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MECHANICAL VALUES AND CHEMICAL RESISTANCES OF PLASTICS

The competitive edge through engineered components made of plastic

Information and conditions concerning the table

"Physical Material Guiding Values"

The information in the list is intended to provide an overview of the properties of our products and to allow a quick comparison of materials. They represent our present standard of knowledge and do not claim to be complete. Because of the high level of dependence on environmental influences and machining methods, the values given here should only be regarded as standard values. In no way do they represent a legally binding assurance in regard to the properties of our products nor to their suitability for specific applications. All the values stated here were determined from average values resulting from many individual measurements and refer to a temperature of 23 °C and 50% RH. For specific applications, we recommend that the suitability of the materials be first tested by practical experiments.

The conditions under which the individual values were determined, and any special features in regard to these values, are contained in the following list with the respective footnotes:

Parameter	Condition	Footnote
Impact resistance DIN EN ISO 179	Measured with an impact pendulum testing machine 0.1 DIN 51 222	1
Creep load DIN 53 444	Load that leads to 1% overall expansion after 1,000 h	2
Coefficient of sliding friction	Hardened and ground against steel, P = 0.05 MPa, V = 0.6 m/s, t = 60 °C in vicinity of running area	3
Linear coefficient of elongation	For temperature range from + 23 °C to + 60 °C	4
Temperature range	Experience values, determined on finished parts without load in warmed air, dependent on the type and form of heat, short-term = max. 1 h, long-term = months	5
Dielectric strength IEC 250	at 10^6 Hz	6
Colours	POM-C natural = white PET-natural = white PVDF-natural = white to ivory (translucent) PE-natural = white PP-H natural = white (translucent) PP-H grey ≈ RAL 7032 PVC-grey ≈ RAL 7011 PEEK natural ≈ RAL 7032 PSU-natural = honey yellow (translucent) PEI-natural = amber (translucent)	7
Units and abbreviations	o. B. = without breakage 1 MPa = 1 N/mm^2 1 g/cm^3 = 1,000 kg/m^3 1 kV/mm = 1 MV/m	none

