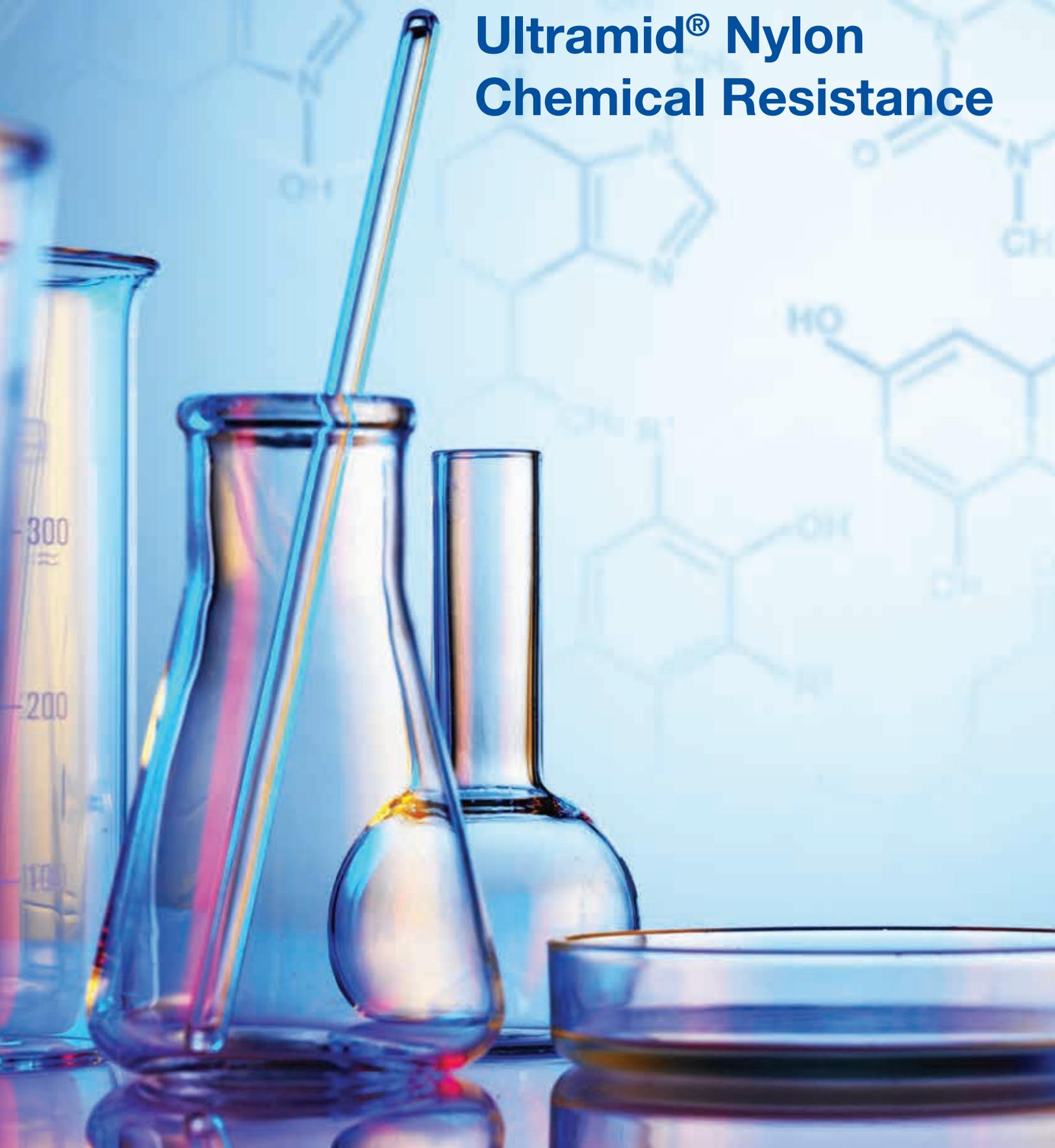


The BASF logo, consisting of a square with a smaller square inside, followed by the letters "BASF" in a bold, sans-serif font.

We create chemistry

Ultramid® Nylon Chemical Resistance



Ultramid® Nylon Chemical Resistance

1. General Information

The information on the following tables relates to unmodified base nylon such as Ultramid® B27E (PA6) and Ultramid® A27E (PA66). Modified or reinforced grades may behave differently.

If you cannot find the information you require here, please contact us at www.nylon.basf.us.

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2. Column Headings

wt. %

Figures under this heading refer to the concentration in wt.% of (unless otherwise stated) an aqueous solution of the substance; SS refers to a saturated solution of the substance; a blank means the information given relates to the pure substance.

°C

The temperature at which the given data is valid. RT means "room temperature" which is taken to be between 15°C and 35°C.

Notes:

Miscellaneous information such as references to other publications, figures, permeability data (diffusion coefficient at 20°C, D20; permeability at 50°C, P50) is given here. Values are written in scientific notation, eg, 2.5E-9 means 2.5 x 10⁻⁹.

The degree of saturation wt/ws of a specimen after a given time can be found from the expression:

$$\frac{w_t}{w_s} = \frac{2.256}{s} \sqrt{Dt}$$

where:

w_t = increase in mass at time t (in s)

w_s = increase in mass at saturation

s = wall thickness in cm

D = diffusion coefficient in cm²/s

t = time in seconds

The above formula can also be used to determine the diffusion coefficient for a particular chemical substance by measuring the rate of absorption.

3. Symbols used to describe the chemical resistance

+ = Resistant

Only slight changes to weight, dimensions, properties. According to current knowledge, the medium causes no irreversible damage to the polymer.

○ = Limited resistance

Noticeable change in properties. Prolonged exposure to the medium may cause irreversible damage (eg, polymer degradation).

- = Not resistant

Medium attacks polymer and/or causes environmental stress-cracking within a short time. Irreversible damage.

