SMOOTH PA

Technical Data Sheet (Ver. 1.0, last updated: August, 2020)

SMOOTH PA is 10% carbon fiber reinforced PA12 filament, which provides improved surface quality, strength and warping. Compared to other polyamide filaments on the market, Smooth PA features low moisture absorption and anti-warping technology.

Physical Properties[1]

Property	Testing Method	Typical Value
Density (g/cm3 at 21.5 °C)	ASTM D792 (ISO 1183, GB/T 1033)	1.06
Melt index (g/10 min)	280 °C, 2.16 kg	25
Heat Deflection Temperature (°C)	ISO75 1.8MPa 0.45MPa	105 131

1. Tested with 3D printed specimen of 100% infill
2. Specimen annealed at 100 for 4hours

Mechanical Properties[1´2]

Property	Testing Method	Typical Value
Tension		
Young's modulus along printing paths (axis 1), MPa	ASTM D638 (ISO 527, GB/T 1040)	5820.0±110
Tensile strength along printing paths (axis 1), MPa	ASTM D638 (ISO527, GB/T 1040)	71.8 ± 3.1
Strain at break along printing paths (axis 1), %	ASTM D638 (ISO527, GB/T 1040)	2.459 ± 0.096
Young's modulus across printing paths (axis 2**), MPa	ASTM D638 (ISO 527, GB/T 1040)	1400.0±30
Tensile strength across printing paths (axis 2), MPa	ASTM D638 (ISO527, GB/T 1040)	26.9 ± 0.9
Strain at break across printing paths (axis 2), %	ASTM D638 (ISO527, GB/T 1040)	3.716 ± 0.229

Young's modulus (axis 3), MPa	ASTM D638 (ISO 527, GB/T 1040)	1050.0±50
Tensile strength (axis 3), MPa	ASTM D638 (ISO527, GB/T 1040)	15.2 ± 1.6
Strain at break (axis 3), %	ASTM D638 (ISO527, GB/T 1040)	1.951 ± 0.232
Compression		
Young's modulus along printing paths, MPa	ASTM D695 (ISO604)	6130.0±820
Compressive strength along printing paths, MPa	ASTM D695 (ISO604)	81.4 ± 1.5
Strain at break along printing paths, %	ASTM D695 (ISO604)	6.994 ± 2.788
Young's modulus across printing paths (axis 2), MPa	ASTM D695 (ISO604)	1540.0±110
Compressive strength across printing paths (axis 2), MPa	ASTM D695 (ISO604)	50.0 ± 1.3
Strain at break across printing paths (axis 2), %	ASTM D695 (ISO604)	7.903 ± 1.488
Young's modulus (axis 3), MPa	ASTM D695 (ISO604)	1270.0±80
Compressive strength (axis 3), MPa	ASTM D695 (ISO604)	39.2 ± 1.0
Strain at break (axis 3), %	ASTM D695 (ISO604)	8.661 ± 0.718
Shear		
Shear modulus (plane 1-2**), MPa	ASTM D5379	411.0±60

Ultimate Shear strength (plane 1-2), MPa	ASTM D5379	16.0±0.6
Shear modulus (plane 1-3), MPa	ASTM D5379	256.0±21
Ultimate Shear strength (plane 1-3), MPa	ASTM D5379	10.2±0.4
Shear modulus (plane 2-3), MPa	ASTM D5379	291±9
Ultimate Shear strength (plane 2-3), MPa	ASTM D5379	12.7±0.3
Other properties		
Bending modulus (bending plane 1-3), MPa	ASTM D790 (ISO 178, GB/T 9341)	3535 ± 239
Bending strength (bending plane 1-3), MPa	ASTM D790 (ISO 178, GB/T 9341)	109.97 ± 1.38
Charpy Impact strength (plane 1-2), kJ/m2	ASTM D256 (ISO 179, GB/T 1043)	12.52 ± 0.68

* Testing geometries of specimens are shown in Figures 2-12.
** The definition of the axes and planes is shown in Figure 1.
1. All testing specimens were printed under the following conditions:
Nozzle temperature = 265 °C, printing speed = 40 mm/s, bed temperature = 45 °C

Recommended Printing Conditions[1]

Parameter	Recommended Setting
Nozzle temperature (°C)	260 - 300
Recommended build surface	Coating with PVP glue
Build plate temperature (°C)	50 - 70
Model cooling fan	Turned off - 20%
Printing speed (mm/s)	30 - 60
Recommended environmental temperature (°C)	Room temp – 50

Other Comments

It is recommended to use hardened steel or other abrasion resistant nozzle.

