Grivory HT

Enhanced Performance at High Temperatures

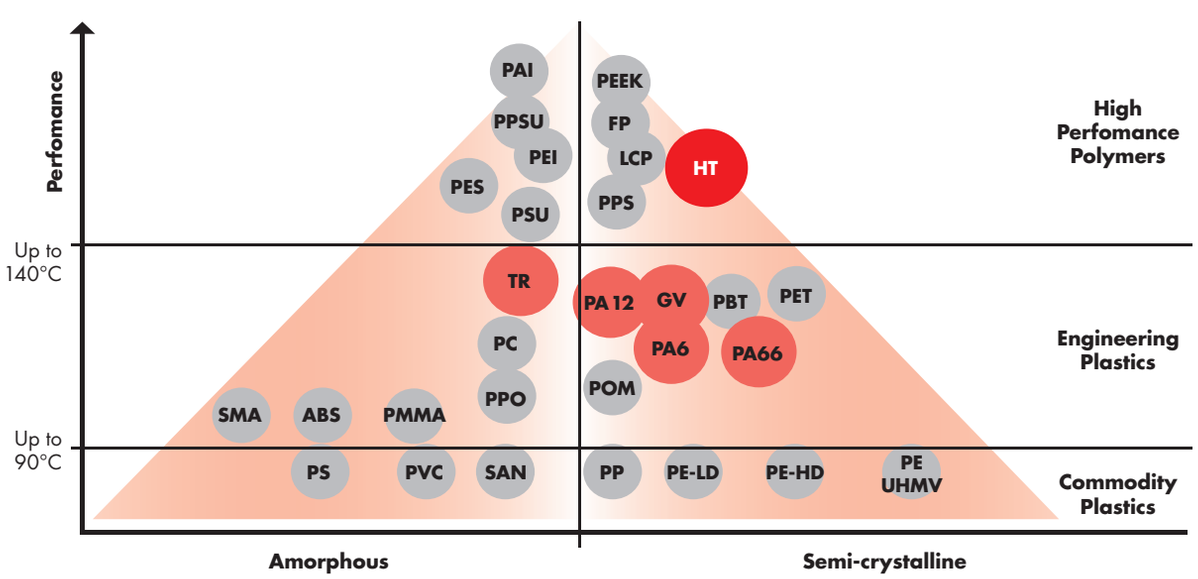
GRIVORY®
EMS

Contents

Introduction

Grivory is the trade name for EMS-GRIVORY's family of semi-crystalline, partially aromatic polyamides. Grivory HT comprises of aromatic, semi-crystalline, high-performance products based on polyphthalamide (PPA) structure. Properties include:

- Excellent stiffness and strength at high operating temperatures
- Good resistance to chemicals and hot water
- Low absoption of moisture or water
- Low moisture effects on mechanical-physical properties
- Good dimensional stability and low warpage
- Good surface quality
- Economical manufacturing



Grivory HT

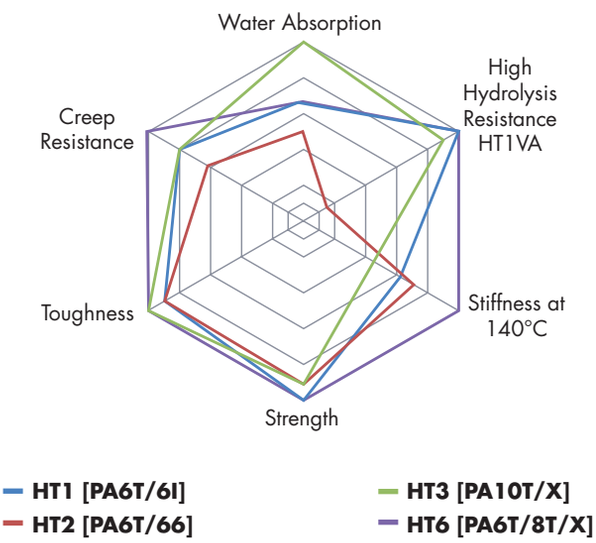
Grivor HT includes several families groups with different base polymers:

