

## TECHNICAL DATA SHEET

### GRIVORY GV-4 FWA BLACK 9225

#### Product description

Grivory GV-4 FWA black 9225 is a 40% glass fibre reinforced engineering thermoplastic material based on a combination of semi-crystalline Polyamide with partially aromatic copolyamide.

Grivory GV-4 FWA black 9225 is used for injection moulding 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 GV-4 FWA black 9225 is suitable for all engineering thermoplastic applications with the requirement of approvals in contact with food and/or drinking water.**

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**EMS**

## APPROVALS:

### Grivory GV FWA in Contact With Drinking Water

**Germany (KTW, W270):** Grivory GV-4 FWA black 9225 has been tested according to the KTW recommendations of the German Federal Environmental Authority and is approved for applications in direct contact with cold drinking water.

Additionally, Grivory GV-4 FWA black 9225 fulfills the requirements of DVGW-Arbeitsblatt W 270, "The Growth of Microorganisms on Materials Intended for Use in Drinking Water Systems - Examination and Assessment", for the protection of drinking water against microorganisms.

**France (ACS):** Grivory GV-4 FWA black 9225 has been tested according to AFNOR XP P 41-250 and obtained an ACS ("Attestation de Conformité Sanitaire"), whereby it is approved for direct contact with drinking water in France.

**UK (WRAS):** Grivory GV-4 FWA black 9225 has been tested according to BS 6920:2000 and is a "Water Regulations Advisory Scheme (WRAS) - Approved Product". It is suitable for cold drinking water in the UK.

**USA (NSF 61):** Grivory GV-4 FWA black 9225 is certified by NSF for cold water applications according to NSF/ANSI Standard 61, "Drinking Water System Components - Health Effects".

### Grivory GV FWA in Contact With Food

**EU:** Grivory GV-4 FWA black 9225 meets the relevant requirements laid down in Regulation (EC) No. 1935/2004 as amended and is in compliance with Regulation (EU) No. 10/2011 of January 14, 2011 as amended.

**USA (FDA):** Grivory GV-4 FWA black 9225 is approved for direct, repeated food contact according to the applicable paragraphs of the FDA Code of Federal Regulations 21, for non-alcoholic food and under all conditions of use.

The detailed compliance description can be obtained from the corresponding "Supplier Compliance Statement for Applications in Food Contact", available upon request.



The **Grivory GV FWA grades** fulfill the requirements of the following EU Directives: 94/62/EC (packaging), 2000/53/EC (end-of-life vehicles, ELV), 2011/65/EU and 2012/19/EU (RoHS and WEEE)

as well as the following EU Regulations:

850/2004 (Persistent Organic Pollutants, POP), 1895/2005 (BADGE, BFDGE, NOGE), 1907/2006 (REACH), 282/2008 (recycled plastic), 1272/2008 (CLP), 552/2009 (Annex XVII REACH, CMR substances), 1005/2009 (ozone depleting substances), and 494/2011 (cadmium).

The **Grivory GV FWA grades** have a low flammability rating and are listed by UL (Underwriters Laboratories Inc.) with flame class UL 94 HB, reference number E 53898.

## PROPERTIES

### Mechanical Properties

		Standard	Unit	State	Grivory GV-4 FWA black 9225
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	14'000 13'000
Tensile strength at break	5 mm/min	ISO 527	MPa	dry cond.	230 210
Elongation at break	5 mm/min	ISO 527	%	dry cond.	3 3
Impact strength	Charpy, 23°C	ISO 179/1eU	kJ/m <sup>2</sup>	dry cond.	90 90
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.	13 13
Notched impact strength	Charpy, -30°C	ISO 179/1eA	kJ/m <sup>2</sup>	dry cond.	11 11
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	255 230

### 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	145
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	0.90
Maximum usage temperature	long term	ISO 2578	°C	dry	100 - 120
Maximum usage temperature	short term	ISO 2578	°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 60093	Ω · m	dry cond.	10 <sup>12</sup> 10 <sup>12</sup>
Specific surface resistivity		IEC 60093	Ω	cond.	10 <sup>13</sup>

### General Properties

Density		ISO 1183	g/cm <sup>3</sup>	dry	1.47
Flammability (UL94)	0.8 mm	ISO 1210	rating	-	HB
Water absorption	23°C/sat.	ISO 62	%	-	4.5
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	1.4
Linear mould shrinkage	long.	ISO 294	%	dry	0.10
Linear mould shrinkage	trans.	ISO 294	%	dry	0.60

Product nomenclature: ISO 16396-PA 66+PA 6I/X,GF40,M1H,C14-140

# Processing information for the injection moulding of Grivory GV-4 FWA black 9225

This technical data sheet for Grivory GV-4 FWA black 9225 provides you with useful information on material preparation, machine requirements, tooling and processing.

## MATERIAL PREPARATION

Grivory GV-4 FWA black 9225 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 GV-4 FWA black 9225 is dried and packed with a moisture content of  $\leq 0.10\%$ . Should the packaging become damaged or the material be 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 of the dryer	-25°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. If the material has been stored open during several days, and it shows strong foaming, unusually easy flowing, streaks and rough surface on the moulding part, then 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

Temperatures above 80°C for desiccant dryers and temperatures above 100°C for vacuum ovens should be avoided.

At longer residence times (over 1 hour) hopper heating or a hopper dryer (80°C) is useful.

### Use of regrind

Grivory GV-4 FWA black 9225 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.

**The use of regrind for components used in direct contact with foodstuffs should be avoided.**

## MACHINE REQUIREMENTS

Grivory GV-4 FWA black 9225 can be processed economically and problem-free on all 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 distance).

#### Selecting the injection unit

$$\text{Shot volume} = 0.5 - 0.8 \times (\text{max. shot volume})$$

## 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 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 show 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

## 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 gates (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 burning marks and improve weld line strength, proper venting of the mould cavity should be provided (venting channels on the parting surface with the following 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 GV-4 FWA black 9225, the following basic settings can be 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 (spec.)	50 - 100 bar
Screw speed	0.1 - 0.3 m/s

## 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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