°C (302°F) 140 hr/150°C (302°F)	-3 -8	-26 -71	-50 -69	6 7
Shell B & B Grease	VMQ	70 hr/74°C (165°F) 912 hr/74°C (165°F)	-15 -16	-34 -9	-10 -20	26 26
	PMQ	70 hr/74°C (165°F) 912 hr/74°C (165°F)	-17 -19	-11 -15	-7 -13	30 30
Socony Mobil RL 147-A No. 7	PMQ	1 day/150°C (302°F) 6 days/150°C (302°F)	-15 -20	- -	- -	50 50
Sun Oil No. 8X2513-1 L	PMQ	1 day/150°C (302°F) 6 days/150°C (302°F)	-25 -45	- -	- -	70 55
Tectyl 502C Rust Inhibitor	MQ	14 days/24°C (75°F)	-5	5	5	nil
Tectyl 511-M Rust Inhibitor	MQ	14 days/24°C (75°F)	nil	5	-5	nil
Texas 1500 Oil (HD Concentrate)	MQ	10 days/150°C (302°F) 21 days/150°C (302°F)	-15 -20	-20 -30	-20 -10	10 10

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Specialty oils, greases and fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Tricresyl Phosphate	MQ VMQ PVMQ	3 days/24°C (75°F)	nil nil nil	nil -5 -5	-5 -5 -5	nil nil nil
	MQ VMQ PVMQ	3 days/177°C (350°F)	nil -5 nil	-40 -25 -45	-40 -10 -50	5 5 5
	VMQ	3 days/200°C (392°F)	DT	DT	DT	DT
Turbo Oil No. 35	PVMQ	7 days/24°C (75°F) 7 days/65°C (150°F)	-15 -20	-35 -35	-20 -25	15 15
	VMQ PVMQ	3 days/71°C (160°F)	-10 -15	-10 -35	-15 -25	10 15
	VMQ PVMQ	3 days/121°C (250°F)	-15 -15	-10 -35	-15 -20	10 15
	FVMQ	3 days/150°C (302°F)	-10	-30	25	10
Ucon Lubricant LB1145 (gear oil) (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil
Ucon Water-Soluble Lubricant 50-HB-55 (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil
Ucon Lubricant 50-HB-100 (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil
Ucon Lubricant 50-HB-260 (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil
Ucon Lubricant 50-HB-280-X (Union Carbide)	MQ VMQ	3 days/150°C (302°F)	-5 -5	- -	- -	nil nil
Ucon Lubricant 50-HB-660 (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil
Ucon Lubricant 50-HB-5100 (Union Carbide)	MQ VMQ PMQ	3 days/150°C (302°F)	nil nil nil	- - -	- - -	nil nil nil

Solvents

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Acetone	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	-10 -10 -10 -20	- - - -85	- - - -75	25 15 20 180
Benzene	VMQ FVMQ	14 days/24°C (75°F)	- -17	- -22	- -15	175 23
	FVMQ	3 days/70°C (158°F)	-10	-50	-40	20

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Solvents (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Butyl Acetate	VMQ PMQ PVMQ	7 days/24°C (75°F)	-30 nil -25	- - -	- - -	150 150 125
Butyl Alcohol (Butanol)	MQ VMQ PMQ PVMQ FVMQ	7 days/24°C (75°F)	-10 -10 -15 -10 nil	- - - - -	- - - - -	20 15 40 35 10
Carbon Tetrachloride	VMQ PVMQ FVMQ	7 days/24°C (75°F)	-20 -10 -5	- - -45	- - -30	165 165 20
	FVMQ	5 days/49°C (120°F)	-10	-	-	20
Chlorobromomethane	FVMQ	7 days/24°C (75°F)	-10	-45	-50	25
	MQ VMQ PVMQ	2 days/67°C (153°F)	-20 -20 -25	- - -	- - -	70 95 235
Chloroform	FVMQ	5 days/24°C (75°F)	-10	nil	nil	30
Chlorothene Solvent (Dow)	FVMQ	1 day/24°C (75°F)	-15	-	-	50
	VMQ	7 days/24°C (75°F)	-	-	-	245
Cyclohexane	FVMQ	2 days/24°C (75°F)	-	-	-	15
	VMQ	7 days/24°C (75°F)	-	-	-	250
Diacetone Alcohol	VMQ	5 days/24°C (75°F)	-5	-	-	5
Dichloroisopropyl Ether	PMQ	7 days/24°C (75°F)	-	-	-	nil
Diethyl Ether	FVMQ	7 days/24°C (75°F)	-10	-40	-45	50
Ethyl Alcohol	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	-5 -5 -10 nil	- - - -30	- - - -15	nil 5 20 5
Ethylenedichloride	FVMQ	3 days/24°C (75°F)	-10	-	-	50
	VMQ	7 days/24°C (75°F)	-	-	-	45
Heptane	FVMQ	7 days/60°C (140°F)	-10	-30	-30	25
Isopropyl Alcohol	PMQ	7 days/24°C (75°F)	-10	-	-	10
Methyl Alcohol	MQ	7 days/24°C (75°F)	nil	nil	nil	nil
Methyl Chloride	FVMQ	14 days/25°C (77°F)	-12	-34	-11	4
	MQ VMQ PVMQ	7 days/24°C (75°F)	NR -15 -15	NR - -	NR - -	NR 150 150
Methylene Chloride	VMQ FVMQ	72 hr/25°C (77°F)	- -	- -	- -	180 70
Mineral Spirits	FVMQ	30 days/24°C (75°F)	nil	nil	nil	nil
Monochlorobenzene	FVMQ	7 days/24°C (75°F)	-5	-45	-40	25