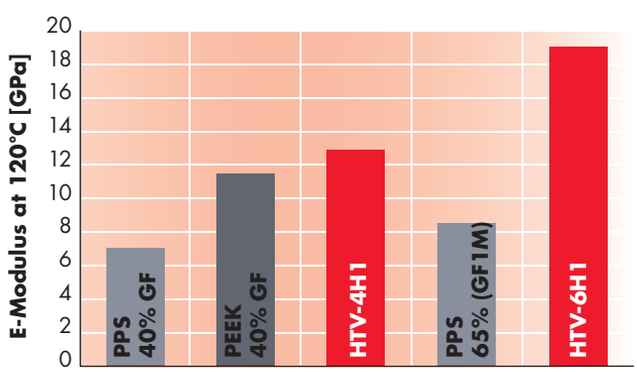
Grivory HT1: PA6T/6I **Grivory HT3: PA10T/X**

Grivory HT2: PA6T/66 **Grivory HT6: PA6T/8T/X**

EMS-GRIVORY has designed the Grivory HT families with a high performance profile. The main distinguishing feature of Grivory HT compared to other polyamides is its good performance at high temperatures. This makes it possible to produce injection moulded parts economically with excellent mechanical properties, heat resistance and chemical resistance.
Grivory HT is an ideal construction material as a metal replacement and offers excellent opportunities for cost, and weight reduction and energy savings.
Grivory HT outperforms polyphenylene sulphide (PPS) and polyetheretherketone (PEEK) in terms of stiffness and strength at application temperatures up to 140°C.

HT Property comparison
[Scale of 1 to 10, where 10 is the highest]





Nomenclature Grivory HT

1. Base Polymer
1: PA6T/PAI
2: PA6T/66
3: PA10T/X
6: PA6/8T/X

3. Modification
A: Aqua (2nd Gen. HY/FWA)
S: Improved surface
Z: Impact modified

5. Head stabilisation
H: Standard
X: Electro compatible

Grivory HT	2	V	S	-	3	H	Blank	Colour xxxx

2. Reinforcement
C: Carbon fibre
M: Mineral
V: Glass fibre
VL: Long glass fibre

4. Reinforcement
1/10 weight %

5. Additional
FWA: drinking water / food approved
HY: Improved Hydrolysis
HYS: Hydrolysis & Demolding improved
LF: Low friction
LW: Laser-writable
V0: Flame retardant

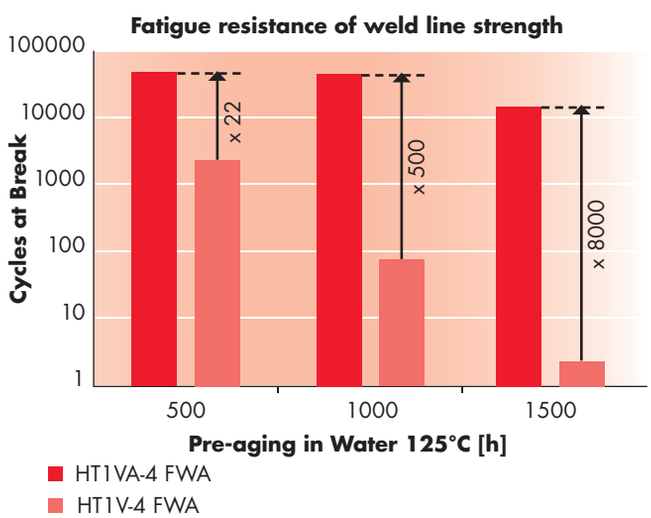
Product overview

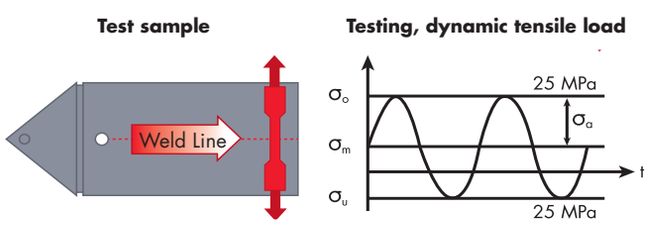
Property	Grade	HT1	HT2	HT3	HT6
High Hydrolysis resistance	HT1A-HY	X			X
High Hydrolysis resistance/suitable for contact with food and drinking water	HT1A-FWA	X			
Electro compatible stabilization	X	X	X	X	X
Flame retardant, halogen free (UL 94, V0)	V0		X	X	X
Long glass fiber reinforced	VL	X			
Carbon-fiber reinforced	C		X	X	X
Low friction	LF		X		X
Renewable raw materials				X	

