

TECHNICAL DATA SHEET

GRILAMID TR FE 11292 NATURAL

(Grilamid TR HT 200)

Product description

Grilamid TR FE 11292 Natural is a transparent, thermoplastic polyamide based on cycloaliphatic and aromatic blocks. Grilamid TR FE 11292 Natural offers a variety of interesting properties such as:

- Resistant to high heat and hydrolysis
- High chemical and stress crack resistance
- Permanent transparency
- Low moisture absorption
- Excellent scratch resistance
- Steam sterilisable at 134 °C
- Outstanding adhesion to LSR

Grilamid TR FE 11292 Natural is suitable for parts exposed to high heat and steam in the following application fields:

- Medical devices
- Domestic and kitchen appliances
- Sanitary / Heating
- Engineering / Agriculture
- Electro / Electronics

Registrations and Listings

- USP Class VI
- ISO 10993

Grilamid TR[®]
EMS

PROPERTIES

Mechanical Properties

		Norm	Unit	State	TR FE 11292 Natural
Tensile E-Modulus	1 mm/min	ISO 527	MPa	dry cond.	2000 2000
Tensile strength at yield	50 mm/min	ISO 527	MPa	dry cond.	80 75
Elongation at yield	50 mm/min	ISO 527	%	dry cond.	8 7
Elongation at break	50 mm/min	ISO 527	%	dry cond.	>50 >50
Impact strength	Charpy, 23°C	ISO 179/2-1eU	kJ/m ²	dry cond.	no break no break
Impact strength	Charpy, -30°C	ISO 179/2-1eU	kJ/m ²	dry cond.	no break no break
Notched impact strength	Charpy, 23°C	ISO 179/2-1eA	kJ/m ²	dry cond.	7 11
Notched impact strength	Charpy, -30°C	ISO 179/2-1eA	kJ/m ²	dry cond.	5 8
Ball indentation hardness		ISO 2039-1	MPa	dry cond.	130 125

Thermal Properties

Glass transition temperatures	DSC	ISO 11357	°C	dry	200
Heat deflection temperature HDT/A	1.80 MPa	ISO 75	°C	dry	165
Heat deflection temperature HDT/B	0.45 MPa	ISO 75	°C	dry	180
Thermal expansion coefficient long.	23-55°C	ISO 11359	10 ⁻⁶ /K	dry	75
Thermal expansion coefficient trans.	23-55°C	ISO 11359	10 ⁻⁶ /K	dry	75
Maximum usage temperature	long term	ISO 2578	°C	dry	100
Maximum usage temperature	short term	EMS	°C	dry	160

Electrical Properties

Dielectric strength		IEC 60243-1	KV/mm	cond.	33 33
Comparative tracking index	CTI	IEC 60112	-	cond.	600
Specific volume resistivity		IEC 60093	Ω · m	dry cond.	10 ⁹ 10 ¹⁰
Specific surface resistivity		IEC 60093	Ω	cond.	10 ¹¹

General Properties

Density		ISO 1183	g/cm ³	dry	1.04
Flammability (UL 94)	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	%	-	1.7
Linear mould shrinkage	long.	ISO 294	%	dry	0.6
Linear mould shrinkage	trans.	ISO 294	%	dry	0.9

Product-nomenclature: ISO16396-PA MACMI/MACMT/12,GHT,C12-020

Processing information for the injection moulding of Grilamid TR FE 11292 Natural

This technical data sheet for Grilamid TR FE 11292 Natural provides you with useful information on material preparation, machine requirements, mould design and processing.

MATERIAL PREPARATION

Grilamid TR FE 11292 Natural is delivered dry and ready for processing in sealed air tight packaging. Pre-drying is not necessary provided the packaging is undamaged. For parts with high wall thickness (> 3 mm) we recommend additional drying at 80°C for minimum 4 hours in a desiccant dryer.

Storage

Amorphous polyamides can be stored over years without influencing its mechanical properties. However, in order to ensure optimal colour and transparency, Grilamid TR XE 11292 Natural should not be stored for more than 6 months. At temperatures above 25 °C in combination with long storage times, the oxidation process of the granulate is accelerated. Hence, it is advised to keep storage temperatures below 25 °C. The above mentioned effect becomes only visible after injection moulding by having a more yellowish appearance. The store room must be dry and protect the bags from the influence of weather and damage.

Handling and safety

Detailed information can be obtained from the material safety data sheet (MSDS) which can be requested with the material order.

