TOUGH PLA

TOUGH PLA is engineered for its **high impact** and strength like ABS and the stiffness of PLA. The material shows excellent results in layer adhesion and is the perfect match for tooling or manufacturing aids where a high impact is needed. TOUGH PLA is a plug & play material and printable on a wide range of temperatures.

Material features:

- High impact and stiffness
- Prints like regular PLA (easy to print)
- No warpage & no shrinkage
- Printable with various print temperatures
- Suitable for applications which needs to be strong
- Industrial touch and feel

Colours:
TOUGH PLA is available in 6 colours.

wh1	bk1	na1	bu2	rd1	gy1

Packaging:
TOUGH PLA is available in nearly any type of packaging and labelling. Ask our team to help you customizing your product.

Filament specs.		
Size	**Ø tolerance**	**Roundness**
1,75mm	± 0,05mm	≥ 95%
2,85mm	± 0,10mm	≥ 95%

Material properties		
Description	**Testmethod**	**Typical value**
Specific gravity	ISO 1183	1,21 g/cc
MFR 210°C/2,16 kg	ISO 1133	8,75 gr/10 min
Tensile strength at yield	ISO 527	46 MPa
Tensile strength at break	ISO 527	19 MPa
Elongation strain at yield	ISO 527	2%
Elongation strain at break	ISO 527	27%
Tensile (E) modulus	ISO 527	2750 MPa
Impact strength - charpy method 23˚C	ISO 179	29,8 kJ/m2
Vicat softening temperature B	ISO 306	57°C
Printing temp.	Internal Method	210±10°C

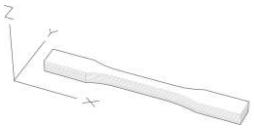
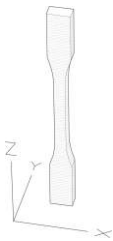
Additional info:
Recommended temperature for heated bed is ≥60°C. Adhesion is possible on different surfaces.
TOUGH PLA can be used on all common desktop FDM or FFF technology 3D printers.

Storage: Cool and dry (15-25˚C) and away from UV light. This enhances the shelf life significantly.

Mechanical Specifications

During additional research, a print profile has been made which was optimized for achieving the best performance on printed parts. Table 1 shows the typical values of an injection moulded specimen compared to a 3D-printed specimen in both the X-Y axis (3D-printed horizontally) and the Z-axis (3D-printed vertically).

Table 1: Data of both injection moulded and 3D-printed specimens.*

	Injection Moulded	3D-Printed X-Y	3D-Printed Z
Young's Modulus [MPa] ISO 527	2750	2450	2200
Stress at Yield [MPa] ISO 527	46	41	33
Stress at Break [MPa] ISO 527	19	32	33
Strain at Yield [%] ISO 527	2	2	2
Strain at Break [%] ISO 527	27	20	2,6
Charpy Impact (Kj/m2) ISO 179	29,8	22,9	2,2
Flexural Strength ISO 178	72	76	60
Flexural Modulus ISO 178	2750	2700	2250
			

TOUGH PLA has excellent impact properties at a broad range of temperatures.

Print Conditions
All specimens have been printed using a 0.4mm nozzle and the layer height was set to 0.2mm. The room in which the 3D-printer was located had an environmental temperature of ± 25°C.

****Test Conditions***
The tensile tests have been carried out according to ISO-527 using modified 1BA specimens (3D-printing) and 1A specimens (injection moulding). The room in which the Universal Testing Machine was located had an environmental temperature of ± 20°C.