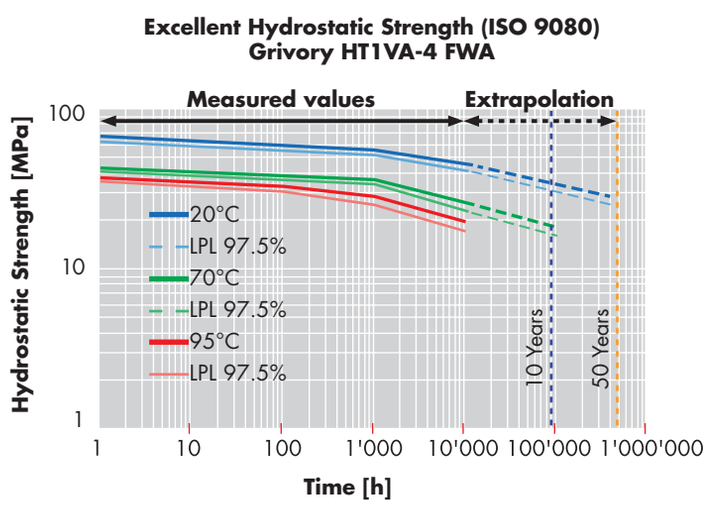
Highlights

Grivory HT1VA High Hydrolysis Resistance

Grivory HT1VA is the new generation of optimized high hydrolysis resistant products. Products offer outstanding fatigue resistance of weld line strength, exceptional long term behavior and excellent hydrostatic strength. Improved demolding increases design freedom by opening the possibility for complex geometries. Processing is similar to Grivory HT1 where the melting temperature is 320°C to 340°C and tool temperature starts at 130°C. The product assortment comprises grades with electro-compatible stabilization and approvals for use in direct contact with food / drinking water.







