Technical data sheet: P-filament

Polypropylene (PP) is one of the most widely used plastics with a broad property profile.
PP is one of the lightest materials and has excellent mechanical and chemical properties.

Material description	
Trade name	P-filament
Manufacturer	PPprint GmbH
Polymer group	Thermoplatic polymer
Chemical name	Polypropylene copolymer
Use	Extrusion-based 3D printing

Suggested 3D print settings (nozzle diameter 0.4 mm)	
Nozzle temperature	200 - 220 °C
Bed temperature	20 °C (50 - 80 °C recommended for the first layer, 100 – 110 °C for non-destructive removal after completion)
Chamber temperature	not required
Bed modification	P-surface
Active fan cooling	recommended
Layer height	0.1 – 0.4 mm
Print speed	15 – 40 mm/s

Material properties		**Test method**
Melt temperature	137 °C	ASTM D3418
Melt Flow Rate[1]	19.3 g/10 min	ISO 1133
Melt Volume Rate[1]	25.7 cm^3/10 min	ISO 1133
Density	0.9 g/cm^3	ISO 1183
Odor	odorless	-
Color	natur	-

[1] Test condition: T = 210 °C; m = 5.0 kg

Mechanical properties: Tensile test		**Test method ISO 527**
All specimens were punched out of printed square tubes consisting of two shells, which were 3D printed with a Raise Pro 3D printer and applying the following printing conditions: Nozzle temperature: 210 ° C; bed temperature: 70 ° C; chamber temperature: 70 ° C; printing speed: 30 mm/s.	90°  punched dog bone: S 3A with an orientation of 90 ° to the nozzle movement direction	0°  punched dog bone: S 3A with an orientation of 0 ° to the nozzle movement direction
E-Modul (MPa)	640 ± 20	660 ± 10
Yield strength (MPa)	18.1 ± 0.1	19.6 ± 0.3
Tensile strength (MPa)	18.7 ± 0.3	35.1 ± 0.6
Strain at break (%)	> 600	> 600

Certifications/approvals*	Description
Regulation EU Nr. 10/2011	Union Guidelines on Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food (Europe)
FDA	Food and Drug administration approval (USA)

* These data are generated using information obtained from the raw material suppliers.

Filament specification		Test method
Diameter 1.75	1.75 ± 0.10 mm	PPprint
Diameter 2.85	2.85 ± 0.10 mm	PPprint
Ovality	0.05	PPprint
Netto weight on spool	600 g ± 5%	PPprint

Annotation:
The data and properties presented here are averages of a standard batch. The 3D printed square tubes from which the specimens were punched out were produced in Slic3r version 1.3.0.

Disclaimer:
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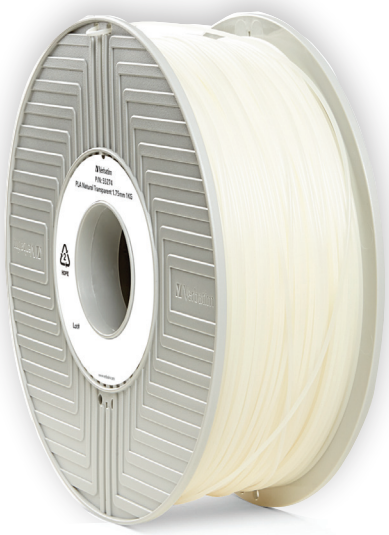
Version: 1.001
Date: 12.02.2019

PP Filament

- High quality Polypropylene (PP) filament for material extrusion (ME)
- One of the most commonly used plastics in industry
- Good mechanical properties of stiffness and tensile strength
- Good surface finish
- Resistant to acids, alkalis and organic solvents
- Very light
- Food package grade pellets used
- Good transparency
- Hinge properties
- Main applications: Technical products, automotive, mechanical engineering, prototypes, toys.



Filament Specifications

Size	Ø tolerance	Length
1.75mm	± 0.05mm	233 m
2.85mm	± 0.05mm	88 m

Material properties

Description	Test method	Typical value
Density	ISO 1183	0.89 g/cm
Melt flow rate	ISO 1133	20.0 g/10min
Viscat softening temperature	ISO 306	115°C
Flexural strength	ISO 178	14 MPa
Flexural modulus	ISO 178	350 Mpa
Impact strength - Charpy method 23°C	ISO 179	10 kJ/m2
Tensile strength	ISO 527	14 Mpa
Tensile elongation	ISO 527	>200 %
Durometer hardness	ISO 868	Shore D55

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PP Filament

Recommended printer set up

Extrusion temperature	240±10°C
Bed temperature	80°C
Printing speed	30 mm/s

Note: PP film tape recommended for print bed

Filaments Available

Colour	Part Number		PANTONE® ref.*	Diameter	Weight
Natural	55952		N/A	1.75 mm	500 g
Natural	55953		N/A	2.85 mm	500 g

* Closest PANTONE® colour reference

Verbatim filament is manufactured from high quality materials to extremely rigid standards. The filaments are manufactured from the highest quality materials and produced to extremely tight tolerances to ensure consistent feed and stable printing. The filaments are distributed in vacuum-sealed bags with desiccant, and wound onto a custom spool that has been designed for strength, uniform dynamic performance and trouble-free dispensing.

