

# Resistance to Chemicals



## PPR Chemical Resistance

### Introduction

The table in this document summarizes the data given in a number of polypropylene chemical resistance tables at present in use in various countries, derived from both practical experience and test results.

Source: ISO/TR 10358

The table contains an evaluation of the chemical resistance to a number of fluids judged to be either aggressive or not towards polypropylene. This evaluation is based on values obtained by immersion of polypropylene test specimens in the fluid concerned at 20, 60 and 100°C and atmospheric pressure, followed in certain cases by the determination of tensile characteristics.

A subsequent classification will be established with respect to a restricted number of fluids deemed to be technically or commercially more important, using equipment which permits testing under pressure and the determination of the “coefficient of chemical resistance” for each fluid. These tests will thus furnish more complete indications on the use of polypropylene pipes for the transport of stated fluids, including their use under pressure.

### Scope and field application:

This document establishes a provisional classification of the chemical resistance of polypropylene with respect to about 180 fluids. It is intended to provide general guidelines on the possible utilization of polypropylene piping for the conveyance of fluids:

- at temperatures up to 20, 60 and 100°C
- in the absence of internal pressure and external mechanical stress (for example flexural stresses, stresses due to thrust, rolling loads)

### Definition, symbols and abbreviations

The criteria of classification, definitions, symbols and abbreviations adopted in this document are as follows:

#### S = Satisfactory

The chemical resistance of polypropylene exposed to the action of a fluid is classified as “satisfactory” when the results of tests are acknowledged to be “satisfactory” by the majority of the countries participating in the evaluation.

#### L = Limited

The chemical resistance of polypropylene exposed to the action of a fluid is classified as “limited” when the results of tests are acknowledged to be “limited” by the majority of the countries participating in the evaluation.

#### NS = Not Satisfactory

The chemical resistance of polypropylene exposed to the action of a fluid is classified as “not satisfactory” when the results of tests are acknowledged to be “not satisfactory” by the majority of the countries participating in the evaluation.

*Sat.sol* Saturated aqueous solution, prepared at 20°C

*Sol* Aqueous solution at a concentration higher than 10%, but not saturated

*Dil.sol* Dilute aqueous solution at a concentration equal to or lower than 10%

*Work.sol* Aqueous solution having the usual concentration for industrial use

Solution concentrations reported in the text are expressed as a percentage by mass. The aqueous solutions of sparingly soluble chemicals are considered, as far as chemical action towards polypropylene is concerned, as saturated solutions

In general, common chemical names are used in this document.

Chemical	Saturation	20°C	60°C	100°C	Chemical	Saturation	20°C	60°C	100°C
Acetic acid	Up to 40%	S	S		Acetic anhydride	100%	S		
Acetic acid	50%	S	S	L	Acetone	100%	S		
Acetic acid, glacial	>96%	S	L	NS	Acetophenone	100%	S	L	

Chemical	Saturation	20°C	60°C	100°C
Acrylonitrile	100%	S		
Air		S	S	S
Allyl alcohol	100%	S	S	
Almond oil		S		
Alum	Sol	S	S	
Ammonia, aqueous	Sat.sol	S	S	
Ammonia, dry gas	100%	S		
Ammonia, liquid	100%	S		
Ammonium acetate	Sat.sol	S	S	
Ammonium chloride	Sat.sol	S	S	
Ammonium fluoride	Up to 20%	S	S	
Ammonium hydrogen carbonate	Sat.sol	S	S	
Ammonium metaphosphate	Sat.sol	S	S	S
Ammonium nitrate	Sat.sol	S	S	S
Ammonium persulphate	Sat.sol	S	S	
Ammonium phosphate	Sat.sol	S		
Ammonium sulphate	Sat.sol	S	S	S
Ammonium sulphide	Sat.sol	S	S	
Amyl acetate	100%	L		
Amyl alcohol	100%	S	S	S
Aniline	100%	S	S	
Apple juice		S		
Aqua regia	HCl/HNO <sub>3</sub> =3/1	NS	NS	NS
Barium bromide	Sat.sol	S	S	S
Barium carbonate	Sat.sol	S	S	S
Barium chloride	Sat.sol	S	S	S
Barium hydroxide	Sat.sol	S	S	S
Barium sulphide	Sat.sol	S	S	S
Beer		S	S	
Benzene	100%	L	NS	NS
Benzoic acid	Sat.sol	S	S	
Benzyl alcohol	100%	S	L	
Borax	Sol	S	S	
Boric acid	Sat.sol	S		
Boron trifluoride	Sat.sol	S		
Bromine, gas		NS	NS	NS
Bromine, liquid	100%	NS	NS	NS
Butane, gas	100%	S		
Butanol	100%	S	L	L
Butyl acetate	100%	L	NS	NS
Butyl glycol	100%	S		
Butyl phenols	Sat.sol	S		
Butyl phthalate	100%	S	L	L
Calcium carbonate	Sat.sol	S	S	S
Calcium chlorate	Sat.sol	S	S	
Calcium chloride	Sat.sol	S	S	S
Calcium hydroxide	Sat.sol	S	S	S