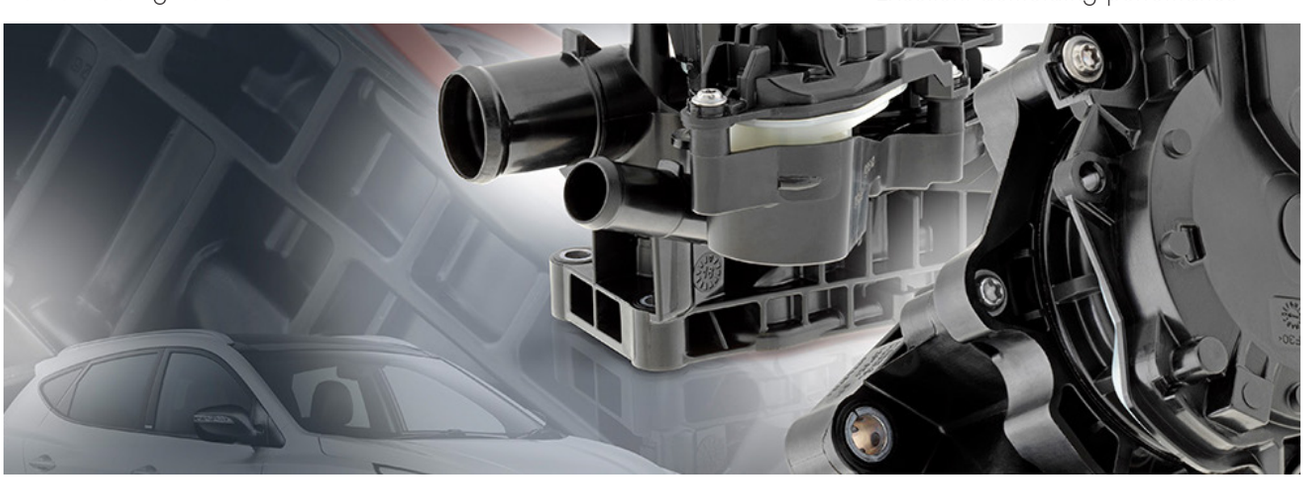
Grivory HT1VA Core products

Property	Standard	Unit	HT1VA-35 HYS	HT1VA-4 HY	HT1VA-4 FWA	HT XE 10814[1]	HT1VA-5 HY	HT1VA-5 FWA
Degree of reinforcement	ISO 3451	%	35	40	40	40	50	50
E-Modulus	ISO 527	GPa	13.5/13.5	14.5/14.5	14.5/14.5	14.5/14.5	18.0/18.0	18.0/18.0
Tensile Strength at Break	ISO 527	MPa	230/220	250/230	250/230	250/230	275/260	275/260
Charpy Impact +23°C	ISO 179	kJ/m²	50/50	70/70	70/70	70/70	70/70	70/70
Charpy Notched Impact +23°C	ISO 179	kJ/m²	11/11	11/11	11/11	11/11	12/12	12/12
Melting Point	ISO 11357	°C	310/-	325/-	325/-	325/-	325/-	325/-
Heat Deflection HDT/C 8.0 MPa	ISO 75	°C	155/-	200/-	200/-	200/-	200/-	200/-
Density	ISO 1183	g/cm³	1.47/-	1.53/-	1.53/-	1.53/-	1.64/-	1.64/-
Water Absorption, 23°C	ISO 62	%	3.5/-	3.5/-	3.5/-	3.5/-	3.0/-	3.0/-
Moisture Absorption, 23°C/50%	ISO 62	%	2.0	1.5	1.5	1.5	1.3	1.3
Shrinkage Long./Trans.	ISO 294	%	0.2/0.9	0.10/0.55	0.10/0.55	0.10/0.55	0.05/0.45	0.05/0.45
Melt Temperatures	–	%	320 to 330	330 to 340	330 to 340	330 to 340	330 to 340	330 to 340
Tool Temperature	–	°C	≥ 130	≥ 140	≥ 140	≥ 140	≥ 140	≥ 140

[1]GF40, Laser transparent

Grivory HT1VA-35 HYS
Active Cooling Valve

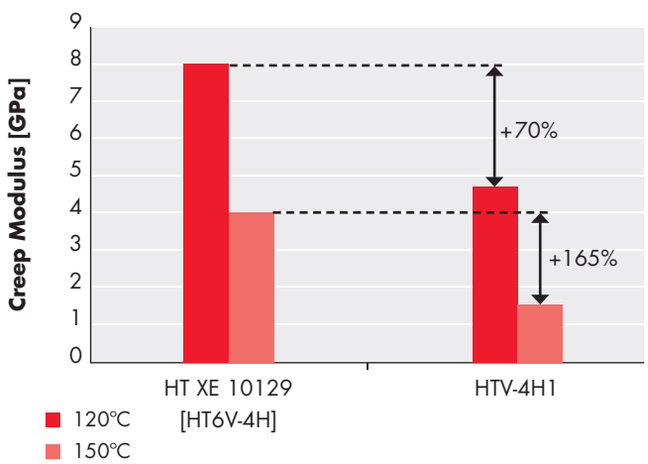
Key properties: High hydrolysis resistance
Excellent demolding perfomance