After printing, it is recommended to anneal the models at 80 - 100°C for 4 - 6 hours.

1. Based on 0.4 mm nozzle and Simplify 3D.
Printing conditions may vary with different nozzle diameters

Appendix

The definition of the axes

Axes X, Y, Z and corresponding planes refer to printer space. Axes 1, 2, 3 and related planes 1-2, 1-3 and 2-3 refer to specimen.

Axis 1 coincides with direction of printing paths. It is located in X-Y plane (printing plane, see Figure 1).

Axis 2 is perpendicular to axis 1 in the printing plane. It is located in X-Y plane.

Axis 3 is perpendicular to axis 1 and axis 2, i.e., coincides with Z axis of Composer printer.

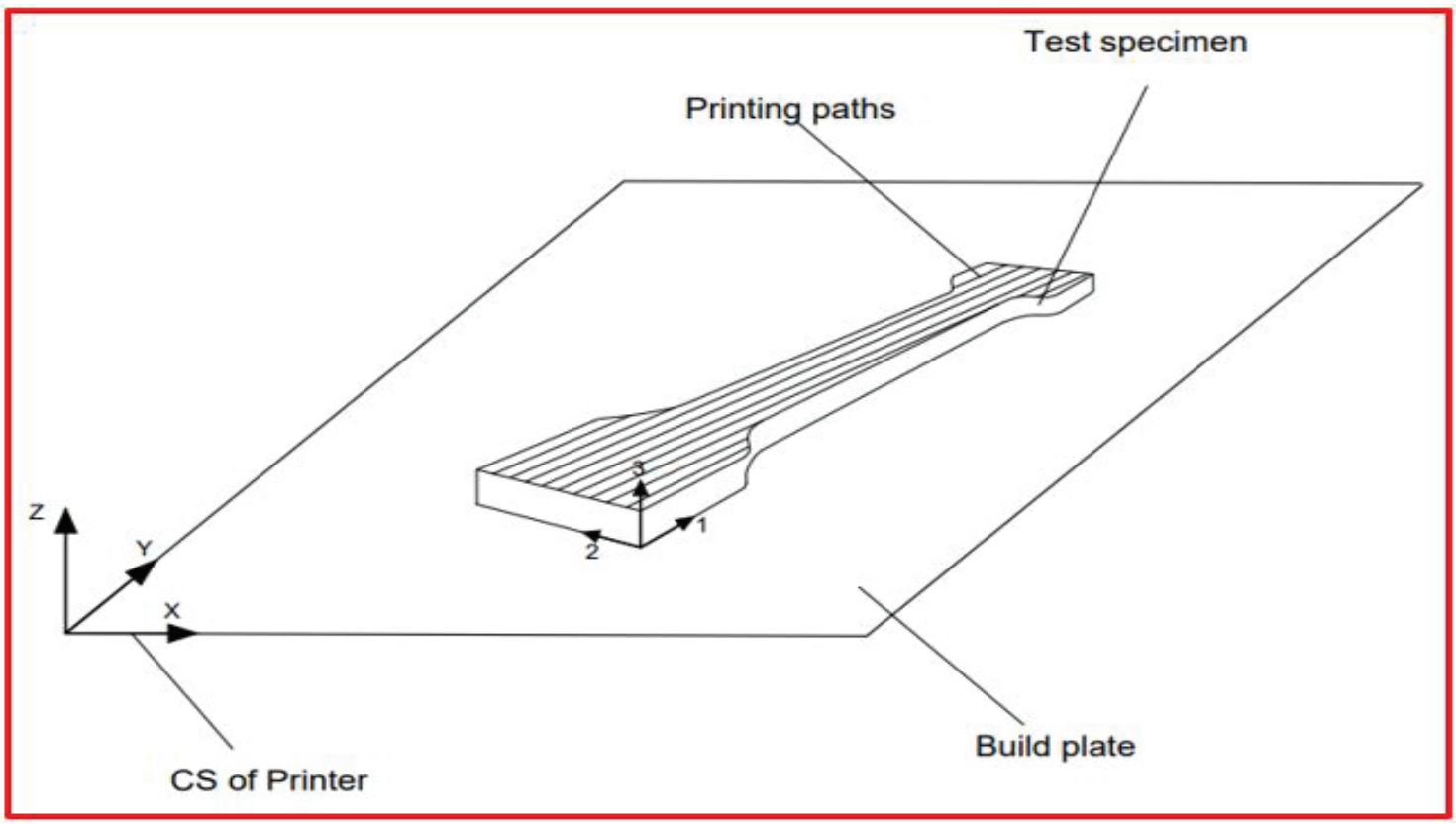

Figure 1. Test specimen on build plate

Testing Geometries

Tensile testing specimen

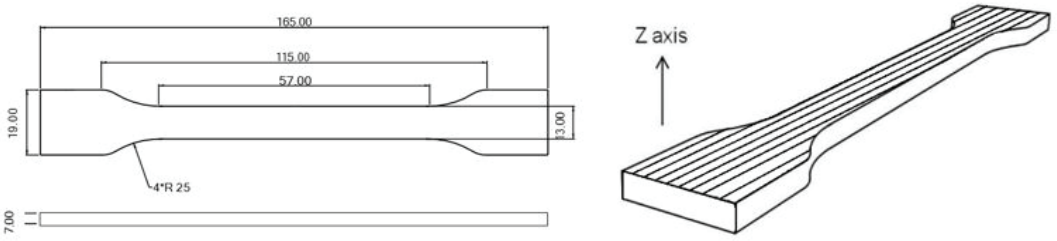

Figure 1.
Tensile testing (axis 1) specimen

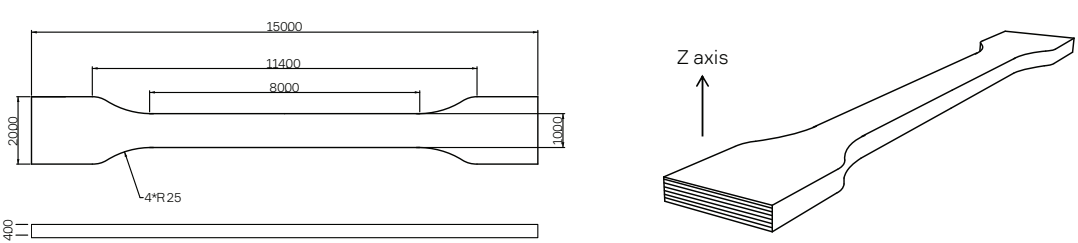

Figure 2.
Tensile testing (axis 2) specimen

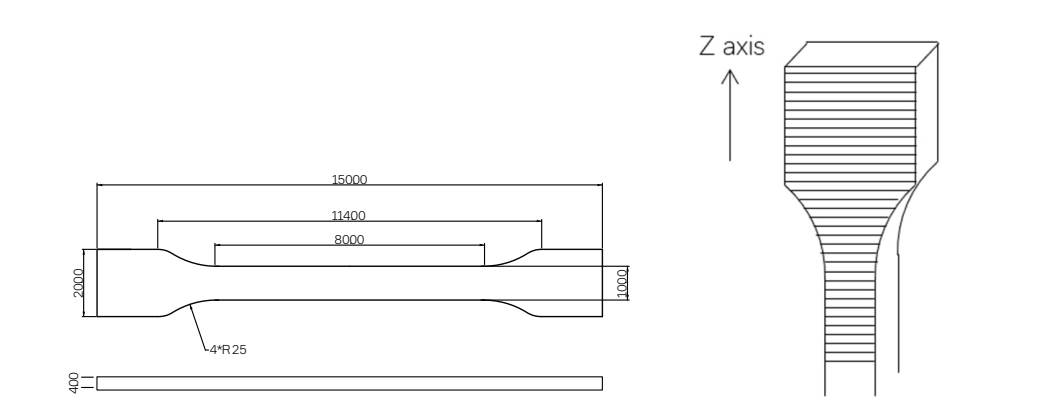

Figure 3.
Tensile testing (axis 3) specimen

