

TECHNICAL DATA SHEET

GRIVORY HT3Z LF

General product description

Grivory HT3Z LF is an unreinforced and impact resistant, PTFE modified engineering thermoplastic based on semi crystalline partially aromatic copolyamide.

This Grivory HT product is partially based on renewable raw materials.

ISO polymer designation: PA 10T/X
ASTM designation: PPA, polyphthalamide

Grivory HT3Z LF is especially used in tribological applications. Grivory HT3Z LF exhibits low moisture absorption, high stiffness and high heat distortion temperature. The PTFE (polytetrafluoroethylene) modification reduces the sliding friction after a short initial phase.

As each tribological system has its own properties (material combination, temperature, force etc.), the suitability of the product has to be tested for each application under practical conditions.



PROPERTIES

Mechanical Properties

| | | Standard | Unit | State | Grivory HT3Z LF |
|---------------------------|---------------|---------------|-------------------|--------------|-----------------|
| Tensile E-Modulus | 1 mm/min | ISO 527 | MPa | dry cond. | 2700 2800 |
| Tensile strength at break | 50 mm/min | ISO 527 | MPa | dry cond. | 80 75 |
| Elongation at break | 50 mm/min | ISO 527 | % | dry cond. | 3 4 |
| Impact strength | Charpy, 23°C | ISO 179/2-1eU | kJ/m ² | dry cond. | 100 95 |
| Impact strength | Charpy, -30°C | ISO 179/2-1eU | kJ/m ² | dry cond. | 95 90 |
| Notched impact strength | Charpy, 23°C | ISO 179/2-1eA | kJ/m ² | dry cond. | 6 6 |
| Notched impact strength | Charpy, -30°C | ISO 179/2-1eA | kJ/m ² | dry cond. | 6 6 |
| Ball indentation hardness | | ISO 2039-1 | MPa | dry cond. | 140 140 |

Thermal Properties

| | | | | | |
|--------------------------------------|------------|-----------|---------------------|-----|-----|
| Melting point | DSC | ISO 11357 | °C | dry | 295 |
| Heat deflection temperature HDT/A | 1.8 MPa | ISO 75 | °C | dry | 110 |
| Heat deflection temperature HDT/C | 8.0 MPa | ISO 75 | °C | dry | 85 |
| Thermal expansion coefficient long. | 23-55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.8 |
| Thermal expansion coefficient trans. | 23-55°C | ISO 11359 | 10 ⁻⁴ /K | dry | 0.8 |
| 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. | 33 33 |
| Comparative tracking index | CTI | IEC 60112 | - | cond. | 400 |
| Specific volume resistivity | | IEC 60093 | Ω · m | dry cond. | 10 ¹⁰ 10 ¹⁰ |
| Specific surface resistivity | | IEC 60093 | Ω | cond. | 10 ¹¹ |

General Properties

| | | | | | |
|------------------------|---------------|----------|-------------------|-----|------|
| Density | | ISO 1183 | g/cm ³ | dry | 1.19 |
| Flammability (UL94) | 0.8 mm | ISO 1210 | rating | - | HB |
| Water absorption | 23°C/sat. | ISO 62 | % | - | 2.5 |
| Moisture absorption | 23°C/50% r.h. | ISO 62 | % | - | 1.4 |
| Linear mould shrinkage | long. | ISO 294 | % | dry | 1.75 |
| Linear mould shrinkage | trans. | ISO 294 | % | dry | 1.20 |

Product-nomenclature acc. ISO 1874: PA10T/X, MH,12-030

Processing information for the injection moulding of Grivory HT3Z LF

This technical data sheet for Grivory HT3Z LF provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory HT3Z LF is delivered dry and ready for processing in sealed, air tight packaging. Predrying is not necessary provided the packaging is undamaged.

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 are safe from getting damaged.

Handling and safety

Detailed information can be obtained from the "Material Safety Data Sheet" (MSDS), which can be requested with every material order.

Drying

Grivory HT3Z LF is dried and packed with a moisture content of $\leq 0.10\%$. Should the packaging become damaged or be left open too long, then the material must be dried. A too high moisture content can be shown by a foaming melt, excessive nozzle drool 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 of the dryer | -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. If material is stored open for days, shows strong foaming, unusually easy flow, streaks or a rough surface on the moulded part, then the maximum 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 temperatures above 80°C in the presence of oxygen. Visible yellowing of the material is an indication of oxidation. Hence, temperatures above 80°C for desiccant dryers and temperatures above 100°C for vacuum ovens should be avoided. In order to detect oxidation it is advised to keep a small amount of granulate (light colours only!) as a comparison sample.

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

Use of regrind

Grivory HT3Z LF is a thermoplastic material. Hence, incomplete mouldings as well as sprues and runners can be reprocessed. The following points should be observed:

- Moisture absorption
- Grinding: Dust particles and particle size distribution
- Contamination through foreign material, dust, oil, etc.
- Level of addition to original material
- Colour variation
- Reduction of mechanical properties

When adding regrind, special care has to be taken by the moulder.

MACHINE REQUIREMENTS

Grivory HT3Z LF can be processed economically and without problems on all machines suitable for polyamides.

Screw

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

Shot volume

The metering stroke (less decompression distance) must be longer than the length of the non-return-valve.

Selecting the injection unit

| |
|-------------------------------------------------------------------|
| Shot volume = 0.5 - 0.8 x (max. shot volume of injection unit) |
|-------------------------------------------------------------------|

Heating

At least three separately controllable heating zones, capable of reaching cylinder temperatures up to 350°C are recommended. Separate nozzle heating is necessary. The cylinder flange temperature must be controllable (cooling).

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 following 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

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

¹⁾ for a cavity pressure of 750 bar

TOOLING

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

For the mould cavities common mould tool steel quality (e.g. hardened steel), which has been hardened to a 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

Asymmetric demoulding and undercuts are to be avoided if possible. Generous provision should be made for ejection with many large pins or a stripper plate. Draft angles for the inner and outer wall between 0.5 and 3° is usually sufficient. Textured surfaces require a larger draft angle (1° per 0.025 mm depth of roughness).

| | | | | | | |
|-------------------------|-----|-----|-----|-----|-----|-----|
| (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 the best mould filling and avoid sink marks, a central gate at the thickest section of the moulding is recommended. Pin point (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 burning marks and improve weld line strength, proper venting of the mould cavity should be provided (venting channels on the parting surface 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 are achieved when a high injection speed and a sufficiently long post pressure time are employed.

The injection speed should be regulated so as to reduce towards the end of the filling cycle in order to avoid burning. For dosing at low screw revolutions and pressure the cooling time should be fully utilised.

Basic machine settings

In order to start up the machine for processing Grivory HT3Z LF, the following basic settings can be recommended:

Temperatures

| | |
|--------|-----------|
| Flange | 60-80°C |
| Zone 1 | 310-325°C |
| Zone 2 | 310-330°C |
| Zone 3 | 310-330°C |
| Nozzle | 305-320°C |
| Tool | 120-160°C |
| Melt | 320°C |

Pressures / Speeds

| | |
|--------------------------|----------------|
| Injection speed | medium to high |
| Hold-on pressure (spec.) | 500-800 bar |
| Dynamic pressure (hydr.) | 5-15 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. An unreinforced 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 330°C (see processing data).

After at least three full air-shots the start up procedure can be performed/carried out.

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 has to be avoided.

CUSTOMER SERVICES

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

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

We are happy to advise 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.