TECHNICAL DATA SHEET

GRILAMID L 20 H FWA BLACK 9225

Product description

Grilamid L 20 H FWA black 9225 is a medium viscosity, unreinforced and heat stabilised polyamide 12 (PA12).

Grilamid L 20 H FWA black 9225 is designed for injection molded components with a thickness of less than 1 mm up to 10 mm and more.

The special features of this grade are:

- very low water absorption
- high impact strength
- high elongation at break
- good chemical resistance
- easy processing
- low density

The composition of Grilamid L 20 H FWA black 9225 makes it suitable for applications in direct contact with potable water as well as food stuff.

Important remark:
When extruded, this product does not fulfill all requirements for the direct contact with potable water. Restrictions apply to its use as a tube in this area. Please consult your EMS specialist for further information.

NSF
Certified to NSF/ANSI 61

Grilamid®
EMS

APPROVALS:

Grilamid L 20 H FWA in contact with drinking water

Germany (KTW, W270): Grilamid L 20 H FWA black 9225 has been tested according to the KTW recommendations of the German Federal Environmental Authority and is approved for applications in contact with drinking water up to 60°C.
Additionally, it fulfils the requirements of DVGW Arbeitsblatt W270, "The Growth of Microorganisms on Materials Intended for Use in Drinking Water Systems - Examination and Assessment".

France (ACS): Grilamid L 20 H FWA black 9225 has been tested according to AFNOR XP P 41-250 and has obtained an ACS ("Attestation de Conformité Sanitaire"), whereby it is approved for contact with drinking water in France.

UK (WRAS): Grilamid L 20 H FWA black 9225 has been tested according to BS 6920:2000 and is certified by the Water Regulations Advisory Scheme (WRAS). It is approved for applications in contact with drinking water up to 60°C.

USA (NSF 61): Grilamid L 20 H FWA black 9225 is certified by NSF for drinking water applications up to 60°C ("Domestic Hot") according to NSF/ANSI Standard 61 ("Drinking Water System Components - Health Effects").

Grilamid L 20 H FWA in contact with food

EU: Grilamid L 20 H 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 as amended.

USA (FDA): According to FDA 21 CFR § 177.1500 (9) and the corresponding paragraphs covering the additives, Grilamid L 20 H FWA black 9225 is approved for direct, repeated contact with all food types under all conditions of use.

The detailed compliance description can be found in the corresponding "Supplier Compliance Statement for Applications in Food Contact".

Grilamid L 20 H FWA black 9225 fulfils 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).

PROPERTIES

Mechanical Properties

		Standard	Unit	State	Grilamid L 20 H FWA black 9225
Tensile E-Modulus	1 mm/min	ISO 527	MPa	cond.	1100
Tensile strength at yield	5 mm/min	ISO 527	MPa	cond.	40
Elongation at yield	5 mm/min	ISO 527	%	cond.	12
Tensile strength at break	5 mm/min	ISO 527	MPa	cond.	-
Elongation at break	5 mm/min	ISO 527	%	cond.	> 50
Impact strength	Charpy, 23°C	ISO 179/2-1eU	kJ/m²	cond.	No break
Impact strength	Charpy, -30°C	ISO 179/2-1eU	kJ/m²	cond.	No break
Notched impact strength	Charpy, 23°C	ISO 179/2-1eA	kJ/m²	cond.	7
Notched impact strength	Charpy, -30°C	ISO 179/2-1eA	kJ/m²	cond.	6
Shore D hardness		ISO 868	-	cond.	70

Thermal Properties

Melting point	DSC	ISO 11357	°C	dry	178
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	45
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	1.2
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10^{-4}/K	dry	1.4
Maximum usage temperature	long term	ISO 2578	°C	dry	90 - 100
Maximum usage temperature	short term	ISO 2578	°C	dry	150

Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	cond.	32
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	cond.	10^{11}
Specific surface resistivity		IEC 60093	Ω	cond.	10^{12}

