

# MACHINING GUIDELINES

	Turning										Milling										Drilling										Belt saw										Circular saw									
	$\alpha$	$\gamma$	$x$	$\nu$	S	$\alpha$	$\gamma$	$\nu$	$\nu$	S	$\alpha$	$\gamma$	$\nu$	$\nu$	$\phi$	$\gamma$	$\alpha$	S	$\alpha$	$\gamma$	$\nu$	$\nu$	$\alpha$	$\gamma$	$\nu$	$t$	$\alpha$	$\gamma$	$\nu$	$t$																				
	8-10	0-5	50-60	200-750	0.3-0.5	5-10	0-15	300-1000	30-120	0.1-0.5	5-10	3-5	60-100	30-120	60-100	3-5	5-10	0.1-0.5	30-40	0-5	1200	3	5-10	0-5	3000-4000	3-5	5-10	0-5	3000-4000	3-5																				
	6-10	0-5	45-60	250-500	0.1-0.5	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-20	60-90	50-150	60-90	10-20	5-15	10-0.3	20-30	2-5	500	3-8	20-30	2-5	2000	3-8	20-30	6-10	2000	3-8																				
	5-15	25-30	15	200-500	0.2-0.5	5-10	0-10	300-500	50-200	0.2-0.3	8-12	10-30	60-90	50-200	60-90	10-30	5-10	0.1-0.3	15-30	0-5	300	2-8	5-10	0-5	1000	2-5	5-10	0-5	1000	2-5																				
	5-10	0-4	15	200-300	0.1-0.2	2-10	2-10	2000	20-60	0.1-0.5	3-8	0-4	60-90	20-60	60-90	0-4	30-40	0.1-0.5	30-40	0-5	1200	3	5-10	0-5	1500-2000	3-5	5-10	0-5	1500-2000	3-5																				
	5-12	6-8	45-60	200-350	0.1-0.5	5-20	5-15	250-350	50-100	0.1-0.3	8-10	10-20	90	50-100	90	10-20	15-30	0.1-0.3	15-30	5-8	300-500	2-8	15-30	5-8	1800-2500	2-8	15-30	5-8	1800-2500	2-8																				
	6-10	0-5	45-60	200-500	0.1-0.4	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-25	90	50-150	90	10-25	15-30	0.1-0.3	15-30	0-5	300-500	2-8	15-30	0-5	1800-2500	2-8	15-30	0-8	1800-2500	2-8																				
	6-8	0-5	45-60	300-600	0.1-0.4	5-15	5-15	250-500	50-200	0.1-0.3	5-10	5-30	90	50-200	90	5-30	20-30	0.1-0.3	20-30	0-5	500-800	2-5	5-10	0-5	1000-2500	2-5	5-10	0-10	1000-2500	2-5																				
	0-15	0-15	45-60	200-500	0.1-0.5	5-15	0-15	250-500	50-100	0.1-0.3	5-16	10-30	90-110	50-100	90-110	10-30	15-40	0.1-0.3	15-40	0-8	300	2-8	10-15	0-15	1000-3000	2-5	10-15	0-15	1000-3000	2-5																				
	5-15	5-15	10	150-500	0.1-0.3	5-15	5-15	250-500	150-300	0.1-0.3	10-16	5-20	110-130	150-300	110-130	5-20	20-30	0.1-0.3	20-30	5-8	300-500	2-5	5-10	0-10	1000-2500	2-5	5-10	0-10	1000-2500	2-5																				
	6-10	0-5	45-60	250-500	0.1-0.5	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-20	60-90	50-150	60-90	10-20	20-30	0.1-0.3	20-30	2-8	500	3-8	20-30	2-8	2000	3-8	20-30	6-10	2000	3-8																				
	5-10	0-5	45-60	250-400	0.2-0.3	5-15	0-10	250-500	30-90	0.1-0.3	5-15	10-20	60-90	30-90	60-90	10-20	15-30	0.1-0.3	15-30	0-4	500	2-5	15-30	0-4	2000	2-5	15-30	0-15	2000	2-5																				
	5-10	0-10	45-60	300-400	0.2-0.3	5-15	0-10	200-400	30-90	0.1-0.4	5-15	10-20	60-90	30-90	60-90	10-20	15-30	0.1-0.4	15-30	0-4	500	2-5	15-30	0-4	2000	2-5	15-30	0-15	2000	2-5																				
	5-10	3-8	45-60	200-500	0.1-0.4	5-15	5-15	180-450	70-200	0.1-0.3	5-15	10-25	90-120	70-200	90-120	10-25	15-30	0.1-0.3	15-30	0-5	500-800	3-5	15-30	0-5	1800-2500	2-5	15-30	0-10	1800-2500	2-5																				
	6-8	2-8	45-60	150-200	0.1-0.5	15-30	6-10	80-100	80-100	0.1-0.3	6	5-10	90-120	80-100	90-120	5-10	15-30	0.1-0.3	15-30	10-15	200-300	3-5	15-30	10-15	500-1500	3-5	15-30	10-15	500-1500	3-5																				
<b>PVC</b>	8-10	0-5	50-60	200-750	0.3-0.5	5-10	0-15	300-1000	30-120	0.1-0.5	5-10	3-5	60-100	30-120	60-100	3-5	5-10	0.1-0.5	30-40	0-5	1200	3	5-10	0-5	3000-4000	3-5	5-10	0-5	3000-4000	3-5																				
<b>PP/PE-HD</b>	6-10	0-5	45-60	250-500	0.1-0.5	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-20	60-90	50-150	60-90	10-20	5-15	0.1-0.3	20-30	2-5	500	3-8	20-30	2-5	2000	3-8	20-30	6-10	2000	3-8																				