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **NR – not recommended**

Solvents (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Naphtha	FVMQ	3 days/24°C (75°F)	-	-	-	10
Nitrocellulose Solvent (Toluene, Ethyl Alcohol, Ethyl Acetate, Methylethylketone, Butyl Acetate)	VMQ PVMQ FVMQ	2 days/24°C (75°F)	-25 -45 -25	- - -	- - -	135 165 65
Ortho-Chloroethylbenzene	FVMQ	7 days/24°C (75°F)	-5	-55	-40	15
Ortho-Chlorotoluene	FVMQ	7 days/24°C (75°F)	-5	-45	-45	20
Oxylene Solvent	FVMQ	1 day/24°C (75°F)	-15	-	-	90
Perchloroethylene	FVMQ	3 days/24°C (75°F)	-10	-	-	10
	PMQ	14 days/24°C (75°F)	-10	-	-	45
	FVMQ	1 day/107°C (225°F)	-15	-	-	20
Propylenedichloride	FVMQ	5 days/49°C (120°F)	-10	-	-	55
Solvatone Solvent (Union Carbide)	VMQ	1 day/24°C (75°F)	-15	-	-	30
Stoddard Solvent	MQ VMQ PVMQ	7 days/24°C (75°F)	NR -20 -15	NR - -	NR - -	NR 160 150
Toluene	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	NR - -20 -10	NR - - -50	NR - - -35	NR 205 150 20
Toluene Vapor	PMQ	14 days/24°C (75°F)	-10	-	-	50
Turpentine	VMQ FVMQ	16 hr/24°C (75°F)	- -	- -	- -	230 15
Xylene (Xylol)	VMQ	15 min/24°C (75°F) 30 min/24°C (75°F) 1 hr/24°C (75°F) 2 hr/24°C (75°F) 5 days/24°C (75°F)	-20 -25 -30 -30 -35	- - - - -	- - - - -	40 45 60 80 135
	FVMQ	3 days/24°C (75°F) 7 days/24°C (75°F)	-10 -10	-45 -55	-35 -40	20 20

Silicone fluids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
XIAMETER™ PMX-200 Silicone Fluid, 0.65 centistokes	FVMQ	3 days/24°C (75°F) 1 day/100°C (212°F) 3 days/150°C (302°F)	-5 -5 -10	-45 - -60	-30 - -30	5 15 25
XIAMETER™ PMX-200 Silicone Fluid, 3 centistokes	FVMQ	3 days/24°C (75°F) 3 days/150°C (302°F)	nil -10	-15 -30	-10 -10	nil 10
XIAMETER™ PMX-200 Silicone Fluid, 10 centistokes	FVMQ (40 durometer)	3 days/23°C (73°F) 14 days/23°C (73°F) 3 days/100°C (212°F) 14 days/100°C (212°F)	-1 -2 -3 -1	-5 -9 -4 -6	3 0 3 0	0 0 1 1
XIAMETER™ PMX-200 Silicone Fluid, 100 centistokes	FVMQ (40 durometer)	3 days/23°C (73°F) 14 days/23°C (73°F) 3 days/100°C (212°F) 14 days/100°C (212°F)	-3 -4 -4 -3	3 1 6 5	7 5 10 10	0 0 0 0