Chemical	Saturation	20°C	60°C	100°C
Calcium hypochlorite	Sol	S		
Calcium nitrate	Sat.sol	S	S	
Camphor oil		NS	NS	NS
Carbon dioxide, dry gas		S	S	
Carbon dioxide, wet gas		S	S	
Carbon disulphide	100%	S	NS	NS
Carbon monoxide, gas		S	S	
Carbon tetrachloride	100%	NS	NS	NS
Castor oil	100%	S	S	
Caustic soda	Up to 50%	S	L	L
Chlorine, aqueous	Sat.sol	S	L	
Chlorine, dry gas	100%	NS	NS	NS
Chlorine, liquid	100%	NS	NS	NS
Chloroacetic acid	Sol	S		
Chloroethanol	100%	S		
Chloroform	100%	L	NS	NS
Chlorosulphonic acid	100%	NS	NS	NS
Chrome alum	Sol	S	S	
Chromic acid	Up to 40%	S	L	NS
Citric acid	Sat.sol	S	S	S
Coconut oil		S		
Copper (11) chloride	Sat.sol	S	S	
Copper (11) nitrate	Sat.sol	S	S	S
Copper (11) sulphate	Sat.sol	S	S	
Com oil		S	L	
Cottonseed oil		S	S	
Cresol	Greater than 90%	S		
Cyclohexane	100%	S		
Cyclohexanol	100%	S	L	
Cyclohexanone	100%	L	NS	NS
Decalin (decahydronaphthalene)	100%	NS	NS	NS
Dextrin	Sol	S	S	
Dextrose	Sol	S	S	S
Dibutyl phthalate	100%	S	L	NS
Dichloroacetic acid	100%	L		
Dichloroethylene (A and B)	100%	L		
Diethanolamine	100%	S		
Diethyl ether	100%	S	L	
Diethylene glycol	100%	S	S	
Diglycolic acid	Sat.sol	S		
Diisooctyl phthalate	100%	S	L	
Dimethyl amine, gas		S		
Dimethyl formamide	100%	S	S	
Diocetyl phthalate	100%	L	L	
Dioxane	100%	L	L	
Distilled water	100%	S	S	S
Ethanolamine	100%	S		

Chemical	Saturation	20°C	60°C	100°C
Ethyl acetate	100%	L	NS	NS
Ethyl alcohol	Up to 50%	S	S	S
Ethyl chloride, gas		NS	NS	NS
Ethylene chloride (mono and di)		L	L	
Ethyl ether	100%	S	L	
Ethylene glycol	100%	S	S	S
Ferric chloride	Sat.sol	S	S	S
Formaldehyde	40%	S		
Formic acid	10%	S	S	L
Formic acid, anhydrous	100%	S	L	L
Fructose	Sol		S	S
Fruit juice			S	S
Gasoline, petrol (aliphatic hydrocarbons)	NS	NS	NS	
Gelatine		S	S	
Glucose	20%	S	S	S
Glycerine	100%	S	S	S
Glycolic acid	30%	S		
Heptane	100%	L	NS	NS
Hexane	100%	S	L	
Hydrobromic acid	Up to 48%	S	L	NS
Hydrochloric acid	Up to 20%	S	S	S
Hydrochloric acid	30%	S	L	L
Hydrochloric acid	From 35% to 36%	S	---	---
Hydrofluoric acid	Dil.sol	S	---	---
Hydrofluoric acid	40%	S	---	---
Hydrogen	100%	S	---	---
Hydrogen chloride, dry gas	100%	S	S	
Hydrogen peroxide	Up to 10%	S		
Hydrogen peroxide	Up to 30%	S	L	
Hydrogen sulphide, dry gas	100%	S	S	
Iodine, in alcohol		S		
Isooctane	100%	L	NS	NS
Isopropyl alcohol	100%	S	S	S
Isopropyl ether	100%	L		
Lactic acid	Up to 90%	S	S	
Lanoline		S	L	
Linseed oil		S	S	S
Magnesium carbonate	Sat.sol	S	S	S
Magnesium chloride	Sat.sol	S	S	---
Magnesium hydroxide	Sat.sol	S	S	---
Magnesium sulphate	Sat.sol	S	S	---
Malic acid	Sat.sol	S	S	---
Mercury (11) chloride	Sat.sol	S	S	---
Mercury (11) cyanide	Sat.sol	S	S	---
Mercury (1) nitrate	Sol	S	S	---
Mercury	100%		S	S