<b>ABS</b>	5-15	25-30	15	200-500	0.2-0.5	5-10	0-10	300-500	50-200	0.2-0.3	8-12	10-30	60-90	50-200	60-90	10-30	5-10	0.1-0.3	15-30	0-5	300	2-8	5-10	0-5	1000	2-5	5-10	0-5	1000	2-5																				
<b>PMMA</b>	5-10	0-4	15	200-300	0.1-0.2	2-10	2-10	2000	20-60	0.1-0.5	3-8	0-4	60-90	20-60	60-90	0-4	30-40	0.1-0.5	30-40	0-5	1200	3	5-10	0-5	1500-2000	3-5	5-10	0-5	1500-2000	3-5																				
<b>PC/PPE</b>	5-12	6-8	45-60	200-350	0.1-0.5	5-20	5-15	250-350	50-100	0.1-0.3	8-10	10-20	90	50-100	90	10-20	15-30	0.1-0.3	15-30	5-8	300-500	2-8	15-30	5-8	1800-2500	2-8	15-30	5-8	1800-2500	2-8																				
<b>PA</b>	6-10	0-5	45-60	200-500	0.1-0.4	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-25	90	50-150	90	10-25	15-30	0.1-0.3	15-30	0-5	300-500	2-8	15-30	0-5	1800-2500	2-8	15-30	0-8	1800-2500	2-8																				
<b>PDM</b>	6-8	0-5	45-60	300-600	0.1-0.4	5-15	5-15	250-500	50-200	0.1-0.3	5-10	5-30	90	50-200	90	5-30	20-30	0.1-0.3	20-30	0-5	500-800	2-5	5-10	0-10	1000-2500	2-5	5-10	0-10	1000-2500	2-5																				
<b>PET</b>	0-15	0-15	45-60	200-500	0.1-0.5	5-15	0-15	250-500	50-100	0.1-0.3	5-16	10-30	90-110	50-100	90-110	10-30	15-40	0.1-0.3	15-40	0-8	300	2-8	10-15	0-15	1000-3000	2-5	10-15	0-15	1000-3000	2-5																				
<b>PVDF</b>	5-15	5-15 <td>10</td> <td>150-500</td> <td>0.1-0.3</td> <td>5-15</td> <td>5-15</td> <td>250-500</td> <td>150-300</td> <td>0.1-0.3</td> <td>10-16</td> <td>5-20</td> <td>110-130</td> <td>150-300</td> <td>110-130</td> <td>5-20</td> <td>20-30</td> <td>0.1-0.3</td> <td>20-30</td> <td>5-8</td> <td>300-500</td> <td>2-5</td> <td>5-10</td> <td>0-10</td> <td>1000-2500</td> <td>2-5</td> <td>5-10</td> <td>0-10</td> <td>1000-2500</td> <td>2-5</td>	10	150-500	0.1-0.3	5-15	5-15	250-500	150-300	0.1-0.3	10-16	5-20	110-130	150-300	110-130	5-20	20-30	0.1-0.3	20-30	5-8	300-500	2-5	5-10	0-10	1000-2500	2-5	5-10	0-10	1000-2500	2-5																				
<b>E-GFPE</b>	6-10	0-5	45-60	250-500	0.1-0.5	10-20	5-15	250-500	50-150	0.1-0.3	5-15	10-20	60-90	50-150	60-90	10-20	20-30	0.1-0.3	20-30	2-8	500	3-8	20-30	2-8	2000	3-8	20-30	6-10	2000	3-8																				
<b>PSU/PPSU</b>	5-10	0-5	45-60	250-400	0.2-0.3	5-15	0-10	250-500	30-90	0.1-0.3	5-15	10-20	60-90	30-90	60-90	10-20	15-30	0.1-0.3	15-30	0-4 <td>500</td> <td>2-5</td> <td>15-30</td> <td>0-4 <td>2000</td> <td>2-5</td> <td>15-30</td> <td>0-15</td> <td>2000</td> <td>2-5</td> </td>	500	2-5	15-30	0-4 <td>2000</td> <td>2-5</td> <td>15-30</td> <td>0-15</td> <td>2000</td> <td>2-5</td>	2000	2-5	15-30	0-15	2000	2-5																				
<b>PEI</b>	5-10	0-10	45-60	300-400	0.2-0.3	5-15	0-10	200-400	30-90	0.1-0.4	5-15	10-20	60-90	30-90	60-90	10-20	15-30	0.1-0.4	15-30	0-4 <td>500</td> <td>2-5</td> <td>15-30</td> <td>0-4 <td>2000</td> <td>2-5</td> <td>15-30</td> <td>0-15</td> <td>2000</td> <td>2-5</td> </td>	500	2-5	15-30	0-4 <td>2000</td> <td>2-5</td> <td>15-30</td> <td>0-15</td> <td>2000</td> <td>2-5</td>	2000	2-5	15-30	0-15	2000	2-5																				
<b>PEEK</b>	5-10	3-8	45-60	200-500	0.1-0.4	5-15	5-15	180-450	70-200	0.1-0.3	5-15	10-25	90-120	70-200	90-120	10-25	15-30	0.1-0.3	15-30	0-5	500-800	3-5	15-30	0-5	1800-2500	2-5	15-30	0-10	1800-2500	2-5																				
<b>GF mod</b>	6-8	2-8	45-60	150-200	0.1-0.5	15-30	6-10	80-100	80-100	0.1-0.3	6	5-10	90-120	80-100	90-120	5-10	15-30	0.1-0.3	15-30	10-15	200-300	3-5	15-30	10-15	500-1500	3-5	15-30	10-15	500-1500	3-5																				