Physical Material Guiding Values

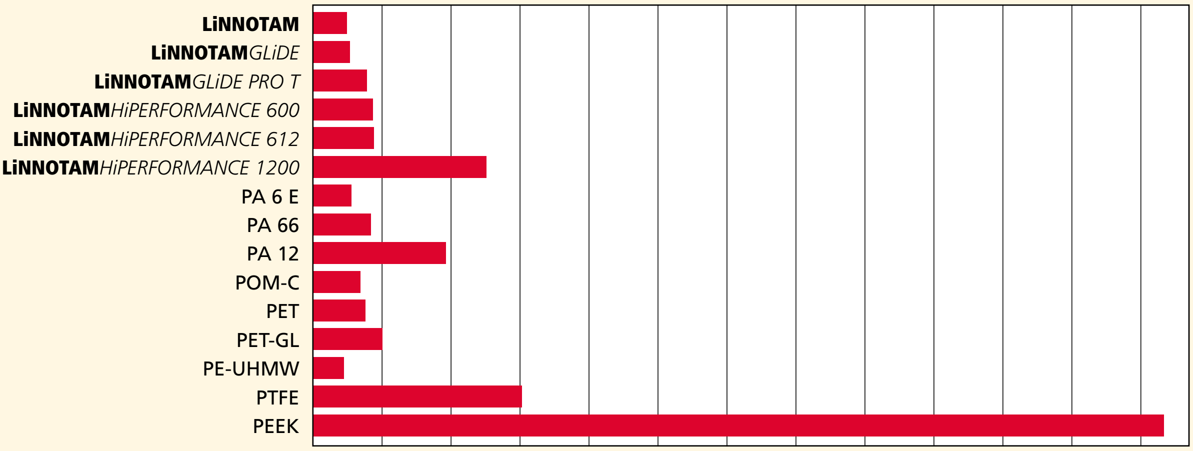
As of 2016

No.	Product	Material	Colours (standard)	Test specimen condition	Density DIN EN ISO 1183 1 ρ g/cm³	Yield stress DIN EN ISO 527 2 σ_{zS} MPa	Elongation at break DIN EN ISO 527 3 ε_{zR} %	E-Module (tensile) DIN EN ISO 527 4 E_t MPa	E-Module (bending) DIN EN ISO 178 5 E_{B3} MPa	Flexural strength DIN EN ISO 178 6 σ_{bB} MPa	Impact strength DIN EN ISO 179 7 a_{cU} kJ/m²	Notched-bar impact strength DIN EN ISO 179 8 a_{cN} kJ/m²	Ball indentation hardness $H_{358/30}$ DIN EN ISO 2039-1 9 H_K MPa	Creep rate stress at 1% elongation DIN EN ISO 899-1 10 $\sigma_{1/1000}$ MPa	Sliding friction coefficient against steel (dry running) [3)] 11 μ –	Sliding wear against steel (dry running) [3)] 12 V µm/km	Melting temperature DIN EN ISO 3146 13 T_m °C	Thermal conductivity DIN 52 612 14 λ W/(K·m)
					Mechanical values													
1	**LINNOTAM**	PA 6 C	natural/black/blue	dry/humid	1.15	80/60	40/100	3,100/1,800	3,400/2,000	140/60	o. B.	>4/>15	160/125	>7	0.36/0.42	0.10	+ 220	0.23
2	**LINNOTAM** MoS	PA 6 C + MoS2	black	dry/humid	1.15	85/60	40/100	3,200/1,850	3,300/2,000	130/50	o. B.	>5/>15	150/115	>7	0.32/0.37	0.10	+ 220	0.23
3	**LINNOTAM** HS	PA 6 C-WS	black	dry/humid	1.15	90/60	30/80	2,500/2,000	3,000/2,300	120/40	o. B.	>4/>12	170/130	>7	0.36/0.42	0.10	+ 220	0.23
4	**LINNOTAM***GLiDE*	PA 6 C + Oil	natural/black/yellow green/red	dry/humid	1.14	80/55	50/120	2,800/1,700	3,000/1,900	135/55	o. B.	>5/>15	150/100	>7	0.15/0.20	0.03	+ 220	0.23
5	**LINNOTAM***GLiDE PRO T*	PA 6 C + solid lubricant	grey/red/green	dry/humid	1.14	80/60	40/100	3,100/1,800	3,300/2,000	110/60	o. B.	>4/>15	160/125	>7	0.15/0.23	0.03	+ 220	0.23
6	**LINNOTAM***DRiVE 600 FE*	PA 6 C + impact modified	–	dry/humid	1.15	90	20	2,800	2,500	160/130	o. B.	>15	175	>7	0.36/0.42	–	+ 225	0.23
7	**LINNOTAM** *HiPERFORMANCE 612*	PA 6/12 G	natural	dry/humid	1.12	80/55	55/120	2,500/1,500	2,800/1,800	135/55	o. B.	>12	140/100	>15	0.36/0.42	0.12	+ 220	0.23
8	**LINNOTAM** *HiPERFORMANCE 1200*	PA 12 G	natural	dry	1.03	60/50	55/120	2,200/1,800	2,400	90	o. B.	>15	100	>11	0.4	–	+ 190	0.23
9	**LINNOTAM** CC	PA 6 C-CC	natural/black	dry	1.15	71	>40	2,800	2,700	97	o. B.	–	125	–	0.36/0.42	–	+ 220	0.23
10	Polyamide 6	PA 6	natural/black	dry/humid	1.14	70/45	50/180	2,700/1,800	2,500/1,400	130/40	o. B.	>3/o.B.	160/70	>8	0.38/0.42	0.23	+ 218	0.23
11	Polyamide 66	PA 66	natural/black	dry/humid	1.14	85/65	30/150	3,000/1,900	2,900/1,200	135/60	o. B.	>3/>15	170/100	>8	0.35/0.42	0.1	+ 265	0.23
12	Polyamide 66 + Glass fibre	PA 66 GF 30	black	dry	1.35	160	3	11,000	–	–	50	6	240/200	40	0.45/0.5	–	+ 255	0.3
13	Polyamide 12	PA 12	natural	dry	1.02	50	>200	1,800	1,500	60	o. B.	>15	100	>4	0.32	0.8	+ 178	0.30
14	Polyacetal Copolymer	POM-C	natural[7)]/black	dry	1.41	65	40	3,000	2,900	115	o. B.	>10	150	13	0.32	8.9	+ 168	0.31
15	Polyacetal Copolymer Glass fibre	POM-C GF 30	black	dry	1.59	125	3	9,300	9,000	150	30	5	210	40	0.50	–	+ 168	0.40
16	Polyethylenterephtalat	PET	natural[7)]/black	dry	1.38	80	40	3,000	2,600	125	82	14	140	13	0.25	0.35	+ 255	0.24
17	Polyethylenterephtalat + solid lubricant	PET-GL	lightgrey	dry	1.38	75	5	2,230	–	–	23	10	–	–	0.2	0.1	+ 245	0.23
18	Polytetrafluorethylen	PTFE	natural	dry	2.18	25	380	750	540	6	o. B.	16	30	1.5	0.08	21.0	+ 327	0.23
19	Polyvinyldifluorid	PVDF	natural[7)]	dry	1.78	56	22	2,000	2,000	75	o. B.	>15	120	3	0.3	–	+ 178	0.19
20	Polyethylene 1,000	PE-UHMW	natural[7)]/black/green	dry	0.94	22	350	800	800	27	o. B.	o.B.	40	–	0.29	0.45	+ 133	0.38
21	Polypropylene Homopolymer	PP-H	natural[7)]/grey[7)]	dry	0.91	32	70	1,400	1,400	45	o. B.	7	70	4	0.35	11.0	+ 162	0.22
22	Polyvinylchloride	PVC-U	grey[7)]/black/red/ white	dry	1.42	58	15	3,000	–	82	o. B.	4	130	–	0.6	56.0	–	0.156
23	Polyetherketone	PEEK	natural[7)]/black	dry	1.32	95	45	3,600	4,100	160	o. B.	7	230	–	0.34	–	+ 340	0.25
24	Polyetherketone (modified)	PEEK-GL	black	dry	1.48	118	2	8,100	10,000	210	25	2.5	215	–	0.11	–	+ 340	0.24
25	Polysulfone	PSU	natural[7)]	dry	1.24	75	>50	2,500	2,700	106	o. B.	4	150	22	0.4	–	–	0.26
26	Polyether amide	PEI	natural[7]	dry	1.27	105	>50	3,100	3,300	145	o. B.	–	165	–	–	–	–	0.22

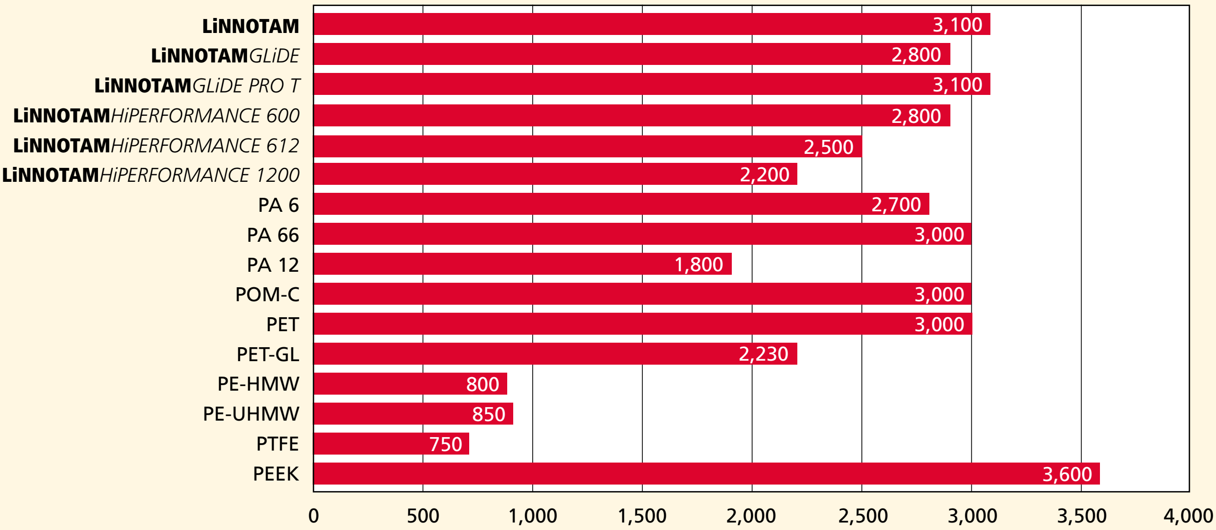
All of these values were calculated as the average of many measurements and refer to a temperature of 23 °C and 50% RF.