S = Plastic dissolved by the chemical

Number after the resistance symbol

This number refers to the mass increase after the polymer specimen has been saturated. The values given are only rough values and refer to unreinforced grades. The actual weight change depends on the grade of plastic and its crystallinity. The percentage change in length can be taken as being roughly a quarter of the percentage weight change.

Number after the resistance symbol:

This number refers to the mass increase after the polymer specimen has been saturated. The values given are only rough values and refer to unreinforced grades. The actual weight change depends on the grade of plastic and its crystallinity. The percentage change in length can be taken as being roughly a quarter of the percentage weight change.

Chemical resistance overview of Ultramid® Nylon

Rating	Chemical
Very resistant	Aliphatic and aromatic hydrocarbons 91A
	Alkalis
	Brake fluids
	Ethers, esters
	Greases
	Ketones
	Fuels (gasoline, diesel)
	Paints
	Lubricants
	Detergent
Not resistant	Halogens (fluorine, chlorine, bromine, iodine)
	Mineral acids and certain organic acids
	Oxidants Phenols Zinc chloride solutions
Solvent for the resin	
1. Room temperature	Formic acid (> 60%)
	Fluorinated solvents
	m-Cresol
	Phenol
	Sulfuric acid (96%)
2. Elevated temperature	Benzyl alcohol
	Glycols
	Formamide

Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Acetaldehyde soln.	40	RT	○ (12%)	
Acetamide soln.	50	RT	○ (7%)	[2], [11]
Acetamide soln.	50	> 140	S	
Acetic acid	95	RT	-	
Acetic acid	10	RT	○	
Acetic acid	5	RT	+ (10%)	PA: $D_{25} = 1.4E-8 \text{ cm}^2/\text{s}$
Acetone		RT	+ (2%)	PA: $P_{20} = 0.01 \text{ (g}\cdot\text{mm}/\text{m}^2\text{h)}$
Acetone		60	+	
Acetophenone		RT	+	
Acetyl chloride		RT	-	
Acetylene		RT	+	
Acrylic acid		> 30	S	[11]
Acrylic acid (soln. in aliphatic hydrocarbons)	3	80	○ (2%)	
Air		RT	+	
Alcohols: see "Methanol", "Ethanol" etc.				
Aliphatic hydrocarbon blend		RT	+	
Alkylbenzenes (Shellsol® A)		RT	+	
Allyl alcohol		RT	○	
Aluminium acetate soln. SS		RT	+	
Aluminium hydroxide soln. SS		RT	+	
Aluminium salts of mineral acids in soln. (eg, chloride, sulfate, nitrate)	20	RT	○	PA: may cause stress cracking [6]
Aluminium salts of mineral acids in soln. (eg, chloride, sulfate, nitrate)	SS	50	-	
Amines, aliphatic		RT	+ ($\leq 8\%$)	
Amino acids	SS	RT	+	
Ammonia soln.		RT	+	PA 6 (10 bar/50°C): $D_{50} = 2E-8 \text{ cm}^2/\text{s}$ [9]; PA: $P_{20} = 1E-10 \text{ (cm}^2/\text{s} \cdot \text{mbar)}$
Ammonia soln.		70	○	
Ammonia soln.	20	RT	+	PA: $P_{20} = 0.06 \text{ (g}\cdot\text{mm}/\text{m}^2 \cdot \text{h)}$
Ammonia soln.	20	60	+	
Ammonium thiocyanate soln.	SS	RT	+	
Ammonium hydrogen carbonate soln.	SS	RT	+	
Ammonium salts of minerals acids in soln.	10	RT	+	
Ammonium salts of minerals acids in soln.	10	50	○	
Amyl acetate		RT	+	
Amyl acetate		100	-	
Amyl alcohol		RT	+ ($\leq 5\%$)	
Aniline		RT	○	
Anodizing baths (30% nitric acid/10% sulfuric acid)		RT	○	
Anthraquinone		85	○	

+ = Resistant ○ = Limited resistance - = Not resistant S = Plastic dissolved by the chemical

Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Antifreeze: see "Coolants"				
Antimony trichloride soln.	SS	RT	–	
Aqua regina (HCl/HNO ₃)		RT	–	
Argon		RT	+	
Aromatic hydrocarbon blend		80	+	
Asphalt		RT	+	
Asphalt		> 100	○	
Bacteria (DIN 53739)		RT	+	
Baking enamels		150	+	Baking up to 30 min; particularly suitable for glass-reinforced grades
Barium salts of mineral acids		RT	○	PA: conc. solns. of barium thiocyanate cause stress cracking [9]
Benzaldehyde		RT	○	
Benzene		RT	+	PA: P ₂₀ = 0.5 (g · 100 μm/m ² · h)
Benzene		80	+	
Benzoic acid soln.	20	RT	○	
Benzoic acid soln.		SS	RT	–
Benzyl alcohol		RT	○ (3 – 30%)	
Beverages		RT	+	See also "Fruit juices", "Brandy", "Wine"
Bitumen (DIN 51567)		RT	+	
Bitumen (DIN 51567)		> 100	○	
Bleaching agent (aqueous; 12.5% active chlorine)		RT	–	
Boric acid soln.	10	RT	○	
Boron trifluoride		RT	–	
Brake fluids		RT	+ (3 – 10%)	
Brake fluids: (DOT 3 – 5, FMVSS 116)		125	○	
Brake fluids: (SAE J 1703; DIN 53521)		150	–	
Brake fluids: Hydraulan® (BASF)		60	+	
Brake fluids: Hydraulan® (BASF)		120	+	
Brandy		RT	+ (10%)	
Bromine vapour		RT	–	
Bromine water	SS	RT	–	
Bromochlorodifluoromethane		RT	+	
Bromotrifluoromethane		RT	+	
Butadiene		RT	+	
Butane		RT	+	PA 66: P ₂₀ < 10 (cm ³ · 100 μm/m ² · d · bar)
Butanediols		RT	+	
Butanediols		> 140	○	
Butanols		RT	+ (2 – 9%)	PA: P ₂₀ approx. 2E-12 mol/cm · s; D ₂₀ = 3E-12 cm ² /s
1-Butene, cis-2-butene, (liquefied gas DIN 51622)		RT	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Butene glycol	RT	+		
Butene glycol		> 160	○	
Butter, buttermilk		RT	+	
Butyl acetate		RT	+	
Butyl acrylate		RT	+	
n-Butyl ether		RT	+	
n-Butyl glycol (glycol monobutyl ether)		RT	+	
Butyl glycolate		RT	+	
Butyl phthalate		RT	+	
Butyric acid soln.	20	RT	○	
-Butyrolactone		RT	+ (2%)	[16]
-Butyrolactone		>90	○	[16]
Calcium chloride soln.	SS	RT	+ (10%)	
Calcium chloride soln.	SS	60	○	
Calcium chloride soln. (alcoholic)	20	RT	○	Dissolves PA
Calcium hydroxide soln. (lime water)	SS	RT	+	
Calcium hypochlorite and bleaching powder soln.	SS	RT	-	
Camphor soln. in alcohol	50	RT	+	Weight increase owing to alcohol uptake
-Caprolactam (aqueous solution)	50	RT	+	
-Caprolactam (aqueous solution)	50	> 150	○	Dissolves PA 6 above 150 °C, PA 66 above 170 °C
-Caprolactam (molten)		> 120	○	[2]
Carbon dioxide		70	+	PA: P ₂₀ = 40 – 60 (cm ³ · 100 μm/m ² · d · bar)
Carbon disulfide		RT	+	PA: P ₂₀ = 0.02 (g·mm/m ² · h)
Carbon disulfide		60	-	
Carbon monoxide		70	+	
Casein		RT	+	
Caustic soda soln.: see "Sodium hydroxide soln."				
Cellulose lacquers		RT	+	see also "Paint solvents"
Cement		RT	+	[1], [8]
Ceresin		RT	+	
Chloral hydrate		RT	-	[11]
Chloramines	< 10	RT	-	
Chlorinated biphenyls		80	○	see also "Clophen A 60/petroleum ether"
Chlorine, chlorine water		RT	-	see also "Bleaching agent"
Chloroacetic acid soln.	10	RT	-	
Chlorobenzene		20	+	PA: P ₅₀ = 1.0 (g · mm/m ² · 103 h)
Chlorobenzene		50	+	
Chlorobromomethane		RT	○ (3 – 30%)	
Chlorodifluoroethylene		RT	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Chlorodifluoromethane, chlorodifluoroethane		RT	+	
Chloroform		RT	○ (5 – 25%)	PA: P ₂₀ = 0.1 (g · mm/m ² · h)
Chlorosulfonic acid soln.	<10	RT	–	
Chloroethene®: see 1,1,1-Trichloroethane				
Chromic acid	10	RT	–	
Chromic acid	1	RT	○	
Chromyl chloride		RT	–	
Citric acid soln.	10	RT	+ (≤ 10%)	PA: D ₂₅ = 1E-8 cm ² /s
Citric acid soln.	10	50	+	
Citric acid soln.	20	80	+	
Citrus fruit juices		RT	+	
Citrus oils		RT	+	
Cleaning agent: all-purpose cleaner		RT	+	
Cleaning agent: household cleaner (Ajax, ATA, Domestos, Rilan)	10	RT	+	
Cleaning agent: toilet cleaner (pH < 3)		RT	○	
Cleaning agent: window cleaner		RT	+	
Clophen A 60/petroleum ether (1 : 1)		RT	+	
Cobalt salt solns.	20	RT	○	PA: stress cracking possible eg, with CoCl ₂ , Co(SCN) ₂ ; [6], [15]
Concrete		RT	+	PA: [1]
Coolants: Glysantin®/Water 1 : 1		106	○	
Copper (II) salt solns.		10	○	PA: nitrate and chloride cause stress cracking; [6], [10]
Coumarone and coumarone resins		RT	+	
Cresols		RT	S	
Crude oil: see "Petroleum"				
Cutting oils: see Lubricating oils				
Cycloalkanes		RT	+	
Cyclohexane, cycloheptane		RT	+	
Cyclohexanol (and esters thereof)		RT	+ (2 – 6%)	
Cyclohexanone		RT	+	
Decontaminating agent (MIL-D-50030 F)		RT	+	= diethylenetriamine/NaOH/ethylene glycol monoethyl ether (70 : 2 : 28)
Dekalin®		RT	+ (1–2%)	
Descaler (based on formic, acetic, citric acids)	10	RT	+	
Descaler (based on formic, acetic, citric acids)	10	50	○	
Descaler (based on sodium hydrogen sulfate)	10	RT	+	
Detergent soln, heavy-duty	< 10	RT	+	
Detergent soln, heavy-duty	< 10	80	○	
Developer soln. (Rodinal®, Agfa, pH 11)		RT	+	
Dibutyl phthalate		RT	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Dibutyl phthalate		60	+	
p-Dichlorobenzene		RT	+ (2%)	
1,2-Dichloroethane		RT	+ (2 – 5%)	
Dichloroethylene		RT	+	
Dichlorofluoromethane		RT	+	
Dichloromethane: see “Methylene chloride”				
Dichlorotetrafluoroethane		RT	+	
Diesel fuel: see “Fuels”				
Diethyl ether		RT	+ (3%)	PA: P ₂₀ = 0.03 (g · mm/m ² · h)
Diethylene glycol		> 140	S	See also “Glycol”
Difluoromethane		RT	+	
Dimethyl ether		RT	+	
Dimethylacetamide		RT	+	PA 6 on prolonged exposure: ; [11]
Dimethylacetamide		> 150	–	
Dimethylamine		RT	+	
Dimethylformamide		RT	+ (5%)	
Dimethylformamide		90	○ (15%)	
Dimethylformamide		> 140	S	
Dimethylsilane		RT	+	
Dimethylsulfoxide (DMSO)		RT	+	
Dimethylsulfoxide (DMSO)		125	S	
Diethyl phthalate		RT	+	
Dioxan		RT	+	PA: P ₂₀ = 0.001 (g · mm/m ² · h)
Dioxan		60	+	
Diphyl® (biphenyl and diphenyl ether)		80	+	
Diisopropyl ether		RT	+	PA: P ₂₀ = 0.005 (g · mm/m ² · h)
Dishwasher detergent soln.	< 10	95	+	
Disinfectant (alcohol-based)	< 10	RT	+	[3], [4]
Disinfectant (aldehyde-based)	< 10	RT	+	[3], [4]
Disinfectant (based on phenols)	< 10	RT	○	PA is however resistant under normal conditions of use