It is recommended to use only sharpened HSS tools(High Speed Steel.)

Due to the danger of stress cracking we do recommend to use no cooling agents oil based(for to clean the parts well after machining). Amorphous materials should be annealed during machining.

To avoid treatment problems we recommend a heating up of the materials on approx. 120 °C. Use only sharpened tools with small feed.

With these materials we should be paid attention to a good exhaust of the machining area.

# CHEMICAL RESISTANCE

	Konz. (%)	PVC-U		PP		PE-UHMW		PMMA		PS-HI		ABS		PC		PPE	
		20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C
Acetone	100	-	-	+	+0	+	+0	-	-	-	-	-	-	-	-	-	-
Formic acid	10	+	0	+	+	+	+	-	-	+	+	+	+	+	+	+	+
Ammonia	konz	+	0	+	+	+	+	+	+	+	+	+	+	-	-	+	+
Ammonium chloride		+	+	+	+	+	+	-	-	+	+	+	+	+	+	-	-
Amyl alcohol		+	0	+	+	+	+	-	-	+	0	+	-	-	-	-	-
Apple juice		+	+					+	-	+				0	0	+	+
Benzene		-	-	0	-	+	+0	-	-	-	-	-	-	-	-	-	-
Bleaching solution	12.5Cl	+	+	0	0									-	-	-	-
Boric acid	100	+	0	+	+	+	+			+	0			+			
Brake fluid		+	+	+	+	+	+			-	-	-	-	-	-	-	-
Butyl acetate		-	-	0	-	+	+	-	-	-	-	-	-	-	-	-	-
Calcium chloride		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Chlorine, gas	100	0	0	-	-			0	-	-	-	-	-	0	-	-	-
Chlorobenzene	100	-	-	+	0/-					-	-	-	-	-	-	-	-
Chloroform		-	-	0	-			-	-	-	-	-	-	-	-	-	-
Cyclohexene	100	+	0	+	-	+	+	-	-	-	-	+	-	-	-	-	+
Cyclohexanone	100	-	-	+	0/-	+		-	-	-	-	-	-	-	-	-	+
Diethylene oxide, THF		-	-	0				-	-					-	-	-	-
1,4 Dioxane	100	-	-	0/-		+		-	-	-	-	-	-	+0	-	0	
Diesel fuel		+	-	+	+	+	+	+	-	+	-	+	-	0	-	+	+
Acetic acid	100	+	-	+	0	+	+	-	-	+	-	-	-	-	-	-	+
Vinegar, standard	5-10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ethyl acetate	100	-	-	+	+0	+	+	-	-	-	-	-	-	-	-	-	+
Ethylene alcohol	96	+	0	+	+	+	+	+0	-	+	-	-	-	+0	0	+	+
Ethylene chloride	100	-	-	+0				-	-	-	-	-	-	-	-	-	-
Hydrofluoric acid	40	+	0	+	+	+	+	-	-	-	0	-	-	-	-	-	+
Formaldehyde, aqu	40	+	+	+	+	+	+	+	+	+	+	0	+	+	+	+	+
Frost protection agent		+	+	+	+	+	+			+		+		+		+	+
Glycerin	100	+	+	+	+	+	+	+		+		+	+	+0	0	+	+
Glycol	100	+	+	+	+	+	+	+		+		+		+		+	+
Heating oil		+	+	+	+0	+	+	+		+		+	+	0	+	+	+
Heptane	100	+	+	0	0	+	+0	+		+		+		+		+	+
Isopropyl alcohol	100	+	-	+	+	+	+	+0				0	-	0	-	+	+
Mercurochrome		0	-	+	0	+	+	-	-			0	-	0	-	-	+
Potassium hydroxide liquor	50	+	+	+	+	+	+	+	-	+	0	+	+0	-	-	-	+
Cresol		-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-
Linseed oil		+	+	+	+	+	+	+		+		+	+	+	+	+	+
Methyl alcohol	100	+	+0	+	+	+	+	-	-	+		-	-	-	-	-	+
Methylene chloride	100	-	-	0/-	-	0/-	-	-	-	-	-	-	-	-	-	-	-
Methyl ethyl ketone	100	-	-	+	0	+	+	-	-	-	-	-	-	-	-	-	-
Milk		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