Thermal values					Electrical values						Miscellaneous data			
Specific thermal capacity	Coefficient of linear expansion [4]	Operating temperature range, (long-term) [5]	Operating temperature range, (short-term) [5]	Fire behaviour after UL 94 IEC 60695	Dielectric constant [6] IEC 60250	Dielectric loss facto [6]	Specific volume resistance IEC 60093	Surface resistance IEC 60093	Dielectric strength IEC 60243	Creep resistance IEC 60112	Moisture absorption in NK DIN EN ISO 62	Water absorption until saturated DIN EN ISO 62	Specific properties	No.
15	16	17	18	19	20	21	22	23	24	25	26	27	28	
c	α	–	–	–	ε_R	tan δ	ρ_D	R_o	E_d	–	$w(H_2O)$	W_s	–	
J/(g·K)	$10^{-5}\cdot K^{-1}$	°C	°C	–	–	–	Ω·cm	Ω	kV/mm	–	%	%		
1.7	7-8	-40 to +105	+ 170	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	2.2	6.5	hard, pressure and abrasion resistant can be produced in largest dimensions	1
1.7	7-8	-40 to +105	+ 160	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	2.2	6.5	as PA 6 C , except increased cristallinity	2
1.7	7-8	-40 to +105	+ 180	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	2.2	7	as PA 6 C , except heat ageing resistant	3
1.7	7-8	-40 to +105	+ 160	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	1.8	5.5	high abrasion resistance, low sliding friction	4
1.7	7-8	-40 to +105	+ 160	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	2.2	6.5	low stick-slip, very slow sliding friction	5
1.7	7-8	-40 to +105	+ 160	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	CTI 600	1.9	5.8	high impact and shock resistance, with steel core	6
1.7	7-8	-40 to +105	+ 160	HB	3.7	0.03	10^{15}	10^{13}	50/20	KA 3c	1.9	5.8	as PA 6 C , except set for high impact strength	7
1.7	10-11	-60 to +110	+ 150	HB	3.7	0.03	10^{15}	10^{13}	50/20	CTI 600	0.9	1.4	low water absorption, very good long-term rupture strength	8
1.7	8-9	-40 to +90	+ 150	HB	3.7	0.03	$10^{15}/10^{12}$	$10^{13}/10^{12}$	50/20	KA 3C/KA 3b	2.5	7.5	higher impact strength than PA 6 C	9
1.7	8-9	-30 to +100	+ 140	HB	7	0.3	$10^{15}/10^{12}$	$10^{13}/10^{10}$	50/20	CTI 600	3.0	10.0	tough, good vibration damping	10
1.7	9-10	-30 to +100	+ 150	HB	5.0	0.2	$10^{15}/10^{12}$	$10^{12}/10^{10}$	50/20	CTI 600	2.5	9.0	high abrasion resistance (similar to PA 6 C)	11
1.5	2-3	-30 to +120	+ 180	HB	3.7	0.02	$10^{14}/10^{13}$	$10^{13}/10^{12}$	60/30	CTI 475	1.5	5.5	high strength, low thermal expansion	12
2.09	11-12	-70 to +70	+ 140	HB	3.1	0.03	2×10^{15}	10^{13}	30	CTI 600	0.8	1.5	tough, hydrolysis resistance, negligible moisture absorption	13
1.45	9-10	-30 to +100	+ 140	HB	3.9	0.003	10^{15}	10^{13}	20	CTI 600	0.2	0.8	very high strength, impact resistance, low tendency to creep	14
1.21	3-4	-30 to +110	+ 140	HB	4.8	0.005	10^{15}	10^{13}	65	KA 3C/ KC >600	0.17	0.6	high strength, low thermal expansion	15
1.1	7-8	-20 to +100	+ 160	HB	3.6	0.008	10^{16}	10^{14}	50	CTI 600	0.25	0.5	tough, hard, negligible cold flow, dimensionally stable	16
–	6-7	-20 to +110	+ 160	HB	3.6	0.008	10^{16}	10^{14}	–	CTI 600	0.2	0.5	as PET, plus highest wear resistance	17
1	18-20	-200 to +260	+ 280	V-0	2.1	0.0005	10^{18}	10^{17}	40	CTI 600	0.01	< 0.01	high chemical resistance, low strength	18
0.96	13	-40 to +140	+ 160	V-0	8.0	0.165	5×10^{14}	10^{13}	25	CTI 600	< 0.04	< 0.04	resistant to UV-, b- and λ-Radiation, resistant to abrasion	19
1.84	18	-260 to +50	+ 80	HB	3.0	0.0004	$>10^{16}$	10^{14}	44	CTI 600	0.01	< 0.01	as PE-HMW, but more abrasion resistant at low friction values	20
1.7	16	0 to +80	+ 100	HB	2.25	0.00033	$>10^{16}$	10^{14}	52	CM 600	< 0.01	< 0.01	as PE-HD, but higher thermal strength	21
1.05	8	0 to +50	+ 70	V-0	3.3	0.025	10^{16}	10^{13}	39	KA 3b	< 0.01	< 0.01	good chemical resistance, hard and brittle	22
1.06	4-5	-40 to +250	+ 310	V-0	3.2	0.002	10^{16}	10^{16}	24	CTI 150	0.2	0.45	high temperature resistance, hydrolisis dimensionally stable	23
–	3	-40 to +250	+ 310	V-0	3.2	–	10^{5}	–	24.5	–	0.14	0.3	as PEEK, except higher pv-values, better sliding properties	24
1	5-6	-40 to +160	+ 180	V-0	3.0	0.002	10^{17}	10^{17}	30	CTI 150	0.4	0.8	can be sterilised in steam, hydrolisis resistant, radiation resistant	25
–	5-6	-40 to +170	+ 200	V-0	3.0	0.003	10^{18}	10^{17}	33	CTI 175	0.75	1.35	high strength and rigidity, high thermal resistance	26