Disinfectant (based on quaternary ammonium compounds)	< 10	RT	+	[3], [4]
Disinfectant (based on quaternary phosphonium compounds)	< 10	RT	+	[3], [4]
Disinfectant (chlorine-based)	< 10	RT	○	[3], [4]
Disinfection by boiling		100	+	
Disinfection by fractional vacuum process			+	
Disinfection by gas sterilization: see “Ethylene oxide”				
Disinfection by hot air/steam/hot air			+	See also “Steam (sterilization over 50 cycles)”
Disinfection by irradiation (25 kGy for 6 h)			+	PA: slight yellowing
Dispersions, aqueous (BASF Acronal®, Propiofan®)			+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Edible fats and oils		100	+	
Electroplating baths, acidic		RT	-	see also: "Anodizing baths" and solutions of metal salts
Electroplating baths, alkali (cyanides)		RT	+	
Engine oils: see "Lubricating oils"				
Epichlorhydrin		RT	○	
Ethane		RT	+	PA: $P_{20} < 10 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m/m}^2 \cdot \text{d} \cdot \text{bar)}$
Ethanol		RT	+(15%)	PA: $P_{20} = 0.2 \text{ (g} \cdot \text{mm/m}^2 \cdot \text{h)}$
Ethanol, dilute 40 vol.		RT	+	
Ethereal oil		RT	+	
Ethyl acetate		RT	+(1%)	PA: $P_{20} = 0.008 \text{ (g} \cdot \text{mm/m}^2 \cdot \text{h)}$
Ethyl chloride		RT	+	
Ethylene		RT	+	PA: $P_{20} < 10 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m/m}^2 \cdot \text{d} \cdot \text{bar)}$
Ethylene carbonate		50	+	
Ethylene carbonate		100	-	
Ethylene chlorohydrin		RT	○	
Ethylene oxide		RT	+	PA: $P_{20} < 100 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m/m}^2 \cdot \text{d} \cdot \text{bar)}$
Ethylene oxide		> 80	-	
Ethylene oxide (gas sterilization)			○	PA: 30 – 70 °C up to 8 h: +
Ethylenediamine		RT	+(8 – 15%)	
Exhaust fumes from internal combustion engine		RT	+	
Fats and waxes, edible fats		RT	+	see also "Edible fats and oils"
Fatty acids		RT	+	
Fatty alcohols		RT	+	
Fatty alcohols, sulfonated		RT	+	
Fluorinated hydrocarbons, fluorocarbons		70	+	
Fluorine		RT	-	
Formaldehyde		RT	+	
Formaldehyde solution	30	RT	+(5 – 15%)	
Formamide		RT	+	
Formamide		> 150	S	
Formic acid soln.	10	R	○	Conc. acid dissolves nylons (50% for PA 6, 80% for PA 66); [2]
Formic acid soln.	10	50	-	
Fruit juices		RT	+	
Fuel, engine: Diesel		85	+	PA: $P_{40} = 0.001 \text{ (g} \cdot \text{mm/m}^2 \cdot \text{h)}$
Fuel, engine: FAM test fuel (5% ethanol)		55	+(9 – 14%)	
Fuel, engine: Gasoline (normal & premium grade)		RT	+	PA: $P_{40} = 0.006 \text{ (g} \cdot \text{mm/m}^2 \cdot \text{h)}$
Fuel, engine: Gasoline (normal & premium grade)		85	+	
Fuel, engine: High-performance fuels (Dekalin®, perhydrofluorene)		85	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Fuel, engine: M15 mixture (15% methanol)		55	+ (9 – 14%)	
Fuel, engine: M15 mixture (15% methanol)		70	○	
Fungi (DIN 53739; ISO 846)			+	[19]
Furfural		RT	+ (2 – 7%)	
Furfuryl alcohol		RT	+	Solvent for PA 610 above 90 °C
Gas sterilization: see "Ethylene oxide (gas sterilization)"				
Gasoline: see Fuels				
Gear oils (EP, hypoid, ATF, manual transmission)		≤ 110	+	See also "Lubricating oils"; PA: temperature/time limits see fig. 13
Gelatine	RT		+	
Glue		RT	+	
Glycerol		RT	+	
Glycerol		170	S	
Glycolic acid soln.	30	RT	–	
Glycols, alkyl glycol ethers		RT	+ (2 – 10%)	See also "Brake fluids", "Coolants"; [11]
Glysantin® (BASF): see "Coolants"				
Grease (based on ester oils, diester oils, phosphoric acid esters, synthetic oils)		≤ 110	○	[5]
Grease (based on polyphenylester)		≤ 110	+	
Grease (based on silicone oils): see "Silicone oils"				
Grease: antifriction bearing grease DIN 51825 (based on metal soaps)		≤ 110	+	PA: Lithium grease may cause increased swelling under some circumstances.
Hair dyes		RT	○ (≤ 11%)	
Hardening oils		RT	+	
Heating oil (DIN 51603)		RT	+	
Helium		RT	+	
Heptane		RT	+	PA: $P_{20} = 0.1 \text{ (g} \cdot \text{mm/m}^2 \cdot \text{h)}$
Hexachloroethane		RT	+	
Hexachlorobenzene		80	+ (1%)	
Hexafluoroisopropanol		RT	S	
Hexamethylenetetramine		RT	+	
Hexane		RT	+	
Humic acids		RT	○	PA: chemical attack possible under extreme conditions
Hydraulic fluids		100	+	
Hydraulic oil (DIN 51525)		100	+	
Hydraulic oil (MIL-H 5606)		100	+	
Hydraulic oil (VDMA 24318)		100	+	
Hydrazine		RT	+	
Hydriodic acid, hydrogen iodide soln.		RT	–	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Hydrobromic acid soln.	10	RT	–	
Hydrochloric acid	> 20	RT	–	
Hydrochloric acid	2	RT	–	[17]
Hydrofluoric acid 40		RT	–	
Hydrofluosilicic acid	30	RT	–	
Hydrogen		RT	+	PA: $P_{20} = 300 - 400 \text{ (cm}^3 \cdot 100 \mu\text{m/m}^2 \cdot \text{d} \cdot \text{bar)}$
Hydrogen chloride gas		RT	–	see also "Hydrochloric acid"
Hydrogen fluoride		RT	–	
Hydrogen peroxide soln.	0.5	RT	+	
Hydrogen peroxide soln.	30	RT	–	
Hydrogen sulfide	< 10	RT	○	PA: possible damage by sulfuric acid formed by oxidation
Hydrogen sulfide (dry)		RT	+	PA: $P_{20} = 2.4\text{E-}12 \text{ (cm}^2\text{/s} \cdot \text{mbar)}$
Hydroquinone soln.	5	RT	–	
Hyraulac® (BASF): see "Brake fluids"				
Impregnating oils		RT	+	
Ink		RT	+	
Iodine (alcoholic solution)		RT	–	
Iron (III) chloride	SS	RT	–	
Iron (III) chloride soln., acidic		10	RT	–
Iron (III) chloride soln., neutral		10	RT	+ (4 – 10%)+
Iron (III) thiocyanate soln.	10	RT	○	
Isocyanates, aromatic		RT	+	
Isooctane		80	+	
Isopropanol		RT	+ (5 – 15%)	PA: $P_{20} = 20 \text{ (g} \cdot 100 \mu\text{m/m}^2 \cdot \text{d)}$; $D_{20} = 1\text{E-}11 \text{ cm}^2\text{/s}$
Isopropanol		60	+	
Ketones (aliphatic)		RT	+	
Lactic acid		10	+	
Lactic acid		90	–	
Laughing gas: see "Nitrous oxide"				
Lead acetate soln.	10	RT	+	
Lime: see "Cement"				
Linseed oil		RT	+	
Lithium bromide, lithium chloride soln. (aqueous)	10	RT	○	PA: environmental stress-cracking in saturated solutions
Lithium chloride soln. (alcoholic)	20	RT	S	
Lithium hydroxide	10	20	+	
Lithium hydroxide	10	80	–	
LPG (DIN 516222): see "Propane, propene"				
Lubricating oils				