2-Hydropropionic acid	90	+	+	+	+	+	+	+		+	+0	+0		+		-	-
Mineral oils, aromatic free		+	+	+	+0	+	+	+									
Sodium Hydrogen sulphite		+	+	+	+	+	+	+		+	0	+		+			
Sodium carbonate, aqu		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Sodium chloride, aqu		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Sodium nitrate, aqu		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Sodium thiosulfate		+	+	+	+	+	+	+		+		+	+	+	+	+	+
Sodium hydroxide liquor	15	+	+	+	+	+	+	+		+		+	+	-	-	-	+
Sodium hydroxide liquor	60	+	+	+	+	+	+	-	-	+	-	+	-	-	-	-	+
Nitrobenzene		-	-	+	+0	+	+	-	-	-	-	-	-	-	-	-	-
Oxalic acid		+	+	+	+	+	+	+		+		+	+	+	+	+	+
Ozone, gas	< 0.5 ppm	+	+	-	-	+0	-	+		+		+	+	0	-	-	-
Paraffine oil	100	+	0	+	+	+	+	+		+	+	+	+	+	+	+	+
Perchloroethylene		-	-	0	-	0	-	0		-	-	-	-	-	-	-	-
Petroleum ether	100	+	+	+	0	+	0	+		-	-	-	-	0	-	-	-
Petroleum, aromatic free	100	+	+					0		-	-	0	0/-	0	-	-	+
Phenol, aqu	ca. 9	0	-	+	+	+	+	-	-	+	0	0	-	-	-	-	-
Phosphoric acid	50	+	+	+	+	+	+	-	-	+		+	+	+	+	+	+
Propyl alcohol		+	0	+	+	+	+			+		+	-	+		+	+
Pyridine		-	-	+	+	0				-	-	-	-	-	-	-	-
Nitric acid	10	+	+	+	+	+	+	+	+	+	-	+		0	-	-	-
Nitric acid	50	+	+	-	-	0	0/-	-	-	-	-	+0	-	-	-	-	-
Hydrochloric acid	10	+	+	+	+	+	+	+		+	+	+	0/-	+	-	-	+
Hydrochloric acid	konz	+	+	+	/0	+	+	+		0	-	+0	-	0/-	-	-	+
Carbon disulphide	100	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphuric acid	96	+	+0	0/-	-	0	-	-	-	-	-	-	-	-	-	-	-
Hydrogen sulphide		+	+	+	+	+	+	+		0		+		+		+	+
Silicone oil		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Food oil		+	+	+	+	+	+			+		+		+		+	+
Carbon tetrachloride		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrahydrofurane	100	-	-	0/-				-	-	-	-	-	-	-	-	-	-
Toluene	100	-	-	+				-	-	-	-	-	-	-	-	-	-
Transformer oil		+	+	+	+0	+	+	+		+	+0	+	+0				
Fuel, aromatic free		+	+	+	+	+	+	+		-	-	+0		0	-	-	-
Premium Fuel		-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-
Trichloroethylene	100	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Water		+	+	+	+	+	+	+	+	+	+	+	+	+	+0	+	+
Hydrogen peroxide	10	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+
Xylene		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Citric acid	10											+	+				



Since almost any material is subject to aging, therefore is only a limited life the expectancy.

Following factors have influence on the chemical stability : Temperature, duration, concentration, tension level of the part mechanical strength, etc.

From the data of the list of the chemical stability the suitability of a material cannot be judged without above mentioned restrictions.

In special applications it is up to the user to determine the suitability of the plastic by running trials in real time.

