PROVISIONAL
TECHNICAL DATA SHEET

GRILAMID XE 4074
NATURAL

Later designation:
Grilamid LBKN-50H FWA NATURAL

Product description

Grilamid XE 4074 NATURAL is a 50% glass bead reinforced, heat stabilised polyamide 12 (PA12) injection moulding grade with the following special features:

- high dimensional stability
- very low water absorption
- low shrinkage
- isotropic shrinkage
- good chemical resistance
- good hydrolysis resistance
- good abrasion resistance
- easy processing

The special composition of Grilamid XE 4074 NATURAL makes it suitable for direct contact with potable water up to 85°C as well as with foodstuff.

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APPROVALS:

Grilamid XE 4074 NATURAL in contact with drinking water

Germany (KTW, W270): Grilamid XE 4074 NATURAL 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 85°C. Additionally, it fulfils the requirements of DVGW-Arbeitsblatt W 270, "The Growth of Microorganisms on Materials Intended for Use in Drinking Water Systems - Examination and Assessment".

France (ACS): Grilamid XE 4074 NATURAL has been tested according to AFNOR XP P 41-250 and obtained an ACS ("Attestation de Conformité Sanitaire"), whereby it is approved for contact with drinking water in France.

UK (WRAS): Grilamid XE 4074 NATURAL 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 85°C.

USA (NSF 61): Grilamid XE 4074 NATURAL is certified by NSF (National Sanitation Foundation) for drinking water applications up to 82°C ("commercial hot") according to NSF/ANSI Standard 61, "Drinking Water System Components - Health Effects".

Grilamid XE 4074 NATURAL in contact with food

EU: Grilamid XE 4074 NATURAL meets the relevant requirements laid down in Regulation (EC) No. 1935/2004 as amended and are in compliance with Regulation (EU) No. 10/2011 2011 as amended.

USA (FDA): Grilamid XE4074 NATURAL meets the requirements for direct, repeated food contact according to the applicable paragraphs of the FDA Code of Federal Regulations 21, for all food types and under Conditions of Use A through H and J according to 21 CFR § 176.170, table 1 and 2.

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

Grilamid XE 4074 NATURAL fulfils the requirements of the following EU Directives:
78/142/EEC (vinyl chloride), 94/62/EC (packaging), 2000/53/EC (end-of-life vehicles, ELV), 2002/16/EC (epoxy derivatives), 2002/61/EC (azo colourants), 2002/62/EC (organic tin com-pounds), 2002/95/EC und 2002/96/EC (RoHS and WEEE), 2003/11/EC (PBB, PBDE), 2003/53/EC (nonylphenol(-ethoxylates)), 2004/21/EC (azo colourants), 2005/69/EC (PAH), 2005/84/EC (phthalates), 2006/122/EC (PFOS, PFOA), 2009/251/EC (dimethyl fumarate), 2011/65/EC (RoHS 2)

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 XE 4074 NATURAL
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry	3700
				cond.	3500
Tensile strength at break	5 mm/min	ISO 527	MPa	dry	50
				cond.	50
Elongation at break	5 mm/min	ISO 527	%	dry	10
				cond.	10
Impact strength	Charpy, 23°C	ISO 179/2-1eU	kJ/m²	dry	65
				cond.	60
Impact strength	Charpy, -30°C	ISO 179/2-1eU	kJ/m²	dry	40
				cond.	40
Notched impact strength	Charpy, 23°C	ISO 179/2-1eA	kJ/m²	dry	5
				cond.	4
Notched impact strength	Charpy, -30°C	ISO 179/2-1eA	kJ/m²	dry	4
				cond.	4
Shore D hardness		ISO 868	-	dry	84
				cond.	84

