PROVISIONAL DATA SHEET

GRIVORY XE 4217
BLACK 9233

General product description

Grivory XE 4217 black 9233 is a high heat stabilized, 45% glass fibre reinforced, semi-crystalline, thermoplastic engineering material for injection moulding.

Polymer designation according to ISO: PA 6T/66+X
Acc. to ASTM: PPA, polyphthalamide

The main distinguishing feature of Grivory HT-PPA, 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.

The special property profile of Grivory XE 4217 black 9233 makes it suitable for automotive parts with very high demands on heat stability. Parts of good surface quality are feasible.

Grivory XE 4217 black 9233 is applicable for engine compartment and powertrain applications such as:

- Charge air ducts
- Charge air cooler tanks
- Air intake silencers
- Oil sumps
- Functional parts

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PROPERTIES

Mechanical Properties

		Standard	Unit	State	Grivory XE 4217 black 9233
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	15000 13000
Tensile strength at break	5 mm/min	ISO 527	MPa	dry cond.	230 165
Elongation at break	5 mm/min	ISO 527	%	dry cond.	2.7 2.7
Impact strength	Charpy, 23°C	ISO 179/1eU	kJ/m²	dry cond.	70 80
Impact strength	Charpy, -30°C	ISO 179/1eU	kJ/m²	dry cond.	60 60
Notched impact strength	Charpy, 23°C	ISO 179/1eA	kJ/m²	dry cond.	11 11
Notched impact strength	Charpy, -30°C	ISO 179/1eA	kJ/m²	dry cond.	9 9
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	270 250

Thermal Properties

Melting point	DSC	ISO 11357	°C	dry	300
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	240
Heat deflection temperature HDT/C	8.00 MPa	ISO 75	°C	dry	170
Thermal expansion coefficient long.	23-55°C	ISO 11359	10^{-6}/K	dry	20
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10^{-6}/K	dry	70
Maximum usage temperature	long term	ISO 2578	°C	dry	150
Maximum usage temperature	short term	EMS	°C	dry	250

Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	dry cond.	45 45
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	dry cond.	10^{10} 10^{10}
Specific surface resistivity		IEC 60093	Ω	cond.	10^{12}

General Properties

Density		ISO 1183	g/cm³	dry	1.58
Flammability (UL94)	0.8 mm	ISO 1210	rating	-	HB
Water absorption	23°C/sat.	ISO 62	%	-	4.3
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	1.7
Linear mould shrinkage	long.	ISO 294	%	dry	0.15
Linear mould shrinkage	trans.	ISO 294	%	dry	0.80

Product-nomenclature acc. ISO 1874: PA6T/66+X, MH, 14-110, GF45

Processing information for the injection moulding of Grivory XE 4217 black 9233

This technical data sheet for Grivory XE 4217 black 9233 provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory XE 4217 black 9233 is delivered dry and ready for processing in sealed, air tight 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 are 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

For the processing of Grivory XE 4217 black 9233 a moisture content of ≤ 0.1% is recommended. Should the packaging get damaged or the material is left open too long, it must be dried. A too high moisture content shows up as 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, the above mentioned minimal drying time will be sufficient. For material, which is stored open over days, showing strong foaming, unusually easy flowing, streaks and rough surface on the moulded part, 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 subjected to the effects of oxidation at temperatures above 80°C in the presence of oxygen. In the case of light coloured material visible yellowing 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 (in the case of light coloured material) 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 XE 4217 black 9233 is a thermoplastic material. Hence incomplete mouldings as well as sprues and runners can be reprocessed. The following points should be observed:

- Moisture absorption
- Regrinding: dust particles and particle size distribution
- Contamination through foreign material, dust, oil, etc.
- Quantity 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 XE 4217 black 9233 can be processed economically and without problems on all injection moulding machines suitable for 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 stroke).

Selecting the injection unit

Shot volume = 0.5 - 0.8 x
(max. shot volume)

Heating
At least three separately controllable heating zones which should be 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 the necessary retraction of the screw following the metering stroke (decompression), air may be 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)] cavity pressure of 750 bar

TOOLING

The design of the mould should follow the general rules for glass fiber reinforced thermo-plastics.

For the mould cavities common tool steel quality (e.g. through hardened or case 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 mould (e.g. pin point gates, hot runner nozzles).

Demoulding / Draft angle
Parts moulded from Grivory HT-PPA 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

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).

Gate and runner
To achieve an optimal mould filling and to avoid sink marks, a central gate at the thickest section of the moulding part 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)

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 if a sufficiently long post pressure is employed.

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

Basic machine settings
For the processing of Grivory XE 4217 black 9233, following basic settings are recommended:

Temperatures

Flange	60 - 80°C
Zone 1	305 - 320°C
Zone 2	305 - 330°C
Zone 3	305 - 325°C
Nozzle	300 - 320°C
Tool	90 - 120°C
Melt	310°C

Pressures / Speeds

Injection speed	medium - high
Hold-on pressure (spec.)	500 - 750 bar
Dynamic pressure (spec.)	50 - 100 bar
Peripheral screw speed	5 - 15 m/min

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 purging material.

Cylinder heating should start with a clean, product-free screw, starting from the temperature level of the purging material of 300°C up to the required temperature level of 310°C (see processing data).

After at least three full dosings (free-shots) the start up procedure can be implemented with minimal dwell time.

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

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 technical support program:

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

We are happy to advise you. You are welcome to contact one of our sales offices.

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