

## Products Made From Polysulfone

This document applies to HeatLink products including, but not limited to:

- TwistSeal® (55 mm) Manifold
- TwistSeal® Mini (40mm) Manifolds
- HPP fittings
- HPP Multiport Tees
- HPP Mini Multiport Tees

## Polysulfone, The Material

Polysulfone is a strong thermoplastic that can be extruded, molded or thermoformed into a wide range of shapes and products. Most plastics require a chemical modifier to become a heat stable material. Polysulfone however, has heat stability in its unmodified or natural form. The addition of chemical modifiers can add both favorable and non-favorable characteristics to the product. Polysulfone is the strongest and most heat resistant thermoplastic available today. The range of temperatures where polysulfone offers useful characteristics is from  $-101^{\circ}\text{C}$  ( $150^{\circ}\text{F}$ ) to  $149^{\circ}\text{C}$  ( $300^{\circ}\text{F}$ ) and over a long period of time.

The raw polysulfone is transparent with a light amber color. To achieve a uniform black color, which is seen in the HeatLink products, a carbon black coloring agent is evenly distributed by the polysulfone manufacturer. Table #1 highlights some of the main properties of polysulfone.

Property	Description
Transparent	Light Amber Color
Rigid	Flexural Modulus = 390,000psi (2,689Mpa)
Tough	421kJ/m <sup>2</sup> Tensile Impact Strength
Low Creep	<0.02mm/mm Elongation in 15,000hrs at 3,000psi at 99°C (210°F)
High Continuous Temperature Use	140 to 160°C (284 to 320°F)

**Table #1.** Highlights of the Polysulfone Properties\*

Polysulfone is important to the structural plastics class because it provides better economics and performance than the materials that were available years ago.

## General Characteristics

Polysulfone is available in a large range of colors. Colors can be added by pre-compounding or by “dry coloring” the natural material with soluble dyes. The addition of carbon black to the polysulfone has been found to significantly improve the weathering resistance of the polymer when being considered for outdoor applications.

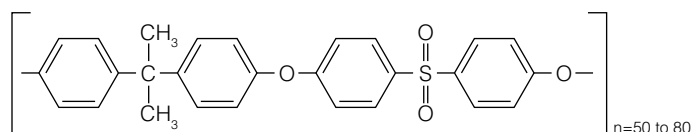
Polysulfone is used in a variety of applications that include the electrical, appliance and medical fields. Polysulfone can also be used to make plastic films or sheets if required.

## Chemical Structure

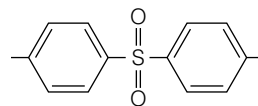
Polysulfone has the following repeating unit as its backbone. Polymers are made up of long chains and these units can repeat as high as 80 times in one chain.

The molecular structure is composed of phenylene units that are linked by three different chemical groups: isopropylidene, ether and a sulfone unit (see Figure 1). Each of these groups contributes specific properties to the polymer. The most distinctive feature of the backbone is the diphenylene sulfone group.

The influence of the diphenylene sulfone group (see Figure 2) on the properties of the polymer has been the focus of intense research since the early 1960's by the Union Carbide laboratories. It was expected that polymers with this group would have excellent thermal and oxidative properties due to the electronic and chemical nature of the group.



**Figure #1.** Molecular Structure of Polysulfone\*



**Figure #2.** The Diphenylene Sulfone Group\*

## Chemical Resistance

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**Do Not** allow detergents, cleaners, chemicals, solvents, sealants or glues to come into contact with HeatLink polysulfone products. Should polysulfone products come in contact with any of chemical listed as “not recommended,” they should be discarded immediately.

Common Plumbing and Heating Industry Chemicals	Rating	Comments
ABS Cleaner	X	
ABS Solvent Cement (Glue)	X	
Ethylene Glycol	A	
Propylene Glycol	B	
Leak Detection Solutions		It is recommended that only products specifically designed and approved for PEX and polymer fittings be used.
Molybdate-based Corrosion Inhibitor (#01205)	A	
O-ring Lubricant (#79951, #79952)	A	
PVC Primer	X	
PVC Solvent Cement (Glue)	X	
Solder Flux	X	
Spray Foam Insulation	X	Do not allow contact with spray foam.