Thermal Properties

Melting point	DSC	ISO 11357	°C	dry	178
Heat deflection temperature HDT/A	1.8 MPa	ISO 75	°C	dry	80
Heat deflection temperature HDT/C	8.0 MPa	ISO 75	°C	dry	50
Thermal expansion coefficient long.	23-55°C	ISO 11359	10^{-4}/K	dry	0.7
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10^{-4}/K	dry	0.7
Maximum usage temperature	long term	ISO 2578	°C	dry	90 - 120
Maximum usage temperature	short term	ISO 2578	°C	dry	150

Electrical Properties

Dielectric strength		IEC 60243-1	kV/mm	dry	35
				cond.	35
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	dry	10^9
				cond.	10^9
Specific surface resistivity		IEC 60093	Ω	cond.	10^{10}

General Properties

Density		ISO 1183	g/cm³	dry	1.49
Flammability (UL94)	0.8 mm	ISO 1210	rating	-	HB
Water absorption	23°C/saturated	ISO 62	%	-	1.1
Moisture absorption	23°C/50% r. h.	ISO 62	%	-	0.5
Linear mould shrinkage	long.	ISO 294	%	dry	0.8
Linear mould shrinkage	trans.	ISO 294	%	dry	0.9

Product-nomenclature acc. ISO 1874: PA12, MH, 18-040N, GB50

Processing information for injection moulding of Grilamid XE 4074 NATURAL

This technical data sheet for Grilamid XE 4074 NATURAL provides you with useful information on material preparation, machine requirements, tooling and processing.

MATERIAL PREPARATION

Grilamid XE 4074 NATURAL is delivered dry and ready for processing in sealed packaging. Predrying is not necessary provided the packaging is undamaged.

Storage

Sealed, undamaged bags can be kept over a period of time of at least one year when stored in 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

Grilamid XE 4074 NATURAL is dried and packed with a moisture content of ≤ 0.10 %. Should the packaging become damaged if it is left open 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:

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

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 material is stored open for days, shows strong foaming, unusually easy flow, streaks or a rough surface on the moulded part, then the maximum drying time is required.

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

Drying temperature

Polyamides are affected by 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. At longer residence times (over 1 hour) a hopper dryer (80°C) is useful.

Use of regrind

Grilamid XE 4074 NATURAL 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.
- Level of addition to original material
- Colour variation
- Reduction of mechanical properties

When adding regrind, special care has to be taken by the moulder.

For components with direct contact to drinking water or food the use of regrind should be avoided. As long as the mechanical performance made with regrind is secured, a new drinking water certification will become necessary.

MACHINE REQUIREMENTS

Grilamid XE4074 NATURAL 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 (less decompression distance) must be longer than the length of the non-return-valve.

Selecting the injection unit

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

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

[1)] for a cavity pressure of 750 bar

TOOLING
The design of the mould tool should follow the general rules for 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
Asymmetric demoulding and undercuts are to be avoided if possible. Generous provision should be made for ejection with many large pins or a stripper plate. Draft angles for the inner and outer wall between 0.5 and 3° is usually sufficient. Textured surfaces require a larger draft angle (1° per 0.025 mm depth of roughness).

(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 the best mould filling and avoid sink marks, a central gate at the thickest section of the moulding is recommended. Pin point (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 and improve weld line 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).

PROCESSING

Mould filling, post pressure and dosing
The best surface finish and a high weld line strength are achieved when a high injection speed and a sufficiently long post pressure time are employed.

The injection speed should be set 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 machine for processing Grilamid XE 4074 NATURAL, the following basic settings are recommended:

Temperatures

Flange	80°C
Zone 1	265°C
Zone 2	270°C
Zone 3	275°C
Nozzle	270°C
Tool	80°C
Melt	270-280°C

Pressures / Speeds

Injection speed	medium - high
Hold-on pressure (spec.)	300-800 bar
Dynamic pressure (spec.	50-100bar
Screw speed	0.1-0.3 m/s

CUSTOMER SERVICES

EMS-GRIVORY is a specialist in polyamide synthesis and the processing of these materials. Our customer services are not only concerned with the manufacturing and supply of engineering thermoplastics but also provide full technical support including:

- 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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