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **NR – not recommended**

Silicone fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
XIAMETER™ PMX-200 Silicone Fluid, 1000 centistokes	FVMQ (40 durometer)	3 days/23°C (73°F) 14 days/23°C (73°F) 3 days/100°C (212°F) 14 days/100°C (212°F)	-3 -4 -5 -2	3 1 -2 0	4 2 0 5	0 0 1 0
XIAMETER™ PMX-200 Silicone Fluid, 60000 centistokes	VMQ PMQ FVMQ	1 day 24°C (75°F)	-5 -5 nil	-10 -10 -10	nil -10 nil	5 5 nil
	PMQ FVMQ	3 days/24°C (75°F)	-5 nil	-15 -10	-5 -15	5 nil
	VMQ PMQ FVMQ	7 days/24°C (75°F)	-5 -10 nil	-10 -5 -5	nil -5 nil	10 10 nil
	VMQ PMQ FVMQ	1 day 150°C (302°F)	-5 -10 -5	-15 -5 -15	-10 nil -5	15 10 nil
	VMQ PMQ FVMQ	3 days/150°C (302°F)	-10 -10 -5	-15 -15 -25	-10 -10 nil	15 10 nil
	VMQ PMQ FVMQ	7 days/150°C (302°F)	-10 -10 -5	-30 nil -25	-20 -25 -15	15 15 nil
XIAMETER™ PMX-0210 Silicone Fluid, 1000 centistokes	FVMQ	16 hr/260°C (500°F)	-	-	-	-3
XIAMETER™ PMX-0210 Silicone Fluid, 6000 centistokes	75/25 VMQ/FVMQ 50/50 VMQ/FVMQ	70 hr/177°C (350°F) 70 hr/177°C (350° F)	-10 -10	-16 -13	-20 -21	11 8
DOWSIL™ 510 Fluid	MQ VMQ PVMQ	3 days/24°C (75°F)	-15 -15 -20	- - -	- - -	40 35 35
	VMQ	1 day/l50°C (302°F)	-20	-	-	35
	MQ VMQ PVMQ FVMQ	3 days/150°C (302°F)	-20 -25 -30 nil	- - - -10	- - - -15	40 45 50 nil
DOWSIL™ 550 Fluid	MQ VMQ PVMQ	3 days/24°C (75°F)	-5 -5 -10	- - -	- - -	5 10 10
	MQ VMQ PVMQ FVMQ	3 days/150°C (302°F)	-10 -10 -10 nil	- - - -3	- - - -15	10 10 10 nil
	VMQ	7 days/150°C (302°F)	-	-	-	10

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **NE – no effect**

Silicone fluids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
DOWSIL™ 702 Diffusion Pump Fluid	VMQ	1 day/150°C (302°F)	-25	-	-	60
DOWSIL™ 710 Fluid	FVMQ	3 days/150°C (302°F)	nil	nil	-15	nil
	VMQ	7 days/150°C (302°F) 7 days/150°C (302°F) 7 days/200°C (392°F)	-5 -10 -10	- - -	- - -	5 5 10
DOWSIL™ 710 Fluid	MQ VMQ PVMQ	3 days/24°C (75°F)	-5 -5 -5	- - -	- - -	nil 5 5
	MQ VMQ PVMQ	3 days/150°C (302°F)	-10 -5 -10	- - -	- - -	5 5 10
	FVMQ	14 days/200°C (392°F)	-20	-70	10	nil
DOWSIL™ FS-1265 Fluid	VMQ FVMP PVMQ	7 days/150°C (302°F)	nil -20 -5	10 -55 15	-5 -45 -10	nil 80 5

