

TECHNICAL DATA SHEET

GRIVORY HT2C-3X BLACK 9833

Product description

Grivory HT2C-3X black 9833 is a 30% carbon-fibre reinforced engineering thermoplastic material based on a semi-crystalline, partially aromatic copolyamide.

Acc. to ISO: PA 6T/66.

Acc. to ASTM: PPA, polyphthalamide

Grivory HT2C-3X black 9833 is an injection moulding material which has a low density. It is electrically conductive.

The main distinguishing feature of Grivory HT, when compared to other polyamides, is its good performance at high temperatures providing parts which are stiffer, stronger and have better heat distortion stability and chemical resistance.

Grivory HT is suitable for production of technical parts in the application fields of

- Electrical / Electronics
- Automotive
- Mechanical engineering
- Safety technology

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PROPERTIES

| Mechanical Properties | | Standard | Unit | State | Grivory HT2C-3X black 9833 |
|---------------------------|---------------|-------------|-------------------|--------------|-------------------------------|
| Tensile E-Modulus | 1 mm/min | ISO 527 | MPa | dry cond. | 24'500 24'000 |
| Tensile strength at break | 5 mm/min | ISO 527 | MPa | dry cond. | 275 265 |
| Elongation at break | 5 mm/min | ISO 527 | % | dry cond. | 2.0 2.0 |
| Impact strength | Charpy, 23°C | ISO 179/1eU | kJ/m ² | dry cond. | 55 55 |
| Impact strength | Charpy, -30°C | ISO 179/1eU | kJ/m ² | dry cond. | 50 50 |
| Notched impact strength | Charpy, 23°C | ISO 179/1eA | kJ/m ² | dry cond. | 8 8 |
| Notched impact strength | Charpy, -30°C | ISO 179/1eA | kJ/m ² | dry cond. | 7 7 |
| Ball indentation hardness | | ISO 2039-1 | MPa | dry cond. | 300 290 |

Thermal Properties

| | | | | | |
|--------------------------------------|------------|-----------|---------------------|-----|------|
| Melting point | DSC | ISO 11357 | °C | dry | 310 |
| Heat deflection temperature HDT/A | 1.80 MPa | ISO 75 | °C | dry | 290 |
| Heat deflection temperature HDT/C | 8.00 MPa | ISO 75 | °C | dry | 245 |
| Thermal expansion coefficient long. | 23-55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.15 |
| Thermal expansion coefficient trans. | 23-55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.75 |
| Maximum usage temperature | long term | ISO 2578 | °C | dry | 140 |
| Maximum usage temperature | short term | ISO 2578 | °C | dry | 240 |

Electrical Properties

| | | | | | |
|------------------------------|-----|-------------|-------|--------------|------------|
| Dielectric strength | | IEC 60243-1 | kV/mm | dry cond. | - - |
| Comparative tracking index | CTI | IEC 60112 | - | cond. | - |
| Specific volume resistivity | | IEC 60093 | Ω · m | dry cond. | <50 <50 |
| Specific surface resistivity | | IEC 60093 | Ω | cond. | 100 |

General Properties

| | | | | | |
|------------------------|----------------|----------|-------------------|-----|------|
| Density | | ISO 1183 | g/cm ³ | dry | 1.32 |
| Flammability (UL 94) | 0.8 mm | ISO 1210 | rating | - | HB |
| Water absorption | 23°C/saturated | ISO 62 | % | - | 4.5 |
| Moisture absorption | 23°C/50% r.h. | ISO 62 | % | - | 1.5 |
| Linear mould shrinkage | long. | ISO 294 | % | dry | 0.05 |
| Linear mould shrinkage | trans. | ISO 294 | % | dry | 0.45 |

Product-nomenclature acc. ISO 1874: PA 6T/66, MH, 14-250, CF30

Information for injection moulding of Grivory HT2C-3X black 9833

This technical data sheet for Grivory HT2C-3X black 9833 provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory HT2C-3X black 9833 is delivered dry and ready for processing in sealed packaging. Pre-drying is not necessary.