**Table #2.** Chemical Resistance of Polysulfone to Some Common Plumbing and Heating Industry Chemicals

A = Little or no interaction

B = Slight interaction

X = Not recommended

<sup>1</sup> Elevated temperatures may reduce resistance

<sup>2</sup> Exposure to elevated stress may damage polymer

<sup>3</sup> Prolonged exposure may reduce resistance

<sup>4</sup> Room Temperature only

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
1-(4-Chlorophenyl)ethanone, pure	20	B	Acetaldehyde, pure	50	X
1-(4-Chlorophenyl)ethanone, pure	50	X	Acetamide	20	X
1,3-Butadiene, pure	20	X	Acetic Acid Benzyl Ester, pure	20	X
1,3-Butadiene, pure	50	X	Acetic Acid Benzyl Ester, pure	50	X
1,4-Dioxane, pure	20	X	Acetic Acid Phenylmethyl Ester, pure	20	X
1,4-Dioxane, pure	50	X	Acetic Acid Phenylmethyl Ester, pure	50	X
1:3 Mixture Of Nitric And Hydrochloric Acids, pure	20	X	Acetic acid, 10%	20	A
1:3 Mixture Of Nitric And Hydrochloric Acids, pure	50	X	Acetic acid, 20%	20	A
1-Pentanol, pure	20	B	Acetic acid, 5%	20	A
1-Pentanol, pure	50	B	Acetic acid, 50% <sup>1</sup>	20	A
1-Phenylethanone, pure	20	X	Acetic acid, glacial <sup>1</sup>	20	A
1-Phenylethanone, pure	50	X	Acetic Anhydride, pure	20	X
1-Undecanol, pure	20	B	Acetic Anhydride, pure	50	X
1-Undecanol, pure	50	B	Acetone, pure	20	X
2,2,4-Trimethylpentane, pure	20	B	Acetone, pure	50	X
2,2,4-Trimethylpentane, pure	50	B	Acetonitrile, pure	20	X
2,2'-Oxybispropane, pure	20	X	Acetonitrile, pure	50	X
2,2'-Oxybispropane, pure	50	X	Acetophenone, pure	20	X
2,4,6-Trinitrophenol, pure	20	X	Acetophenone, pure	50	X
2,4,6-Trinitrophenol, pure	50	X	Acetyl chloride	20	X
2-Ethylbutyric Acid, 100%	22	A	Acrylonitrile, pure	20	X
2-Hydroxy-1,2,3-Propanetricarboxylic Acid Tributyl Ester, pure	20	B	Acrylonitrile, pure	50	X
2-Hydroxy-1,2,3-Propanetricarboxylic Acid Tributyl Ester, pure	50	X	Adhesive (Eastman 910)	20	A
2-Hydroxybenzaldehyde, pure	20	B	Adipic Acid, pure	20	A
2-Hydroxybenzaldehyde, pure	50	B	Adipic Acid, pure	50	A
2-Isopropoxypropane, pure	20	X	Alanine, pure	20	A
2-Isopropoxypropane, pure	50	X	Alanine, pure	50	A
2-Methoxyethanol, pure	20	X	Alconox, 1%	20	A
2-Methoxyethanol, pure	50	X	Allyl Alcohol, pure	20	B
2-Methoxyethyl Oleate, pure	20	B	Allyl Alcohol, pure	50	B
2-Methoxyethyl Oleate, pure	50	X	Aluminum Chloride, pure	20	A
2-Propanol, pure	20	A	Aluminum Chloride, pure	50	A
2-Propanol, pure	50	B	Aluminum Hydrate, pure	20	B
2-Propanone, pure	20	B	Aluminum Hydrate, pure	50	B
2-Propanone, pure	50	X	Aluminum Hydroxide, pure	20	B
2-Propenenitrile, pure	20	X	Aluminum Hydroxide, pure	50	B
2-Propenenitrile, pure	50	X	Aluminum Salts, pure	20	B
3-Phenyl-2-propenal, pure	20	B	Aluminum Salts, pure	50	B
3-Phenyl-2-propenal, pure	50	B	Aluminum sulfate, 10%	20	A
4'-Chloroacetophenone, pure	20	B	Aluminum trichloride, 10%	20	A
4'-Chloroacetophenone, pure	50	X	Aluminum Trihydrate, pure	20	B
5% Acetone and Water, N/A	22	A	Aluminum Trihydrate, pure	50	B
Acetaldehyde, pure	20	X	Amino Acids, pure	20	A
			Amino Acids, pure	50	A
			Aminoethanol (2-)	20	A
			Ammonia, 25% <sup>2</sup>	20	A

