

Comparative Physical Properties: LEP Engineering Plastics

LEP: ENGINEERING PLASTICS

Properties	Test Methods			Units	uhmwpe 1000	uhmwpe 1000BR	Tivar-88®	hmwpe	hdpe	nylon 6SA extruded	nylon 6PLA cast	nylon 66SA	nylon LFX	Nylatron® GSM	Nylatron® GS	Nylatron® NSM	Nylatron® MC901	nylon 4.6	acetal C	acetal H	acetal-U	petp natural	petp TX	polyprop	abs	pvc	acrylic pmma	polycarb
	ISO	DIN	ASTM																									
Colour	-	-	-	-	white	black	blue	white	white assorted	white black	ivory black	white black	green	grey-black	grey-black	grey	blue	red-brown	white black	white black	blue	white black	pale grey	natural black	white black	grey	clear	clear
Density	1183	53479	D792	g/cm³	0.93	0.93	0.944	0.95	0.95	1.14	1.15	1.14	1.135	1.16	1.15	1.14	1.15	1.8	1.41	1.43	1.34	1.39	1.44	0.9	1.04	1.36	1.19	1.2
Food grade					Y	N	N	Y	Y	Y	Y/N	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	N	Y/N	Y	Y
UV resistance (1 = very poor; 10 = excellent)					1	6	2	1	1	5	5	5	5	6	6	5	5	4	1	1	1	6	6	1	2	3	4	4
Water absorption:					79	-	-	78	67	-	-	-	-	-	-	-	-	-	-	-	-	-	73	-	-	-	-	-
- after 24/96 h immersion in water of 23°C (1)	62	53495	D570	mg	-	-	-	0.43	0.43	86/168	44/83	40/76	44/83	52/98	46/85	40/76	49/93	90/180	20/37	18/36	-	6/13	5/11	-	-	-	30/-	13/23
- at saturation in air of 23°C/50%RH	62	53495	D570	%	-	-	-	-	-	1.28/1.5	0.65/1.22	0.6/1.13	0.66/1.24	0.76/1.43	0.68/1.22	0.59/1.12	0.72/1.37	1.30/2.60	0.24/0.45	0.21/0.43	-	0.07/0.16	0.06/13	-	0.4	0.2	-	0.18/0.33
- at saturation in water of 23°C (2)				%	-	-	-	-	-	2.6	2.2	2.4	2	2.4	2.3	2	2.3	2.8	0.2	0.2	0.14	0.25	0.23	-	-	-	-	0.15
				%	0.01	0.02	nil	-	-	9	6.5	8	6.3	6.7	7.8	6.3	6.6	9.5	0.85	0.85	0.8	0.5	0.47	0.01	-	-	-	0.35
Thermal (3) (2)																												
Melting temperature			D3417	°C	137-143	137-143	137-143	-	-	220	220	255	220	220	255	220	220	295	165	175	166	255	255	-	-	-	-	-
Vicat softening point VST/B/50	306	53460	D1525	°C	-	-	-	-	125	-	-	-	-	-	-	-	-	-	-	-	140	-	-	98	75	115	150	
Thermal conductivity at 23°C		53752	D696	W/(K·m)	0.4	0.4	-	-	-	0.28	0.29	0.28	0.28	0.3	0.29	0.29	0.29	0.3	0.31	0.31	-	0.29	0.29	0.22	-	0.14	-	0.21
Co-efficient of linear thermal expansion:																												
- average value between 23 and 60°C				m/(m·K)	-	-	-	-	-	90×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	80×10 ⁻⁶	110×10 ⁻⁶	95×10 ⁻⁶	140×10 ⁻⁶	60×10 ⁻⁶	65×10 ⁻⁶	100×10 ⁻⁶	80×10 ⁻⁶	70×10 ⁻⁶	65×10 ⁻⁶	
- average value between 23 and 100°C				m/(m·K)	200×10 ⁻⁶	200×10 ⁻⁶	180×10 ⁻⁶	200×10 ⁻⁶	200×10 ⁻⁶	105×10 ⁻⁶	90×10 ⁻⁶	95×10 ⁻⁶	90×10 ⁻⁶	125×10 ⁻⁶	110×10 ⁻⁶	-	80×10 ⁻⁶	85×10 ⁻⁶	200×10 ⁻⁶	-	-	-	-					
Temperature deflection under load:																												
- Method A: 1.8MPa	+	75		°C	42	42	-	-	-	70	80	85	75	80	85	75	80	160	105	115	84	75	75	-	-	-	-	130
Max allowable service temperature in air:																												
- for short periods (4) (4)				°C	120	120	-	-	-	160	170	180	165	170	180	165	170	200	140	150	140	160	160	-	-	-	-	135
- continuously for 5,000/20,000 h (5) (5)				°C	-80	-80	-	-80	-80	85/70	105/90	95/80	105/90	105/90	95/80	105/90	105/90	155/135	115/100	105/90	100	115/100	115/110	-	70	60	65	125/115
Minimum service temperature (6) (6)				°C	-200	-150	-	-100	-	-40	-40	-30	-20	-30	-20	-30	-30	-40	-50	-50	-	-20	-20	-	-50	-15	80	-60