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TECHNICAL DATA SHEET

Description

PP3D is a medium fluidity polypropylene with an excellent impact resistance, specially designed for 3D printing FDM Technology for its excellent processability.

Applications

PP3D is specifically indicated for 3D Printing Filament in which the main requirement is high mechanical strength together with excellent processability and stability of the constructed part, such as:

- Automotive: prototypes, aesthetic parts, specific tools or tools, etc.
- Aerospace: prototypes.
- Technical components: toys, textiles, footwear, jewelry, leisure, etc.

Recommended melt temperature range from 190°C to 250°C. Processing conditions should be optimised for each production line.

The properties mentioned herein are exclusively related to pure grade PP3D, not in conjunction with any other additives or fillers.

PP3D complies with the European Directives regarding materials intended for contact with foodstuffs. The product mentioned herein is not intended to be used for medical, pharmaceutical or healthcare applications and we do not support their use for such applications . For further information, please contact with us.

Storage

PP3D should be stored in a dry atmosphere, on a paved, drained and not flooded area, at temperatures under 60°C and protected from UV radiation. Storage under inappropriate conditions could initiate degradation processes or undesired migration of additives included in its formulation which may have a negative influence on the processability and properties of the transformed product.

RECREUS INDUSTRIES S.L. VAT: ESB54876479
C/El Envelope, F13-F14, Pol. Ind. Finca Lacy
03600, Elda (Alicante) - SPAIN

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info@recreus.com
www.recreus.com

PROPERTIES	VALUE	UNIT	MÉTHOD
General			
Melt flow rate (230°C / 2,16 kg)	20	g/10min	ISO 1133
Density at 23°C	905	kg/m³	ISO 1183
Mechanical			
Flexural modulus of elasticity	800	MPa	ISO 178
Charpy impact strength (23°C, notched)	60	kJ/m²	ISO 179
Charpy impact strength (-20°C, notched)	10	kJ/m²	ISO 179
Izod impact strength (23°C, notched)	50	kJ/m²	ISO 179
Thermal			
HDT B 0,45MPa	61	°C	ISO 75-2

Printing properties	Recommended
Printing temperatures	235°C
Printing speed	40 mm/s
Hot-bed temperature	40°C with primer
Optimal layer height	0.2 mm
Minimal nozzle diameter	0.4 - 0.6 mm
Retraction parameters in direct drive (DD)	3.2 mm
Retraction parameters in bowden type (BT)	6 mm
Retraction speed in direct drive (DD)	40 mm/s
Retraction speed in bowden type (BT)	25 mm/s
Travelling speed	150 mm/s
Outer perimeters	25 mm/s
Inner perimeters	30 mm/s
Layer fan regular	0%
Layer fan in layer below 15 sec	80%
First layer adhesion brim depending on the part dimensions	5-10 mm
Brass nozzle recommended	

Instructions to use 3D primer for PP filament

Follow the instructions below for using the 3D primer with the PP filament:

1° Open the primer bottle and apply it in the printing area.

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2º Wait about **5 min** before print to let the primer dry.

3º Set bed temp to **40ºC** (not more temperature if not the part will warp).

4º When the part is finished, heat up the bed up to **85ºC** to release the printed part.

MATERIAL SAFETY DATA SHEET

1. Product and company identification

1.1. Trade name

PP3D

1.2. Company details

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(0034) 865 777 966
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www.recreus.com

2. Hazards identification

2.1 Classification of the substance or mixture: This product is not classified as dangerous for health or the environment according to EC norm 1272/2008/CE (CLP).

2.2 Label elements: This product does not need dangerous label according to EC norm 1272/2008/CE (CPL).

2.3 Other hazards: Results of the assessment of PBT and vPvB in the product, in accordance with the criteria set out in Annex XIII of REACH, can be found in Section 12.5 of this information note about product safety. Please refer to Sections 5, 6 and 7 of this information note about product safety for information on other dangers, different from classification dangers but which may contribute to the overall hazards of the product.