**Table #3. Chemical Resistance of Polysulfone**

A = Little or no interaction

B = Slight interaction

X = Not recommended

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
Ammonia, 29% <sup>2</sup>	20	A	Benzol, pure	20	X
Ammonia, pure	20	B	Benzol, pure	50	X
Ammonia, pure	50	B	Benzonitrile	20	X
Ammonium acetate, saturated	20	A	Benzyl Acetate, pure	20	X
Ammonium chloride, 10%	20	A	Benzyl Acetate, pure	50	X
Ammonium Chloride, pure	20	A	Benzyl Alcohol, pure	20	X
Ammonium Chloride, pure	50	A	Benzyl Alcohol, pure	50	X
Ammonium Glycolate, pure	20	B	Benzyl chloride	20	X
Ammonium Glycolate, pure	50	B	Black Flag, 100%	23	A
Ammonium hydroxide, 15% <sup>1</sup>	20	A	Black Flag, 100%	66	A
Ammonium hydroxide, 29% <sup>1</sup>	20	A	Black Flag, 100%	90	A
Ammonium hydroxide, 30% <sup>1</sup>	20	A	Black liquor <sup>1</sup>	20	A
Ammonium hydroxide, 5% <sup>1</sup>	20	A	Boric Acid, pure	20	A
Ammonium nitrate, 10%	20	A	Boric Acid, pure	50	A
Ammonium Oxalate, pure	20	A	Brake fluid	20	X
Ammonium Oxalate, pure	50	A	Brine	20	A
Ammonium persulfate, 24%	20	A	Bromine, 10% <sup>1,3</sup>	20	B
Ammonium Salts, pure	20	B	Bromine, pure	20	X
Ammonium Salts, pure	50	B	Bromine, pure	50	X
Ammonium sulfate, 10%	20	A	Bromobenzene	20	X
Amyl acetate	20	X	Bromoform, pure	20	X
Amyl alcohol	20	A	Bromoform, pure	50	X
Amyl Alcohol, pure	20	B	Butadiene, pure	20	X
Amyl Alcohol, pure	50	B	Butadiene, pure	50	X
Amyl Chloride, pure	20	X	Butanol <sup>2</sup>	20	A
Amyl Chloride, pure	50	X	Butter, salted <sup>2</sup>	20	A
Aniline, pure	20	X	Butyl Acetate, pure	20	X
Aniline, pure	50	X	Butyl Acetate, pure	50	X
Anti-Freeze <sup>2</sup>	20	A	Butyl alcohol	20	A
Antimony trichloride	20	X	Butyl cellosolve	20	A
Aqua Regia, pure	20	X	Butyl Chloride, pure	20	X
Aqua Regia, pure	50	X	Butyl Chloride, pure	50	X
Arsenic Acid, pure	20	A	Butyl Citrate, pure	20	B
Arsenic Acid, pure	50	A	Butyl Citrate, pure	50	X
Automotive grease <sup>2</sup>	20	A	Butyl ether	20	A
Aviation Gasoline, N/A	22	X	Butyl phthalate	20	X
Barbitol solvent	20	A	Butylamine (n-)	20	X
Barium chloride, 10%	20	A	Butylated hydroxy anisole	20	X
Benzaldehyde	20	X	Butylated hydroxy toluene	20	A
Benzaldehyde, pure	50	X	Butyraldehyde	20	X
Benzenamine, pure	20	X	Butyric acid	20	X
Benzenamine, pure	50	X	Calcium Chloride, pure	20	A
Benzene sulfonic acid	20	X	Calcium Chloride, pure	50	A
Benzene, pure	20	X	Calcium dinitrate, 10%	20	A
Benzene, pure	50	X	Calcium hydroxide	20	B
Benzoic acid <sup>3</sup>	20	B	Calcium hypochlorite, 3.5% <sup>3</sup>	20	A

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Chemical	Temp (°C)	Rating
Calcium hypochlorite, saturated <sup>3</sup>	20	A
Calcium propionate <sup>2</sup>	20	A
Calgon liquid	20	A
Carbazole, pure	20	X
Carbazole, pure	50	X
Carbitol	20	A
Carbitol Solvent (Diethylene Glycol Monoethyl Ether), 100%	22	A
Carbon Disulfide, pure	20	X
Carbon Disulfide, pure	50	X
Carbon Tetrachloride, pure	20	X
Carbon Tetrachloride, pure	50	X
Caustic potash, 30% <sup>4</sup>	20	A
Caustic potash, 50% <sup>4</sup>	20	A
Caustic potash, concentrated <sup>4</sup>	20	A
Caustic soda, 1%	20	A
Caustic soda, 50% <sup>1</sup>	20	A
Cedarwood Oil, pure	20	B
Cedarwood Oil, pure	50	B
Cellosolve (2-ethoxyethanol)	20	A
Cellosolve® Acetate, pure	20	B
Cellosolve® Acetate, pure	50	X
Chlorine, dry gas, 10%	20	X
Chlorine, water solution	20	X
Chlorine, wet gas	20	X
Chlorine, wet gas, 10%	20	X
Chloroacetic acid	20	X
Chlorobenzene, pure	20	X
Chlorobenzene, pure	50	X
Chloroethanol (2-)	20	X
Chloroform, pure	20	X
Chloroform, pure	50	X
Chlorophenol, 5%	20	X
Chromic Acid, 12%	22	A
Chromic Acid, 12%	85	X
Chromic acid, 20%	20	X
Chromic acid, 50%	20	X
Chromic acid, 60%	20	X
Chromic acid, sulfuric acid mixture, 96%	20	X
Cinnamaldehyde, pure	20	B
Cinnamaldehyde, pure	50	B
Cinnamic Aldehyde, pure	20	B
Cinnamic Aldehyde, pure	50	B
Cinnamon Oil, pure	20	B
Cinnamon Oil, pure	50	B
Citric acid, 10%	20	A