Compressive testing specimen

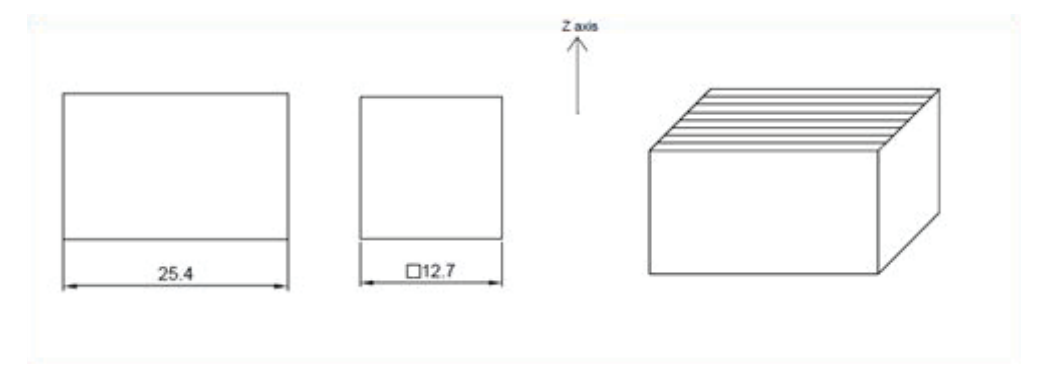

Figure 4.
Compressive 0° testing (X-Y) specimen

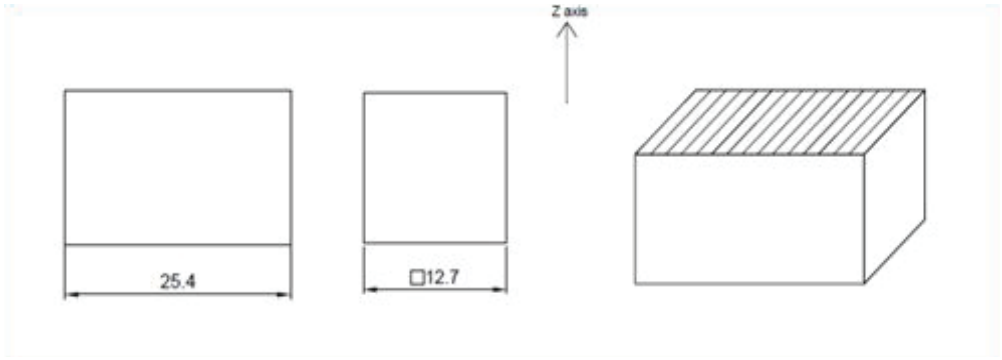

Figure 5. Compressive 90° testing (X-Y) specimen

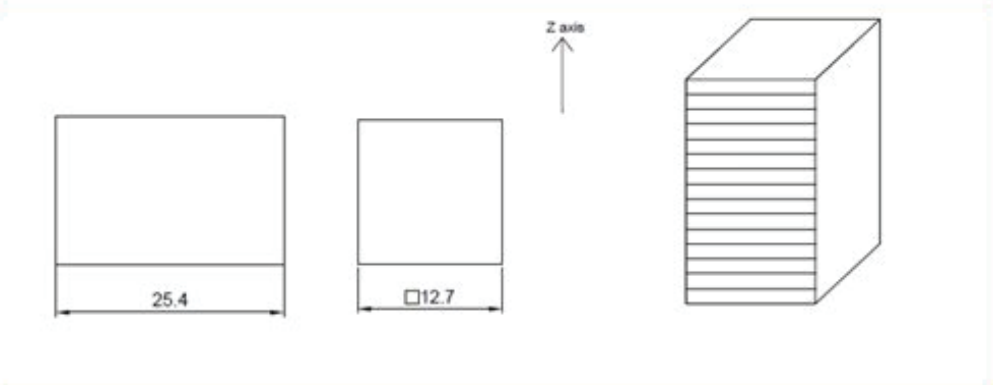

Figure 6. Compressive testing (Z) specimen

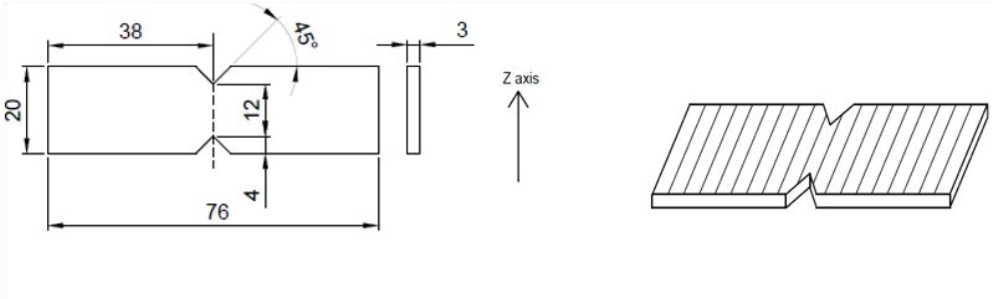

Figure 7. Shear testing (X Y) specimen

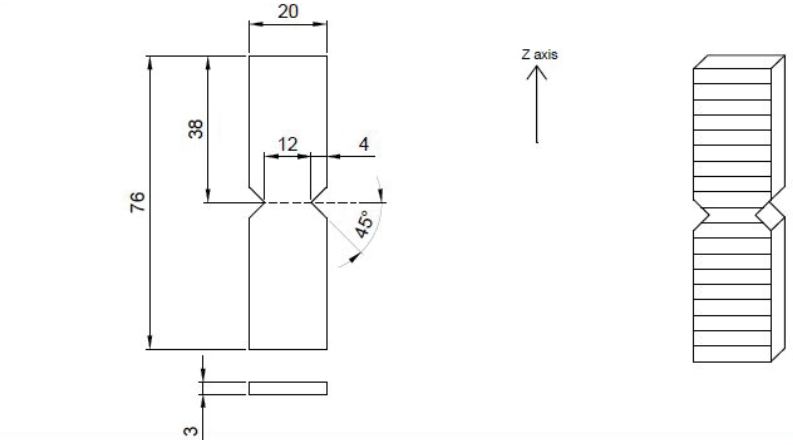

Figure 8. Shear testing (Z-0°) specimen

Flexural testing specimen

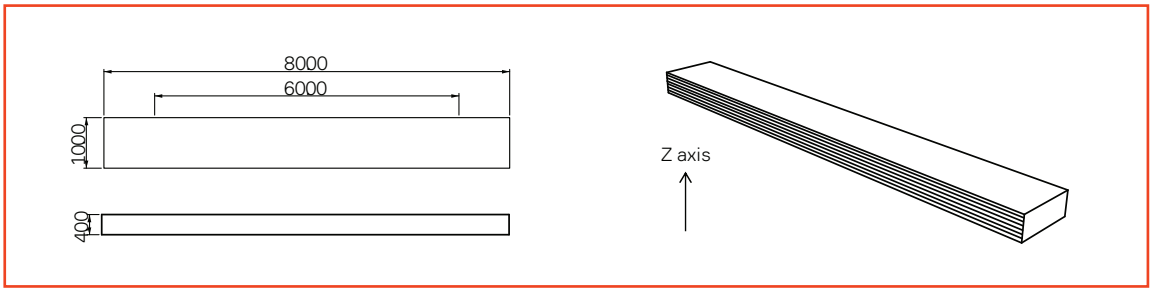

