# Addigy® PA6/66-GF20 FR LS

Low Smoke Filament

covestro

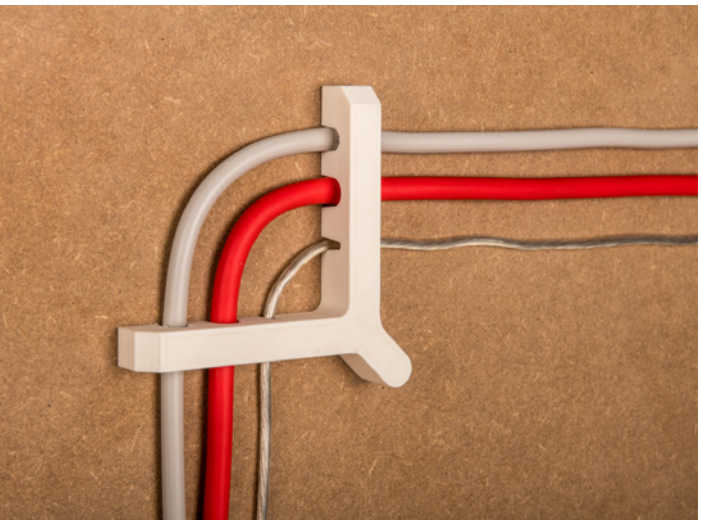
# Addigy® PA6/66-GF20 FR LS

**Addigy® PA6/66-GF20 FR LS** is one of few commercial filaments that meet norms EN 45545-2, NFPA 130 (ASTM E162, ASTM E662), SMP 800-C and FAR 25.853. Its certifications for flame, smoke and toxicity (FST) make it suitable for railway and other transportation applications.

The Low Smoke filament is a cost-efficient and easier-to-print solution for applications that need to meet European and North American railway norms. This innovative material can be printed easily on standard filament printers, eliminating the need for high-temperature printers.

The proprietary formulation uses a non-halogenated flame retardant with reduced ecological impact, and the composition has been optimized to avoid typical smoke development and achieve the low smoke requirements of the European and North American standards.

The glass-filled material has a high heat deflection temperature.



## Key benefits

- Passes standards EN 45545-2, NFPA 130 (ASTM E162, ASTM E662), SMP 800-C and FAR 25.853
- Non-halogenated flame retardant material
- Reduced flame spread, smoke density and toxicity
- Low levels of toxic fume emissions and smoke density allow for safe evacuation in the event of a fire
- Cost-efficient alternative that can be printed on standard FFF printers and does not require high-temperature printers
- Glass-filled material allows for superior thermal performance at elevated temperatures/heat deflection temperature (HDT)
- Reduced thermo-oxidative degradation
- Can be post-processed and painted

## Applications

- Electrical in-train parts such as connectors, covers or enclosures, outlet boxes, panels
- Small electrical components such as cable guides, reading lights
- Other internal and external train applications, also visible parts
- Aerospace components

# Technical Data

## Mechanical properties

| Property | Typical values | Units | Test method | Test specimen |
|---|---|---|---|---|
| Tensile stress at yield, 50 mm/min | – | MPa | ISO 527 | Injection-molded |
| | – | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| at -40°C | – | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| | – | MPa | ISO 527 | 3D-printed XZ/on edge at 235°C |
| Tensile stress at break, 50 mm/min | 46 | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| at -40°C | 52 | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| | 53 | MPa | ISO 527 | 3D-printed XZ/on edge at 235°C |
| Tensile elongation at yield, 50 mm/min | – | % | ISO 527 | 3D-printed XY/flat at 240°C |
| at -40°C | – | % | ISO 527 | 3D-printed XY/flat at 240°C |
| | – | % | ISO 527 | 3D-printed XZ/on edge at 240°C |
| Tensile elongation at break, 50 mm/min | – | % | ISO 527 | Injection-molded |
| | 2.5 | % | ISO 527 | 3D-printed XY/flat at 240°C |
| at -40°C | 2.1 | % | ISO 527 | 3D-printed XY/flat at 240°C |
| | 1.7 | % | ISO 527 | 3D-printed XZ/on edge at 240°C |
| Tensile modulus (modulus of elasticity), 1 mm/min | 3999 | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| at -40°C | 4056 | MPa | ISO 527 | 3D-printed XY/flat at 240°C |
| | 4876 | MPa | ISO 527 | 3D-printed XZ/on edge at 240°C |
| Flexural modulus | 5588 | MPa | ISO 178 | Injection-molded |
| Flexural strength | 147 | MPa | ISO 178 | Injection-molded |
| Charpy impact notched | 13.1 | MPa | ISO 179 | 3D-printed XY/flat at 240°C |