Storage

Sealed, undamaged bags can be kept over a long period of time in storage facilities which are dry, protected from the influence of weather and where the bags can be protected from damage.

Handling and safety

Detailed information can be obtained from the material safety data sheet (MSDS) which can be requested with every material order.

Drying

During its manufacturing process Grivory HT2C-3X black 9833 is dried and packed with a moisture content of below 0.10 %. Should the packaging become damaged or the material is left open too long, then the material must be dried. A too high moisture content can be shown by a foaming melt and silver streaks on the moulded part.

Drying can be done as follows:

Desiccant dryer

| | |
|-------------|--------------|
| Temperature | max. 80°C |
| Time | 4 - 12 hours |
| Dew point | -40°C |

Vacuum oven

| | |
|-------------|--------------|
| Temperature | max. 100°C |
| Time | 4 - 12 hours |

Drying time

If there is only little evidence of foaming of the melt or just slight silver streaks on the part, then the above mentioned minimal drying time will be sufficient. Material, which is stored open over days, which shows strong foaming, unusually easy flowing, streaks and rough surface on the moulding part, then the maximal drying time is required.



Silver streaks can also be caused by overheating of the material (over 350°C) or by too long melt residence time in the barrel.

Drying temperature

Polyamides are affected by oxidation at high temperatures. A visible yellowing of material in light colour is an indication of oxidation. Desiccant dryer temperature should not exceed 80°C. In a vacuum oven at lower oxygen pressure a higher temperature (100°C) is possible.

At longer residence times (over 1 hour) a hopper dryer (80°C) is useful.

Use of regrind

Grivory HT2C-3X black 9833 is a thermoplastic material. This allows recycling of sprues, runners and rejected components in the running process.

To ensure a trouble free processing, special precaution has to be taken by the moulder. Following points have to be kept in mind:

- Avoid moisture absorption of the regrind (otherwise drying is necessary)
- Contamination by foreign material such as other polymers, dust or oil has to be avoided

Property and colour changes of the part can be controlled with proper handling measures.

MACHINE REQUIREMENTS

Grivory HT2C-3X black 9833 can be processed economically on all machines suitable for polyamides.

Screw

Wear protected, 3-zone universal screws with non-return valves are recommended.

Screw

| | |
|-------------------|-------------|
| Length | 18 D - 22 D |
| Compression ratio | 2 - 2.5 |

Shot volume

The metering stroke must be longer than the length of the non-return-valve.

Selecting the injection unit

$$\text{Shot volume} = 0.5 - 0.8 \times (\text{max. shot volume})$$

Heating

At least three separately controllable heating zones, able of reaching cylinder temperatures up to 350°C are required. A separate nozzle heating is necessary. The cylinder flange temperature must be controllable.

Nozzle

Open nozzles are simple, allow an easy melt flow and are long lasting. There is, however, the danger that during retraction of the screw after injection of the melt, air maybe drawn into the barrel (decompression). For this reason, needle shut-off nozzles are often used.

Clamping force

As a rule of thumb the clamping force can be estimated using the following formula:

Clamping force

$$7.5 \text{ kN}^{1)} \times \text{projected area (cm}^2\text{)}$$

¹⁾ in cavity pressure of 750 bar

TOOLING

The design of the mould tool should follow the general rules for reinforced thermoplastics.

For the mould cavities common mould tool steel quality (e.g. hardened steel) which has been hardened to level of 56 - 65 HRC is necessary. We recommend additional wear protection in areas of high flow rates in the tool (e.g. pin point gates, hot runner nozzles).

Demoulding / Draft angle

Parts moulded from Grivory HT are setting very quickly showing excellent dimensional stability. Asymmetric demoulding and undercuts are to be avoided. It is favourable to foresee high numbers of large ejector pins or a stripper plate.

