Guidelines for chemical resistance of polymers

The extent to which polymers are subjected to attack by chemicals is determined by a number of parameters, related both to the chemical and the polymer involved:

- Polymers are more susceptible to solvent or chemical attack when under stress and/or strain. Stress can be internal, caused during the manufacturing of the product, or due to externally applied loads.
- The nature and strength of the chemical will affect the amount of damage. While some dilute chemicals will not attack a polymer, more concentrated solutions can do considerable harm.
- The extent of chemical attack on a certain polymer is mainly dependent on the chemical structure of the polymer. In addition, the severity of attack generally reduces with increase in polymer molecular weight, crystallinity, and level of chain branching.
- The effects of chemical exposure are increased at higher temperatures and with longer periods of exposure.

Chemical attack can cause polymers to partially dissolve, plasticize, react chemically and absorb these chemicals. These events will not always lead to product failure, but the mechanical properties may be reduced and the weight of the products may change. For non-loaded parts this will often not influence the parts functionality. Most important, however, is that chemical attack can cause stress cracks, which can be defined as fine cracks on or under the surface of the plastic. These cracks may range from those of relatively large size, individually visible to the unaided eye, down to those of almost microscopic size, visible only by the appearance of 'blooming' or haziness (a dull surface). Stress cracks or crazes will usually lead to failure or rejection of the affected part. Attack will usually lead to preferential softening/plasticizing of the polymer which in turn will lower the stress level for crack generation. The amount and severity of cracking/crazing depends largely on the chemical similarity of the solute and the solvent.

These data are based upon information from material suppliers and careful examination of available published information and are believed to be accurate. However, since the resistance of plastics can be affected by the mentioned factors, this information should be considered as a general guide rather than an unqualified guarantee. Ultimately, the customer must determine by himself the suitability of the material used in various solutions.

+ = *Negligible effect: good resistance, no reduction in physical properties, should be suitable for applications where these environmental conditions exists.*

0 = *Limited absorption or attack: Should be suitable for most applications. Little reduction in physical properties. Some higher reduction in physical properties occurs after long exposure or at high temperature. The user is advised to make its own test to determine the suitability of the material in the particular environment.*

- = Extensive attack: The material is damaged or significant changes in physical properties occur after exposure to the substance. The product is not recommended.

+= resistant **o = limited resistance** **- = non-resistant**

Substance	Conc.	ISOCLEAR DAFNELOY PC			ISOFIL ISOPLEN ISOGLASS DAFNELEN PP			ISONYL DAFNEMID PA 6			ISOBLEND DAFNEBLEND PC-ABS			ISODUR DAFNELOY PBT			ISORYL PPO			ISOTER DAFNELAC ABS			ISOFORM DAFNELAN POM		
		T (°C)			T (°C)			T (°C)			T (°C)			T (°C)			T (°C)			T (°C)			T (°C)		
		23	60	100	23	60	100	23	60	100	23	60	100	23	60	100	23	60	100	23	60	100	23	60	100
Acetamide	50%							+															o		
Acetic Acid	10%	+	o	-	+	+		o	-	-	+			+	o	-	+	+	+				o	-	
Acetic Acid	50%	-	-	-	+	+		-	-	-	-			o	o	-	o		o						
Acetone		-	-	-	+	-	-	+			-	-		+	-	-	-	-	-	-	-	-	o	o	
Acrylic Acid	10%							-	-	-															
Acrylic Acid	50%							-	-	-															