Fig 10.
Flexural testing specimen

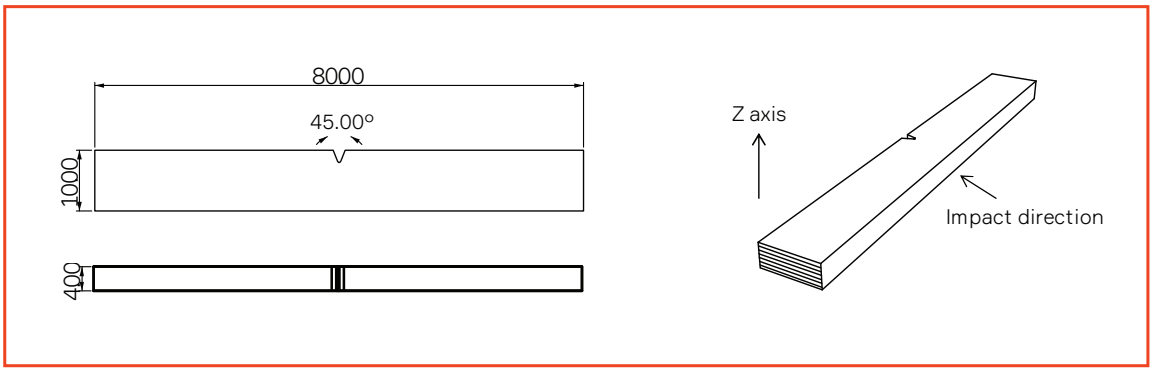

Fig 11.
Impact testing specimen

Disclaimer

The typical values presented in this data sheet are intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes. Actual values may vary significantly with printing conditions.

End-use performance of printed parts depends not only on materials, but also on part design, environmental conditions, printing conditions, etc. Product specifications are subject to change without notice.