GRIVORY HT

GRIVORY XE 4027 NATURAL

Product description

Grivory XE 4027 natural is a 30% glass-fibre reinforced flame retardant (UL 94 V-0) engineering thermoplastic material based on a semi-crystalline, partially aromatic copoly-amide.
This Grivory HT product is partially based on renewable raw materials.

Grivory XE 4027 natural is free of halogens and red phosphorus.

RoHS: Grivory XE 4027 natural is in compliance with RoHS (2002/95/EC, Restriction of Hazardous Substances).

WEEE: Parts produced from Grivory XE 4027 natural are not subject to "selective treatment" according the Directive 2002/96/EC on Waste Electrical and Electronic Equipment.

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

The main distinguishing features of Grivory HT, when compared to other poly-amides, are its good performance at high temperatures providing parts which are stiffer, stronger, have better heat distortion and dimensional stability as well as excellent chemical resistance and low moisture absorption.

Grivory XE 4027 natural is especially suitable for injection moulded components in electrical and electronic applications which require a flame class acc. UL 94 V-0. The material is suitable for lead-free SMT reflow soldering acc. e.g. JEDEC J-STD-020C (peak temperature 260°C). Components conforming to JEDEC MSL1 are achievable.

PROPERTIES

Mechanical Properties		Standard	Unit	State	Grivory XE 4027 natural
Tensile E-modulus	1 mm/min	ISO 527	MPa	dry cond.	10000 10000
Tensile strength at break	5 mm/min	ISO 527	MPa	dry cond.	130 130
Elongation at break	5 mm/min	ISO 527	%	dry cond.	2 2
Impact strength	Charpy, 23°C	ISO 179/2-1eU	kJ/m^2	dry cond.	50 50
Impact strength	Charpy, -30°C	ISO 179/2-1eU	kJ/m^2	dry cond.	50 50
Notched impact strength	Charpy, 23°C	ISO 1792-/1eA	kJ/m^2	dry cond.	8 8
Notched impact strength	Charpy, -30°C	ISO 179/2-1eA	kJ/m^2	dry cond.	7 7
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	235 235
Thermal Properties					
Melting point	DSC	ISO 11357	°C	dry	295
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	260
Heat deflection temperature HDT/C	8.00 MPa	ISO 75	°C	dry	155
Thermal expansion coefficient long.	23-55°C	ISO 11359	$10^{-4}/K$	dry	0.2
Thermal expansion coefficient trans.	23-55°C	ISO 11359	$10^{-4}/K$	dry	0.7
Maximum usage temperature	long term	ISO 2578	°C	dry	150
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 60093	Ω · m	dry cond.	10^9 10^9
Specific surface resistivity		IEC 60093	Ω	cond.	10^{11}
General Properties					
Density		ISO 1183	g/cm^3	dry	1.41
Flammability (UL 94)	0.4 - 3.2 mm	ISO 1210	rating	-	V-0
Glow wire temperature (3mm)	IEC GWFI	IEC 60695-2-12	°C	-	960
	IEC GWIT	IEC 60695-2-13	°C		800
Water absorption	23°C/saturated	ISO 62	%	-	2.3
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	0.9
Linear mould shrinkage	long.	ISO 294	%	dry	0.3
Linear mould shrinkage	trans.	ISO 294	%	dry	1.0

Product nomenclature acc. ISO 1874: PA 10T/X, MHF, 11-100, GF30

Information on Injection Moulding of Grivory XE 4027 natural

This technical data sheet for Grivory XE 4027 natural provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory XE 4027 natural 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 XE 4027 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.

The 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

Openly stored material which shows foaming, unusually easy flow or rough surfaces on the moulded part needs drying.

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 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 sample of granules (light colour only !) forcomparison.
At longer residence times (over 1 hour) a hopper dryer (80°C) is useful.

Use of Regrind

Grivory XE 4027 natural is a thermoplastic material. This allows recycling of sprues, runners and rejected components in the running process

It is recommended to add a maximum of 25% regrind as long as the requirements on the final part allow the addtion of regrind.

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 (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 XE 4027 natural can be processed economically on all injection moulding machines suitable for polyamides.

Screw

Wear and corrosion protected, 3-zone universal screws with check 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 check 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 an easy melt flow and are long lasting. There is, however, the danger that during retraction of the screw after injection, 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 kN[1)] x projected area (cm^2)

[1)] 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 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. The 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

Venting
In order to prevent burn marks and to improve the weld line strength, proper venting of the mould cavity should be provided. Venting channels on the parting surface with dimensions of depth 0.02 mm and width 2 - 5 mm are recommended.

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 filling, the following points should be considered:

Gate diameter

0.8 x thickest wall section
of the injection moulded part

Runner diameter

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

PROCESSING

Mould Filling, Post Pressure and Dosing
The best surface finish and a high weld line strength are achieved with a high injection speed and when a sufficiently long post pressure 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 speeds and pressure the cooling time should be fully utilised.

Basic Machine Settings
In order to start up the machines for processing Grivory XE 4027 natural, following basic settings can be recommended:

Temperatures

Flange	80°C
Zone 1	305 - 320°C
Zone 2	305 - 320°C
Zone 3	305 - 320°C
Nozzle	305 - 320°C
Tool	110 - 150°C
Melt	300 - 330°C

Speeds / Pressures

Injection speed	medium - high
Hold-on pressure (spec.)	500 - 800 bar
Dynamic pressure (hydr.)	5 - 15 bar
Peripheral 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 300-330°C (see processing data).

After at least three full dosings (free-shots) - applying the shortest possible residence time - 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 advise you. Simply call one of our sales offices.

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This version replaces all previous product specific data sheets.

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