Silicone compounds and greases

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
MOLYKOTE 4 Electrical Insulating Compound	PMQ	1 day/24°C (75°F) 3 days/24°C (75°F) 7 days/24°C (75°F)	-5 -5 -5	- - -	- - -	5 10 20
	MQ VMQ PMQ	1 day/150°C (302°F)	-20 -15 -5	- - -	- - -	25 25 15
	VMQ PMQ	3 days/150°C (302°F)	- -10	- -	- -	25 25
	VMQ PMQ	7 days/150°C (302°F)	- -10	- -	- -	30 30
	PMQ	1 day/200°C (392°F) 3 days/200°C (392°F) 7 days/200°C (392°F)	-10 -20 -30	- - -	- - -	20 30 40
MOLYKOTE 5 Compound	MQ VMQ	1 day/150°C (302°F)	-20 -15	- -	- -	20 15
MOLYKOTE 111 Compound	PMQ	1 day/150°C (302°F) 3 days/150°C (302°F) 1 day/200°C (392°F) 1 day/250°C (482°F)	nil nil nil -25	- - - -	- - - -	10 10 10 nil
MOLYKOTE 33 Grease	FVMQ	3 days/25°C (77°F) 3 days/177°C (350°F)	-5 -11	- -	- -	4 9
DOWSIL™ 340 Heat Sink Compound	VMQ	70 hr/150°C (302°F)	-9	-	-	11

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups**

Food products

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Beer	VMQ FVMQ	22 hr/70°C (158°F)	nil -5	- -	- -	nil nil
Butter (liquid)	VMQ FVMQ	22 hr/70°C (158°F)	-5 -3	- -	- -	nil nil
Coca -Cola Syrup	VMQ FVMQ PVMQ	1 day/24°C (75°F)	nil nil 5	nil 10 nil	nil 15 5	nil nil nil
	VMQ FVMQ PVMQ	28 days/24°C (75°F)	nil nil nil	-10 20 nil	-10 20 10	nil nil nil
	VMQ FVMQ PVMQ	60 days/24°C (75°F)	nil nil 5	-10 -5 -5	-10 -5 -5	nil nil nil
Coffee	VMQ	7 days/83°C (180°F) 14 days/83°C (180° F)	-5 -5	-15 -5	nil nil	nil 5
Lard	VMQ (high strength)	1 day/200°C (392°F) 3 days/200°C (392°F) 7 days/200°C (392°F)	nil -5 BR	-35 -80 BR	-40 -75 BR	5 5 BR
	VMQ	7 days/200°C (392°F) 1 hr/260°C (500°F)	nil -10	-30 -25	-35 -20	nil 5
Mazola Oil	VMQ	7 days/150°C (302°F)	-5	-15	-10	nil
Orange Peel Oil	VMQ	1 day/24°C (75°F)	-	-	-	-100
Orange Syrup	VMQ PVMQ FVMQ	1 day/24°C (75°F)	nil nil nil	nil 5 -15	5 10 5	nil nil 5
	VMQ PVMQ FVMQ	28 days/24°C (75°F)	nil nil -5	-5 15 -15	-5 25 5	nil nil nil
	VMQ PVMQ FVMQ	60 days/24°C (75°F)	nil nil -5	-5 nil -35	-10 5 -15	nil nil 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated** **BR – brittle**

Food products (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Scotch Whisky	VMQ PVMQ FVMQ	1 day/24°C (75°F)	nil nil nil	nil nil -15	-5 5 3	nil nil 5
	VMQ PVMQ FVMQ	28 days/24°C (75°F)	nil nil -5	-5 5 -15	10 20 15	nil nil nil
	VMQ PVMQ FVMQ	60 days/24°C (75°F)	nil nil -5	-10 -10 -35	5 -5 -15	nil 5 3
Spry Shortening	VMQ	7 days/150°C (302°F)	-5	-15	-15	nil
Tab Concentrate	VMQ PVMQ FVMQ	1 day/24°C (75°F)	nil nil nil	nil nil -5	5 3 3	nil nil nil
	VMQ PVMQ FVMQ	28 days/24°C (75°F)	nil nil nil	5 5 nil	30 10 10	nil nil nil
	VMQ PVMQ FVMQ	60 days/24°C (75°F)	nil nil nil	nil -5 -10	-10 -5 -5	nil nil nil
Tia Maria Liquor	VMQ PVMQ FVMQ	1 day/24°C (75°F)	nil nil nil	nil 10 -10	5 10 3	nil nil nil
	VMQ PVMQ FVMQ	28 days/24°C (75° F)	nil nil -5	nil 10 -15	10 10 20	nil nil nil
	VMQ PVMQ FVMQ	60 days/24°C (75°F)	nil nil -5	-5 -5 -25	-5 nil -5	nil nil nil
Vegetable Oil (Kraft)	VMQ (high strength)	1 day/200°C (392°F) 3 days/200°C (392°F) 7 days/200°C (392°F)	-5 nil -5	-30 -40 -80	-25 -45 -75	5 5 5
Vinegar	VMQ (high strength)	1 day/24°C (75°F) 7 days/24°C (75°F)	nil nil	-5 -5	nil nil	nil nil

