



## **Grivory and Grilon LFT**

**Polyamides with Spine**

**GRIVORY<sup>®</sup>**  
**EMS**

**GRILON<sup>®</sup>**  
**EMS**

## ■ Introduction



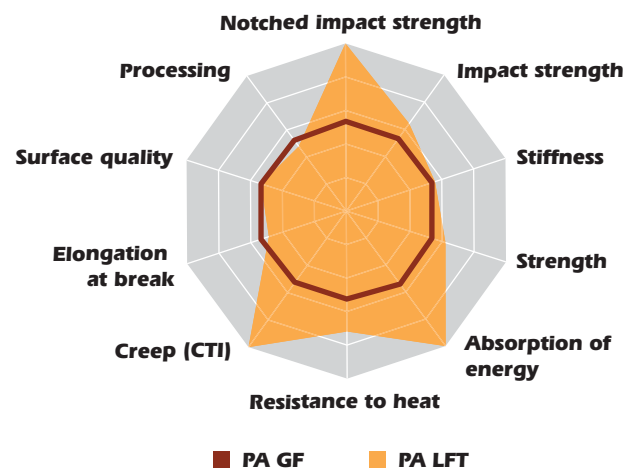
### Strong product with long fibres

EMS-GRIVORY is breaking new ground with long glass-fibre reinforced polyamides (PA-LFT). Since the start of 2008, EMS-GRIVORY has been manufacturing PA-LFT products based on the well established product families Grilon TS, Grivory GV and Grivory HT, at the production site in Gross-Umstadt, Germany. In a pultrusion process developed by EMS, long glass fibres are impregnated into a polyamide melt and then cut in the typical, 10-mm-long granule form. In the finished component, the long glass fibres form a non-woven fibre structure which provides the material with a more isotropic reinforcement. The finished components exhibit significantly improved mechanical properties compared to short glass-fibre products (PA-GF). This improvement in mechanical performance is also given at high temperatures and even above the glass transition point.

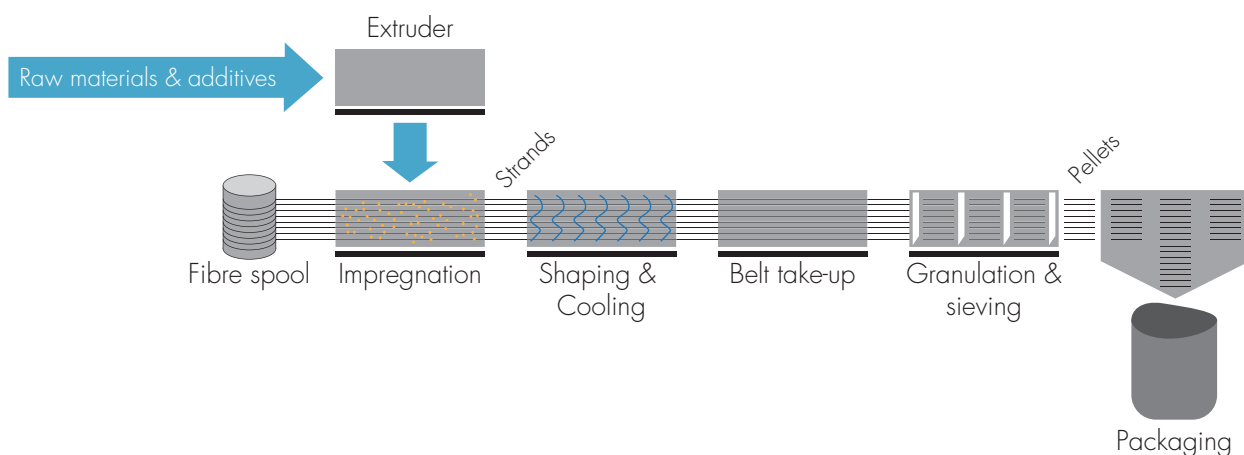
With PA-LFT products, high-performance structural components can be manufactured which are capable of resisting high application temperatures or absorbing high impact forces. PA-LFT is a cost-saving and low-weight alternative to die-cast metals and comes into its own where short glass-fibre products (PA-GF) with high filler content reach their limits.