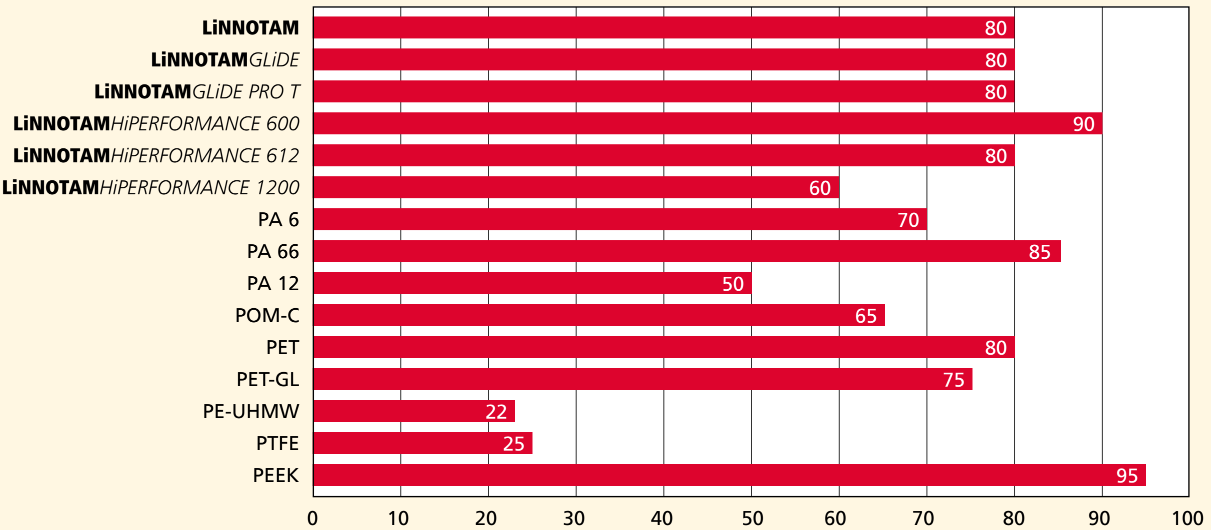
Comparison of material costs (volume prices)



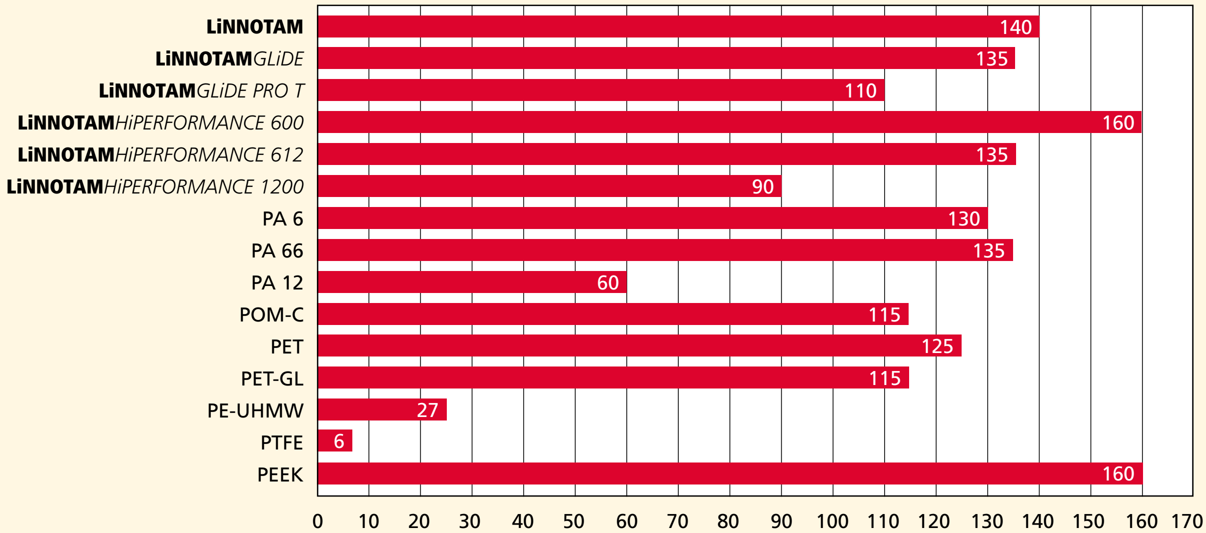
E-modulus from tensile test in MPa (short term value)



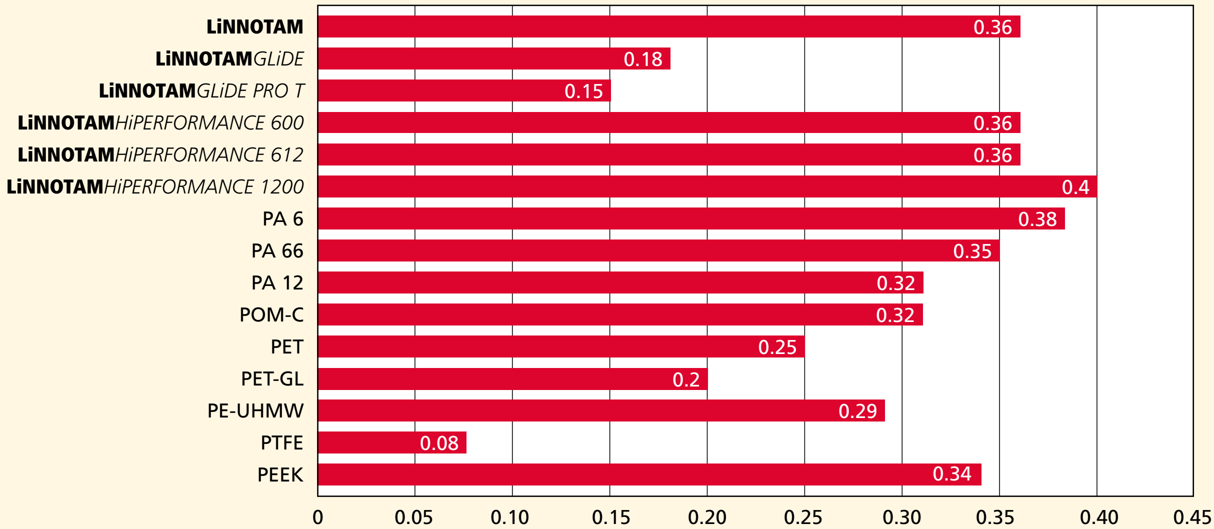
Permissible yield stress in MPa (short term value)