Chemical	Temp (°C)	Rating
Citric acid, 1M	20	A
Citric acid, 2%	20	A
Citric acid, 40%	20	A
Citric Acid, 40%	22	A
Comet w/ Bleach Powder, 100%	23	A
Comet w/ Bleach Powder, 100%	66	A
Coolanol Refrigerant #25, As rec'd	121	A
Coolanol Refrigerant #25, As rec'd	121	A
Copper Sulfate, pure	20	A
Copper Sulfate, pure	50	A
Corn oil <sup>2</sup>	20	A
Cotton Seed oil <sup>2</sup>	20	A
Cresol, pure	20	X
Cresol, pure	50	X
Cresyl Diphenyl phosphate	20	X
Crude Oil (East Texas), 100%	60	B
Cupric chloride, saturated	20	A
Cyanoethylene, pure	20	X
Cyanoethylene, pure	50	X
Cyclohexane	20	X
Cyclohexanol	20	A
Cyclohexanone, pure	20	X
Cyclohexanone, pure	50	X
Cyclopentane, pure	20	X
Cyclopentane, pure	50	X
Decahydronaphthalene	20	X
Decahydronaphthalene, pure	50	X
Decalin, pure	20	X
Decalin, pure	50	X
Diacetone Alcohol, pure	20	X
Diacetone Alcohol, pure	50	X
Diacetone, pure	20	X
Diacetone, pure	50	X
Dibutyl phthalate, pure	20	X
Dibutyl Phthalate, pure	50	X
Dichlorobenzene (p-), vapor	20	X
Dichlorodifluoromethane (Freon 12)	20	A
Dichloromethane	20	X
Diesel fuel	20	A
Diesel fuel (fuel oil #2)	20	A
Diethyl Benzene, pure	20	X
Diethyl Benzene, pure	50	X
Diethyl Ether, pure	20	X
Diethyl Ether, pure	50	X
Diethyl Ketone, pure	20	X
Diethyl Ketone, pure	50	X

**Table #3. Chemical Resistance of Polysulfone**

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
Diethyl Malonate, pure	20	B	Ethyl Benzene, pure	50	X
Diethyl Malonate, pure	50	B	Ethyl Benzoate, pure	20	X
Diethylamine, pure	20	B	Ethyl Benzoate, pure	50	X
Diethylamine, pure	50	B	Ethyl Butyrate, pure	20	X
Diethylene Dioxide, pure	20	X	Ethyl Butyrate, pure	50	X
Diethylene Dioxide, pure	50	X	Ethyl Chloride, pure	20	X
Diethylene glycol	20	X	Ethyl Chloride, pure	50	X
Diethylene glycol monoethyl ether	20	X	Ethyl Cyanoacetate, pure	20	B
Diisopropyl Ether, pure	20	X	Ethyl Cyanoacetate, pure	50	B
Diisopropyl Ether, pure	50	X	Ethyl Lactate, pure	20	B
Dimethyl Acetamide, pure	20	X	Ethyl Lactate, pure	50	B
Dimethyl Acetamide, pure	50	X	Ethylbutyric acid (2-)	20	A
Dimethyl Formamide, pure	20	X	Ethylene Chloride, pure	20	X
Dimethyl Formamide, pure	50	X	Ethylene Chloride, pure	50	X
Dimethyl Ketone, pure	20	B	Ethylene dichloride	20	X
Dimethyl Ketone, pure	50	X	Ethylene glycol monomethyl ether	20	X
Dimethyl sulfoxide	20	X	Ethylene Glycol, pure	20	A
Dimethylaniline	20	X	Ethylene Glycol, pure	50	A
Dimethylformamide (N,N-)	20	X	Ethylene oxide	20	A
Dimethylsulfoxide, 50% (DMSO)	20	B	Ethylene oxide, gas	20	A
Dimethylsulfoxide, pure	20	X	Ethylene Oxide, pure	20	B
Dimethylsulfoxide, pure	50	X	Ethylene Oxide, pure	50	X
Dioctylphthalate <sup>2</sup> (dioctyl phthalate)	20	A	Ethylenediamine, 92% <sup>4</sup>	20	A
Dioxane, pure	20	X	EtO, pure	20	B
Dioxane, pure	50	X	EtO, pure	50	X
DIPE, pure	20	X	Fantastik, 100%	23	A
DIPE, pure	50	X	Fantastik, 100%	66	A
Dipropylene Glycol, pure	20	B	Fantastik, 100%	90	A
Dipropylene Glycol, pure	50	B	Fatty Acids, Saturated, pure	20	B
DMSO, pure	20	X	Fatty Acids, Saturated, pure	50	B
DMSO, pure	50	X	Fatty Acids, Unsaturated, pure	20	B
Dowtherm	20	X	Fatty Acids, Unsaturated, pure	50	B
Easy-off, 100%	23	X	Ferric chloride, 10%	20	A
Easy-off, 100%	66	X	Ferrous sulfate, saturated	20	A
Epichlorohydrin	20	X	Fluorides, pure	20	A
Ethanol, 40% <sup>1,2</sup>	20	B	Fluorides, pure	50	A
Ethanol <sup>1,2</sup>	20	A	Fluorine, gas	20	X
Ether, pure	20	X	Formaldehyde, 10%	20	A
Ether, pure	50	X	Formaldehyde, 2%	20	A
Ethyl Acetate, pure	20	X	Formaldehyde, 30%	20	A
Ethyl Acetate, pure	50	X	Formaldehyde, 37% <sup>1</sup>	20	A
Ethyl alcohol, 15%	20	A	Formaldehyde, 40% <sup>1</sup>	20	A
Ethyl alcohol, 40% <sup>1,2</sup>	20	B	Formalin, 10%	20	A
Ethyl alcohol, 95% <sup>1,2</sup>	20	B	Formalin, 40% <sup>1,3</sup>	20	B
Ethyl alcohol, pure <sup>1,2</sup>	20	B	Formic acid, 10% <sup>1</sup>	20	B
Ethyl Benzene, pure	20	X	Formic acid, 100% <sup>1</sup>	20	X