### Added performance all along the line

PA-LFT products exhibit significantly improved notched impact strength, absorption of energy and creep strength (comparative tracking index). In these areas they are outstandingly superior to polyamides reinforced with short glass fibres. The long glass-fibre structure provides components with high dimensional stability and a low tendency to shrink. When exposed to dynamic loading, fatigue behaviour of these components is better than for PA-GF.



### LFT Process

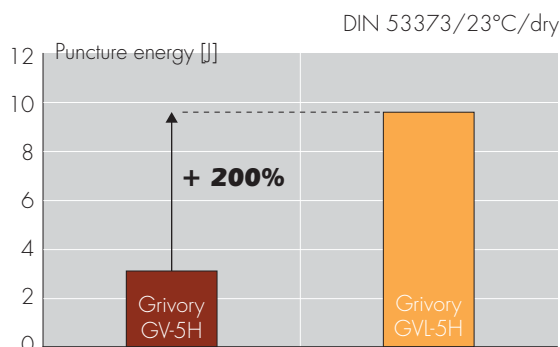


# Absorption of energy



## Materials which can take the knocks

PA-LFT products are substantially more resistant to impact stressing. The remarkably high energy absorption is illustrated by the penetration test. Compared to polyamides reinforced with short glass fibres, PA-LFT products have three times higher values. A real advantage for components which are exposed to high impact stressing.

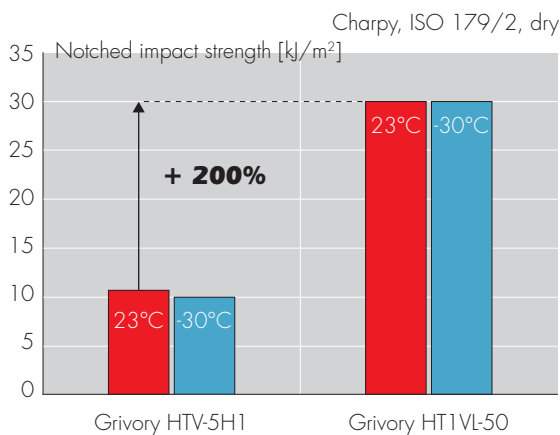


Penetration



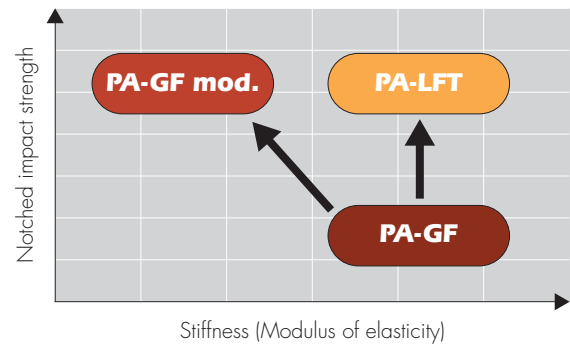
Hinged break

The internal fibre structure of the component increases its resistance to crack formation and, when compared to conventional PA-GF products, exhibits clearly better break behaviour. This also applies at low temperatures.



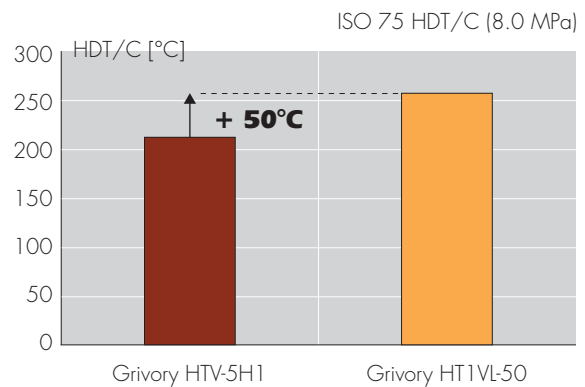
## Reinforcement with no ifs and buts

Impact strength can be increased without losing stiffness. This is not possible with conventionally reinforced polyamides as inclusion of elastomer constituents which absorb energy, always leads to loss of stiffness.