Grivory HT6 Enhanced High Temperature

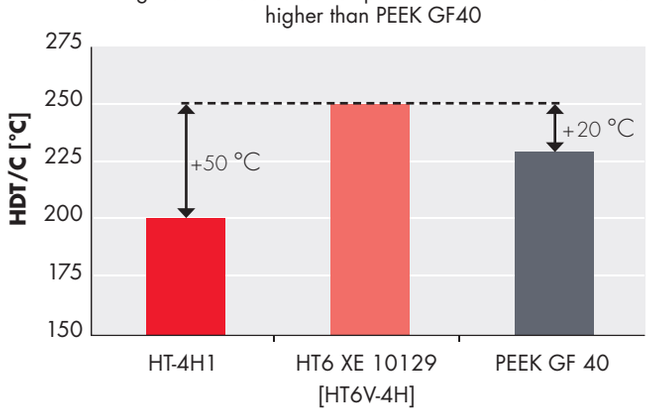
Compared to conventional PPA, Grivory HT6 has a 20 °C higher glass transition temperature with a comparable melting point. The advantage is significantly increased load-bearing capacity at high temperatures. The heat distortion temperature (HDT/C) has been increased by 50 °C to 250 °C. This is 20 °C more than with PPEK. Its extreme creep resistance makes Grivory HT6 suitable not only for components at elevated temperatures, but also wherever the highest resistance to deformation under load is required. Despite higher performance, processing is similar to Grivory HT1, where the melting temperature is 330°C to 350°C and tool temperature starts at 160 °C. Grivory HT 6 is the first choice for highly stressed components at high and low temperatures. Compared to conventional PPA, HT6 can be used to design thin-walled components and thus reduce manufacturing and energy costs.

10000 Hours & 40 MPa Load



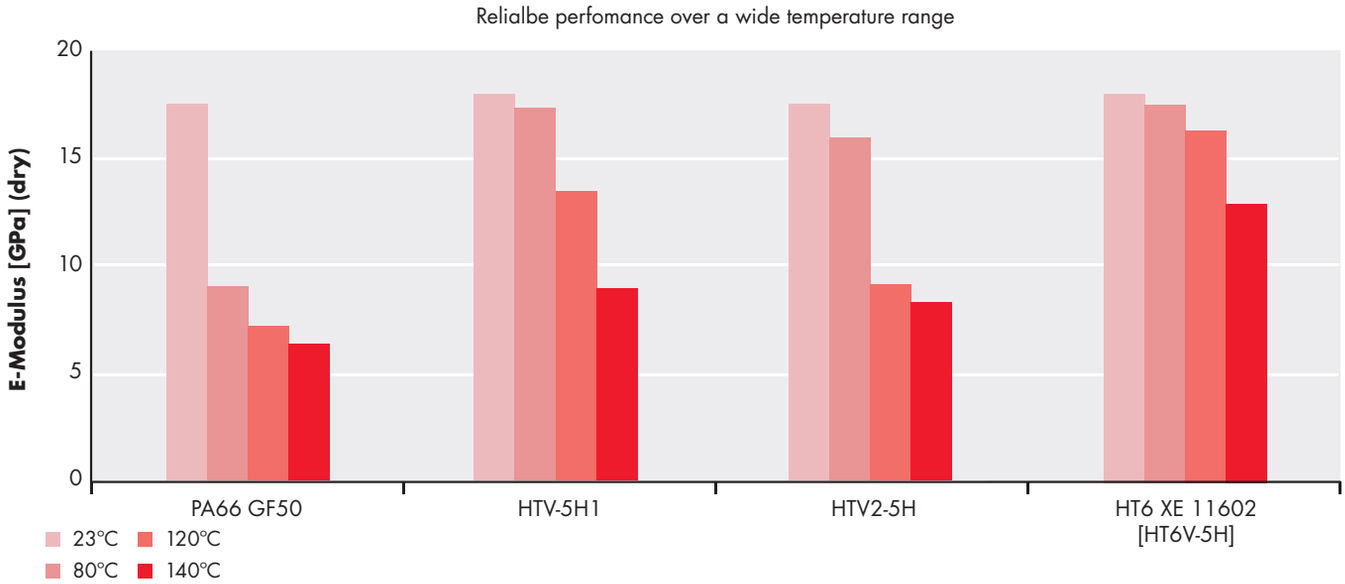
Excellent Heat Deformation Resistance

Highest heat deflection temperature of all PPA and 20 % higher than PEEK GF40



Consistent stiffness

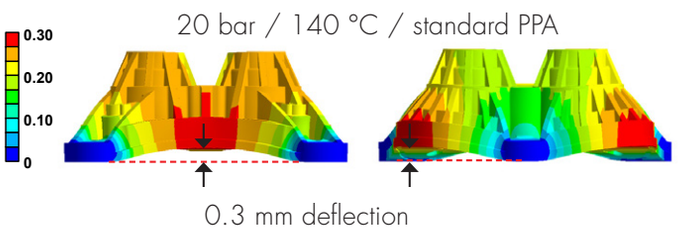
Relialbe perfomance over a wide temperature range