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
Formic acid, 25% <sup>1</sup>	20	B	Hydrogen peroxide, 3%	20	A
Formic acid, 3% <sup>1</sup>	20	A	Hydrogen peroxide, 30%	20	A
Formic acid, 50% <sup>1</sup>	20	B	Hydrogen peroxide, 90%	20	A
Formic acid, 88% <sup>1</sup>	20	X	Inhibited Acid Drain Cleaner, 100%	22	X
Formic acid, pure <sup>1</sup>	20	X	Iodine Crystals, pure	20	A
Freon 111	20	A	Iodine Crystals, pure	50	B
Freon TF, pure <sup>1</sup>	20	B	Iodine solutions	20	X
Freon TMC	20	X	Isobutanol, pure	20	A
Freon TMS2	20	A	Isobutanol, pure	50	B
Fuel Oil No. 1, pure	20	A	iso-Butyl Alcohol, pure	20	A
Fuel Oil No. 1, pure	50	B	iso-Butyl Alcohol, pure	50	B
Furfural	20	X	Isooctane	20	A
Gasoline, pure	20	B	Isopropanol, 100% <sup>1,3</sup>	20	B
Gasoline, pure	50	B	iso-Propanol, 100% <sup>1,3</sup>	20	B
Glutaraldehyde Disinfectant, pure	20	A	Isopropanol, pure <sup>1,3</sup>	20	B
Glutaraldehyde Disinfectant, pure	50	B	Isopropanol <sup>1,3</sup>	20	B
Glutaraldehyde, pure	20	A	Isopropyl Acetate, pure	20	X
Glutaraldehyde, pure	50	B	Isopropyl Acetate, pure	50	X
Glycerine, pure	20	A	Isopropyl Alcohol, pure	20	A
Glycerine, pure	50	A	Isopropyl Alcohol, pure	50	B
Glycerol, pure	20	A	Isopropyl Benzene, pure	20	X
Glycerol, pure	50	A	Isopropyl Benzene, pure	50	X
Grape juice	20	A	Isopropyl Ether, pure	20	X
Grease <sup>2</sup>	20	A	Isopropyl Ether, pure	50	X
Green liquor	20	A	Ivory, 100%	23	A
Gulf Seneca Oil #49, 100%	22	A	Ivory, 100%	66	X
Heptane (n-) <sup>2</sup>	20	A	Ivory, 100%	90	X
Heptane, 0.05%	20	A	Jet Dry, 100%	23	X
Hexane, pure	20	A	Jet Dry, 100%	66	X
Hexane, pure	50	B	Jet Dry, 100%	90	X
Hexanol	20	A	Jet Fuel, pure	20	B
Household Detergent (Joy), 5%	22	A	Jet Fuel, pure	50	B
Hydrated Alumina, pure	20	B	Jubilee wax <sup>4</sup>	20	A
Hydrated Alumina, pure	50	B	Kerosene, pure	20	A
Hydraulic oil	20	A	Kerosene, pure	50	B
Hydrazine, pure	20	X	Ketchup	20	A
Hydrazine, pure	50	X	Lacquer Thinner, pure	20	X
Hydrobromic acid, 20%	20	A	Lacquer Thinner, pure	50	X
Hydrobromic acid, 69% <sup>1</sup>	20	A	Lactic acid, 3%	20	A
Hydrochloric acid, 20% <sup>2</sup>	20	A	Lactic acid, 60% <sup>3</sup>	20	A
Hydrochloric acid, 37% <sup>1</sup>	20	A	Lactic acid, 85% <sup>3</sup>	20	A
Hydrochloric acid, 5% <sup>2</sup>	20	A	L-alpha-amino Propionic Acid, pure	20	A
Hydrofluoric acid, 25% <sup>1,3</sup>	20	A	L-alpha-amino Propionic Acid, pure	50	A
Hydrofluoric acid, 4% <sup>1,3</sup>	20	B	Lard	20	A
Hydrofluoric acid, 50% <sup>1,3</sup>	20	A	Lauric acid <sup>3</sup>	20	A
Hydrogen peroxide	20	A	Lead Acetate, pure	20	A