3. Composition/information on ingredients

3.1 Substances: Not applicable

3.2 Mixtures: Propylene-ethylene heterophasic copolymer with a degree of purity over 99% with additives. Dangerous components Reg. (CE) 1272/2008 (CLP): Not applicable.

4. First aid measures

4.1 Description of first aid measures

- **Inhalation:** Move the person to fresh air. Administer oxygen if necessary.
- **Ingestion/Aspiration:** It is not frequent. Intestinal absorption is very low.

- **Contact skin:** In case of burns with the molten polymer quickly cool material with abundant water. Do not remove the solidified product off burn without medical assistance. See a doctor and treat as a normal burn.
- **Contact eyes:** In case of burns with the molten polymer quickly cool material with abundant water. Do not remove the solidified product off burn without medical assistance. See a doctor and treat as a normal burn. In case of contact with eyes wash with plenty of water if necessary, keeping your eyes open for at least 15 minutes.

4.2 Most important symptoms and effects, both acute and delayed

- **Inhalation:** Powder polypropylene may be irritating to nose and throat. Vapors from melted product may cause irritation to the respiratory tract.
- **Ingestion/Aspiration:** This type of exposure is easy to prevent and infrequent. Not toxic if swallowed.
- **Contact skin:** Contact with molten product may cause burns.
- **Contact eyes:** Vapors from melted product and powdery material may be irritating to the eyes. Contact with molten product may cause burns.

4.3 Indication of any immediate medical attention and special treatment needed

Seek medical care.

5. Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media: AFFF foam, dry chemicals powder, CO2, and water spray.

Unsuitable extinguishing media: Water applied directly in jet stream may disperse the product.

5.2. Special hazards arising from the substance or mixture

Combustion products: Complete combustion: CO2, and H2O. Incomplete combustion: CO, soot, aldehydes, ketones, hydrocarbons and volatile fatty acids.

Special measures: N/A.

Special hazards: Molten polymer may spread fire. Fire may produce irritating gases.

5.3. Advice for firefighters:

Clothing and gloves resistant to fire and SCBA.

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions: Avoid contact with melted product and inhalation of vapors.
Prevent inhalation of the polymer powder.
Keep unnecessary people away.

Personal protection: Use protective mask in presence of polymer powder.
In case of high concentrations of vapors from melted product, respiratory protective mask
is recommended.
Wear safety goggles and waterproof gloves to avoid direct contact with melted product.

6.2. Environmental precautions

Avoid spillages to sewer and waterways, and avoid dispersion of the product.

6.3 Methods and material for containment and cleaning up

To prevent slipping and sliding, spills should be collected with shovels or other means and placed into suitable containers.

6.4 Reference to other sections

Section 8 contains more detailed advice on personal protective equipment and section 13 on waste disposal.

7. Handling and storage

7.1. Precautions for safe handling

General precautions: Do not smoke, eat, or drink while handling product.

Wear appropriate protective equipment in the areas of handling molten product.

Remove all sources of ignition in the area of product handling and storage.

Transport equipment should be properly grounded (static charge accumulation by friction).

Ensure safe systems of work.

Specific conditions: Good local exhaust ventilation system.

Protective mask in presence of vapors from melted product and powdery material.

7.2 Conditions for safe storage, including any incompatibilities

Temperature and decomposition products: The product is stable under normal conditions.

Dangerous reactions: N/A

Storage conditions: Storage at room temperature and protect it from sunlight in cool and well ventilated places.

Storage in properly labeled and sealed containers.

Protect containers from fire.

Eliminate all possible sources of ignition.

Polymer has a marked tendency to build up static charge when transferred by pneumatic transport, so proper grounding should be ensured.

Never weld in storage areas without proper precautions.

Incompatible materials: Chlorine, fuming nitric acid and strong oxidizing agents.

7.3 Specific end use(s)

See section 1 or exposure scenario.

8. Exposure controls/personal protection

8.1 Control parameters

N/A

DNEL: N/A

PNEC: N/A

8.2 Exposure control

Local appropriate ventilation. Do not smoke and avoid all ignition sources. Avoid prolonged contact and inhalation of vapors.

Individual protection measures, such as personal protective equipment

Ventilation: During fused deposition modeling operations, use with ventilation adequate to reduce levels of air contaminants below that which may cause personal injury or illness. Local exhaust ventilation that removes air contaminants from the breathing zone is prefered. General, mechanical, or dilution ventilation may be suitable.

Respiratory protection: Respiratory protective mask when melted product vapors or dust are present.