+ resistant 0 partly resistant - non-resistant

PA 6		PA 6.6		POM		PET		PVDF		E-CTFE		PSU		PPSU		PEI		PEEK		
20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	20 °C	60 °C	
0	0	0	0	+	0	0	-	+/0	-	+	+	-	-	-	-	-	-	+	+	
-	-	-	-	+	-	+	0	+	+	+	+						-	-	0	0
+/0	-	+/0	-	+	+	0	-	+	+	+	+	0					-	-	+	0
+		+		+/0	0			+	+	+	+						+	+	+	+
+		+		+				+	+									+		+
+		+		+				+	+								+			+
+	+	+	+	0	0	0	-	+	+	+	+	-	-	0	0				+	
-	-	-	-	-	-			0		+	+									
+/0	0	+/0	0	0/-	-			+	+	+	+	+							+	+
+	+	+	+	+		+	+	+	+	+	+						+	+	+	
+	+	+	+	+	0	+	+	+	-	+	+	+	+	+	+	+/0			+	
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
-	-	-	-					+	+	+	+								+	
+				0	0	-	-	+	+	+	+	-	-					+	+	
-	-	0	0/-	-	-	-	-	+	+			-	-					+		
+		+		+				+	+	+	+	+		+						
+		+		+				+	0	+	0								+	
+		+		+	+	+		+	+			+		+					+	
+	+	+	+	0	0	0		0	-	+	+							+	+	
+	+	+	+	+	+	+	+	+	+	+	+	+	+					+	+	+
-	-	-	-	0	-	-	-	+	0	+	+	+	+					+	+	+
+		+		+	+	+	0	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	0	0	+	+	+	+	+	+	+	+					+	+	+
-	-	-	-	0	-	-	-	+	0	+	+	+	+					+	+	+
+		+		+	+	+	0	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	0	0	+/0	-	+	0			-	-					+	+	+
+	+	+	+	+	0	+	+	+	+	+	+	+	+	+	+			+	+	+
+		+				0/-	-	+	+	+	+							+	+	+
-	-	-	-	-	-	-	-	+	+	+	+	0	0/-					-	-	-
+	+	+	+	+	+			+	+	+	+			+				+	+	+
+	+	+	+	+	+		0	+	+	+	+	+						+	+	+
+	0	+	0	+	+	+	0	+	+	+	+	+	+					+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+						+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+					+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	0	+	+			+/0		+				+	+	+
-	-	-	-	-	-			+	+	+	+									0
0	0	0	0	0																+
+		+		0	0	+	+	+	+	+	+									+
+	+	+	+	+	+	+	+	+	+	+	+	+	-	0	0	+	+	+	+	+
-	-	-	-	-	-			+/0	0											+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			+	+	+
+/0	-	+/0	-	+	-	+	0	+	+	+	+	+	0					+	+	+
+	+	+	+	+	+	0	-	+	+/0	+	+	-	-	+	0	+			+	+
				0	-	+	0	+	+	+	+	+	+	+	+			+	+	+

# TECHNICAL PROPERTIES I

	Test method	Unit	CAST NYLON							
			nat. blue	black	+MoS2	+Oil	+Wax	+Lube	+GF	AST
<b>Physical Properties</b>	<b>물리적 특성</b>									
1. Specific gravity(p)	ISO 1183	g/cm <sup>3</sup>	1.16	1.14	1.14	1.14	1.14	1.30	1.23	
2. Water absorption	DIN 53495	%	3.00	2.70	0.30	0.7	0.30	2.10	2.20	
3. Max. permissible service temperature (no stronger mech. stress involve)	-	-	-	-	-	-	-	-	-	-
upper temperature limit	-	°C	110	100	110	110	110	100	100	
lower temperature limit	-	°C	-40	-40	-40	-40	-40	-40	-40	
<b>Mechanical Properties</b>	<b>기계적 특성</b>									
1. Tensile strength at yield ( $\sigma_s$ )	ISO 527	MPa	85	77.7	69.7	80	81.5	89	80	
2. Elongation at yield ( $\epsilon_s$ )	ISO 527	%	-	-	-	-	-	-	-	
3. Tensile strength at break ( $\sigma_R$ )	ISO 527	MPa	-	-	-	-	-	-	-	
4. Elongation at break ( $\epsilon_R$ )	ISO 527	%	>20	>20	>20	>20	>20	-	-	
5. Impact strength ( $\alpha_n$ )	ISO 179	KJ/m <sup>2</sup>	3.4	3.4	4.9	-	5.4	-	3.0	
6. Notch impact strength ( $\alpha_k$ )	ISO 179	KJ/m <sup>2</sup>	6.0	6.5	6.3	-	4.3	-	-	
7. Ball indentation hardn.(H <sub>k</sub> )/ Rockwell	ISO 2039-1	MPa	115	110	119	-	118	-	120	
8. Flexural strength( $\sigma_b$ 3.5%)	DIN 53505	MPa	85	85	96	-	100	-	111	
9. Modulus of elasticity(Et)	ISO 178	MPa	2700	2243	2387	-	2419	-	-	
<b>Thermal Properties</b>	<b>열적 특성</b>									
1. Vicat softening temp. VST/B/50	ISO 306	°C	-	-	-	-	-	-	-	
VST/A/%0		°C	-	-	-	-	-	-	-	
2. Heat deflection temperature HDT/B	ISO 75	°C	215	205	-	-	211	220	217	
HDT/A		°C	70	-	71	-	-	105	-	
3. Cof. of linear therm. expansion ( $\alpha$ )	DIN 53752	K <sup>-1</sup> × 10 <sup>-4</sup>	-	-	-	-	-	-	-	
4. Thermal conductivity at 20 °C ( $\lambda$ )	DIN 52612	W/(m × K)	0.25	0.25	-	-	-	-	-	
<b>Electrical Properties</b>	<b>전기적 특성</b>									
1. Volume resistivity( $\rho_D$ )	VDE 0303	$\Omega \times \text{cm}$	9.1 × 10 <sup>13</sup>	7 × 10 <sup>15</sup>	7.4 × 10 <sup>16</sup>	-	5.6 × 10 <sup>14</sup>	9.1 × 10 <sup>13</sup>	1.5 × 10 <sup>7</sup>	
2. Surface resistivity ( $R_o$ )	VDE 0303	$\Omega$	>10 <sup>13</sup>	>10 <sup>13</sup>	>10 <sup>12</sup>	>10 <sup>12</sup>	10 <sup>12</sup>	≥10 <sup>13</sup>	-	
3. Dielectric constant at 1MHz( $\epsilon_r$ )	DIN 53483		7.42	-	3.08	-	-	3.12	-	
4. Diel. loss factor at 1 MHz ( $\tan \delta$ )	DIN 53483		0.175	-	0.018	-	-	0.02	-	
5. Dielectric strength	VDE 0303	kV/mm	20.4	-	22.4	25	25	25.0	-	
6. Tracking resistance	DIN 53483		KB 600	-	KB 600	KB 600	KB 600	KB 600	-	
<b>Additional Data</b>	<b>기타</b>									
1. Bondability										
2. Friction coefficient	DIN 53375		0.40	0.22	0.15	-	0.10	-	-	
3. Flammability	UL 94		HB	HB	HB	HB	HB	HB	HB	
4. UV stabilisation										