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Lubricating oil: gear oil (eg, ATF)		≤ 130	+	
Lubricating oil: HD engine oils, hydraulic oils, transformer oils		≤ 130	+	
Lubricating oil: hypoid gear oil (with EP additives, MIL-L 2105 B)		≤ 110	+	
Lubricating oil: hypoid gear oil (with EP additives, MIL-L 2105 B)		120	-	
Lubricating oil: without HD or EP additives (ASTM reference oil)		100	○	Possible attack by acids formed by oxidation
Lutensit®, Lutensol® (BASF)		RT	+	
Magnesium salt solns. (chloride, nitrate, sulfate)	10	RT	+ (5 – 10%)	
Maleic acid soln.	25	RT	○	
Malic acid	SS	RT	+	
Malt		RT	+	
Manganese salt solns (chloride, sulfate)	10	RT	+	
MAPP gas (C3, C4 aliphatic hydrocarbons)		RT	+	
Mercury		RT	+	
Mercury (II) chloride	SS	RT	-	
Mersolates®		RT	+	
Methane		RT	+	
Methanol		RT	+ (9 – 14%)	PA: P ₂₀ = 0.2 (g · mm/m ² · h); D ₂₀ = 1E-8 cm ² /s
Methyl acetate		RT	+ (2%)	
Methyl chloride		RT	+	
Methyl chloroform: see "1,1,1-Trichloroethane"				
Methyl ethyl ketone		RT	+ (2%)	PA: P ₂₀ = 0.001 (g · mm/m ² · h)
Methyl formate		RT	+	
Methyl glycol		RT	+	
Methylamine		RT	+ (7%)	
Methylaniline		RT	+ (3 – 15%)	
Methylbromide		RT	+	PA: P ₆₀ = 6E-13 (cm ² /s · mbar)
Methylene chloride		RT	○	
N-methylpyrrolidone		RT	+	
N-methylpyrrolidone		> 150	S	
Microbes		RT	+	
Milk		RT	+	
Mineral oils: see "Lubricating oils"				
Molasses		RT	+	
Mortars: see "Cement"				
Moulds (DIN 53739; ISO 846 A, B; MIL-T 18404)		RT	+	[19]
Naphtha		RT	+	
Naphthalene		RT	+	
Naphthalenesulfonic acids		RT	-	
Naphthenic acids		RT	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Naphthols		RT	–	
Natural gas		RT	+	
Nekaniil®, NekaI® surfactants (BASF)	< 10	50	+	
Neon		RT	+	
Nickel nitrate	10	RT	○	PA: environmental stress-cracking possible; [6]
Nickel plating baths: see "Electroplating baths"				
Nickel salt solns. (chloride, sulfate)	10	RT	+	
Nitric acid > 50		RT	–	
Nitric acid 2		RT	–	
Nitrilotriacetic acid (sodium salt)		RT	+	
Nitrobenzene, nitrotoluene		RT	○	
Nitrobenzene, nitrotoluene	> 100		S	[12]
Nitrocellulose lacquers (alcoholic, hazard class A I)		RT	○	
Nitrocellulose lacquers (alcohol-free, hazard class A II)		RT	+	
Nitrogen (200 bar)		RT	+	PA: $P_{20} = 6 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m}^2 \cdot \text{d} \cdot \text{bar)}$
Nitrogen oxides (dinitrogen tetraoxide)		RT	○	[8]
Nitrogen oxides (under pressure)		RT	–	
Nitromethane, nitropropane		RT	○	
Nitrous fumes		RT	○	
Nitrous oxide		RT	+	
Noble gases (argon, helium, neon)		RT	+	PA: for helium $P_{20} = 340 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m}^2 \cdot \text{d} \cdot \text{bar)}$
Octane, octene		RT	+	
Oil, for transformers, switchgear (DIN 51507)		50	+	
Oils (vegetable, ethereal, mineral)		RT	+	See also "Lubricating oils"
Oleic acid		RT	+	
Oleum		RT	S	
Oxalic acid soln.	10	RT	○	
Oxalic acid soln.	10	80	–	
Oxygen (atmospheric pressure)		RT	+	PA: $P_{20} = 10 - 15 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m}^2 \cdot \text{d} \cdot \text{bar)}$; $D_{20} = 1.3\text{E-}9 \text{ cm}^2/\text{s}$
Oxygen (high pressure)		RT	– (*)	(*): not BAM-approved (German materials testing institute)
Ozone		RT	–	
Ozone (1 ppm in water)		RT	+	
Ozone (20 ppm in air)		RT	○	[8]
Paint solvents		RT	+	Alcoholic solvents cause PA to swell
Paints: see "Paint solvents", "Baking enamels"				
Palamoll®, Palatinol® grades (BASF)		RT	+	
Palatal® resins (BASF): see "Polyester resins"				
Palmitic acid		80	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Paraffin wax, liquid paraffin		RT	+ (< 0.2%)	
Peracetic acid		RT	-	
Perchloroethylene: see "Tetrachloroethylene"				
Perfume (alcoholic solution)		RT	+	
Perhydrol: see "Hydrogen peroxide soln."				
Petroleum		RT	+	
Petroleum ether, petroleum solvents		80	+	
Phenol		> 43	S	[11], [12]
Phenol	88	RT	S	
Phenol (alcoholic soln.)	70	RT	O	
Phenyl ether (guaiacol, cresol)		RT	-	
Phenylethyl alcohol		RT	O	[11]
Phenylethyl alcohol		> 160	S	
Phosphate (inorganic) solns. (neutral and alkaline)	10	RT	+	
Phosphate esters: see "Hydraulic fluids"				
Phosphine		RT	+	
Phosphoric acid	10	RT	-	
Phosphoric acid	85	RT	S	
Photographic developer		RT	+	
Photographic fixer		RT	+	
Phthalic acid soln.	SS	RT	O	
Plasticizers: see "Palamoll®, Palatinol®"				
Plastomoll® (adipates, BASF) DDA, NA, DIDA		RT	+	
Polyester resins (eg, BASF Palatal® resins)		RT	+	
Polyglycols, polyols		RT	+	
Potassium bromide soln.	10	RT	O	
Potassium chloride soln.	10	RT	+	
Potassium chloride soln.	10	70	+	
Potassium dichromate soln.	5	RT	O	
Potassium hydroxide soln.	50	RT	O	Unfilled PA: +; glass fibres attacked in reinforced grades.
Potassium nitrate soln.	10	RT	+	
Potassium permanganate soln.	1	RT	-	
Potassium thiocyanate soln.	SS	RT	-	
Propane, propene		RT	+	PA: $P_{20} < 10 \text{ (cm}^3 \cdot 100 \text{ } \mu\text{m}^2 \cdot \text{d} \cdot \text{bar)}$ for propane
Propanol (n-, iso-)		RT	+ (5 – 15%)	PA: $D_{20} = 1\text{E-}11 \text{ cm}^2/\text{s}$; $P_{20} = 20 \text{ (g} \cdot 100 \text{ } \mu\text{m}^2 \cdot \text{d)}$ creep strength see fig. 7
Propanol (n-, iso-)	> 100	S		
Propionic acid soln.	5	RT	+	
Propionic acid soln.	10	RT	-	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Propionic acid soln.	50	RT	–	
Protein solutions		RT	+	
Pulp slurries		≤ 60	+	
Pulp slurries		95	–	
Pyridine		RT	+	PA: P ₂₀ = 0.0002 (g · mm/m ² · h)
Pyridine		80	○ (15 – 20%)	
Pyrocatechol soln.	6	RT	–	
Pyrrolidone		RT	+	
Pyruvic acid soln.	10	RT	○	
Rainwater (acidic)		RT	+	
Refrigerator oil		RT	+	
Resorcinol (alcoholic soln.)	50	RT	○	
Resorcinol/methanol/benzene/water (40 : 35 : 10 : 5)		RT	○	Adhesive solvent
Road salt, road-salt solutions		RT	+	PA may be attacked by any zinc chloride that forms
Salicylic acid soln.	SS	RT	+	
Seawater: see "Water"				
Silane (tetramethylsilane)		RT	+	
Silicone oils		≤ 80	+	
Silicone oils		> 100	○	
Soap solution	< 10	80	+	
Soda soln.	10	RT	+ (3 – 10%)	
Sodium bromide soln.	10	RT	○	
Sodium chlorate soln.	10	RT	+	
Sodium chlorite soln.	10	RT	○	
Sodium dodecylbenzenesulfonate soln.		RT	+	
Sodium hydrogen carbonate soln.	10	RT	+	
Sodium hydrogen sulfate soln.	10	RT	+	
Sodium hydrogen sulfite soln.	10	RT	+	
Sodium hydroxide soln.	10	RT	+	
Sodium hydroxide soln.	50	RT	○	
Sodium hydroxide soln.	10	80	–	
Sodium hypochlorite soln.	10	RT	○	
Sodium hypophosphite soln.	10	RT	+	
Sodium lauryl sulfate paste	30	RT	+	
Sodium lignosulfonate		RT	+	
Sodium nitrilotriacetate soln.	10	RT	+	
Sodium oleate		RT	+	
Sodium pentachlorophenolate		RT	+	
Sodium perborate soln.	3	RT	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Sodium pyrosulfite soln.	10	RT	+	
Sodium salt solns. (neutral, eg, chloride, nitrate, sulfate)	10	RT	+	
Soil (acidic: pH 3)		RT	+	see also "Humic acids"
Soil (neutral; alkaline: pH 10)		RT	+	see also "Bacteria", "Moulds"
Soldering fluid		RT	-	
Steam		100	○	
Steam (50-µm film)		116	-	Evidence of molecular degradation after 5 cycles
Steam (sterilization over 50 cycles)		134	○	Sterilization (DIN 58946 parts 1 – 5): PA 66: +; PA 6: -
Stearic acid, stearate, alkyl stearate		RT	+	
Sterilization, sterilizing agent see "Disinfectant"				
Stoving enamels: see "Baking enamels"				
Styrene	80	+		
Sulfolane (tetramethylenesulfone)		RT	+ (1%)	
Sulfolane (tetramethylenesulfone)	> 80	S		
Sulfonates (eg, alkyl aryl sulfonate)	<10	RT	+	
Sulfur		RT	+	
Sulfur dioxide (dry)		RT	+	PA: $P_{20} = 2.3E-11$ (cm ² /s · mbar) [13]; high absorption under high pressure [16]
Sulfur dioxide (moist)		RT	○	
Sulfur hexafluoride (20 bar)		RT	+	
Sulfuric acid	> 80	RT	S	
Sulfuric acid	2	RT	-	
Sulfurous acid soln.	SS	RT	○	
Sweat (DIN 54020)		RT	+	[7]
Tall oil		RT	+	
Tallow		RT	+	
Tar: see "Bitumen"				
Tartaric acid 10		RT	+ (4 – 10%)	
Tartaric acid 50		RT	○	
Termites		RT	+	Surface may be eaten into slightly
Tetrachloroethylene		RT	○	[18]
Tetrachloroethylene	80		-	[18]
Tetrachloromethane		RT	+ (1 – 4%)	PA: $P_{20} = 0.08$ (g · mm/m ² h)
Tetrafluoromethane		RT	+	
Tetrafluoropropanol		RT	-	
Tetrahydrofuran		RT	+ (2 – 10%)	PA: $P_{20} = 0.001$ (g · mm/m ² h)
Tetralin®		RT	+ (2–3%)	
Tin (II) salts of mineral acids	10	RT	○	
Toluene		RT	+	PA: $P_{20} = 0.005$ (g · mm/m ² h)
Toluene		100	+	