General Properties

Density		ISO 1183	g/cm³	dry	1.01
Flammability (UL94)	0.8 mm	ISO 1210	rating	-	HB
Water absorption	23°C/sat.	ISO 62	%	-	1.5
Moisture absorption	23°C/50% r.h.	ISO 62	%	-	0.7
Linear mould shrinkage	long.	ISO 294	%	dry	0.80
Linear mould shrinkage	trans.	ISO 294	%	dry	0.85

Product Nomenclature: ISO 16396-PA12,,M1H,C18-010

Processing information for injection moulding of Grilamid L 20 H FWA black 9225

This technical data sheet for Grilamid L 20 H FWA black 9225 provides you with useful information on material preparation, machine requirements, tooling and processing based on our experience.

MATERIAL PREPARATION

Grilamid L 20 H FWA black 9225 is delivered in aluminium laminated plastic bags and ready for processing. Under appropriate storage conditions, predrying is not necessary.

Storage

Sealed, undamaged bags can be kept for at least one year when stored in dry and clean facilities where the bags are protected from the influence of weather.

Handling and Safety

Detailed information regarding handling and safety can be found in the Material Safety Data Sheet (MSDS) which can be requested at any time.

Drying

Grilamid L 20 H FWA black 9225 is dried and packaged with a moisture content of ≤ 0.10%. Should the packaging become damaged or be left exposed to ambient humidity for too long, then the material must be dried. A too high moisture content becomes evident by a foaming melt, excessive nozzle drool and silver streaks on the moulded part.

Drying can be done as follows:

Dry-air Dryer

Temperature	max. 80°C
Time	4 - 12 hours
Dew point of the dryer	≤(-40)°C

Vacuum Dryer

Temperature	max. 100°C
Time	4 - 12 hours

Drying Time

A minimal drying time may be sufficient if there is only low foaming of the melt or slight silver streaks on moulded parts. For material which was exposed to ambient humidity over days, showing strong foaming, unusually easy flowing, streaks and rough surface on moulded parts, the maximum drying time will be required.



Silver streaks can also be caused by overheating of the material or by a too long residence time of the melt in the barrel.

Drying Temperature

In a dry-air dryer the temperature should not exceed 80°C. Only in a vacuum dryer, at a distinctly reduced oxygen rate, a higher temperature up to 100°C is recommended. Drying temperatures above 100°C should be avoided. An indication for oxidative deterioration of polyamides, especially with light colours, is a visible yellowing. To identify a possible yellowing, it is recommended to keep a small retain sample as a reference.

At higher residence times of granules in the feed hopper (more than 1 hour), a separate heating unit for the feed hopper or a hopper dryer is recommended. The temperature should be set to 80°C to avoid moisture absorption of the granules mainly caused by back venting over the feed throat.

Use of regrind

Grilamid L 20 H 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:

- Possible moisture absorption
- Regrinding: dust content and particle size distribution
- Contamination by other polymers, dust, oil, etc.
- Repeatable percentage in use with virgin material
- Possible colour variation
- Reduction of mechanical properties

If regrind material is used, the moulder has to work very accurately to avoid quality degradation on finished parts.

The use of regrind for components in direct contact with potable water or food should be avoided. If this is not feasible, the approval process for the finished part has to be carried out on samples with the maximum regrind content.

MACHINE REQUIREMENTS

Grilamid L 20 H FWA black 9225 can be processed on all injection moulding machines suitable for polyamides.

Screw

Wear protected universal screws with 3 zones and non-return valve are recommended. Preferable feed zone length is 60% of the screw length.

Screw

Length	18 D - 22 D
Compression ratio	2 - 2.5

Shot Volume

In relation to the required shot volume, the injection unit should be chosen so that the average dwell time of the polymer melt in the barrel is as short as possible.

