3D PRINTING TECHNOLOGIES, MATERIALS & APPLICATIONS FOR POLYMERS

PROTOTAL GROUP

SLS	SAF™	MJF	FDR	SLA	FDM	PolyJet™
Selective Laser Sintering	Selective Absorption Fusion	Multi Jet Fusion	Fine Detail Resolution	Stereolithography	Fused Depostion Modelling	Material Jetting
Technology Application						
SLS, SAF™, MJF and FDR are all part of the powder bed fusion technology branch within industrial 3D printing. This branch of technologies has high dimensional accuracy, is used for various applications, and can supplement traditional manufacturing technologies in small- to mid-sized serial production			FDR is also a powder bed fusion technology based on SLS. However, FDR excells at very small parts with very fine details	SLA has one of the best dimensional accuracies within 3DP technologies, but due to its chemical properties, its longevity is lower, which is why SLA is mainly used for prototypes and models	FDM has lower dimensional accuracy but offers a vast selection of materials. It is used for prototypes, models, or niche production with specific material property requirements	PolyJet™ has exceptionally high dimensional accuracy and can combine 500,000 different colors and varying hardnesses in the same print, making it ideal for prototypes and models
Material Selection						
PA 11 PA 2200 PA 3200 GF PA 2210 FR PA 2241 FR PA 603-CF PA 620-MF PA 640-GSL PA 12 Alu TPU 59A TPU 88A (black & white) FS3200PA-F	Polypropylene (PP)	PA 11 PA 12 PA 12 S PA 12 White PA 12 GB	PA 1101	Accura ClearVue Accura Extreme Accura 25 Accura HPC Somos® WaterClear Ultra	Ultem (9085 & 1010) Polycarbonate (PC) PC/ABS & PC-ISO ABS (ESD7, M30 & M30i) ASA SR-30 PEKK & PEKK-ESD PA 12 CF Polypropylene (PP) & other engineering materials	Digital Materials
Manufacturing Details						
Manufacturing via infrared laser from nylon (PA) or thermoplastic polyuretane (TPU) powder	Manufacturing via infrared light from polypropylene powder	Manufacturing via infrared light from nylon powder	Manufacturing via infrared laser from biobased nylon powder	Manufacturing via ultraviolet laser from epoxy resin	Manufacturing via extrusion from a polymer thread	Manufacturing via ultraviolet laser from acrylic based fluid
Maximum Build Sizes						
700 x 380 x 580 mm	315 x 208 x 293 mm	380 x 284 x 380 mm	200 x 250 x 125 mm	1500 x 750 x 550 mm	900 x 600 x 900 mm	490 x 390 x 200 mm
Post-Processing Offerings						
Bead blasting, vapor smoothing (max 385 x 585 x 385 mm), vibration grinding, dyecoloring, assembly, sanding. coating, lacquering, painting, metal plating & threaded/ non-threaded inserts			Bead blasting, vapor smoothing (max 385 x 585 x 385 mm) & dyecoloring	Assembly, support removal, sanding, coating, lacquering, painting, metal plating, threaded/non-threaded inserts	Support removal, sanding & threaded/non-threaded inserts	

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Prototal Group is Europe's largest service provider of additive manufacturing, vacuum casting, and injection molding, including tools. With more than 350+ employees, 130+ industrial 3D printers and a local presence in seven countries across Europe. We are your trusted partner in manufacturing, offering an advanced digital distributed manufacturing network combined with highly regarded experts in the field. Prototal Group is an EOS End-to-End Production Partner and an HP Digital Manufacturing Partner. Visit prototalgroup.com for more information.

3D PRINTING GUIDELINES
FOR EVERY POLYMER TECHNOLOGY

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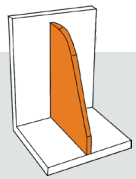
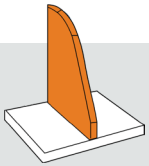
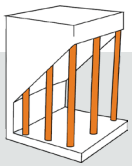
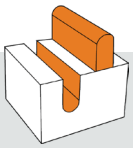
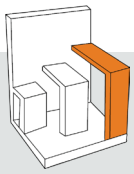
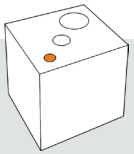
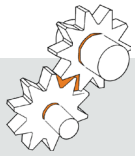
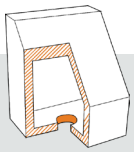
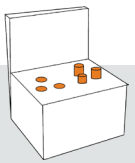
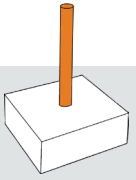
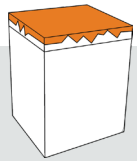