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups**

Water and steam

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Water	MQ VMQ PVMQ	7 days/24°C (75°F)	nil nil nil	-5 - -5	-5 - -10	5 nil nil
	MQ VMQ PVMQ	7 days/70°C (158°F)	-5 nil -5	-5 -5 -10	5 10 -5	5 nil nil
	MQ PVMQ FVMQ	3 days/100°C (212°F)	-5 -3 nil	-5 -5 -	-15 -5 -	nil nil nil
	MQ VMQ	7 days/100°C (212°F)	-5 nil	-20 -	20 -	nil 5
	VMQ	14 days/100°C (212°F)	nil	-	-	5
	MQ	1 day/121°C (250°F) 3 days/121°C (250°F)	-5 -5	- -	- -	5 5
	FVMQ	70 hr/150°C (302°F)	-5	-	-	nil
	MQ	1 day/177°C (350°F) 3 days/177°C (350°F)	-15 DT	- DT	- DT	15 DT
Steam	MQ VMQ PVMQ	7 days/5 psi	-5 -5 -5	-25 -15 -10	5 5 10	nil 5 nil
	MQ VMQ PVMQ	14 days/5 psi	-5 -5 -5	-35 -30 -3	-10 -15 10	5 3 nil
	MQ VMQ PVMQ	7 days/10 psi	-5 -5 -5	-30 -30 -10	-10 -10 -10	5 5 nil
	MQ VMQ PVMQ	14 days/10 psi	-5 -5 -5	-35 -40 -10	-15 -20 -10	5 5 nil
	MQ VMQ PVMQ	7 days/20 psi	-5 -5 -3	-35 -35 -15	-15 -20 -15	5 3 nil
	MQ VMQ PVMQ	14 days/20 psi	-5 -5 -5	-45 -45 -20	-20 -40 -15	5 5 nil
	VMQ	1 day/50 psi 3 days/50 psi 5 days/50 psi 7 days/50 psi	-5 -5 -5 -5	-25 -30 -40 -65	-10 -5 -25 -30	5 5 5 5

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Water and steam (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Steam	VMQ	1 day/65 psi 3 days/65 psi 7 days/65 psi 1 day/80 psi 3 days/80 psi 7 days/80 psi	-10 -5 -10 -10 -10 -10	-30 -50 -65 -40 -60 -75	-30 -25 -50 -10 -40 -45	5 5 5 5 10 5
	MQ	16 hr/100psi	-10	-30	25	nil
	MQ VMQ* PVMQ FVMQ	1 day/100 psi	-10 3 -5 -5	-40 -11 -25 -20	-10 -2 5 15	5 -2 nil nil
	MQ VMQ PVMQ	3 days/100 psi	-10 4 -10	-60 -25 -35	-20 -10 -5	10 -4 nil
	MQ VMQ PVMQ	7 days/100 psi	-20 6 -20	-30 -35 -75	-25 -26 -75	5 -6 nil

Acids

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Acetic Acid (5%)	VMQ	7 days/24°C (75°F)	-5	-	-	5
Acetic Acid, glacial	MQ VMQ PVMQ	7 days/24°C (75°F)	-5 -5 -5	- - -	- - -	nil 5 5
	FVMQ	2 days/24°C (75°F)	-	-	-	20
Hydrochloric Acid (5% in Perchloroelhylene)	VMQ FVMQ	1 day/100°C (212°F)	-30 -15	- -	- -	100 10
Hydrochloric Acid (10%)	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	nil -5 nil -5	- - - -25	- - - -15	nil nil nil nil
Hydrochloric Acid (18%)	FVMQ	3 days/24°C (75°F) 3 days/65°C (150°F)	nil nil	-20 -35	-10 -10	nil 10
Hydrochloric Acid (36%, concentrated)	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	PR -5 BR -5	PR - BR -45	PR - BR -30	PR 5 BR 10
Hydrofluoric Acid (48%)	PMQ	9 days/27°C (80°F)	DT	DT	DT	DT
Nitric Acid (10%)	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	nil nil nil nil	- - - -10	- - - -3	10 nil nil nil