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Ultramid® Chemical Resistance

Chemical	Wt. %	°C	Resistance	Notes
Town gas		RT	+	
Trichloroacetic acid ethyl ester		RT	○	PA 66: limited resistance; PA 6: not resistant
Trichloroacetic acid soln.	50	RT	–	
1,1,1-Trichloroethane (Chlorothene®)		45	+	[18]
Trichloroethanol, trifluoroethanol		RT	–	[11]
Trichloroethylene		RT	○ (4 – 10%)	PA: P ₅₀ = 0.02 (g · mm/m ² · d)
Trichloroethylene		> 40	–	
Trichlorotrifluoroethane		RT	+	
Triethanolamine		RT	+	
Trilon® A, B (BASF)	10	RT	+	
Trilon® A, B (BASF)	10	60	+	
Trimethylamine		RT	+	
Tri-p-cresyl phosphate		RT	+	
Turpentine oil		RT	+ (1%)	
Turpentine substitute (white spirit)		RT	+	
Uranium fluoride		RT	–	
Uric acid soln.	20	RT	+	
Urine		RT	+	
Vacuum		RT	+	
Vaseline		RT	+	
Vinyl chloride, bromide, fluoride		80	+	
Vulcanization		≤ 180	+	
Water (including seawater)		RT	+	
Water (including seawater), chlorinated (0.5 mg/l)		80	+	
Water glass		RT	+	
Wax		80	+	
Wax polishes		RT	+	
WC cleaner (pH < 3)		RT	○	
Wine		RT	+	
Xylene		RT	+	
Xylene		100	+	
Yeast		RT	+	
Zinc (galvanized metal surfaces) exposed to weather (see “Zinc chloride”)		RT	+	Formation of zinc chloride possible on exposure to salt water
Zinc chloride		RT	+	
Zinc chloride soln.	10	RT	○	PA: stress cracking under certain circumstances
Zinc chloride soln.	37	RT	–	
Zinc thiocyanate, bromide, iodide, nitrate	30	RT	–	