Flammability (8) (7):																												
- oxygen index	4589			%	<20	<20	-	-	-	25	25	26	-	25	26	-	25	24	15	15	-	25	25	-	-	-	-	25
- according to UL94 (3/6mm thickness)				HB(1.6thk)	HB(1.6thk)	-	-	HB	HB	HB/HB	HB/HB	HB/V-2	HB/HB	HB/HB	-	HB/HB	HB/HB	HB	HB	V-0	-	25						
Mechanical at 23°C (9) (8)																												
Tension test (10) (9):																												
- tensile strength at yield /				Mpa	19/-	22/-	22.4/38.6	28/36	23/32	76/-	85/-	90/-	70/-	78/-	92/-	76/-	81/-	100/-	68/-	78/-	43	90/-	-76	26	41/35	55/30	70/-	70/-
- tensile strength at break (11) (10)	+	527	53455	Mpa	-	-	-	-	-	45/-	45/-	55/-	45/-	50/-	55/-	50/-	55/-	55/-	68/-	78/-	-	90/-	-76	-	-	-	-	70/-
- tensile strain at break (11) (10)	++	527		%	>50	>50	-	>50	-	>50	25	>40	25	25	20	25	35	25	35	35	-	15	7	-	-	-	-	>50
- tensile modulus of elasticity (12) (11)	+	527	53457	Mpa	750	950	744	1200	800	3250	3500	3450	3000	3300	3500	3100	3200	3300	3100	3600	2200	3700	3450	1150	2100	3000	3300	2400
	++	527		Mpa	-	-	-	-	-	1400	1700	1650	1450	1600	1675	1500	1550	1300	3100	3600	-	3700	3450	-	-	-	2400	
Creep test in tension (9):																												
- stress to produce 1% strain in 1,000 h (σ 1/1,000)	+	899		Mpa	-	-	-	-	-	18	22	20	18	21	21	18	21	22	13	15	-	26	23	-	-	-	-	17
	++	899		Mpa	-	-	-	-	-	7	10	8	8	9	9	8	9	7.5	13	15	-	26	23	-	-	-	17	
Charpy impact strength - unnotched (14) (13)	+	179/1eU	53453	kJ/m²	no break	no break	-	10	10	no break	no break	no break	≥50	no break	no break	≥100	no break	no break	≥150	≥200	50	≥50	40	40	-	-	no break	
Charpy impact strength - notched (15)	+	179/1eA		kJ/m²	110P	≥90P	-	>20	-	5.5	3.5	4.5	4	3.5	4	4	3.5	8	7	10	5	2	2.5	-	37	3	9	
Izod impact strength - notched	+	180/2A		kJ/m²	-	-	-	-	-	5.5	3.5	4.5	4	3.5	4	4	3.5	8	7	10	-	2	2.5	-	-	-	9	
	++	180/2A		kJ/m²	-	-	-	-	-	15	7	11	7	7	9	7	25	7	10	-	2	2.5	-	-	-	-	9	
Ball indentation hardness (14)	+	2039-1	53456	N/mm²	36	36	-	46	40	150	165	160	145	160	165	150	160	165	140	160	110	170	160	67	84	120	120	
Rockwell hardness (14)	+	2039-2			-	-	-	-	-	M85	M88	M88	M82	M84	M88	M81	M85	M92	M84	M88	-	M96	M94	-	-	-	-	M75
Shore hardness D (3/15s)	+	868			68	64-70	69	64	60	-	-	-	-	-	-	-	-	-	-	-	-	-	66	-	-	-	-	
Co-efficient of friction																												
- dynamic (16) (16)			D1984		0.13	0.13-0.17	0.11	-	-	0.25-0.4	0.25-0.4	0.25-0.4	0.15-0.25	0.16-0.25	0.16-0.25	0.13-0.23	-	0.4	0.3-0.4	0.3-0.4	0.15-0.25	0.25-0.35	0.15-0.25	-	-	-	-	
Sand slurry - uhmwpe 1000 grade =100				[µm/Km lost]	100	110	80	300	600	-	160	150	-	-	-	-	-	-	728	-	-	610	-	550	-	950	1800	650
Wear @ 3N/mm² 0.33m/sec					8	-	-	160	-	19	12	14	4.5	11	12-	4.5	12	-	45	45	34	3	2	-	-	-	3000	
Wear @ 9.4N/mm² 0.33m/sec					-	-	-	-	-	-	-	47	18	-	-	-	-	-	>150	>150	37	7	7	-	-	-	-	
Compression test (13) (12):																												
- compressive stress at 1/2/5% nominal strain (11)	+	604		Mpa	4.5/8/14	6/10.5/18	-	-	-	24/46/80	26/51/92	25/49/92	22/43/79	25/49/88	25/49/92	23/44/81	24/47/86	23/45/94	19/35/67	22/40/75	-	26/51/103	24/47/95	-	-	-	-	18/35/72
Electrical at 23°C																												
Electric strength (1mm thickness)	+	60243		kV/mm	45	-	-	-	-	25	25	27	22	24	26	25	25	25	20	20	35	22	21	-	-	-	-	28
	++	60243																										