

# TECHNICAL DATA SHEET

## GRIVORY HTV-4X1 NATURAL

### Product description

Grivory HTV-4X1 natural is a 40% glass-fibre reinforced engineering thermoplastic material based on a semi-crystalline, partially aromatic copolyamide.

Acc. to ISO: PA 6T/6I.

Acc. to ASTM: PPA, Polyphthalamide

Grivory HTV-4X1 is a specially heat stabilised injection moulding material.

It is particularly suitable and approved for parts in house-hold appliances in contact with food and drinking water.

The main distinguishing feature of Grivory HT, when compared to other polyamides, is its good performance values 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:

- Electro
- Electronics
- Automotive
- Safety technology
- Mechanical engineering
- Domestic appliances

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**EMS**

## PROPERTIES

### Mechanical Properties

		Standard	Unit	State	Grivory HTV-4X1 natural
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	14500 14000
Tensile strength at break	5 mm/min	ISO 527	MPa	dry cond.	220 210
Elongation at break	5 mm/min	ISO 527	%	dry cond.	2 2
Impact strength	Charpy, 23°C	ISO 179/1eU	kJ/m <sup>2</sup>	dry cond.	70 70
Impact strength	Charpy, -30°C	ISO 179/1eU	kJ/m <sup>2</sup>	dry cond.	70 70
Notched impact strength	Charpy, 23°C	ISO 179/1eA	kJ/m <sup>2</sup>	dry cond.	8 8
Notched impact strength	Charpy, -30°C	ISO 179/1eA	kJ/m <sup>2</sup>	dry cond.	8 8
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	310 300

### Thermal Properties

Melting point	DSC	ISO 11357	°C	dry	325
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	280
Heat deflection temperature HDT/C	8.00 MPa	ISO 75	°C	dry	175
Thermal expansion coefficient long.	23-55°C	ISO 11359	10 <sup>-4</sup> /K	dry	0.15
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10 <sup>-4</sup> /K	dry	0.5
Maximum usage temperature	long term	ISO 2578	°C	dry	140
Maximum usage temperature	short term	ISO 2578	°C	dry	250

### Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	dry cond.	35 35
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	dry cond.	10 <sup>11</sup> 10 <sup>11</sup>
Specific surface resistivity		IEC 60093	Ω	cond.	10 <sup>12</sup>

### General Properties

Density		ISO 1183	g/cm <sup>3</sup>	dry	1.53
Flammability (UL94)	0.8 mm	ISO 1210	rating	-	HB
Water absorption	23°C/sat.	ISO 62	%	-	3.5
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	1.5
Linear mould shrinkage	long.	ISO 294	%	dry	0.10
Linear mould shrinkage	trans.	ISO 294	%	dry	0.55

Product-nomenclature acc. ISO 1874: PA 6T/6I, MH, 12-140, GF40

## Processing information for the injection moulding of Grivory HTV-4X1 natural

This technical data sheet for Grivory HTV-4X1 natural provides you with useful information on material preparation, machine requirements, tooling and processing.

### MATERIAL PREPARATION

Grivory HTV-4X1 natural is delivered dry and ready for processing in sealed, air tight packaging. Predrying 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 HTV-4X1 natural is dried and packed with a moisture content of  $\leq 0.10\%$ . 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 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. 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 subjected to the affects of 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 colour 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 HTV-4X1 natural 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.
- Quantity 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 HTV-4X1 natural can be processed economically and without problems on all machines suitable for polyamides.

#### Screw

Wear protected, universal screws with shut-off nozzles are recommended (3 zones).

##### Screw

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

#### Shot volume

The metering stroke must be longer than the length of the back flow valve (without decompression distance).

##### Selecting the injection unit

$$\text{Shot volume} = 0.6 - 0.9 \times (\text{max. shot volume})$$

## Heating

At least three separately controllable heating zones, able of reaching cylinder temperatures up to 350°C. A 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 screws 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

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

<sup>1)</sup> in cavity pressure of 750 bar

## TOOLING

The design of the mould tool should follow the general rules for glass fibre 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 solidify 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 an optimal mould-fill and to 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 filing, 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 weldline 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 is achieved with a high injection speed and when a sufficiently long post pressure is 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 machines for processing Grivory HTV-4X1 natural, following basic settings can be recommended:

#### Temperatures

Flange	80 - 100°C
Zone 1	330 - 340°C
Zone 2	330 - 345°C
Zone 3	330 - 345°C
Nozzle	330 - 340°C
Tool	140 - 160°C
Melt	340°C

#### Pressures / Speeds

Injection speed	medium - high
Hold-on pressure (spec.)	500 - 750 bar
Dynamic pressure (hydr.)	5 - 15 bar
Screw speed	50 - 100 min <sup>-1</sup>

### 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 340°C (see processing data).

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

After completion of production with Grivory HT-PPA 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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