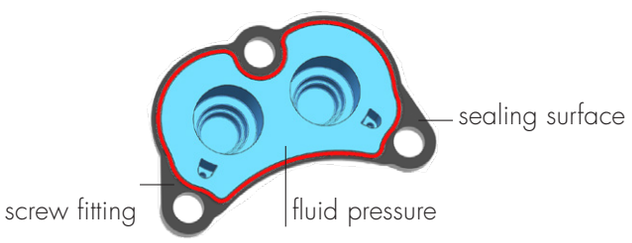


Cost and Weight Reduction Case Study

Cover for pressurized gearbox component

- Load case: internal pressure 20 bar/140 °C
- Fixation: 3 screws
- Critical: deflection of sealing surface (leakage)
- Max. 0,3 mm total deformation allowed

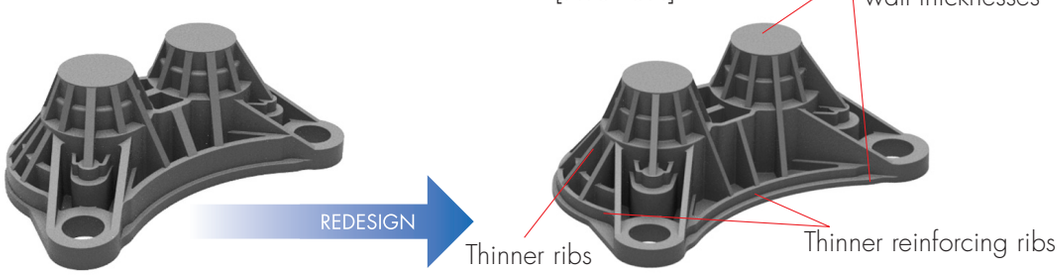




Redesign Adapted to Higher Material Stiffness

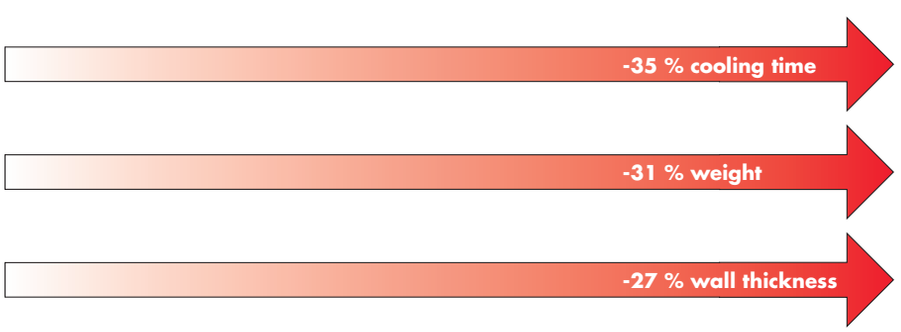
Original design
standard PPA

Redesign
HT XE 11602
[HT6V-5H]



