TECHNICAL DATA SHEET

GRIVORY GV-6H NATURAL

Product description

Grivory GV-6H natural is a 60% glass-fiber reinforced engineering thermoplastic material based on a combination of semi-crystalline Polyamide with partially aromatic copolyamide.

Grivory GV-6H natural is used for injection molding technical parts, exhibiting exceptional characteristics even after moisture absorption:

- high stiffness and strength
- dimensional stability
- low warpage
- good chemical resistance
- good surface finish

Grivory GV is the economical alternative to die-cast alloys.

GRIVORY®
EMS

PROPERTIES

Mechanical Properties

		Standard	Unit	State	Grivory GV-6H natural
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	22000 21000
Tensile strength at break	5 mm/min	ISO 527	MPa	dry cond.	260 240
Elongation at break	5 mm/min	ISO 527	%	dry cond.	2 2
Impact strength	Charpy, 23°C	ISO 179/1eU	kJ/m²	dry cond.	80 80
Impact strength	Charpy, -30°C	ISO 179/1eU	kJ/m²	dry cond.	80 80
Notched impact strength	Charpy, 23°C	ISO 179/1eA	kJ/m²	dry cond.	14 14
Notched impact strength	Charpy, -30°C	ISO 179/1eA	kJ/m²	dry cond.	13 13
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	315 290

Thermal Properties

Melting point	DSC	ISO 11357	°C	dry	260
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	235
Heat deflection temperature HDT/C	8.00 MPa	ISO 75	°C	dry	175
Thermal expansion coefficient long.	23-55°C	ISO 11359	10^{-6}/K	dry	15
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10^{-6}/K	dry	90
Maximum usage temperature	long term	ISO 2578	°C	dry	100 - 120
Maximum usage temperature	short term	EMS	°C	dry	220

Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	dry cond.	33 33
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 62631-3-1	Ω · m	dry cond.	10^{14} 10^{14}
Specific surface resistivity		IEC 62631-3-2	Ω	cond.	10^{15}

General Properties

Density		ISO 1183	g/cm³	dry	1.69
Flammability (UL94)	0.8 mm	IEC 60695-11-1	rating	-	HB
Water absorption	23°C/sat.	ISO 62	%	-	3.5
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	1.2
Linear mold shrinkage	long.	ISO 294	%	dry	0.05
Linear mold shrinkage	trans.	ISO 294	%	dry	0.30

Product-nomenclature: ISO 16396-PA66+PA6I/X,GF60,MH,C14-220

Processing information for the injection molding of Grivory GV-6H natural

This technical data sheet for Grivory GV-6H natural provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory GV-6H natural is delivered dry and ready for processing in sealed, airtight 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 GV-6H natural is dried and packed with a moisture content of ≤ 0.10 %. Should the packaging become damaged or the material is left open for too long, the material must be dried. A too high moisture content shows by a foaming melt and silver streaks on the molded part.

Drying can be done as follows:

Desiccant dryer

Temperature:	max. 80°C
Time:	4 - 12 hours
Dew point of the dryer:	-25°C

Vacuum oven

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

Drying time
If there is only little evidence of a foaming melt or just slight silver streaks on the part, then the above mentioned minimal drying time will be sufficient. If the material is left open for days, displays strong foaming, unusually easy flowing, streaks or a rough surface on the molded part, then the maximum drying time is required.



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

Drying temperature
Polyamides are subjected to the effects 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 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 GV-6H natural is a thermoplastic material. Hence, incomplete moldings 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 with foreign material, dust, oil, etc.
- Quantity addition to original material
- Color variation
- Reduction of mechanical properties

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

MACHINE REQUIREMENTS

Grivory GV-6H natural can be processed economically and problem free on all machines suitable for glass fiber reinforced polyamides.

Screw
Wear protected, universal screws (3 zones) 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 back flow valve (without decompression distance).

Selecting the injection unit

Shot volume = 0.5 - 0.8 x
(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 (cooling).

Nozzle
Open nozzles are simple, allow for an easy melt flow and are long lasting. There is however the danger that during screw retraction (decompression), after melt injection, air maybe drawn into the barrel. 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 kN[1)] x projected area (cm^2)

[1)] in cavity pressure of 750 bar

TOOLING
The design of the mold tool should follow the general rules for glass-fiber reinforced thermoplastics.

For the mold cavities common mold tool steel quality (e.g. hardened steel) which has been hardened to a level of 56 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).

Demolding / Draft angle
Parts molded from Grivory show excellent dimensional stability. Asymmetric demolding and undercuts are to be avoided. It is favorable to foresee high numbers of large ejector pins or a stripper plate. Demolding 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
Demolding 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
Demolding angle (%)	1.8	2	2.5	3	4	5

Gate and runner
To achieve an optimal mold-fill and to avoid sink marks, a central gate at the thickest section of the molding is recommended. Pin point gates (direct) or tunnel gates are more economical and more common with technical molding.

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

Gate diameter

0.8 x thickest wall section of the injection molded part

Runner diameter

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

VENTING
In order to prevent burn marks and improve weld line strength, proper venting of the mold cavity should be provided (venting channels on the parting surface dimensions: Depth 0.02 mm, width 2 - 5 mm).

PROCESSING

Mold filling, post pressure and dosing
The best surface finish and a high weld line strength is achieved with a high injection speed combined with a sufficiently long post pressure. The injection speed should be regulated 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 utilized.

Basic machine settings
In order to start up the machines for processing Grivory GV-6H natural, following basic settings are recommended:

Temperatures

Flange	80°C
Zone 1	260°C
Zone 2	270°C
Zone 3	275°C
Nozzle	270°C
Tool	80 - 120°C
Melt	270 - 300°C

Pressures / Speeds

Injection speed	medium - high
Hold-on pressure (spec.)	300 - 800 bar
Dynamic pressure (hydr.)	5 - 15 bar
Screw speed	50 - 100 min^{-1}

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
- Mold and component design

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

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