Drying

Grilamid TR FE 11292 Natural is dried and packed with a moisture content of $\leq 0.08\%$. Should the packaging become damaged or be left open too long, then the material must be dried. A too high moisture content is shown by a foaming melt cake, excessive nozzle drool and silver streaks on the moulded part.

Drying has to be done as follows:

Desiccant air dryer

Temperature	max. 80°C
Time	8 - 12 hours
Dew point of the dryer	< -30°C

Vacuum oven

Temperature	max. 100°C
Time	6 - 10 hours

Circulating air drying ovens are not suitable for Grilamid TR. To review / monitor the effective moisture content it is recommended to use a moisture measuring device (e.g. 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. If material is stored open for days, shows significant foaming, unusual 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 (over 330 °C) or by a too long 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. In order to avoid issues with moisture we recommend using always a desiccant drying system.

If the materials residence time in the hopper is over an hour, a desiccant dryer on the hopper (80 °C) is recommended.

Use of regrind

Grilamid TR FE 11292 Natural is a thermoplastic material. Hence, waste parts as well as sprues and runners can be reprocessed. The following points have to be considered though:

- No thermal degradation in the previous last processing
- No contamination through foreign material, dust, oil, etc.
- Regrind has to be dry

When adding regrind, special care is required during processing. For high-quality technical parts it is highly recommended to only use virgin material.

MACHINE REQUIREMENTS

Grilamid TR FE 11292 Natural can be processed using any injection moulding machines suitable for polyamides.

Screw

Length	18 D - 25 D
Compression ratio	2 - 2.5

Shot volume

The minimal metering stroke (without screw retraction) must be longer than the length of the non-return-valve.

Selecting the injection unit

$$\text{Shot volume} = 0.5 - 0.9 \times \text{max. dosing volume of the injection unit}$$

Heating

At least three separately controllable heating zones capable of reaching cylinder temperatures up to 350 °C plus a separate nozzle heating is required. The cylinder flange temperature must be controllable (flange, intake).

Nozzle

Open nozzles with accurate heating are to be preferred. There is however the danger of air getting drawn into the barrel during the screw retraction. If shut-off nozzles are used, high frictional heat and pressure loss have to be kept at a minimum level. 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

$$7.5 \text{ kN}^1) \times \text{projected area (cm}^2)$$

¹⁾ max. cavity pressure of 750 bar

MOULD DESIGN

The mould should be design according to the general rules for transparent thermoplastics.

For the mould cavities usual mould steel quality (e.g. hardened steel), which has been hardened to a level of 56 HRC is sufficient.

Venting

In order to prevent burn marks at the end of filling and at positions of weld lines, proper venting of the mould cavity is important. Venting outside the mould parting surface can be done by additional ejector pins (0.02 mm).

Gate and runner

To achieve the best mould filling and avoid sink marks, a central gate at the thickest section of the part is recommended. Pin point (direct) or tunnel gates are more economical and also common for technical injection moulding parts.

To avoid early 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)

PROCESSING

Basic machine settings

In order to start up the machine for processing Grilamid TR FE 11292 Natural, the following basic settings are recommended:

Temperatures

Flange (Intake)	min. 80°C
Feeding section	280-300°C
Compression section	290-310°C
Metering section	300-320°C
Nozzle	290-300°C
Mould	100-140°C
Melt	300-320°C

Holding pressure / Metering

Holding pressure (spec.)	400 - 600 bar
Dynamic pressure (spec.)	50 - 150 bar
Screw speed	0.1 - 0.3 m/s

The injection speed should be reduced towards the end of the filling process in order to avoid burn marks. For dosing with a low screw rotation and pressure the whole cooling time can be used.

Mould release agent

When demoulding issues occur, we recommend the use of the masterbatch Grilamid MB TR 4034 LS or MB 5032 LS with a blend ratio of 2 - 4%. The masterbatch improves the demoulding of parts with a complex design, undercuts, long demoulding paths and hot cores.

Color neutralizer

To neutralize the inherent material colour, the masterbatch Grilamid MB TR 90 Blue 4545 can be used (blend ratio = 2-4%) for technical applications.

For applications involving direct contact with food, the masterbatch Grilamid MB TR 60 Violet 4518 must be used (blend ratio = 2-4%).

The masterbatches have no significant influence on the mechanical properties and have no negative effect on the transparency even at high wall thickness when used with the recommended blend ratio.

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 moulds
- 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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