## Flammability properties

| Property | Typical values | Test method | Test specimen |
|---|---|---|---|
| UL 94 flammability rating | V-2 at 0.4mm | UL 94 | 3D-printed XY/flat at 240°C |
| | V-2 at 0.8 mm | UL 94 | 3D-printed XY/flat at 240°C |
| | V-2 at 1.6 mm | UL 94 | 3D-printed XY/flat at 240°C |
| | V-1 at 2.0 mm | UL 94 | 3D-printed XY/flat at 240°C |
| | V-0 at 3.2 mm | UL 94 | 3D-printed XY/flat at 240°C |

## EN 45545-2+A1 NORM

| Property | Typical values | Units | Test method | Test specimen |
|---|---|---|---|---|
| Oxygen index | 33.6 at 4 mm | % | R22 - EN ISO 4589-2 | 3D-printed XY/flat at 240°C |
| Maximum optical density ($D_s$ max) | 111.1 at 4 mm | | R22 - EN ISO 5659-2, 25 kW/m2 | |
| $CIT^a_{NLP}$ | 0.51 at 4 mm | | NF X 70-100-1,NF X 70-100-2,600°C | |

## NFPA 130 NORM

| Property | Typical values | Test method | Test specimen |
|---|---|---|---|
| Radiant panel index ($I_s$) | 8 at 6 mm | ASTM E162-15b | 3D-printed XY/flat at 240°C |
| Optical density at 4 minutes ($D_s$) | 94 at 6 mm | ASTM E662-18 | |
| Toxic gas generation | pass | Bombardier SMP 800-C | |

## FAR 25.853 NORM

| Property | Typical values | Units | Test method | Test specimen |
|---|---|---|---|---|
| Burn length | 20.3 (0.8) | mm (") | Vertical test – 12 seconds, FAR 25.853 | 3D-printed XY/flat at 240°C |
| Flame time | 6.1 | s | Vertical test – 12 seconds, FAR 25.853 | |
| Flaming time of drippings | 0 | s | Vertical test – 12 seconds, FAR 25.853 | |
| Burn rate | n/a (< 38.1 (1.5)) | mm/min (in/min) | Horizontal test – 12 seconds, FAR 25.853 | |

# Technical Data

## Thermal properties

| Property | Typical values | Units | Test method | Test specimen |
|---|---|---|---|---|
| Melting point | 195 | °C | ISO 11357, DSC[b] | |
| Glass transition temperature | – | °C | ISO 11357, DSC[b] | |
| Heat deflection temperature at 1.8 MPa (A) | 114 | °C | ISO 75 | 3D-printed XY/flat at 240°C |
| Heat deflection temperature at 0.45 MPa (B) | 168 | °C | ISO 75 | |

## General properties

| Property | Typical values | Units | Test method | Test specimen |
|---|---|---|---|---|
| Density | 1293 | kg/m³ | ISO 1183 | |
| pH | 4.5 | | | 1% in H2O |
| Non-volatile-matter content | ~30 | % | ISO 3251 | |

a. Conventional Index of Toxicity. b. DSC = differential scanning calorimetry at 10°C/minute.

Note: results are generated according to the valid testing standards indicated above and the standard operating procedures used by the testing facilities.

## More information at am.covestro.com

Covestro Deutschland AG
Kaiser-Wilhelm-Allee 60
51373 Leverkusen
Germany

solutions.covestro.com
info@covestro.com


Edition: May 2022 · Printed in Germany