***Data based on XIAMETER™ RBB-2030-80 Silicone Rubber and XIAMETER™ RBB-2030-40 Silicone Rubber**

MQ – methyl groups only
V – vinyl groups
P – phenyl groups
F – fluorine-containing groups
DT – deteriorated
BR – brittle
pr – poor

Acids (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Nitric Acid (50%)	FVMQ	3 days/24°C (75°F) 3 days/65°C (150°F)	5 -10	-15 -80	-10 -30	5 5
Nitric Acid (70%, concentrated)	MQ VMQ PVMQ FVMQ	7 days/24°C (75°F)	PR 5 BR nil	PR - BR -40	PR - BR -30	PR -10 BR 5
Phosphoric Acid (10%)	MQ PMQ MQ PMQ	7 days/24°C (75°F) 7 days/100°C (212°F)	UA UA UA UA	UA UA UA UA	UA UA UA UA	UA UA UA UA
Phosphoric Acid (85%, concentrated)	MQ PMQ VMQ FMQ	7 days/24°C (75°F) 7 days/100°C (212°F)	UA UA UA 4	UA UA -39 -8	UA UA nil -9	UA UA -23 -2
Stearic Acid	MQ PMQ	7 days/100°C (212°F)	UA UA	UA UA	UA UA	UA UA
Sulfuric Acid (20%)	MQ	1 day/83°C (180°F) 7 days/83°C (180°F)	nil nil	-10 -25	-5 -15	-5 -10
Sulfuric Acid (30%)	PVMQ	2 hr/93°C (200°F)	nil	-20	-5	nil
Sulfuric Acid (50%)	FVMQ	3 days/24°C (75°F) 3 days/65°C (150°F)	nil 5	-5 -35	-5 -15	nil nil
Sulfuric Acid (30%)	MQ VMQ FVMQ PVMQ	7 days/24°C (75°F)	DC DC DC DC	DC DC DC DC	DC DC DC DC	DC DC DC DC

Bases

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Ammonium Hydroxide (saturated)	MQ VMQ PMQ FVMQ PVMQ	7 days/24°C (75°F)	-5 nil UA nil -5	- - UA - -45	- - UA - -5	nil nil UA 0 5
Calcium Oxide (10%, saturated)	VMQ	1 day/150°C (302°F)	5	-15	-10	5
Lithium Hydroxide (2%)	VMQ	1 day/150°C (302°F)	nil	-25	-10	-5
Lithium Hydroxide (5%)	VMQ	1 day/150°C (302°F)	-10	-70	nil	-35
Lithium Hydroxide (10%, saturated)	VMQ	1 day/150°C (302°F)	DT	DT	DT	DT
Potassium Hydroxide (10%)	VMQ	1 day/150°C (302°F)	5	-20	-15	-5
Potassium Hydroxide (25%)	MQ PMQ	7 days/83°C (180°F)	nil -5	- -	- -	5 nil
Potassium Hydroxide (saturated)	VMQ	1 day/150°C (302°F)	-20	-40	-10	-10

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**
BR – brittle **pr – poor** **UA – unaffected** **DC – decompesed**

Bases (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Sodium Hydroxide (10%)	MQ VMQ PMQ PVMQ FVMQ	7 days/24°C (75°F)	-5 -5 - -5 -5	- - - - -45	- - - - -10	nil nil 5 nil nil
Sodium Hydroxide (25%)	MQ PMQ	7 days/83°C (180°F)	-5 -5	- -	- -	nil -10
Sodium Hydroxide (50%)	VMQ PMQ FVMQ	7 days/24°C (75°F)	-5 - -5	- - -10	- - 5	nil 10 nil
	PMQ	7 days/100°C (212°F)	-	-	-	15

Salts

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Copper Sulfate (50%)	PMQ	5 days/100°C (212°F)	UA	UA	UA	UA
Ferric Chloride (60%)	MQ PMQ	7 days/100°C (212°F)	UA FR	UA FR	UA FR	UA FR
Sodium Carbonate (2%)	VMQ PMQ FVMQ	7 days/24°C (75°F)	nil -5 5	- - -	- - -	nil nil nil
Sodium Chloride (10%)	PMQ	7 days/24°C (75°F)	nil nil 5	- - -	- - -	nil nil nil