Chemical	Saturation	20°C	60°C	100°C
Methyl acetate	100%		S	S
Methyl alcohol	5%		S	L
Methyl amine	Up to 32%	S	---	---
Methyl bromide	100%	NS	NS	NS
Methyl ethyl ketone	100%	S		
Methylene chloride	100%	L	NS	NS
Milk		S	S	S
Monochloroacetic acid	>85%	S	S	
Naphtha		S	NS	NS
Nickel chloride	Sat.sol	S	S	
Nickel nitrate	Sat.sol	S	S	
Nickel sulphate	Sat.sol	S	S	
Nitric acid	Up to 30%	S	NS	NS
Nitric acid	From 40% to 50%	L	NS	NS
Nitric acid, fuming (with nitrogen dioxide)		NS	NS	NS
Nitrobenzene	100%	S	L	
Oleic acid	100%	S	L	
Oleum (sulphuric acid with 60% of SO <sub>3</sub> )		S	L	
Olive oil		S	S	L
Oxalic acid	Sat.sol	S	L	NS
Oxygen, gas		S		
Paraffin oil (FL65)		S	L	NS
Peanut oil		S	S	
Peppermint oil		S		
Perchloric acid	(2N) 20%	S		
Petroleum ether (ligroin)		L	L	
Phenol	5%	S	S	
Phenol	90%	S		
Phosphine, gas		S	S	
Phosphoric acid	Up to 85%	S	S	S
Phosphorus oxychloride	100%	L		
Picric acid	Sat.sol	S		
Potassium bicarbonate	Sat.sol	S	S	S
Potassium borate	Sat.sol	S	S	
Potassium bromate	Up to 10%	S	S	
Potassium bromide	Sat.sol	S	S	
Potassium carbonate	Sat.sol	S	S	
Potassium chlorate	Sat.sol	S	S	
Potassium chloride	Sat.sol	S	S	
Potassium chromate	Sat.sol	S	S	
Potassium cyanide	Sol	S	S	
Potassium dichromate	Sat.sol	S	S	S
Potassium ferrocyanide	Sat.sol	S	S	
Potassium fluoride	Sat.sol	S	S	
Potassium hydroxide	Up to 50%	S	S	S
Potassium iodide	Sat.sol	S		
Potassium nitrate	Sat.sol	S	S	
Potassium perchlorate	10%	S	S	
Potassium permanganate	(2N) 30%	S		

Chemical	Saturation	20°C	60°C	100°C
Potassium persulphate	Sat.sol	S	S	
Potassium sulphate	Sat.sol	S	S	
Propane, gas	100%	S		
Propionic acid	>50%	S		
Pyridine	100%	L		
Sea water		S	S	S
Silicone oil		S	S	S
Silver nitrate	Sat.sol	S	S	L
Sodium acetate	Sat.sol	S	S	S
Sodium benzoate	35%	S	L	
Sodium bicarbonate	Sat.sol	S	S	S
Sodium carbonate	Up to 50%	S	S	L
Sodium chlorate	Sat.sol	S	S	
Sodium chloride	Sat.sol	S	S	
Sodium chlorite	2%	S	L	NS
Sodium chloride	20%	S	L	NS
Sodium dichromate	Sat.sol	S	S	S
Sodium hydrogen carbonate	Sat.sol	S	S	S
Sodium hydrogen sulphate	Sat.sol	S	S	
Sodium hydrogen sulphite	Sat.sol	S		
Sodium hydroxide	1%	S	S	S
Sodium hydroxide	From 10 to 60%	S	S	S
Sodium hypochlorite	5%	S	S	
Sodium hypochlorite	10%15%	S		
Sodium hypochlorite	20%	S	L	
Sodium metaphosphate	Sol	S		
Sodium nitrate	Sat.sol	S	S	
Sodium perborate	Sat.sol	S	S	
Sodium phosphate(neutral)		S	S	S
Sodium silicate	Sol	S	S	
Sodium sulphate	Sat.sol	S	S	
Sodium sulphide	Sat.sol	S		
Sodium sulphite	40%	S	S	S
Sodium thiosulphate(hypo)	Sat.sol	S		
Soybean oil	S	L		

Chemical	Saturation	20°C	60°C	100°C
Succinic acid	Sat.sol	S	S	
Sulphuric acid	Up to 10%	S	S	S
Sulphuric dioxide, dry or wet	100%	S	S	
Sulphuric acid	From 10 to 30	S	S	
Sulphuric acid	50%	S	L	L
Sulphuric acid	96%	S	L	NS
Sulphuric acid	98%	L	NS	NS
Sulphurous acid	Up to 30%	S		
Tartaric acid	Sat.sol	S	S	
Tetrahydrofuran	100%	L	NS	NS
Tetralin	100%	NS	NS	NS
Thiophen	100%	S	L	
Tin (IV) chloride	Sol	S	S	
Tin (II) chloride	Sat.sol	S	S	
Toluene	100%	L	NS	NS
Trichloroacetic acid	Up to 50%	S	S	
Trichloroethylene	100%	NS	NS	NS
Triethanolamine	Sol	S		
Turpentine		NS	NS	NS
Urea	Sat.sol	S	S	
Vinegar		S	S	
Water brackish, mineral, potable		S	S	S
Whiskey		S	S	
Wines		S	S	
Xylene	100%	NS	NS	NS
Yeast	Sol	S	S	S
Zinc chloride	Sat.sol	S	S	S
Zinc sulphate	Sat.sol	S	S	S