Skin protection: Gloves, appropriate footwear and clothing.

Eye/face protection: Safety goggles to avoid splashes when handling melted product.

Other protective equipment: Showers and eye-washers in the work area.

Specific hygiene measures: Good work practices and the adoption of good personal hygiene measures reduce unnecessary exposures. Showers should be used. Use soap and no other solvents. Use skin reconditioning cream after work.

Medical Conditions Aggravated by Exposure: N/A

Environmental exposure controls:
Product should not reach the environment through wastewater or sewage. Measures to take in case of accidental release can be found in Section 6 of this information note about product safety.

9. Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance:	Solid (pellets)
Odour:	Odorless
Odour Threshold:	N/A (*)
Colour:	Whitish
pH:	N/A (*)
Boiling Point (°C):	N/A (*)
Melting point/freezing point (°C):	160-170°C
Flash point:	> 320°C
Evaporation Rate:	N/A (*)
Properties Flammable/Explosive:	N/A (*)
Vapor pressure/vapor density:	N/A (*)
Density:	0.902 g/cm3 (ASTM-D-1505)
Solubility/ies:	Aromatic solvents at high temperatures.
Partition coefficient:	n-octanol/water: N/A (*)
Auto-ignition temperature:	N/A (*)
Decomposition temperature:	N/A (*)
Viscosity:	N/A (*)
Explosive properties:	N/A (*)

Oxidising properties: N/A (*)

9.2 Other information

Heat of combustion: 10000 cal/g.

Water solubility: Insoluble.

(*) No data available at the time of writing or because it is not applicable due to the nature and danger of the product.

10. Stability and reactivity

Reactivity: N/A

Chemical stability: Stable material at room temperature. The powder polymer may explode.

Possibility of hazardous reactions: Chlorine, fuming nitric acid and strong oxidizing agents.

Conditions to avoid: Avoid direct contact with the flames and high temperatures.

Incompatible materials: N/A

Hazardous decomposition products: Decomposition products: At temperatures above 300°C it decomposes emitting hydrocarbons. Complete combustion products: CO2, and H2O. Incomplete combustion products: CO, soot, aldehydes, ketones, hydrocarbons and volatile fatty acids.

11. Toxicological information

11.1 Information on toxicological effects

The provided toxicological information results from the application of Annexes VII to XI of Regulation 1907/2006 (REACH).

Acute toxicity: N/A

Skin corrosion/irritation: N/A

Respiratory or skin sensitisation: N/A

Germ cell mutagenicity: N/A

Carcinogenicity: IARC classification: Group 3 (The product is not classifiable as to its carcinogenicity to humans).

Product rating corresponds to the comparison of the results from the toxicological studies with the criteria set out in Regulation (EC) No 1272/2008 for CMR, categories 1A and 1B.

Reproductive toxicity: No evidence of reproductive toxicity in mammals.

STOT-single exposure: N/A

STOT-repeated exposure: N/A

Aspiration hazard: N/A

12. Ecological information

Toxicity: No data on toxicity to aquatic organisms.

Persistence and degradability: The product has long hydrocarbon insoluble chains, which makes biodegradation not easy. Not easily removed from water or soil and has a high persistence in the environment.

Bioaccumulative potential: No bioaccumulative problems in living organisms or incidence in the trophic food web are expected.

Mobility in soil: N/A

Results of PBT and vPvB assessment: This mixture contains no substance considered to be PBT or vPvB.

Other adverse effects: N/A

13. Disposal considerations

13.1. Waste treatment methods

Disposal: Recycle material when possible. Dissolve or mix material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Handling: Labeled and sealed containers.

Provisions: Establishments and companies which recover, dispose, store, transport or handle waste should comply with Dir. 2008/98/EC on waste, or other local, national or

community provisions.

14. Transport information

14.1. UN number: N/A

14.2. UN proper shipping name: N/A

14.3. Hazard classes for transportation: N/A

14.4. Packing group

ADR/RID: N/A

IATA-DGR: N/A

IMDG: N/A

14.5. Environmental hazards

ADR/RID: N/A

IATA-DGR: N/A

IMDG: N/A

14.6. Special precautions for user: Stable at room temperature during transport. To avoid spilling, transport in secure, properly sealed containers.

14.7. Transport in bulk in accordance with appendix II of the Marpol agreement and the IBC code: No category assigned for the IBC code.

15. Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

COMMISSION REGULATION (EU) No 2015/830.

Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Regulation (EC) No 1272/2008 of the European Parliament and the Council of 16 December 2008 on classification, labeling and packaging of substances and mixtures (CLP).