Other chemicals

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Acetonitrile	VMQ FVMQ	20 hr/24°C (75°F)	- -	- -	- -	nil 5
	VMQ FVMQ	168hr/150°C (302°F)	- DI	- DI	- DI	5 DI
Ammonia	MQ VMQ PVMQ	7 days/24°C (75°F)	nil -10 -5	- - -	- - -	nil nil 5
	VMQ FVMQ	24hr/110°C (230°F) 300 lb. pressure	- DT	260 DT	200 DT	- DT
Aniline	FVMQ	7 days/24°C (75°F)	nil	-30	-15	5
Bromine (liquid)	MQ	7 days/24°C (75°F)	25	-	-	15
Butylene Oxide	MQ PMQ	1 day/24°C (75°F)	- -	- -	- -	20 40
Calcium Silicate (10%. saturated)	VMQ	1 day/150°C (302°F)	nil	nil	nil	5
Caprolactam Monomer	VMQ FVMQ	3 days/24°C (75°F)	nil -5	-20 -20	-10 nil	nil nil

MQ – methyl groups only V – vinyl groups P – phenyl groups F – fluorine-containing groups DT – deteriorated
BR – brittle pr – poor FR – fair UA – unaffected DC – decompesed DI – disintegrated

Other chemicals (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
1-Chlorodecane	FVMQ	7 days/24°C (75°F)	-5	-20	-20	10
Dimethyl Formamide	FVMQ	1 day/24°C (75°F)	DT	DT	DT	DT
	MQ PMQ	7 days/24°C (75°F)	nil nil	- -	- -	2 2
Dioctyl Phthalale	VMQ	3 days/70°C (158°F) 6 days/70°C (158°F) 70 hr/150°C (302°F)	-1 -5 -15	-10 -16 -4	-12 -9 8	10 11 13
	FVMQ	70 hr/150°C (302°F)	-9	-13	-13	7
Elhylene Glycol	FVMQ	7 days/24°C (75°F)	nil	-10	-10	nil
Elhylene Glycol (60%)	MQ	7 days/135°C (275°F)	-25	-	-	20
Ethylene Glycol (50%)	VMQ FVMQ	7 days/83°C (180°F)	nil nil	nil -5	10 5	nil nil
	VMQ	70 hr/100°C (212°F) 7 days/100°C (212°F) 14 days/100°C (212°F)	-1 -7 -4	-4 -5 -10	nil 2 -12	1 nil 1
	PVMQ	7 days/121°C (250°F)	-5	-	-	5
Ethylene Glycol Mixture (1/3 Ethylene Glycol; 1/3 EthylAlcohol: 1/3 Water)	VMQ	7 days/100°C (212°F)	-1	-2	-2	5
Ethylene Oxide	MQ	3 days/24°C (75°F)	-	-	-	25
	FVMQ	7 days/24°C (75°F)	-15	-75	-60	100
	VMQ	7 days/71°C (160°F)	-30	-70	-65	95
	MQ	14 days/71°C (160°F)	-	-	-	45
	PVMQ	32 hr/110°C (230°F)	nil	-25	-30	nil
Freon 11 (DuPont)	VMQ PVMQ FVMQ	3 days/24°C (75°F)	- - -	- - -	- - -	175 260 30
Freon 12 (DuPont)	VMQ PVMQ FVMQ	3 days/24°C (75°F)	- - -	- - -	- - -	150 195 45
Freon 21 (DuPont)	MQ	7 days/-55°C (-67°F) 7 days/24°C (75°F)	-5 -15	- -	- -	225 165
Freon 22 (DuPont)	MQ FVMQ MQ VMQ	7 days/-55°C (-67°F) 3 days/24°C (75°F) 7 days/24°C (75°F)	-10 - -5 -5	- - - -	- - - -	110 205 75 75