Selecting the injection unit

Shot volume = [0.5 to 0.8] x max. metered volume

Heating

At least three separately controllable heating zones able to reach cylinder temperatures up to 300°C are recommended. A separate nozzle heating is necessary to avoid a cold slug in the nozzle. The feed zone needs to be temperature controlled to avoid condensation of moisture in the barrel.

Nozzle

Open nozzles are more favourable for flow, show less wear and are more durable compared to needle valve nozzles. To avoid cold slugs in the nozzle, it is recommended to set a cylinder lift-off combined with an adjusted screw retraction after the dosing process. On the other hand, needle valve nozzles increase the shear stress of the material in the mould filling phase and can additionally create critical weld lines on the part, but still can be used if necessary.

Clamping force

The clamping force can be estimated using the following rule of thumb:

Clamping Force

7.5 kN[1)] x projected area (cm^2)

[1)] internal cavity pressure of 750 bar

TOOLING

For the design of the mould, the general rules for unreinforced thermoplastics should be applied accordingly.

For the cavity plates usual, wear resistant tool steel (i.e. hardening steel, case-hardened steel, etc.) hardened to a level of 56 HRC is adequate. We recommend additional wear protection in areas with high flow rates, i.e. pin point gating or hot runner nozzles.

Demoulding / Draft angle

Parts made from Grilamid L 20 H FWA black 9225 show excellent dimensional stability. Asymmetric demoulding and undercuts have to be avoided. It is favourable to implement a high number of large surface pins or a stripper plate. Demoulding draft angles between 1° - 5° are reasonable.

(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 to ensure high weld line strength, proper venting of the mould cavity should be provided (venting channel dimensions on the mould parting surface: Depth 0.02 mm, width 2 - 5 mm). Additional vents are necessary at the ends of the melt flow path.

Gate and Runner

To achieve an optimal filling behaviour and to avoid sink marks, a central gate at the thickest section of the part is recommended. Pin-point or tunnel gates are more economical and more conventional for technical parts, but will cause higher shear stress for the polymer melt.

For a good filling behaviour and to avoid premature solidification of the melt, the following recommendations should be considered:

Gate diameter

0.8 x thickest wall section of the part

Runner diameter

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

PROCESSING

Mould Filling, Holding Pressure, Dosing

The injection rate profile should be adapted to the part design. During the filling stage, the flow front velocity should be kept approximately constant along the melt flow path. Better surface finish and higher weld line strength can be achieved by higher injection rates. At the end of the flow path a reduction of the injection rate is recommended to avoid material burnings (Diesel effect). The change-over point should be adapted in a way to avoid an overpacking of the cavity as well as an inappropriate filling by holding pressure. For the determination of the change-over point a volumetric filling of the cavity of about 98 - 100% should be targeted first. This should be done by a mould filling study. The holding pressure has to be optimized regarding internal stress, warpage, dimensional accuracy as well as avoidance of voids and sink marks. The determination of the gate sealing point should be obligatory. This is done by measuring the part weight with increasing holding time until it is constant. The dosing process should proceed according to the specified values without damaging the material at preferably low screw speed and low back pressure level. Therefore the available cooling time should be fully utilised.

Basic Machine Settings

Based on experience we recommend the following basic settings for processing Grilamid L 20 H FWA black 9225:

Temperatures

Flange	40 - 60°C
Zone 1	240 - 260°C
Zone 2	245 - 265°C
Zone 3	250 - 270°C
Nozzle	245 - 265°C
Tool	60 - 80°C
Melt	240 - 270°C

It is recommended to start the settings of the cylinder temperatures at the lower temperature range. The tool temperature should be set in a way that the measured surface temperature of the tool is in the above mentioned range.

Pressures / Speeds

Injection speed	low - medium
Holding pressure (spec.)	300 - 800 bar
Back 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 services do not just include manufacturing and supply of engineering thermoplastics, but also full technical support:

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

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

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