Demoulding draft angles between 1 to 5° are acceptable. Following values can be considered:

| | | | | | | |
|-------------------------|-----|-----|-----|-----|-----|-----|
| (VDI 3400) | 12 | 15 | 18 | 21 | 24 | 27 |
| Depth of roughness (µm) | 0.4 | 0.6 | 0.8 | 1.1 | 1.6 | 2.2 |
| Demoulding angle (°) | 1 | 1 | 1.1 | 1.2 | 1.3 | 1.5 |

| | | | | | | |
|-------------------------|-----|-----|-----|----|----|----|
| (VDI 3400) | 30 | 33 | 36 | 39 | 42 | 45 |
| Depth of roughness (µm) | 3.2 | 4.5 | 6.3 | 9 | 13 | 18 |
| Demoulding angle (°) | 1.8 | 2 | 2.5 | 3 | 4 | 5 |

Gate and runner

To achieve mould filling and avoid sink marks, a central gate at the thickest section of the moulding is recommended. Pin point gate (direct) or tunnel gates are more economical and more common with technical moulding.

To avoid premature solidification of the melt and difficult mould filling, the following points should be considered:

Gate diameter

0.8 x thickest wall section of the injection moulding part

Runner diameter

1.4 x thickest wall section of the injection moulding part (but minimum 4 mm)

VENTING

In order to prevent burn marks and to improve the weld line strength, proper venting of the mould cavity should be provided mainly on all ends of the melt front and in the area of weld line (venting channels with dimensions: Depth 0.02 mm, width 2 - 5 mm).

PROCESSING

Mould filling, post pressure and dosing

The best surface finish and a high weld line strength is achieved when a high injection speed and a sufficiently long post pressure time is employed.

The injection speed should be chosen to be reduced towards the end of the filling process in order to avoid overheating and burning. For dosing at low screw speed and pressure the cooling time should be fully utilised.

Basic machine settings

In order to start up the machine for processing Grivory HT2C-3X black 9833, following basic settings can be used (we recommend to start with barrel-temperatures in the lower range):

Temperatures

| | |
|--------|-------------|
| Flange | 60 - 80°C |
| Zone 1 | 315 - 330°C |
| Zone 2 | 315 - 340°C |
| Zone 3 | 315 - 335°C |
| Nozzle | 310 - 325°C |
| Tool | 100 - 100°C |
| Melt | 320°C |

Pressures / Speeds

| | |
|--------------------------|---------------|
| Injection speed | medium - high |
| Hold-on pressure (spec.) | 500 - 750 bar |
| Dynamic pressure (spec.) | 50 - 100 bar |
| Screw speed | 0.1 - 0.3 m/s |

Start up and purging

Foreign materials in the cylinder should be removed with suitable purging materials. Hot-runner systems should be purged likewise. Glass fibre reinforced polyamide 66 is a suitable "bridging material".

Cylinder heating should start with a clean, product-free screw, starting from the temperature level of the "bridging material" of 300°C up to the required temperature level of 320°C (see processing data).

After at least three full dosages (free-shot) the start up procedure can be implemented.

After completion of production with Grivory HT the screw, cylinder and melt distribution system should be cleaned out thoroughly.

Conditioning

The dimensions and the mechanical properties of Grivory HT products are only marginally influenced by moisture absorption. For testing purposes, parts can be stored in a climatic chamber until an increase in weight of 1 % has been achieved. In order to avoid stress through swelling conditioning in hot water is to be avoided.

CUSTOMER SERVICES

EMS-GRIVORY is a specialist for polyamide synthesis and polyamide-processing. Our customer services are not only concerned with the manufacturing and supply of engineering thermoplastics but also provide a full of technical support program:

- Rheological design calculation / FEA
- Prototype tooling
- Material selection
- Processing support
- Mould and component design

We are happy to advice you. Simply call one of our sales offices.

The recommendations and data given are based on our experience to date, however, no liability can be assumed in connection with their usage and processing.

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This version replaces all previous product specific data sheets.

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