1) The physical data contained in this table are typical values. They are obtained on the test specimens under specific conditions and represent average values of a large number of tests. The results obtained on this test specimens cannot be applied to finished parts without reservations, as behavior is influenced by processing and shaping.

Reproduction only with our declared permission.

2) Corresponding

3) 65(solid rod 160-200mm  $\phi$ ) 57 (solid rod 220-300mm  $\phi$ )

4) 59(solid rod 160-200mm  $\phi$ ) 51 (solid rod 220-300mm  $\phi$ )

5) For rods up to 160mm  $\phi$ , tubes and profiles on request.

6) The materials PE-HD and PP are admitted by DIBt.

POM-C	POM TX-11H	POM FL2020	POM ES-20	POM ET-20S	POM ELS	POM ESD	HDPE	PE-UHMW	PP	Hipro <sup>h</sup> PP-30GF	PP ELS	ABS
1.39	1.40	1.51	1.36	1.38	1.38	1.33	0.95	0.93	0.91	1.14	0.95	1.04
0.2	0.22	0.18		0.22	0.3	0.3	0.01	0.01	0.01	-	0.1	0.4
-					-	-	DIN 8075	DIN 8075	-	-	-	-
110					110	110	90	90	100	100	100	70
-50					-50	-50	-50	-150	5	5	5	-50
63	62	45	50	40	41	45	22	17	33	57	38	41
10					10	10	11	20	14	-	4	4
-					-	-	31	40	-	85	-	35
31					-	-	≥600	≥350	≥50	3	-	45
o.B.					-	50	o.B.	o.B.	o.B.	22	o.B.	o.B.
6	8	3.8	12	5	-	4	20	o.B.	13	6	o.B.	37
135	80	70		67	-	100	40	36	71	110	-	84
-	84	67	70		59	52	30	27	-	120	-	70
2600	2600	2140	2000	2600	2690	1650	900	680	1450	6500	2200	2100
150					-	130	74	80	83	130	-	98
-					-	-	125	-	-	160	-	-
155	158				-	-	70	65	95	155	-	97
95	110	95			82	71	41	42	-	140	-	-
1.1	1.3	1.3		1.3	-	1.3	1.55	2	1.5	0.7	-	1
0.31					-		0.43	0.42	0.22	0.27	-	0.25
≥10 <sup>13</sup>	1 × 10 <sup>14</sup>	1 × 10 <sup>14</sup>		5 × 10 <sup>1</sup>	≤10 <sup>3</sup>	≤10 <sup>10</sup>	≥10 <sup>15</sup>	≥10 <sup>14</sup>	≥10 <sup>16</sup>	≥10 <sup>14</sup>	50	≥10 <sup>14</sup>
≥10 <sup>13</sup>	1 × 10 <sup>16</sup>	1 × 10 <sup>16</sup>	1 × 10 <sup>5</sup>	1 × 10 <sup>2</sup>	≤10 <sup>6</sup>	≤10 <sup>10</sup>	≥10 <sup>16</sup>	≥10 <sup>12</sup>	≥10 <sup>16</sup>	≥10 <sup>13</sup>	≤10 <sup>6</sup>	≥10 <sup>13</sup>
3.8		3.10			-	-	23	3	2.3	2.6	-	2.8
0.005		0.009			-	-	0.0002	0.0001	0.0002	-	-	0.01
40		16			-	-	17	45	-	40	-	150
CTI 600					-	-	KB ≥600	KB ≥600	KB ≥600	KB ≥600	-	KB ≥600
+					+	+	0	-	0	0	0	+
0.35	0.22				-	-	0.3	0.25	0.3	-	-	0.5
HB	HB				HB	HB	HB	HB	HB	HB	HB	HB
0					0	0	0	-	0	0	0	-