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Ammonia	10%	-	-	-	+	+		+	o		-			+	-	-	+			+	o		+	+	
Ammonia	50%	-	-	-	+	+		o	-					o	-	-	+						+	+	
Ammonium Hydroxide	10%	-	-	-	+	+		-	-	-	o			o	-	-	+	+	+				-		
Ammonium Hydroxide	50%	-	-	-	+	o		-	-	-															
Aniline		-	-	-	+	+		o			-						-	-	-	-	-	-	-	o	
Aqua Regia	10%	o			o	-	-	-	-	-				-	-	-	-	-	-						
Aqua Regia	50%				o	-	-	-	-	-				-	-	-	-	-	-	-	-		-	-	
Boric Acid	100%	+			+	+		o	o											+	+		+		
Benzene		-	-	-	-	-	-	+	+		-			+	-	-	o	-	-	-	-	-	o	o	
Benzine		-	-		o	-		+						+											
Brake Fluids		-	-	-	-	-	-	+	+	o	o			+	+	o				-	-		+		
Bromine	10%	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	
Butyl Alcohol		+	+	+	+	+	+	o			+			+	o		+		o	-	-		+		
Calcium Chloride		+	+		+	+		+	+											+	+		-		
Carbon Disulphide	100%	-	-		o	-		+	-		-									-	-	-	+		
Carbon Tetrachloride (wet)		-	-	-	o	o	-	+	+					+	o		-	-	-	-	-		+	o	
Chlorine (wet)		o			o	-	-	-	-	-	-			-	-	-	+						-	-	
Chlorobenzene	100%	-	-		+	o		+			-									-	-		o	o	
Chloroform		-	-	-	-	-	-	-	-	-	-			-	-	-	o		-	-	-	-	-	-	
Chromic Acid	10%	+	+		+	+		-	-	-	-			o			+	+	+				-		
Chromic Acid	50%	o	-		+	-	-	-	-	-	-						-	-	-				-	-	
Citric Acid	10%	+	+		+	+		+	+	+	+			+	o		+			+	+		+	+	
Citric Acid	50%				+	+		-	-	-										+	o		+		
Copper Sulfate	10%	+			+	+		+	+	+							+						-		
Cyclohexane		+		o	o	-	-	+									-	-	-	o	o		+		

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Cyclohexanol					o	-	-													o	o		+	+	
Cyclohexanone		-	-	-	-	-	-	+									-	-	-	-	-	-	+		
Cyclohexene		-	-		+	-		+									+								
Cresol		-	-		+	o		-	-		-									-	-		-		
Decalin		o			+			+			+														
Diesel Fuel		+	+	+	+	+		+	+		+			+	+		+		-	+	+		+		
Dioxane		-	-	-	-	-	-	+						+	-				-	-	-	-		-	
Distilled Water					+	+					+	o					+			+	+		o		
Ethyl Acetate		-	-	-	+	+		+			-			o	-		-	-	-	-	-	-	+		
Ethyl Alcohol (Ethanol)	85%	+	o		+	+	+	o			o	-		+	o	-	-	-	-	+	o	-	o		
Ethylene Glycol		+	+	+	+	+	+	o			+			+	o	-	+	+		+	+		+	+	
Ethylene Oxide		+	+	+	o	o		o		-				+			+						+		
Food Oil		+			+	+		+									+			+					
Fluorine					-	-	-	-	-	-				-	-	-							-		
Formaldehyde	37%	+	+	+	+	+	o	o	-	-	+						+			+	o	-	o	o	
Formamide								+																	
Formic Acid	10%	+			+	+		o	-	-	o			+	o	-	+	+		+	+				
Formic Acid	50%			-	+	o		-	-	-						-	+						o	o	
Frost Protection Agent		+			+	+		+	+								+			+			+		
Gasoline		o			o	-	-	+	+	+	-			+	o	o	o	-	-				+		
Glycolic Alcohol (Glycerol)		+			+	+		+	o		o			+	+		+			+	+		+		
Heating Oil		o			+	+		+	+		o						+	+		+	+				
Heptane		+			o	-	-	+			+			+	+		-	-	-	+	+		+		
Hydrocloric Acid	10%	+	+	+	+	+	+	-	-	-	+			+	o	-	+	+		+	o		-	-	
Hydrocloric Acid	35%			-	+	o	-	-	-	-	o			-	-	-	+	+		o	-		-	-	
Hydrofluoric Acid	10%	+	+		+	+		-	-	-				+	o		+						-		