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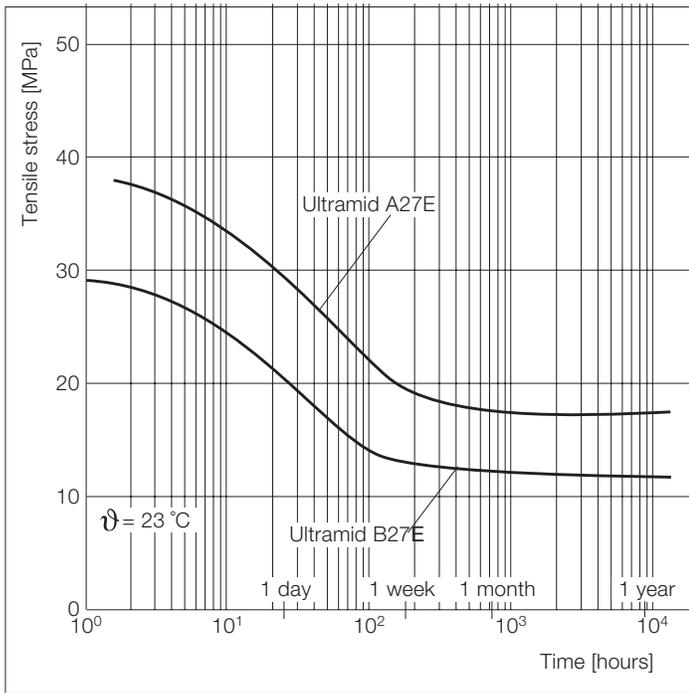