o.B. no break + yes o limited - no

# TECHNICAL PROPERTIES II

		Test method	Unit	PC	UNILATE PC series	PVC-U	PVC-C	PVC HI	PVC ELS	
<b>□ . Physical Propertis</b>	<b>□ . 물리적 특성</b>									
1. Specific gravity(p)	1. 비중	ISO 1183	g/cm <sup>3</sup>	1.2	1.63	1.36	1.55	1.38	1.41	
2. Water absorption	2. 수분 흡수율	DIN 53495	%	0.35	0.10	0.2	0.2	0.2	-	
3. Max. permissible service temperature (no stronger mech. stress involve) upper temperature limit lower temperature limit	3. 사용온도  최고 최저	- - -	- °C °C	- 120 -150	- - 120	- 60 -15	DIN 8061 DIN 8061 -15	DIN 8061 DIN 8061 -15	DIN 8061 DIN 8061 -40	- 60 -15
<b>□ . Mechanical Properties</b>	<b>□ . 기계적 특성</b>									
1. Tensile strength at yield ( $\sigma_s$ )	1. 인장강도	ISO 527	MPa	65	-	55	57	49	40	
2. Elongation at yield ( $\epsilon_s$ )	2. 항복점	ISO 527	%	-	-	3	3	10	4	
3. Tensile strength at break ( $\sigma_R$ )	3. 장력	ISO 527	MPa	-	-	30	80	30	36	
4. Elongation at break ( $\epsilon_R$ )	4. 파단점	ISO 527	%	110	-	33	15	30	20	
5. Impact strength ( $\alpha_n$ )	5. 충격강도	ISO 179	KJ/m <sup>2</sup>	o.B.	64	o.B.	o.B.	o.B.	-	
6. Notch impact strength ( $\alpha_k$ )	6. IZOD 충격강도	ISO 179	KJ/m <sup>2</sup>	30	64	3	8	10	5	
7. Ball indentation hardn.(H <sub>k</sub> )/ Rockwell	7. Rockwell 경도	ISO 2039-1	MPa	110	120	120	150	100	-	
8. Flexural strength( $\sigma_b$ 3.5%)	8. 굴곡강도	DIN 53505	MPa	85	-	90	90	80	-	
9. Modulus of elasticity(Et)	9. 탄성율	ISO 178	MPa	2300	-	3000	3000	2600	3000	
<b>□ . Thermal Properties</b>	<b>□ . 열적 특성</b>									
1. Vical softening temp. VST/B/50 VST/A/%0	1. 연화점	ISO 306	°C	150	-	75 <sup>3)</sup>	105	78	-	
2. Heat deflection temperature HDT/B HDT/A	2. 열변형 온도	ISO 75	°C	137	235	75 <sup>4)</sup>	102	69	-	
3. Cof. of linear therm. expansion ( $\alpha$ )	3. 선팽창계수	DIN 53752	K <sup>-1</sup> × 10 <sup>-4</sup>	0.65	-	0.8	0.6	0.8	-	
4. Thermal conductivity at 20 °C ( $\lambda$ )	4. 열전도도	DIN 52612	W/(m ×K)	0.21	0.51	0.14	0.14	0.17	-	
<b>□ . Electrical Properties</b>	<b>□ . 전기적 특성</b>									
1. Volume resistivity( $\rho_D$ )	1. 체적저항	VDE 0303	$\Omega \times \text{cm}$	$\geq 10^{17}$	$1 \times 10^{11}$	$\geq 10^{15}$	$\geq 10^{15}$	$\geq 10^{15}$	$7.3 \times 10^3$	
2. Surface resistivity ( $R_o$ )	2. 표면저항	VDE 0303	$\Omega$	-	$1 \times 10^{15}$	$\geq 10^{13}$	$\geq 10^{13}$	$\geq 10^{13}$	$\leq 10^6$	
3. Dielectric constant at 1MHz( $\epsilon_r$ )	3. 유전율	DIN 53483		3	3.80	3	3	3	-	
4. Diel. loss factor at 1 MHz( $\tan \delta$ )	4. 유전정점	DIN 53483		0.008	0.025	0.01	0.01	0.01	-	
5. Dielectric strength	5. 유전파괴전압	VDE 0303	kV/mm	27	37	20-40	20-40	20-40	-	
6. Tracking resistance	6. 내 트래킹 저항	DIN 53483		CTI 250	-	KB 600	KB 600	KB 600	-	
<b>□ . Additional Data</b>	<b>□ . 기타</b>									
1. Bondability	1. 접착성			+	-	+	+	+	+	
2. Friction coefficient	2. 마찰계수	DIN 53375		0.55	-	0.6	0.6	0.6	0.6	
3. Flammability	3. 연소성	UL 94		HB	HB	V-0	V-0	V-0	V-0	
4. UV stabilisation	4. UV 안정성			-	-	0	-	0	-	

1) The physical data contained in this table are typical values. They are obtained on the test specimens under specific conditions and represent average values of a large number of tests. The results obtained on this test specimens cannot be applied to finished parts without reservations, as behavior is influenced by processing and shaping.