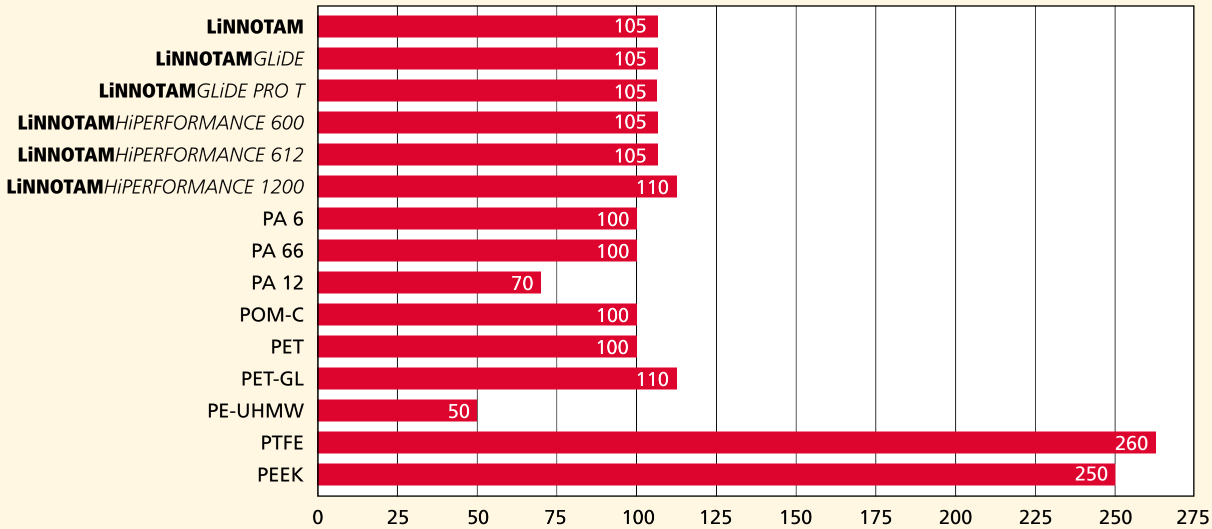
Flexural strength in MPa (short term value)



Coefficient of sliding friction against steel
(hardened and ground, P = 0.05 MPa, v = 0.6 m/s, t = 60 °C in the vicinity of the running surface)

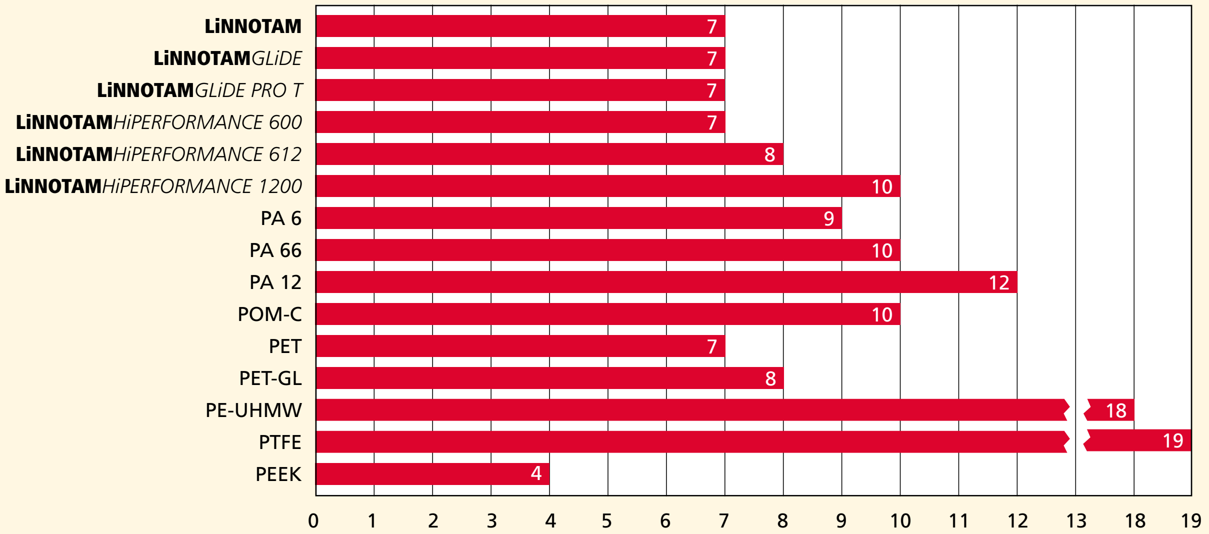


Long term service temperature in °C (in air without static load)