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
Lead Acetate, pure	50	A	MIBK, pure	50	X
Lemon Pledge, 100%	23	X	Mil H-5606 (Mobil-Aerolube), 100%	82	A
Lemon Pledge, 100%	66	X	Milk <sup>2</sup>	20	A
Lime-Away, 100%	23	A	Mineral oil	20	A
Lime-Away, 100%	66	A	Mineral Spirits, pure	20	B
Linseed oil	20	A	Mineral Spirits, pure	50	B
L-Tartaric Acid, pure	20	A	Monochlorobenzene	20	X
L-Tartaric Acid, pure	50	A	Monochlorodifluoromethane (Freon 22) <sup>3</sup>	20	B
Lubricating oil	20	A	Monoethanolamine	20	A
Lysol, 100%	23	X	Morpholine, 0.2%	20	X
Lysol, 100%	66	X	Motor oil	20	A
Magnesium chloride, 10%	20	A	Mr. Clean (Antibacterial), 100%	23	X
Magnesium Chloride, pure	20	A	Mr. Clean (Antibacterial), 100%	66	X
Magnesium Chloride, pure	50	A	Mustard	20	A
Malonic acid	20	A	NALCON 7330 (<1%)	20	A
Margarine <sup>2</sup>	20	A	NALCON 7647 (<1%)	20	A
Mayonnaise	20	A	NALCON 7678 (<1%)	20	A
MEK, pure	20	X	N-amyl acetate	20	X
MEK, pure	50	X	Naphtha VMOP	20	X
Mercuric Chloride, pure	20	A	Naphthalene, vapor	20	X
Mercuric Chloride, pure	50	A	N-butanol <sup>3,4</sup>	20	B
Methanol, 100% <sup>2</sup>	20	A	n-Butyl Acetate, pure	20	X
Methanol <sup>2</sup>	20	A	n-Butyl Acetate, pure	50	X
Methoxyethyl oleate	20	X	n-Butyl Alcohol, pure	20	A
Methoxyethyl Oleate, pure	50	X	n-Butyl Alcohol, pure	50	A
Methyl Acetate, pure	20	X	n-Decane, pure	20	B
Methyl Acetate, pure	50	X	n-Decane, pure	50	B
Methyl Alcohol, pure	20	A	n-Heptane, pure	20	B
Methyl Alcohol, pure	50	B	n-Heptane, pure	50	B
Methyl cellosolve	20	A	Nitric acid, 10% <sup>3,4</sup>	20	B
Methyl chloride	20	X	Nitric acid, 20% <sup>3,4</sup>	20	B
Methyl Ethyl Ketone, pure	20	X	Nitric acid, 25% <sup>3,4</sup>	20	B
Methyl Ethyl Ketone, pure	50	X	Nitric acid, 40% <sup>3,4</sup>	20	B
Methyl formate	20	X	Nitric acid, 5% <sup>3,4</sup>	20	B
Methyl Isobutyl Ketone, pure	20	X	Nitric acid, 50% <sup>3,4</sup>	20	B
Methyl Isobutyl Ketone, pure	50	X	Nitric acid, 6N	20	X
Methyl Propyl Ketone, pure	20	X	Nitric acid, 71%	20	X
Methyl Propyl Ketone, pure	50	X	Nitro Methane	20	X
Methylene Chloride, pure	20	X	Nitrobenzene, pure	20	X
Methylene Chloride, pure	50	X	Nitrobenzene, pure	50	X
Methyloxirane, pure	20	B	Nitrohydrochloric Acid, pure	20	X
Methyloxirane, pure	50	X	Nitrohydrochloric Acid, pure	50	X
Methylpyrrolidone	20	X	Nitromethane	20	X
Methyl-t-Butyl Ether, pure	20	X	Nitromethane, pure	50	X
Methyl-t-Butyl Ether, pure	50	X	Nitropropane	20	X
MIBK, pure	20	X	N-methyl-2-pyrrolidone	20	X