Reproduction only with our declared permission.

2) Corresponding

3) 65(solid rod 160-200mm  $\phi$ ) 57 (solid rod 220-300mm  $\phi$ )

4) 59(solid rod 160-200mm  $\phi$ ) 51 (solid rod 220-300mm  $\phi$ )

5) For rods up to 160mm  $\phi$ , tubes and profiles on request.

6) The materials PE-HD and PP are admitted by DIBt.

PPE	PPE-30GF	PA 6	PA 6.6	PET	PVDF	E-CTFE	PSU	PPSU	PEI	PEI-30GF	PEEK	PEEK-mod	PEEK-30GF
1.06	1.28	1.13	1.13	1.39	1.77	1.68	1.24	1.29	1.27	1.51	1.32	1.48	1.49
0.23	0.2	3	2.8	0.2	≤0.04	≤0.1	0.23	0.35	0.25	0.9	0.5	0.06	0.11
-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	110	70	101	110	150	150	160	180	170	170	260	260	260
-50	-50	-40	-30	-20	-30	-76	-100	-50	-	-	-40	-40	-40
55	-	90/45	80/60	90	50	30	70	76	105	169	97	141	156
5	-	45/20	40/150	-	9	-	55	-	6	-	4.9	-	3
50	105	-	-	>50	46	54	-	-	85	159	-	118	157
3	2	≥50	-	15	80	250	50-100	30	60	3	≥60	3	2.7
o.B.	25	o.B.	o.B.	o.B.	252	o.B.	o.B.	o.B.	o.B.	-	o.B.	27.5	40
15	8	9/o.B.	-	-	22	o.B.	5.3	58	6	8	8.2	6.3	8.9
100	130	160/70	170/100	170	80	R90	M69	M80	M109	M114	M99	-	M103
75	125	77	-	-	80	49	106	91	145	228	170	210	250
2300	8000	3000/1000	3100/2000	3700	2000	1690	2460	2300	3200	9310	3660	8100	10300
135	145	-	-	-	140	-	188	-	211	227	250	-	300
-	-	204	-	-	160	-	185	-	215	-	-	-	-
130	150	160	200	-	145	90	181	214	200	212	240	293	340
115	140	65	100	75	90	63	174	207	190	210	152	277	315
0.6	0.7	0.85	0.80	0.8	1.2	0.8	0.56	0.55	0.56	-	0.47	0.22	0.22
0.22	0.28	0.28	0.23	0.29	0.13	0.15	0.26	0.35	0.24	-	0.25	0.24	0.43
≥10 <sup>15</sup>	≥10 <sup>15</sup>	≥10 <sup>13</sup> / ≥10 <sup>10</sup>	≥10 <sup>13</sup> / ≥10 <sup>10</sup>	≥10 <sup>15</sup>	≥10 <sup>13</sup>	≥10 <sup>15</sup>	≥10 <sup>13</sup>	≥10 <sup>13</sup>	≥10 <sup>13</sup>	≥10 <sup>13</sup>	4.9 × 10 <sup>16</sup>	≥10 <sup>5</sup>	≥10 <sup>13</sup>
≥10 <sup>13</sup>	≥10 <sup>13</sup>	- / ≥10 <sup>10</sup>	- / ≥10 <sup>10</sup>	≥10 <sup>14</sup>	≥10 <sup>14</sup>	≥10 <sup>12</sup>	≥10 <sup>15</sup>	≥10 <sup>15</sup>	≥10 <sup>15</sup>	≥10 <sup>15</sup>	≥10 <sup>15</sup>	≥10 <sup>7</sup>	≥10 <sup>13</sup>
2.6	2.9	3.5/7	3.6/5	3.2	7.25	2.6	3.93	3.5	2.9	3.4	3.2	-	3.3
0.001	0.0015	0.031/0.3	0.026/0.2	0.041	0.18	-	0.003	0.005	0.0013	0.0023	0.003	-	0.004
19	22	20-50	30-50	22	22	21	17	15	33	35	19	24.5	175
CTI 175	CTI 325	CTI 600	CTI 600	CTI 600	CTI 300	CTI ≥600	CTI 150	-	CTI 150	CTI 150	CTI 150	-	-
+	+	+	+	+	0	0	+	+	+	+	+	0	+
0.35	-	0.38-0.45	0.35-0.42	0.25	0.34	0.3	0.4	-	-	-	0.34	0.11	0.42
HB	V-1	HB	V-2	HB	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0	V-0
0	0	-	-	-	+	+	-	+	+	0	0	+	0

o.B. no break + yes o limited - no