Figure 1
Creep behaviour of Ultramid A and B in methanol. Test specimens: DIN 53455, no. 3; temp.: 23°C

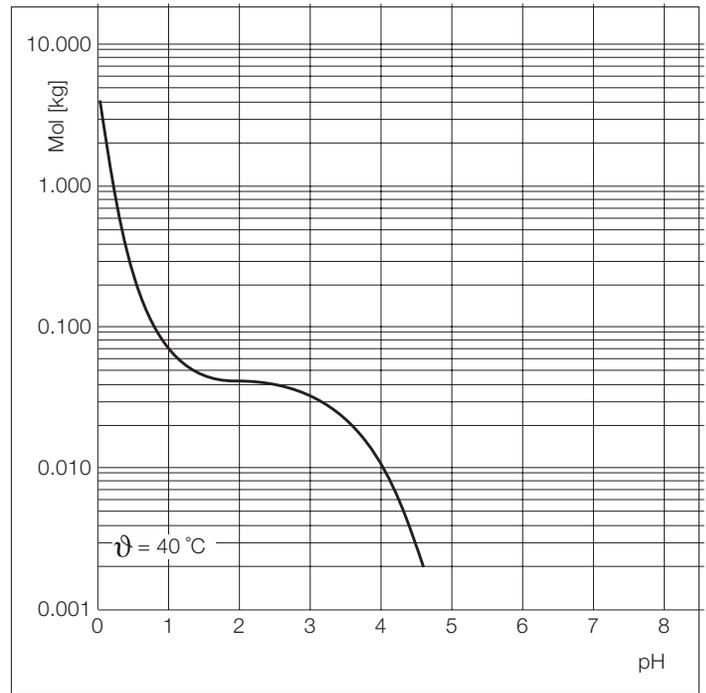


Figure 2
Absorption of hydrochloric acid by Ultramid® B27E as a function of the pH at 40°C. Test specimens: disks (Ø 60 mm x 1 mm) injection moulded with a cold mould

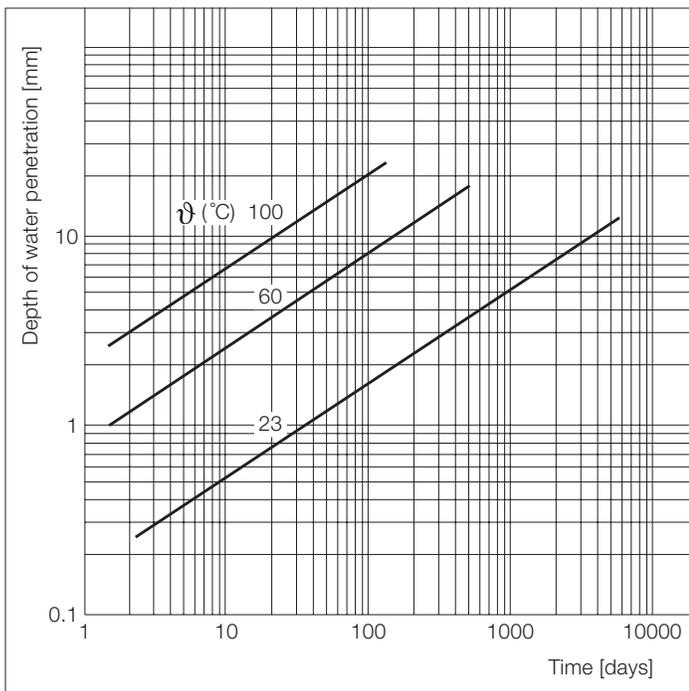


Figure 3
Penetration of water into Ultramid B at 23°C, 60°C and 100°C

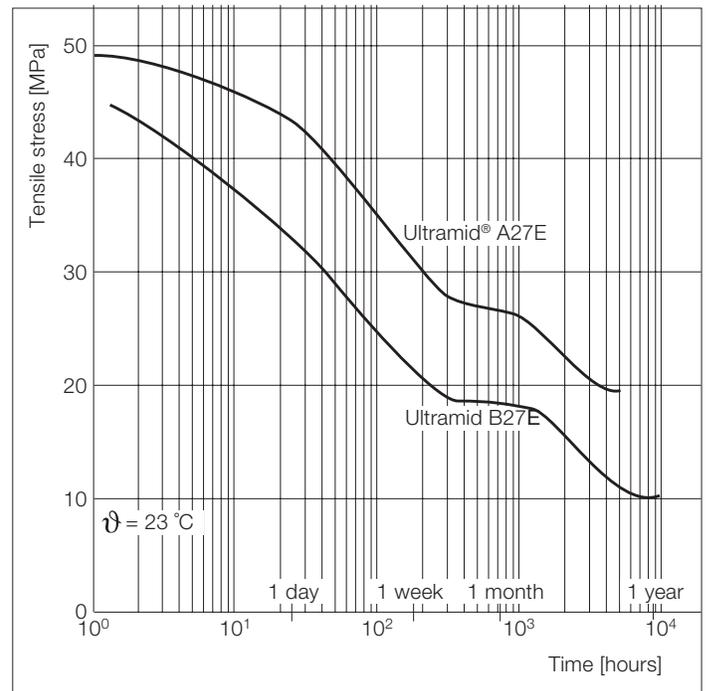


Figure 4
Creep behaviour of Ultramid in distilled water at 23°C Test specimens: DIN 53455, no. 3

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