	Supported Walls	Unsupported Walls	Support & Overhangs	Embossed & Engraved Details	Horizontal Bridges	Holes	Connecting & Moving Parts	Escape Holes	Minimum Features	Pin Diameter	Tolerance
SLS	**EOS** P1XX 0.6 mm P3XX 0.8 mm P5XX 0.6 mm P7XX 0.8 mm **Farsoon** HT601P-4 0.6 mm	1 mm	N/A	1 mm width & height	N/A	> Ø1.5 mm depending on thickness	>0.3 mm for moving parts; > 0.1 mm for connection assemblies; > 0.5 mm radial	> 12 mm multiple holes are preferred	**EOS** P1XX 0.5 mm P3XX 0.6 mm P5XX 0.5 mm P7XX 0.6 mm **Farsoon** HT601P-4 0.5 mm	> 1 mm diameter < 15 mm height	Minimum ± 0.3 mm & ± 0.25% of dimension*
MJF	0.5 mm	1 mm	N/A	0.4 mm width & height	N/A	> Ø0.8 mm depending on thickness	>0.3 mm for moving parts; > 0.3 mm for connection assemblies; > 0.3 mm radial	> 6 mm multiple holes are preferred	0.5 mm	> 1 mm diameter < 15 mm height	Minimum ± 0.3 mm & ± 0.25% of dimension
SAF™	0.8 mm	1 mm	N/A	1 mm width & height	N/A	> Ø1.5 mm depending on thickness	>0.3 mm for moving parts; > 0.1 mm for connection assemblies; > 0.5 mm radial	> 12 mm multiple holes are preferred	2 mm	> 2 mm diameter < 15 mm height	Minimum ±0.3 mm & ±0.25% of dimension
FDR	0.2 mm	0.4 mm	N/A	0.4 mm width & height	N/A	> Ø0.6 mm depending on thickness	>0.3 mm for moving parts; > 0.1 mm for connection assemblies; > 0.5 mm radial	> 6 mm multiple holes are preferred	0.25 mm	> 0.5 mm diameter < 15 mm height	Minimum ± 0.2 mm & ± 0.2% of dimension
SLA	HR 0.25 mm NR 0.5 mm	HR 0.5 mm NR 1 mm	Support ≤ 30°	0.4 mm width & height	N/A	> Ø0.5 mm depending on thickness	> 0.1 mm for moving parts; > 0.1 mm for connections	> 3 mm multiple holes are preferred	0.25 mm	> 0.5 mm diameter < 15 mm height	Minimum ± 0.1 mm & ± 0.15% of dimension
PolyJet™	0.8 mm	1 mm	Support always required	0.5 mm width & height	N/A	> Ø0.5 mm	>0.2 mm for moving parts; >0.1 mm for connection assemblies; >0.8 mm for radial	> 20 mm multiple holes are preferred	0.5 mm	> 1 mm diameter < 15 mm height	Minimum ± 0.2 mm & ± 0.25% of dimension
FDM	0.8 mm	1 mm	Support ≤ 45°	0.6 mm width & height	10 mm	> Ø2 mm	> 0.5 mm	> 20 mm	2 mm	> 3 mm diameter < 15 mm height	Minimum ± 0.2 mm & ± 0.25% of dimension

*The guide above is designed for a trouble free 3D printing experience, smaller tolerances and smaller details are possible, but will have to be verified for every geometry. The guide is intended for parts with uniform wall thickness throughout the entire model, variation in wall thickness is equal to wall thickness x 0.7 (e.g. 2 mm x 0.7 = 1.4 mm growing wall this also minimize warping). Recommended font size for embossed and engraved text is Arial Black. Use bold and font size minimum of 12 (details smaller than the recommended size can disappear). Best result is in the planar region in the z-direction. Preferred file format is .STL.