Weight: 101 g

Weight: 70 g



Grivory HT6 Core Products

Property	Standard	Unit	HT XE 10129 [HT6V-4H]	HT XE 11635 [HT6VA-4HY]	HT XE 11600 [HT6V-4X]	HT XE 11602 [HT6V-5H]	HT XE 11601 [HT6V-5X]	HT XE 11627 [HT6V-6H]
Degree of reinforcement	ISO 3451	%	40	40	40	50	50	60
E-Modulus	ISO 527	GPa	14.5/14.5	14.5/14.5	14.5/14.5	18.0/18.0	18.0/18.0	23.0/23.0
Tensile Strength at Break	ISO 527	MPa	240/240	240/240	240/240	260/260	260/260	260/260
Charpy Impact +23°C	ISO 179	kJ/m²	60/60	60/60	60/60	70/70	70/70	70/70
Charpy Notched Impact +23°C	ISO 179	kJ/m²	11/11	11/11	11/11	12/12	12/12	12/12
Melting Point	ISO 11357	°C	320	320	320	320	320	320
Heat Deflection HDT/C 8.0 MPa	ISO 75	°C	250/-	250/-	250/-	260/-	260/-	260/-
Density	ISO 1183	g/cm³	1.53/-	1.53/-	1.53/-	1.65/-	1.65/-	1.78/-
Water Absorption, 23°C	ISO 62	%	3.5	3.5	3.5	3	3	3
Moisture Absorption, 23°C/50%	ISO 294	%	1.5	1.5	1.5	1.2	1.2	1.2
Mold Shrinkage Long./Trans.	ISO 294	%	0.15/0.75	0.15/0.75	0.15/0.75	0.15/0.6	0.15/0.6	0.15/0.55
Melt Temperatures	–	%	330–340	330–340	330–340	330–340	330–340	330–340
Tool Temperature	–	°C	≥ 160	≥ 160	≥ 160	≥ 160	≥ 160	≥ 160

Values represent [dry/conditioned] states

Basic Product Assortment

HT1

Grades	Reinforcement	Characteristics
HTV-3H1 HTV-4H1 HTV-5H1 HTV-6H1	30% glass fiber 40% glass fiber 50% glass fiber 60% glass fiber	Exhibiting well-balanced mechanical, chemical, and thermal perfo-mance. Usage for functional parts in contact with chemicals at high applications temperatures.
HTV-4X1 HTV-5X1 HTV-6X1	40% glass fiber 50% glass fiber 60% glass fiber	Electro-compatible stabilisation. For application requiring resistance to high electrical voltage, in humid and hot environ-ments.
HT XE 12301 HT XE 12303 HT XE 12304	40% glass fiber 50% glass fiber 60% glass fiber	For higher CTI values, electro-compatible stabilization.

HT3: PPA partially based on renewable raw material

Grades	Reinforcement	Characteristics
HT3Z HT3Z LF BLACK 9564	0	Low friction, exhibiting im-proved tribological properties.
XE 4063 BLACK 9238	GF30	General purpose, high dimensional stability.
XE 4095	GF50	High flow
XE 4101 BLACK 9225	GF40	Drinking water and food approved. [1]
XE 4027	GF30	Flame retardant UL 94 V0

[1] NSF 61 82°C; ACS 23°C; KTW 23°C; W270/ DIN EN 16421 Food contact: EU 10/2011; USA FDA Food Contact Notification 1170; JP Notification No. 196 / 2020

HT2

Grades	Reinforcement	Characteristics
HT2V-3H HT2V-4H HT2V-5H HT2V-6H	30% glass fiber 40% glass fiber 50% glass fiber 60% glass fiber	General purpose, with well-balanced mechanical and thermal properties. Suitable for water-cooled moulds.
HT2V-3X V0 HT2V-4X V0 HT2V-5X V0	30% glass fiber 40% glass fiber 50% glass fiber	Flame retardant, halogen-free, UL 94 V0.
HT2V-3H LF	30% glass fiber	Low friction, exhibiting im-proved tribological properties.
HT2C-3X	30% carbon fiber	Electrically conductive, unbeat-able strength/ density ratio.
HT2C-3X LF	30% glass fiber	Electrically conductive, unbeat-able strength/ density ratio, low friction, exhibiting improved tribologi-cal properties.
HT XE 16125	50% Long glass fibre	High stiffness, high creep resistance.

EMS-GRIVORY
Service and Support

EMS-GRIVORY is a specialist in polyamide synthesis and the processing of polyamide materials.
Our services focus on the success of customer applications with our specialty products and range from manufacturing and material supply to full technical support.