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Hydrofluoric Acid	50%			-	+	o		-	-	-				-	-	-	+			o	o		-	-	
Hydrogen Peroxide	30%	+	+		+	o	-	-	-	-	+			+	o		+			+	+		-		
Hydrogen Sulphide		+			+	+		+			+						+			+			+		
Iodine (solution)		+			+	+		-	-	-							o			o			o		
Isopropyl Alcohol (Isopropanol)		+	+		+	+		o			o	-		+	+		-	-	-	o	-	-	+	+	
Kerosene		+			o	-	-							+	+		+	+		+	+		+	+	
Lactic Acid	10%	+			+			+			+														
Lactic Acid	90%	+			+			-															o		
Linseed Oil		+	+		+	+		+	+								+			+	+		+	+	
Mercurochrome		o			+	o		-	-								+			o					
Methane (gaseous)					+	+		+			+			+									+		
Methyl Alcohol (Methanol)		-	-	-	+	+		o			-			+	o		+	+		-	-		o	o	
Methyl Ethyl Ketone		-	-	-	+	o		o			-			+	o		-	-	-	-	-	-	o	o	
Methylene Chloride		-	-	-	+	-	-	o	o					-	-	-	-	-	-	-	-	-	+		
Milk		+	+		+	+		+	+								+	+		+	+		+	+	
Mineral Oil		+	+	+	+	o		+	+					+	+		+	+	+	+	+	+	+	+	
Nitric Acid	10%	+			+	+	+	-	-	-	+			+	o	-	+	+	+	+	+	+	-	-	
Nitric Acid	35%	o			o	o	-	-	-	-	-			-	-	-	+	+		+	+		-	-	
Nitrobenzene		-	-		+	+		o			+									-	-		o		
Nitrogen								+						+											
Oxalic Acid		+			+	+		o			+						+			+	+		o		
Oxygen (low pressure)		+	+		o	-	-	+																	
Ozone	<5 ppm	-			o	-	-	o			+			+						+	+		-	-	

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Paraffin Oil	100%	+			+	+		+	+								+			+	+		+	+	
Perchloroethylene		-	-		-	-	-	o	-	-				o	-	-	-	-	-	-	-		+		
Petroleum, aromatic free	100%	o	-								o	o					+								
Petroleum Ether	100%	o			+	o		+												o	-				
Phenol (conc.)		-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	-	
Phosphoric Acid	50%	+			+	+		-	-		+						+			+	+		o	-	
Potassium Hydroxide	10%	-	-	-	+	+	+	+		-				-	-	-	+	+							
Potassium Hydroxide	50%	-	-	-	+	+		+		-	-			-	-	-	+	+		+	o		-		
Pyridine		-	-		+	+		+	o											-	-	-	-	-	
Sea Water		+	o		+	+		+	+	o	+			+	+	-	+						+	-	
Silicone Oil		+	+		+	+		+	+		+						+	+		+			+		
Skydrol		-	-	-	+	o								+	+										
Sodium (hot)																									
Sodium Bicarbonate		+	+	+	+	+		+			+						+	+		+			o		
Sodium Chloride	10%	+	+	+	+	+	o	o	o	o	+			+	+	-	+	+	+	+	+	+	+		
Sodium Hydrogen Sulphite		+			+	+		+												+					
Sodium Hydroxide	10%	-	-	-	+	+	+	+		-			-	-	-	-	+	+	+	+	+		+	+	
Sodium Hydroxide	50%	-	-	-	+	+	+	+						-	-	-	+	+		+	o		+	+	
Sodium Hypoclorite		+	+	+	o	-	-	-	-	-	+			o	-	-							-	-	
Sodium Nitrate		+	+		+	+		+									+	+		+	+		o		
Sulfur		+			+	+		+			+			+									+		
Sulfuric Acid	10%	+	+	+	+	+		-	-	-	+			+	o	-	+	+		+	+		+	-	
Sulfuric Acid	35%	+	+		o	-	-	-	-	-	+			+	o	-	+	+		+	+		-	-	
Tartaric Acid	10%	+			+	+		+									+								

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Tartaric Acid	50%				+	+		o															o		
THF		-	-		o			+															o	o	
Toluene		-	-	-	-	-	-	+	+	+	-			o	-	-	-	-	-	-	-	-	o	-	
Trichloroethylene	100%	-	-		-	-	-	o	-	-	-			o	-	-	-	-	-	-	-		o	o	
Vinegar	10%	+	+		+	+		+									+	+		+	o		+	+	
Xylene		-	-	-	-	-	-	+	+	+	-	-	-	o	-	-	-	-	-	-	-	-	+	+	