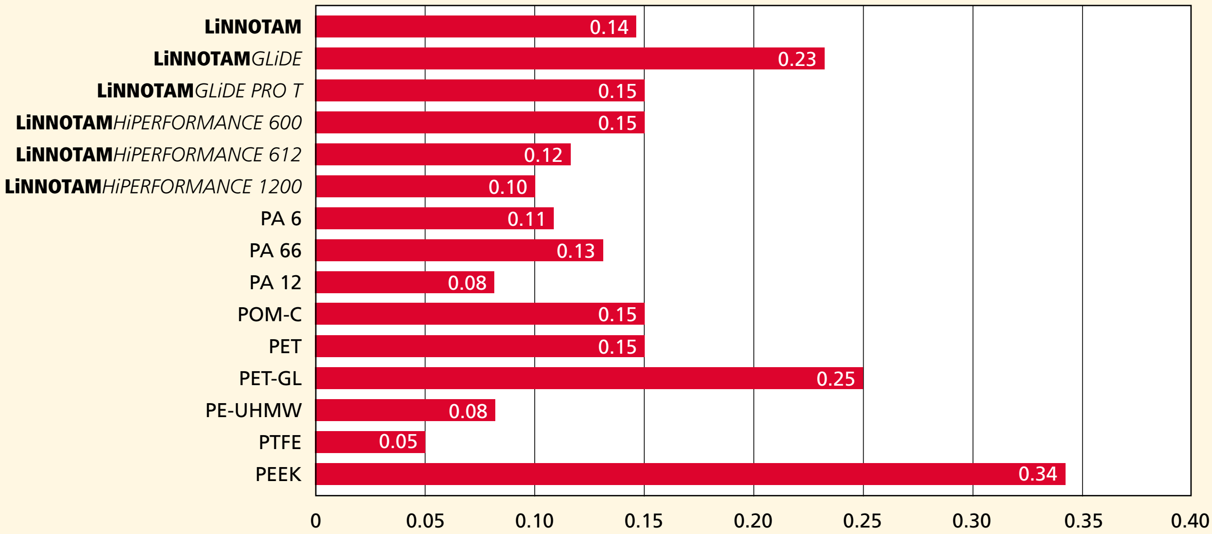


Physical material guiding values

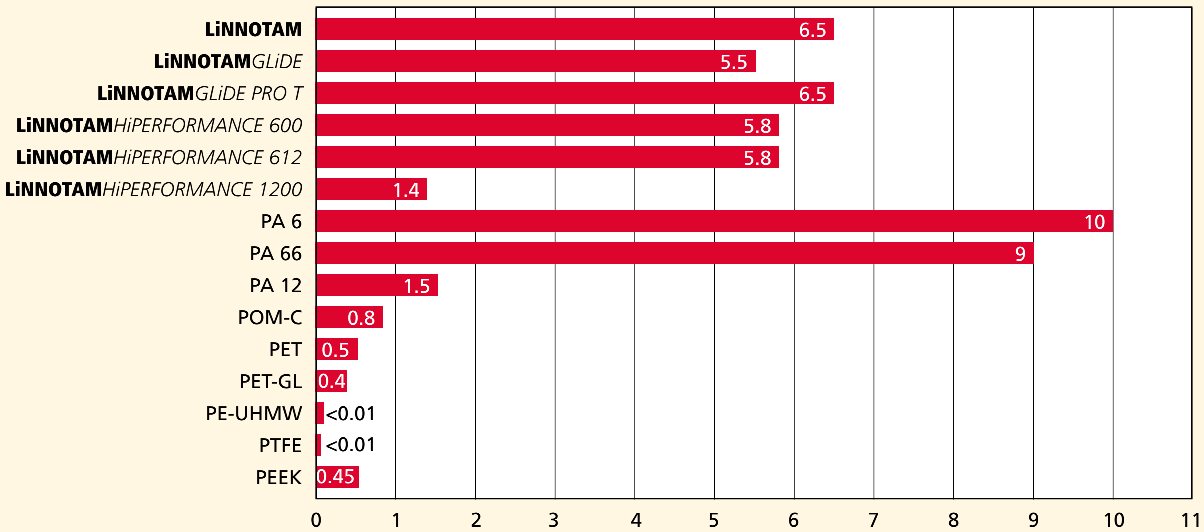
Coefficient of linear expansion ($10^{-5} \cdot K^{-1}$)



pv guiding values in MPa · m/s (dry running with integrated lubrication v = 0.1 m/s)



Water absorption until saturated in %



The information regarding chemical resistance in the following list relates to experiments in which the samples were subjected to the respective media free of external stress and loading. This is supplemented by our practical experience and, in most cases, many years of using plastics in contact with these media. Due to the variety of media, this list is just an excerpt of the data that is available to us. If the list does not contain the medium that you use, we would be happy to provide information on the resistance of our plastics on request.

When using the list, please remember that factors such as:

- deviating degrees of purity of the medium
- deviating concentration of the medium
- temperatures different to those stated
- fluctuating temperatures
- mechanical load
- part geometries, especially those that lead to thin walls or extreme differences in wall thickness
- stresses that are created by machining
- mixtures that are made up of different media
- combinations of the above factors

can have an effect on the chemical resistance.

Nevertheless, in spite of being rated as a component with »limited resistance«, a plastic component can still be superior to a metal part and can also be more practical from an economic aspect.

In the case of oxidising materials such as nitric acid and polar organic solvents, despite a chemical resistance against the medium, in many thermoplastics there is still a danger of stress cracking. Therefore for the manufacture of parts that come into contact with such media, a process should be chosen that creates as little mechanical stress as possible in the workpiece. An alternative is to decrease the stress by annealing the semi-finished products before and during the manufacturing process.

Generally it is not possible to forecast the level of resistance against mixtures of different media, even if the plastic is resistant to the individual components of the mixture.
Therefore in such a case we recommend that the material is stored and aged with the respective mixed medium under the expected environmental conditions. It is also important to remember that where parts are to be subjected to two or more media there could be an additional temperature load in the area of immediate contact due to the evolving reaction heat.

In spite of the rating »resistant«, in certain cases the surfaces of plastics can become matte or discoloured, and transparent plastics can become opaque when they come into contact with the media. However, the resistance remains intact even after these surface changes.

The information contained in the lists corresponds to our present standard of knowledge and should be regarded as standard values. If in doubt, or in the case of specific applications, we recommend that the material be aged under the expected environmental conditions to test its resistance.