## Resilient where others already give up

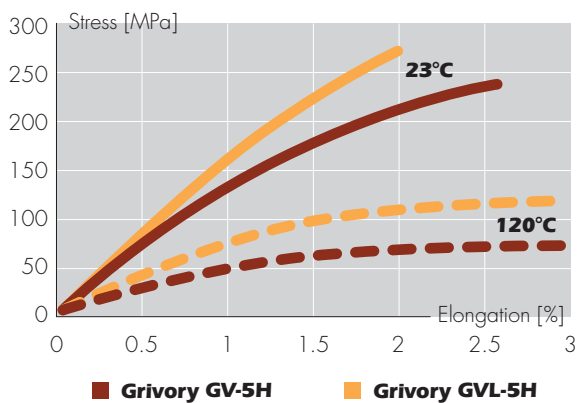
PA-LFT products exhibit excellent resistance to heat (heat distortion temperature) and remain resilient at temperatures up to 260°C. In comparison to PA-GF materials with high filler content, Grivory and Grilon LFT have a heat distortion temperature which is 50°C higher.



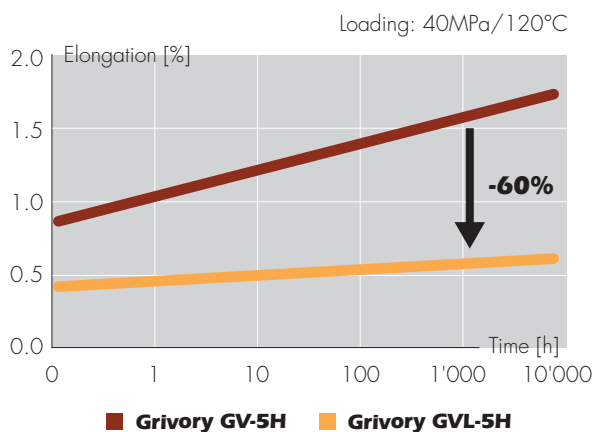


### Dimensionally stable - even under load

The three-dimensional glass-fibre structure gives the matrix additional support - and not only at room temperature, but also at higher temperatures. This increased performance of Grivory GVL-5H is clearly illustrated by the stress-elongation diagram.



Even under permanent stress, a PA-LFT material shows higher performance. Creep behaviour is clearly superior to that of a comparable product reinforced with short glass fibres. After 1,000 hours at 40 MPa and temperatures of 120°C, Grivory GV-LFT shows elongation of only 0.6% while a product reinforced with short glass fibres already has 1.5% elongation.



### External and internal strength

In the finished component, conventional polyamides reinforced with short glass fibres are oriented in the direction of flow. This orientation of the glass fibres can lead to warpage. The long glass fibre structure in PA-LFT components, on the other hand, increases the isotropy of the component and lower warpage is achieved.

Components made of PA-LFT show a significantly slower fatigue behaviour under dynamic loading than PA-GF due to their reinforcing fibre structure. A clearly higher number of flexural fatigue cycles can be achieved than with comparable PA-GF materials.

Despite their higher glass-fibre content, PA-LFT products have good surface quality comparable to that of products reinforced with short glass fibres.

### For high requirements

PA-LFT can be recycled and is simple to process. The improved properties of the polymer materials make them ideal for applications in the automotive industry and mechanical engineering, as well as in the fields of electro/electronics or sport and leisure goods.



**Product range**

EMS-GRIVORY has supplemented its established product families Grilon TS, Grivory GV and HT with products reinforced with long glass fibres.

- **Grilon TS** - Excellent flowability and surface quality combined with increased resilience.
- **Grivory GV** - The established design material for replacement of metal. Stiff and strong, even after absorption of water.
- **Grivory HT** - More performance at higher temperatures. Resistance to chemicals, dimensional stability, stiffness and strength at high temperatures.
- **Grilamid L** - Highest dimensional stability with an exceptional property profile.

The excellent property features of these design materials can be further improved through reinforcement with long glass fibres.

**Simple processing**

Grivory and Grilon LFT can be processed using conventional injection-moulding equipment, whereby a screw diameter larger than 35 mm is of advantage. The property profile of the component is dependent on the length of the glass fibres used; this in turn is influenced by the component design and the manufacturing process. Careful temperature control during melting and low shear when filling the mould also contribute towards achieving maximum component performance.

PA-LFT products can be processed using hot-channel systems where sufficiently large diameters without narrow needle-valve nozzles are recommended.