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
n-Octane, pure	20	B	Phenyl Methyl Ketone, pure	20	X
n-Octane, pure	50	B	Phenyl Methyl Ketone, pure	50	X
N-octane <sup>3,4</sup>	20	B	Phenylacrolein, pure	20	B
O-dichlorobenzene	20	X	Phenylacrolein, pure	50	B
Oil (ASTM #1)	20	A	Phosphoric acid, 20%	20	A
Oil (ASTM #2)	20	A	Phosphoric acid, 5%	20	A
Oil (ASTM #3) <sup>2</sup>	20	A	Phosphoric acid, 85%	20	A
Oil, Cedarwood, pure	20	B	Photographic film developer	20	A
Oil, Cedarwood, pure	50	B	Photographic film fixer	20	A
Oil, Cinnamon, pure	20	B	Picric Acid, pure	20	X
Oil, Cinnamon, pure	50	B	Picric Acid, pure	50	X
Oil, corn <sup>2</sup>	20	A	Pine Oil, pure	20	B
Oil, Mineral, pure	20	A	Pine Oil, pure	50	B
Oil, Mineral, pure	50	A	Pine-Sol, 100%	23	X
Oil, olive <sup>3</sup>	20	A	Pine-Sol, 100%	66	X
Oil, Orange, pure	20	B	Potassium Chloride, pure	20	A
Oil, Orange, pure	50	B	Potassium Chloride, pure	50	A
Oil, Pine, pure	20	B	Potassium Hydroxide, 1%	20	A
Oil, Pine, pure	50	B	Potassium hydroxide, 1N <sup>1,3</sup>	20	A
Oil, vegetable <sup>2</sup>	20	A	Potassium hydroxide, 20%	20	A
Oleic Acid, 100%	22	A	Potassium hydroxide, 25% <sup>1</sup>	20	A
Oleic acid <sup>2</sup>	20	A	Potassium hydroxide, 30% <sup>1,3</sup>	20	A
Orthoarsenic Acid, pure	20	A	Potassium hydroxide, 35% <sup>1,3</sup>	20	A
Orthoarsenic Acid, pure	50	A	Potassium hydroxide, 50% <sup>1,3</sup>	20	A
Oxalic acid, 10%	20	A	Potassium hydroxide, concentrated <sup>1,3</sup>	20	A
Oxalic acid, 20%	20	A	Potassium nitrate, saturated	20	A
Oxygen	20	A	Potassium permanganate, 10%	20	A
Ozone, pure	20	A	Potassium Permanganate, pure	20	A
Ozone, pure	50	A	Potassium Permanganate, pure	50	A
p-Chloroacetophenone, pure	20	B	Propane, pure	20	A
p-Chloroacetophenone, pure	50	X	Propane, pure	50	A
p-Dichlorobenzene, pure	20	X	Propanol	20	A
p-Dichlorobenzene, pure	50	X	Propionic Acid, pure	20	B
Peanut oil <sup>2</sup>	20	A	Propionic Acid, pure	50	B
Pentane	20	A	Propylene Glycol, pure	20	B
Pentyl acetate, pure	20	X	Propylene Glycol, pure	50	B
Pentyl acetate, pure	50	X	Propylene oxide, pure <sup>3</sup>	20	B
Perchloric Acid, pure	20	X	Pyridine, pure	20	X
Perchloric Acid, pure	50	X	Pyridine, pure	50	X
Perchloroethylene, pure	20	X	Raid, 100%	23	X
Perchloroethylene, pure	50	X	Raid, 100%	66	X
Permatex <sup>2</sup>	20	A	Raid, 100%	90	X
Petroleum based oils	20	A	Resorcinol	20	X
Petroleum ether	20	A	Resorcinol, 5%	20	X
Petroleum <sup>2,3</sup>	20	X	Resorcinol, saturated	20	X
Phenol	20	X	Salicylaldehyde, pure	20	B