Chemical resistance

		Concentration	Temperature °C	1 **LiNNOTAM**	2 **LiNNOTAM** HS	3 **LiNNOTAM** MoS	4 **LiNNOTAM***GLiDE*	5 **LiNNOTAM***GLiDE PRO T*	6 **LiNNOTAM***HiPERFORMANCE 600*	7 **LiNNOTAM***HiPERFORMANCE 612*	8 **LiNNOTAM***HiPERFORMANCE 1200*	9 **PA 6** – Polyamide 6	10 **PA 66** – Polyamide 66	11 **PA 12** – Polyamide 12	12 **POM-C** – Polyacetal – Copolymer	13 **PET** – Polyethyleneterephtalat	14 **PET-GL** – Polyethylenterephtalat/solid lubricant	15 **PTFE** – Polytetrafluoroethylen	16 **PVDF** – Polyvinyl difluorid	17 **PE-UHMW** – Polyethylene 1,000	18 **PP-H** – Polypropylene	19 **PVC-U** – Polyvinylchloride (hard)	20 **PEEK** – Polyetherketone	21 **PEEK-GL** – Polyetherketone modified	22 **PSU** – Polysulfone	23 **PEI** – Polyether amide
1	Acetal aldehyde	40	20	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	–	+	+	–	+	+	–	+
2	Acetamide	50	20	+	+	+	+	+	+	+	+	+	+	+	+	/	/	+	–	+	+	/	+	+	/	+
3	Acetone	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	○	○	+	–	+	+	–	+	+	–	–
4	Acrylnitrile	UV	RT	+	+	+	+	+	+	+	+	+	+	+	/	/	/	+	+	+	+	/	+	+	–	/
5	Alkyl alkohol	UV	RT	○	○	○	○	○	○	○	○	○	○	○	/	+	+	+	/	+	+	–	+	+	○	/
6	Aluminium chloride	10	RT	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	+	+	+	+	+	+	+
7	Formic acid	2	RT	○	○	○	○	○	○	○	○	○	○	○	+	+	+	+	+	+	+	+	+	+	/	+
8	Formic acid	UV	RT	L	L	L	L	L	L	L	○	L	L	○	–	○	○	+	+	+	+	+	○	○	–	/
9	Ammonia	10	RT	+	+	+	+	+	+	+	+	+	+	+	+	–	–	+	+	+	+	+	○	○	–	–
10	Ammonium hydroxide	30	RT	+	+	+	+	+	+	+	+	+	+	+	–	–	–	+	–	+	+	/	+	+	+	–
11	Ammoniumnitrate	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	–	–
12	Aniline	UV	RT	–	–	–	–	–	–	–	○	–	–	○	○	+	+	+	+	+	○	–	+	+	–	/
13	Antimontrichloride	10	RT	–	–	–	–	–	–	–	–	–	–	–	/	/	/	+	+	+	+	+	+	+	/	/
14	Benzaldehyde	UV	RT	○	○	○	○	○	○	○	○	○	○	○	+	+	+	+	○	+	+	–	+	+	–	–
15	Petrol, super	HÜ	40	+	+	+	+	+	+	+	+	+	+	+	+	/	/	+	+	○	○	–	+	+	○	–
16	Benzene	UV	RT	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	○	○	–	+	+	–	–
17	Benzene acid	UV	RT	–	–	–	–	–	–	–	+	–	–	+	○	+	+	+	+	+	+	+	+	+	/	/
18	Benzyl alcohol	UV	RT	○	○	○	○	○	○	○	○	○	○	○	+	+	+	+	+	+	+	/	+	+	○	–
19	Bleaching lye (12.5% AC)	HÜ	RT	–	–	–	–	–	–	–	○	–	–	○	–	+	+	+	+	+	+	+	+	+	–	+
20	Borax	WL	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	/	/	+	+	/	/
21	Boric acid	10	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
22	Hydrobromic acid	10	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	–	+	+	+	+	+	+	+	+	/
23	Hydrobromic acid	50	RT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	○	○	/	/
24	Butanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	+
25	Butyl acetate	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	/	/	+	+	–	○
26	Calcium chloride	5	RT	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	+	+	+	+	+	○	+

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27	Calcium chloride in alcohol	20	RT	–	–	–	–	–	–	–	–	L	L	–	–	+	+	+	+	+	+	/	+	+	○	+
28	Calcium hypochloride	GL	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	+	+	+	+	/	/
29	Chlorbenzene	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	○	–	+	+	L	–
30	Chloroacetic acid	UV	RT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	/	+	+	/	/
31	Chloroform	UV	RT	○	○	○	○	○	○	○	○	○	○	○	–	–	–	+	+	○	○	–	+	+	L	–
32	Chromic acid	1	RT	○	○	○	○	○	○	○	○	○	○	○	○	+	+	+	+	+	+	+	+	+	○	+
33	Chromic acid	50	RT	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	○	○	+	+	+	○	/
34	Cyclohexane	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	/
35	Cyclohexanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	–
36	Cyclohexanone	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	–	–	+	○	+	+	+	+	+	L	/
37	Dibutyl phtalate	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	○	/	/	+	+	+	○
38	Dichlorethane	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	–	–	+	+	○	○	–	+	+	L	–
39	Dichlorethylene	UV	RT	+	+	+	+	+	+	+	+	+	+	+	L	L	L	+	+	–	○	–	+	+	/	/
40	Iron(II)chlorid	GL	RT	–	–	–	–	–	–	–	–	–	–	–	○	/	/	+	+	+	+	+	+	+	–	+
41	Iron(III)chlorid	GL	RT	–	–	–	–	–	–	–	–	–	–	–	○	/	/	+	+	+	+	+	+	+	–	+
42	Vinegar	HÜ	RT	–	–	–	–	–	–	–	+	–	–	+	+	+	+	+	○	+	+	+	+	+	/	/
43	Acetic acid	5	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
44	Acetic acid	10	RT	○	○	○	○	○	○	○	+	○	○	+	○	+	+	+	+	+	+	+	+	+	+	+
45	Acetic acid	10	50	–	–	–	–	–	–	–	○	–	–	○	–	+	+	+	+	+	+	+	+	+	+	+
46	Acetic acid	95	RT	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	○	+	+	–	–
47	Acetic acid	95	50	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	○	○	○	–	+	+	–	–
48	Ethylether	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	○	–	+	+	○	+
49	Hydrofluoric acid	WL	RT	L	L	L	–	L	L	L	L	L	L	L	–	–	–	+	+	+	+	+	L	L	–	○
50	Formaldehyde	UV	RT	○	○	○	○	○	○	○	○	○	○	○	+	+	+	+	+	+	+	+	+	+	–	–
51	Glycerine	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	+
52	Fuel	HÜ	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	/	+	+	+	+	+	+	+