Regulation (EC) No 1907/2006 concerning Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).

European Agreement concerning the international carriage of dangerous goods by road (ADR).

Regulation on the international transport of dangerous goods on the railway. (RID)

International maritime code of dangerous goods. (IMDG)

International Air Transport Association (IATA) regulation pertaining to air shipment.

International Bulk Chemical Code (IMSBC Code), MARPOL 73/78. .

Commission Regulation Other hazards

Propylene-ethylene copolymer (CAS: 9010-79-1) is listed in TSCA Chemical Inventory (EPA).

15.2. Chemical safety assessment

A chemical safety assessment has not been carried out.

16. Other information

Glossary

MSDS: Material safety data sheet

CAS: Chemical Abstract Service

IARC: International Agency for Research on Cancer

ACGIH: American Conference of Governmental Industrial Hygienists.

TLV: Threshold Limit Value

TWA: Time Weighted Average

STEL: Short-term Exposure Level

REL: Recommendable Exposure Limit

PEL: Permissible Exposure Limit

INSHT: Instituto Nacional de Seguridad e Higiene en el Trabajo.

VLA-ED: Environmental limit value - daily exposure

VLA-EC: Limit environmental value - short exposure

DNEL/DMEL: Derived no-effect level / Derivation of minimal effects levels

PNEC: Predicted No Effect Concentration

LD50: Lethal Dose Medium

LC50: Lethal Concentration Medium

EC50: Effective Concentration Medium

IC50: Inhibitory Concentration Medium

BOD: Biological Oxygen Demand.

NOAEL: No observable adverse effect level

NOEL: No observed effect level

NOAEC: No observed adverse effect concentration

NOEC: No observed effect concentration

N/A: Not applicable

|| - | : Changes from the last revision

Databases consulted

EINECS: European Inventory of Existing Commercial Substances.

TSCA: Toxic Substances Control Act, US Environmental Protection Agency.

HSDB: US National Library of Medicine.

RTECS: US Dept. of Health & Human Services.

EINECS: European Inventory of Existing Commercial Substances.

TSCA: Toxic Substances Control Act, US Environmental Protection Agency.

HSDB: US National Library of Medicine.

RTECS: US Dept. of Health & Human Services

Hazard Class-and-Category shown in the document

N/A: Not applicable

INFORMATION NOTE ABOUT PRODUCT SAFETY

Purchasing companies have an obligation to ensure that their employees are properly trained on the safe handling and use of the product in accordance with the guidelines contained in this information note about product safety. Furthermore, companies purchasing this product are required to inform their employees, and individuals who could manipulate or use it within their facilities, about all indications included in the INFORMATION NOTE ABOUT PRODUCT SAFETY, in particular those relating to the product's risks to the health and safety of people and to the environment. Safety Information Sheet/Fact Sheet prepared in compliance with Article 32 of

Regulation (EC) 1907/2006 (REACH), in order to communicate information down the supply chain for substances on their own or in mixtures for which a safety data sheet is not required in the SDS format. Therefore, this document does not constitute a Material Safety Data Sheet (MSDS/SDS) according to Article 31 of REACH, given that for the purposes of REACH, it is not compulsory to provide a MSDS/SDS for the substance or mixture covered under this Safety Information Sheet/Fact Sheet. The information contained in this Safety Information/Fact Sheet has been prepared by Repsol in accordance with the best available information based on technical data believed to be reliable at the time of issue. Recipients rely on the information at their own risk. Consequently, no aspect of this document should be construed as a recommendation on the use of any substance or mixture, nor as any use recommendation that may be in conflict with existing patents that may cover or protect any substance, mixture or product, or its use. This document does not constitute any license granting, and consequently the recipient is not granted freedom of operation under any patent owned by Repsol (the issuer of this document) or third parties. All information, and where appropriate, statements or suggestions contained in this Safety Information Sheet/Fact Sheet are exempt from warranty, express or implied, regarding the accuracy of the information, and the risk associated with the use of the same including marketing, fitness for a particular purpose and for any use, or that the use of such information will not infringe any patent. All implied warranties of merchantability or fitness for any purpose are expressly excluded and consequently Repsol assumes no responsibility for the results obtained or for any damage (including damage to people, property and environment) that may arise, in whole or in part, from the use made by the recipient of the information contained therein.

Disclaimer

Is under responsibility of the 3d printer parts manufacturer or end user the compliance of the plastic object, for the specific use, with the overall migration limit, the specific migration limit and other restrictions. Do not hesitate to contact our technical service for explanations, advising and for any other need.

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