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Chemical	Temp (°C)	Rating	Chemical	Temp (°C)	Rating
Salicylaldehyde, pure	50	B	Sodium hypochlorite, 15%	20	A
Salicylic acid, powder	20	A	Sodium silicate, 1.7% <sup>2</sup>	20	A
Salicylic acid, saturated	20	A	Sodium sulfate, 10%	20	A
sec-Butanol, pure	20	A	Sodium sulfide, 10%	20	A
sec-Butanol, pure	50	B	Sodium thiosulfite, 10%	20	A
sec-Butyl Alcohol, pure	20	A	Solder Flux, 100%	23	A
sec-Butyl Alcohol, pure	50	B	Solder Flux, 100%	66	X
Shout, 100%	23	X	Solder Flux, 100%	90	X
Shout, 100%	66	X	Sorbic acid	20	A
Shout, 100%	90	X	Stearic Acid, pure	20	A
Silastic 140	20	A	Stearic Acid, pure	50	B
Silicone compounds <sup>2</sup>	20	A	Stoddard Solvent <sup>2</sup>	20	A
Silicone Oil, pure	20	A	Sulfolane	20	X
Silicone Oil, pure	50	A	Sulfur dioxide, liquid (46 psig) <sup>2,3</sup>	20	B
Silver Acetate, pure	20	A	Sulfur dioxide, pure <sup>2,3</sup>	20	B
Silver Acetate, pure	50	A	Sulfur dioxide, wet gas <sup>2,3</sup>	20	B
Silver Nitrate, pure	20	A	Sulfur salts <sup>2,3</sup>	20	B
Silver Nitrate, pure	50	A	Sulfuric acid, 20% <sup>3</sup>	20	A
Simple Green, 100%	23	X	Sulfuric acid, 25% <sup>3</sup>	20	A
Simple Green, 100%	66	X	Sulfuric acid, 30% <sup>3</sup>	20	A
Simple Green, 100%	90	X	Sulfuric acid, 5% <sup>3</sup>	20	A
Skydrol LD4 Aviation Hydraulic Fluid, pure	20	X	Sulfuric acid, 6% <sup>3</sup>	20	A
Skydrol LD4 Aviation Hydraulic Fluid, pure	50	X	Sulfuric acid, 60% <sup>3</sup>	20	A
Soda Ash, pure	20	A	Sulfuric acid, 65% <sup>3</sup>	20	A
Soda Ash, pure	50	A	Sulfuric acid, 6N	20	X
Sodium Acetate, pure	20	A	Sulfuric acid, 85% <sup>3</sup>	20	A
Sodium Acetate, pure	50	A	Sulfuric acid, 95%	20	X
Sodium bicarbonate, 10%	20	A	Sulfuric acid, 96%	20	X
Sodium carbonate, 10%	20	A	Sulfuric acid, 98%	20	X
Sodium Carbonate, pure	20	A	Sulfuric acid, concentrated	20	X
Sodium Carbonate, pure	50	A	Sunlight Dishwashing Soap, 100%	23	A
Sodium chloride, 10%	20	A	Sunlight Dishwashing Soap, 100%	66	A
Sodium chromate, 10%	20	A	Tartaric Acid, pure	20	A
Sodium Dichromate, pure	20	A	Tartaric Acid, pure	50	A
Sodium Dichromate, pure	50	A	TCA, pure	20	B
Sodium hydroxide, 0.1N	20	A	TCA, pure	50	X
Sodium hydroxide, 1%	20	A	tert-Butanol, pure <sup>1,2</sup>	20	B
Sodium hydroxide, 10% <sup>1</sup>	20	A	tert-Butyl alcohol, pure <sup>1,2</sup>	20	B
Sodium hydroxide, 15% <sup>1</sup>	20	A	Tetrachlorodifluoroethane (Freon BF) <sup>2</sup>	20	A
Sodium hydroxide, 25% <sup>1</sup>	20	A	Tetrahydrofuran, pure	20	X
Sodium hydroxide, 30% <sup>1</sup>	20	A	Tetrahydrofuran, pure	50	X
Sodium hydroxide, 5%	20	A	Thionyl Chloride, pure	20	X
Sodium hydroxide, 50% <sup>1</sup>	20	A	Thionyl Chloride, pure	50	X
Sodium hydroxide, concentrated	20	A	Tilex Mildew Remover, 100%	23	A
Sodium hypochlorite, 10%	20	A	Tilex Mildew Remover, 100%	66	A
Sodium hypochlorite, 0.17%	20	A	Tincture of Iodine, pure	20	B

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Chemical	Temp (°C)	Rating
Tincture of Iodine, pure	50	X
Toluene, pure	20	X
Toluene, pure	50	X
Tomato juice	20	A
Transmission oil	20	A
Tribromomethane, pure	20	X
Tribromomethane, pure	50	X
Tributyl Citrate, pure	20	B
Tributyl Citrate, pure	50	X
Trichloroacetic acid, 25%	20	A
Trichloroacetic Acid, pure	20	B
Trichloroacetic Acid, pure	50	X
Trichlorobenzene	20	X
Trichloroethane, pure	20	X
Trichloroethane, pure	50	X
Trichloroethylene, pure	20	X
Trichloroethylene, pure	50	X
Trichlorofluoroethane (Freon TF)	20	A
Triethylamine	20	X
Triethylene Glycol, pure	20	A
Triethylene Glycol, pure	50	B
Triphenylphosphite	20	X
Tripropylene Glycol, pure	20	A
Tripropylene Glycol, pure	50	A
Tris Buffer Solution, pH 11, pure	20	B
Tris Buffer Solution, pH 11, pure	50	B
Tris Buffer Solution, pH 7.0, pure	20	B
Tris Buffer Solution, pH 7.0, pure	50	B
Trisodium Phosphate, pure	20	B
Trisodium Phosphate, pure	50	B
Turpentine	20	X
Ultra Chlorox, 100%	23	X
Ultra Chlorox, 100%	66	X
Undecyl Alcohol, pure	20	B
Undecyl Alcohol, pure	50	B
Urea	20	A
Urea, 6N	20	X
Urea, pure	20	B
Urea, pure	50	B
Varsol <sup>2</sup>	20	A
Vinyl Cyanide, pure	20	X
Vinyl Cyanide, pure	50	X
Vinylidene chloride	20	X
Water	20	A
Wetting Agent (Tergitol 7), 100%	22	A
White Spirits, pure	20	B

Chemical	Temp (°C)	Rating
White Spirits, pure	50	B
Xylene, pure	20	X
Xylene, pure	50	X
Zinc chloride, saturated	20	A
Zinc Stearate, pure	20	A
Zinc Stearate, pure	50	A

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