TECHNICAL DATA SHEET

GRIVORY GTR 45

Product description

Grivory GTR 45 is a transparent engineering thermoplastic based on amorphous, partially aromatic copolyamide for injection moulding.

Compared to other semi crystalline polyamides the most interesting property of Grivory GTR 45 is the transparency even at high wall thicknesses.

Grivory GTR 45 is suitable for production of optically and technically demanding parts in the application segments:

- Electro / Electronics
- Mechanical engineering
- Domestic appliances
- Safety technology
- Packaging

Grivory GTR 45 can be used where transparency with solvent resistance is needed and is particularly suitable and approved for parts in contact with non alcoholic food, cosmetics and cold (< 30°C) drinking water.

GRIVORY®

EMS

PROPERTIES

Mechanical Properties

		Standard	Unit	State	Grivory GTR 45
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	3000 3000
Tensile strength at yield	50 mm/min	ISO 527	MPa	dry cond.	100 100
Elongation at yield	50 mm/min	ISO 527	%	dry cond.	5 5
Tensile strength at break	50 mm/min	ISO 527	MPa	dry cond.	* *
Elongation at break	50 mm/min	ISO 527	%	dry cond.	> 50 > 50
Impact strength	Charpy, 23°C	ISO 179/1eU	kJ/m²	dry cond.	> 100 > 100
Impact strength	Charpy, -30°C	ISO 179/1eU	kJ/m²	dry cond.	> 100 > 100
Notched impact strength	Charpy, 23°C	ISO 179/1eA	kJ/m²	dry cond.	8 8
Notched impact strength	Charpy, -30°C	ISO 179/1eA	kJ/m²	dry cond.	8 2
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	145 145

Thermal Properties

Glass transition temperature	DSC	ISO 11357	°C	dry	125
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	105
Heat deflection temperature HDT/B	0.45 MPa	ISO 75	°C	dry	115
Thermal expansion coefficient long.	23-55°C	ISO 11359	10^{-4}/K	dry	0.6
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10^{-4}/K	dry	0.6
Maximum usage temperature	long term	ISO 2578	°C	dry	40 - 60
Maximum usage temperature	short term	ISO 2578	°C	dry	70

Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	dry cond.	27 27
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	dry cond.	10^{12} 10^{12}
Specific surface resistivity		IEC 60093	Ω	cond.	10^{13}

General Properties

Density		ISO 1183	g/cm³	dry	1.18
Flammability (UL94)	0.8 mm	ISO 1210	rating		V2
Water absorption	23°C/sat.	ISO 62	%		7
Moisture absorption	23°C/50% r.h.	ISO 62	%		2
Linear mould shrinkage	long.	ISO 294	%	dry	0.35
Linear mould shrinkage	trans.	ISO 294	%	dry	0.45

Product-nomenclature acc. ISO 1874: PA6I/6T, FT, 11-030

Processing information for the injection moulding of Grivory GTR 45

This technical data sheet for Grivory GTR 45 provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grivory GTR 45 is delivered dry and ready for processing in sealed, air tight packaging. Predrying is not necessary.

Storage
Sealed, undamaged bags can be kept for 6 months 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 GTR 45 is dried and packed with a moisture content of ≤ 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:	< -30°C

Vacuum oven

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

Circulating air drying ovens are not suitable for Grivory GTR 45. To review / monitor the effective moisture content it is recommended to use a moisture measuring device (eg Aboni or Aquatrac).

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 GTR 45 is a thermoplastic material. Hence, incomplete mouldings as well as sprues and runners can be reprocessed. The following points should be observed:

- No thermal degradation from previous processing
- No contamination through foreign material, dust, oil, etc.
- Regrind has to be dry and dust-free.

When adding regrind, special care has to be taken by the moulder. For high-quality technical parts only virgin material has to be used .

MACHINE REQUIREMENTS

Grivory GTR 45 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

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

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

Nozzle
Open nozzles with accurate heating are to prefer. There is however the danger that during screw retraction after metering air maybe drawn into the barrel. If shut-off nozzles are used high frictional heat and pressure loss have to be avoided. Axial sliding shut-off nozzles are not suitable.

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 thermoplastics.

For the mould cavities common mould tool steel quality (e.g. hardened steel) which has been hardened to 56 HRC is necessary.

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 moulding part

Runner diameter

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

Venting
In order to prevent burn marks at the final filling location and at weld line locations , proper venting of the mould cavity is important. For venting away from the mould parting surface additional ejector pins should be provided (depth 0.02-0.03 mm, length 2 - 5 mm).

PROCESSING

Mould filling, holding pressure and metering (dosage)
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 GTR 45, the following basic settings are recommended:

Temperatures

Flange (Intake)	60 - 80°C
Zone 1	260 - 280°C
Zone 2	270 - 290°C
Zone 3	280 - 300°C
Nozzle	290 - 310°C
Tool	80 -120°C
Melt	290 - 310°C

Holding pressure / Metering

Holding pressure	400 - 800 bar
Dynamic pressure	50 - 150 bar
Screw speed	0.1 - 0.3 m/s

COLOUR NEUTRALIZER

To neutralize the inherent material colour, the masterbatch Grivory G21 violet 4513 can be used (blend ratio = 1 - 4%)

The masterbatch has no significant influence on the mechanical properties and has no negative effect on the transparency even at high wall thicknesses when used at the recommended blend ratio.

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. Simply call one of our sales offices.

WIS/updated 10/2010
www.emsgrivory.com