Product family	Product designation	Share of long glass fibres
Grilon TS PA 66 + PA6	Grilon TSGL-40/4	40%
	Grilon TSGL-50/4	50%
	Grilon TSGL-60/4	60%
Grivory GV PA 66 + PA 6I/6T	Grivory GVL-4H	40%
	Grivory GVL-5H	50%
	Grivory GVL-6H	60%
Grivory HT PA 6T/6I	Grivory HT1VL-50	50%
	Grivory HT1VL-60	60%
Grilamid L PA12	Grilamid LVL-5H	50%
	Grilamid LVL-6H	60%





## **EMS-GRIVORY worldwide**

[www.emsgrivory.com](http://www.emsgrivory.com)

### **Introducing ourselves**

EMS-GRIVORY is a unit of the business area Performance Polymers of the EMS Group and employs around 760 employees throughout the world.

The largest development and production site is located in Domat/Ems, Switzerland. We also have technology, production and sales facilities in most of the important markets in Europe, Asia and the USA.

#### **Switzerland**

EMS-CHEMIE AG  
Business Unit EMS-GRIVORY  
Via Innovativa 1  
CH-7013 Domat/Ems  
Phone +41 81 632 78 88  
Fax +41 81 632 76 65  
[welcome@emsgrivory.com](mailto:welcome@emsgrivory.com)

#### **Germany**

EMS-CHEMIE (Deutschland) GmbH  
Warthweg 14  
D-64823 Gross-Umstadt  
Phone +49 6078 783 0  
Fax +49 6078 783 416  
[welcome@de.emsgrivory.com](mailto:welcome@de.emsgrivory.com)

#### **France**

EMS-CHEMIE (France) S.A.  
73-77, rue de Sèvres  
Boîte postale 52  
F-92105 Boulogne-Billancourt Cedex  
Phone +33 1 41 10 06 10  
Fax +33 1 48 25 56 07  
[welcome@fr.emsgrivory.com](mailto:welcome@fr.emsgrivory.com)

EMS-GRIVORY, a business  
unit of the EMS Group

#### **Great Britain**

EMS-CHEMIE (UK) Ltd.  
Darfin House, Priestly Court  
Staffordshire Technology Park  
GB-Stafford ST18 0AR  
Phone +44 1785 283 739  
Fax +44 1785 283 722  
[welcome@uk.emsgrivory.com](mailto:welcome@uk.emsgrivory.com)

#### **Italy**

EMS-CHEMIE (Italia) S.r.l.  
Via Visconti di Modrone, 2  
I-20122 Milan  
Phone 00 800 1100 1122  
Fax 00 800 1100 2233  
[welcome@it.emsgrivory.com](mailto:welcome@it.emsgrivory.com)

\* from Italy only

#### **United States**

EMS-CHEMIE (North America) Inc.  
2060 Corporate Way  
P.O. Box 1717  
Sumter, SC 29151, USA  
Phone +1 803 481 61 71  
Fax +1 803 481 61 21  
[welcome@us.emsgrivory.com](mailto:welcome@us.emsgrivory.com)

#### **China**

EMS-CHEMIE (China) Ltd.  
Room 1908  
Far East International Plaza  
319 Xian Xia Road  
Shanghai 200051  
P. R. China  
Tel. +86 21 6295 7186  
Fax +86 21 6295 7870

#### **Japan**

EMS-CHEMIE (Japan) Ltd.  
EMS Bldg., 2-11-20 Higashi-koujiya  
Ota-ku, Tokyo 144-0033  
Tel. +81 3 5735 0611  
Fax +81 3 5735 0614  
[welcome@jp.emsgrivory.com](mailto:welcome@jp.emsgrivory.com)

#### **Taiwan**

EMS-CHEMIE (Taiwan) Ltd.  
36, Kwang Fu South Road  
Hsin Chu Industrial Park  
Fu Kou Hsiang  
Hsin Chu Hsien 30351  
Taiwan, R.O.C.  
Tel. +886 35 985 335  
Fax +886 35 985 731  
[welcome@tw.emsgrivory.com](mailto:welcome@tw.emsgrivory.com)

#### **Korea**

EMS-CHEMIE (Korea) Ltd.  
#1 226 Dong-Gwan, Doosan Venturedigm  
126-1, Pyeongchon-dong, Dongan-gu  
Anyang-si, Gyeonggi-do, 431-070  
Republic of Korea  
Tel.: +82 31 478 3159  
Fax: +82 31 478 3157  
[welcome@kr.emsgrivory.com](mailto:welcome@kr.emsgrivory.com)

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