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**

Other chemicals (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Freon 113 (DuPont)	MQ	7 days/-55°C (-67°F) 7 days/24°C (75°F)	-5 -5	- -	- -	200 150
Freon 114 (DuPont)	MQ PVMQ FVMQ	3 days/24°C (75°F)	- - -	- - -	- - -	130 135 25
HMS 20-1083	VMQ PVMQ	3 days/24°C (75°F)	-20 -15	- -	- -	125 100
Hydrazine (Anhydrous)	FVMQ	3 days/24°C (75°F)	ES	ES	ES	ES
Hydrogen Peroxide (3%)	PMQ	7 days/24°C (75°F)	UA	UA	UA	UA
Hydrogen Peroxide (30%)	PMQ	7 days/24°C (75°F)	UA	UA	UA	UA
Hydrogen Peroxide HTP (90%)	FVMQ	7 days/65°C (150°F)	nil	-20	-15	5
Isopropyl Nitrate	FVMQ	7 days/24°C (75°F)	-	-	-	200
Methyl Methacrylate	VMQ FVMQ	4 hr/25°C (77°F)	- -	- -	- -	106 104
Molybdenum Disulfide	VMQ PVMQ FVMQ	3 days/24°C (75°F)	nil nil nil	- - -	- - -	nil nil nil
	VMQ PVMQ FVMQ	3 days/150°C (302°F)	nil nil 5	- - -	- - -	nil nil nil
Monoethanolamine	VMQ	70 hr/24°C (75°F) 70 hr/38°C (100°F)	nil -5	-20 -25	5 5	nil 5
	VMQ FVMQ	70 hr/121°C (250°F)	-25 DT	-80 DT	-5 DT	5 DT
Pentachlorophenol (10% in Ethanol)	PMQ	7 days/24°C (75°F)	-	-	-	5
Phenol (70%)	MQ	7 days/100°C (212°F)	-30	-	-	5
Phenol (85%)	MQ	7 days/24°C (75°F)	-10	-	-	10
Phthalic Acid Anhydride	MQ	7 days/149°C (300°F)	5	-	-	nil
Phthalic Anhydride	MQ VMQ FVMQ	1 day/200°C (392°F)	nil nil nil	- - -	- - -	nil nil nil
	MQ VMQ FVMQ	5 days/200°C (392°F)	-2 nil -2	- - -	- - -	nil nil 7
	MQ VMQ FVMQ	7 days 200°C (392°F)	-2 nil 2	- - -	- - -	2 nil 7

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**
UA – unaffected **ES – excessive swell**

Other chemicals (cont.)

Immersion medium	ASTM designation	Immersion conditions	Hardness change points	Tensile change %	Elongation change %	Volume change %
Polyglycol (Dow 80-6)	VMQ PVMQ	7 days/24°C (75°F)	-5 -5	- -	- -	5 5
	MQ VMQ	7 days/121°C (250°F)	-5 -10	- -	- -	5 5
Polystyrene (expandable)	VMQ	7 days/24°C (75°F)	nil	5	10	nil
Propylene Oxide	MQ	7 days/24°C (75°F)	-20	-	-	150
RX-1099 (Vinyl Plastisol)	VMQ FVMQ	7 days/24°C (75°F)	-5 -5	- -	- -	10 5
Salicylanilide (10% in 2 B Ethanol)	PMQ	7 days/24°C (75°F)	-	-	-	5
Santicizer 141 (Monsanto)	VMQ PVMQ FVMQ	70 hr/150°C (302°F)	DT DT DT	DT DT DT	DT DT DT	DT DT DT
Styrene Monomer	PVMQ	1 hr/24°C (75°F) 1 hr/100°C (212°F)	-10 -20	- -	- -	55 115
Sulfur (molten)	PMQ	7 days/121°C (250°F)	UC	UC	UC	UC
	VMQ	4 days/199°C (390°F)	-22	DT	DT	DT
Sulfur Dioxide (dry gas)	MQ VMQ PVMQ	7 days/24°C (75°F)	nil -5 nil	- - -	- - -	nil nil nil
Sulfur Dioxide (liquid)	MQ	7 days/24°C (75°F)	nil	-	-	5
Sulfur Hexafluoride	VMQ FVMQ	1 day/150°C (302°F)	nil nil	- -	- -	nil nil
	VMQ FVMQ	2 days/199°C (390°F)	nil 5	- -	- -	nil nil
	VMQ FVMQ	3 days/199°C (390°F)	nil 5	- -	- -	nil nil
Tar	PMQ	7 days/100°C (212°F)	nil	-	-	10
Tetrahydrofuran (Tetramethylene Oxide)	VMQ FVMQ	1 day/25°C (77°F)	- -	- -	- -	260 170
Trichloroethylene	FVMQ	1 day/24°C (75°F)	-10	-	-	25
	MQ	7 days/24°C (75°F)	-	-	-	250
	FVMQ	5 days/49°C (120°F)	-10	-	-	20
Trifluorochloroethylene	MQ	7 days/-58°C (-65°F)	-20	-	-	100

MQ – methyl groups only **V – vinyl groups** **P – phenyl groups** **F – fluorine-containing groups** **DT – deteriorated**
UC – unchanged

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Form No. 45-0113-01-0925 S2D