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3D PRINTING MATERIAL DATA SHEET
FOR SERIAL PRODUCTION

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	SLS									MJF				SAF™
	Selective Laser Sintering									Multi Jet Fusion				Selective Absorption Fusion
	FS3200PA-F	PA 2200	PA 2210 FR	PA 2241 FR	PA 3200 GF	PA 603-CF	PA 640-GSL	TPU 88A	PA12 Alu	PA 11	PA 12	PA 12 White	PA 12 GB	PP
Material Colour	Black	White	White	White	Off-white	Dark grey	Dark grey	Black and neutral option	Silver	Dark grey	Dark grey	White	Dark grey	Dark grey
Material Specification	PA1012-based plastic powder	Standard PA 12	Flame retardant PA 12 without halogen	Flame retardant PA 12 with halogen	Glass-filled PA 12	Carbon-filled PA 12	Hollow glass sphere & carbon-filled PA 12	Shore 88A TPU	Aluminium-filled PA 12	Bio-based polymer	Standard PA 12	Standard PA 12, white colour	Glass-filled PA 12	Polypropylene
Hardness	-	75D	75D	-	80D	-	-	88A	-	-	-	-	82D	-
Flexural Modulus MPa	1350	1500	1750	-	2900	9170	5040	-	3600	1800	1730	-	2400	992
Flexural Strength MPa	45	58	45	-	73	-	-	-	72	70	65-70	-	57.5	25
Tensile Modulus MPa	1450	1650	2300-2500	1900	3200	7900	3816	-	3800	1800	1700-1800	1850-1900	2500	1260
Tensile Strength MPa	42	48	41-46	49	51	85	49	7-16	48	42	48	49	30	26
Softening Temp B/50 °C	-	-	-	-	-	-		-	169	-	-	-	-	-
Heat Deflection Temp °C @ 0.45MPa	145	176	154	154	179	179	180	-	175	185	175	-	174	107
Heat Deflection Temp °C @ 1.82MPa	52	70	84	84	96	173	170	-	144	54	95	-	114	56
Glass Transition Temp °C	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melting Temp °C	185.5	176	172-180	185	185	-	-	200	176	202	-	-	186	-
Elongation at Break %	25-40	18	4	-	9	4	3	90-430	4	50	15-20	17	-	22
Bulk Density g/cm³	0.52	0.45	1.06	1.00	0.63	0.41	0.37	0.5	1.36	0.48	0.425	0.435	0.48	-

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The provided data is for general reference only. Actual material properties may vary depending on part geometry and processing conditions. We strongly recommend conducting your own testing to verify suitability for your specific application. At Prototal Group, we offer a wide range of materials and technologies to ensure the perfect match for your needs.

3D PRINTING MATERIAL DATA SHEET
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	SLA				FDM								
	Stereolithography				Fused Deposition Modelling								
	Accura 25	Accura ClearVue	Accura HPC	Accura Xtreme	Ultem 9085	Ultem 1010	Polycarbonate (PC)	ABS (M30)	PA 12 CF	PP	PEEK	Carbon PEEK	Carbon PA
Material Colour	White	Transparent	White	Grey	Beige	Beige	White, Black & Red option	Black	Black	Semi transparent	Beige	Black	Black
Material Specification	PP like	USP Class VI	Ceramic-filled polymer	ABS like	PEI (Polyetherimide)	PEI (Polyetherimide)	Standard polycarbonate	Acrylonitrile Butadiene Styrene	Carbon-filled PA 12	Polyproylene	Standard PEEK	Carbon-filled PEEK	Carbon-filled PA6
Hardness	80	80	-	86	-	-	-	-	-	-	-	87	-
Flexural Modulus MPa	1380-1660	1980-2310	8700-10200	1520-2070	2400	2910	2150	2220	1110	-	2490	-	-
Flexural Strength MPa	55-58	72-84	137-157	52-71	104	-	-	-	153	-	99	-	-
Tensile Modulus MPa	1590-1660	2270-2640	9000-9700	1790-1980	2520	2910	2250	2400	9460	1620	332	1380	14700
Tensile Strength MPa	38	46-53	66-89	38-44	68	79	57.3	28	84	20	37	138	138
Softening Temp B/50 °C	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Deflection Temp °C @ 0.45MPa	58-63	51	73	62	178.2	214.1	144	103.8	-	62	-	-	-
Heat Deflection Temp °C @ 1.82MPa	51-55	50	62	54	170.2	212.2	140.7	99.9	-	-	-	149	180
Glass Transition Temp °C	60	62	-	52 / 70-74	-	-	-	-	-	-	154	149	-
Melting Temp °C	-	-	-	-	-	-	-	-	-	-	303	343	-
Elongation at Break %	13-20	3-15	0.8-0.19	14-22	5.4	4.0	5.2	8.1	-	-	55	-	1.58
Bulk Density g/cm³	1.19	1.17	1.61	1.19	-	-	-	-	-	-	-	-	-

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