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53	Heptanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	○	+
54	Hexane	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	+
55	Isopropanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	○	○	+	+	+	+	+	+	+	○	/
56	Potash lye	10	RT	+	+	+	+	+	+	+	+	+	+	+	+	–	–	+	+	+	+	+	+	+	○	+
57	Potash lye	10	80	+	+	+	+	+	+	+	+	+	+	+	+	–	–	+	○	–	+	–	+	+	○	–
58	Potash lye	50	RT	○	○	○	○	○	○	○	+	○	○	+	+	–	–	+	+	+	+	+	+	+	○	–
59	Ketone (aliphatic)	UV	RT	○	○	○	○	○	○	○	○	○	○	○	+	–	–	+	/	+	/	/	+	+	/	/
60	Methanol	50	RT	+	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	+	+	+	+	○	+
61	Methanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	+	+	+	+	○	+
62	Methylene chlorid	UV	RT	–	–	–	–	–	–	–	○	–	–	○	–	–	–	+	+	○	○	L	+	+	L	L
63	Mineral oil	HÜ	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
64	Sodium hypochloride	10	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	○	+	+	+	+	/
65	Sodium lye	10	RT	+	+	+	+	+	+	+	+	+	+	+	+	○	○	+	○	+	+	+	+	+	+	○
66	Sodium lye	10	80	–	–	–	–	–	–	–	–	–	–	–	+	–	–	+	○	○	+	○	+	+	+	–
67	Sodium lye	50	RT	○	○	○	○	○	○	○	○	○	○	○	+	–	–	+	○	+	+	+	+	+	+	–
68	Sodium lye	50	80	–	–	–	–	–	–	–	–	–	–	–	+	–	–	+	○	○	+	○	+	+	+	–
69	Nitrobenzene	UV	RT	–	–	–	–	–	–	–	–	–	–	–	○	○	○	+	+	+	+	–	+	+	–	–
70	Nitrotoluene	UV	RT	○	○	○	○	○	○	○	○	○	○	○	○	+	+	+	/	+	+	–	+	+	/	/
71	Oxalic acid	10	RT	○	○	○	○	○	○	○	○	○	○	○	–	+	+	+	+	+	+	+	+	+	+	+
72	Phenol	90	RT	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	+	+	○	+	+	–	–
73	Phenol	UV	40	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	+	+	–	+	+	–	–
74	Phenol	UV	60	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	○	–	–	–	+	+	–	–
75	Phenol	UV	80	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	○	–	–	–	+	+	–	–
76	Phosphoric acid	10	RT	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	+	+
77	Phosphoric acid	25	RT	–	–	–	–	–	–	–	–	–	–	–	○	+	+	+	+	+	+	+	+	+	+	+
78	Phosphoric acid	85	RT	L	L	L	L	L	L	L	L	L	L	L	–	+	+	+	+	+	+	+	+	+	○	–
79	Propanol	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
80	Nitric acid	10	RT	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	+	+	+	+	+	+	+	+

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81	Nitric acid	10	60	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	+	–	–	–	+	+	/	/
82	Nitric acid	50	RT	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	–	–	–	○	○	+	/
83	Nitric acid	80	RT	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	○	–	–	–	○	○	+	/
84	Hydrochloric acid	10	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	+	+	+	+	+	+
85	Hydrochloric acid	20	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	+	+	+	+	+	+
86	Hydrochloric acid	30	RT	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	+	+	+	+	+	○	+
87	Sulphuric acid	40	RT	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	+	+	○	○	+	+
88	Sulphuric acid	40	60	–	–	–	–	–	–	–	–	–	–	–	–	○	○	+	+	+	+	○	–	–	○	○
89	Sulphuric acid	96	RT	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	○	○	+	L	L	L	–
90	Sulphuric acid	96	60	L	L	L	L	L	L	L	L	L	L	L	–	–	–	+	+	–	–	○	L	L	L	–
91	Carbon tetrachloride	UV	RT	+	+	+	+	+	+	+	+	+	+	+	○	+	+	+	+	–	–	–	+	+	+	+
92	Tolual	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	○	–	+	+	–	–
93	Trichlorethylene	UV	RT	○	○	○	○	○	○	○	○	○	○	○	○	○	○	+	+	○	○	–	+	+	L	–
94	Hydrogen peroxide	10	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
95	Hydrogen peroxide	20	RT	–	–	–	–	–	–	–	○	–	–	○	+	+	+	+	+	+	+	+	+	+	+	+
96	Hydrogen peroxide	30	RT	–	–	–	–	–	–	–	–	–	–	–	○	+	+	+	+	+	+	+	+	+	+	+
97	Hydrogen peroxide	30	60	–	–	–	–	–	–	–	–	–	–	–	–	+	+	+	/	○	○	○	+	+	/	/
98	Xylene	UV	RT	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	○	○	–	+	+	○	○
99	Citric acid	10	RT	○	○	○	○	○	○	○	+	○	○	+	+	+	+	+	+	+	+	+	+	+	○	+
100	Citric acid	10	50	○	○	○	○	○	○	○	○	○	○	○	–	+	+	+	+	+	+	+	+	+	○	+

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Our machining capabilities:

- CNC milling machines, workpiece capacity up to max. 3,000 x 1,000 mm
- CNC lathes, chucking capacity up to max. 1,560 mm diameter
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- CNC automatic lathes up to 100 mm diameter spindle swing
- Band saws up to dia 810 mm
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- Four-sided planers up to 125 mm thickness and 225 mm width
- Thickness planers up to 230 mm thickness and 1,300 mm width
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- Gear cutting machines for gears starting at module 0.5 to 1,500 mm
- Parts marking with print, laser, embossing or stamping
- Assembly work
- Annealing ovens for thermal treatment

We machine:

- Polyamide PA
- Polyacetal POM
- Polyethylene terephthalate PET
- Polyethylene 1,000 PE-UHMW
- Polyethylene 500 PE-HMW
- Polyethylene 300 PE-HD
- Polypropylene PP-H
- Polyvinyl chloride (hard) PVC-U
- Polyvinylidene fluoride PVDF
- Polytetrafluoroethylene PTFE
- Polyetheretherketone PEEK
- Polysulphon PSU
- Polyether imide PEI

Examples of parts:

- Rope sheaves and castors
- Guide rollers
- Deflection sheaves
- Friction bearings
- Slider pads
- Guide rails
- Gears
- Sprocket wheels
- Spindle nuts
- Curved feed tables
- Feed tables
- Feed screws
- Curved guides
- Metering disks
- Curved disks
- Threaded joints
- Seals
- Inspection glasses
- Valve seats
- Equipment casings
- Bobbins
- Vacuum rails/panels
- Stripper rails
- Punch supports

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