Quality System Certification
IATF 16949:2016
All manufacturing sites

Laboratory Accreditation
ISO/IEC 17025:2017
Sumter South Carolina Site

Design Concept
Design Proposals (Variants)
Part Cost Calculations

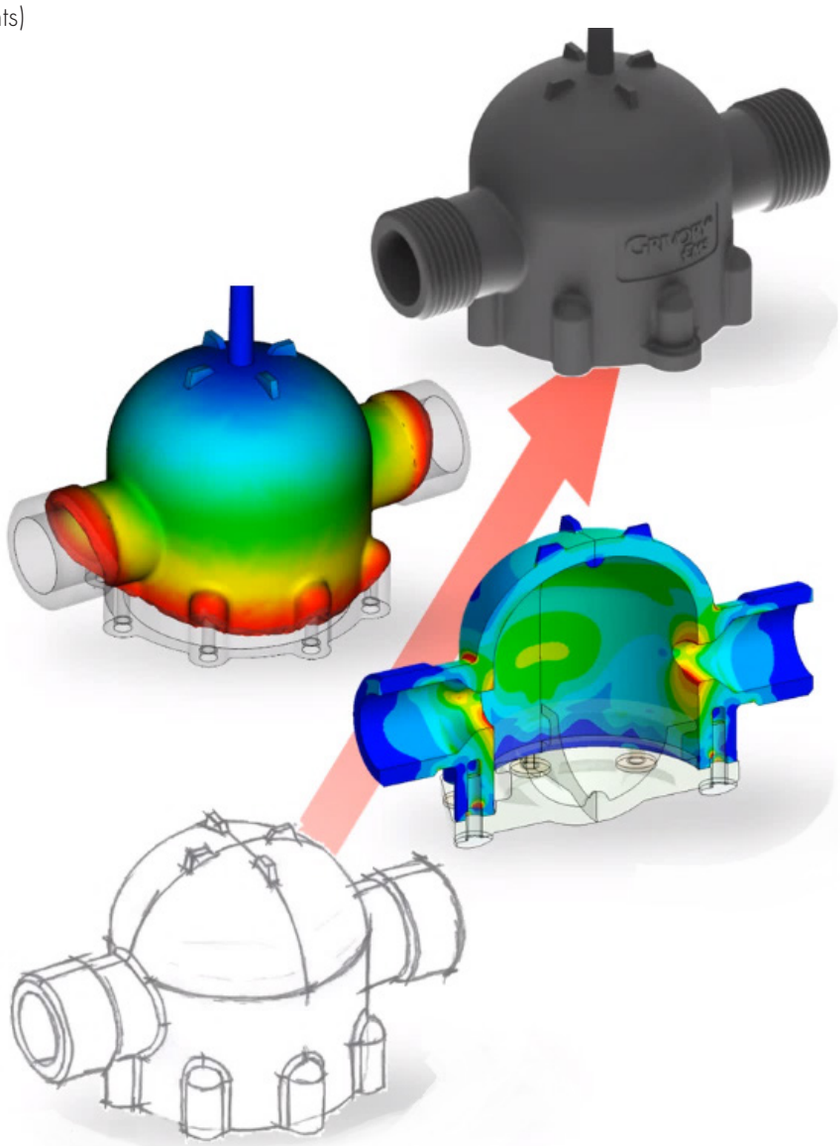
Material Selection
Comparative evaluation

Design Evaluation
Design recommendations
Moldflow and FEA

Prototypes
Prototype production
Die cast tool modification

Application Related Tests
Test method development
Characterization and Analysis

Sampling and start of production
Processing and tool optimization



You receive comprehensive technical support from our Application Development Center.

Temperature module and test chamber in material testing.

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EMS-GRIVORY – The leading manufacturer of high-performance polyamides

EMS-GRIVORY is the leading manufacturer of high-performance polyamides and the supplier with the widest range of polyamide materials. Our products are well-known throughout the world under the trademarks Grilamid, Grivory and Grilon.

We offer our customers a comprehensive package of high-capacity and high-quality products along with segment-specific advisory competence in distribution and application development. We maintain our market leadership through continual product and application development in all segments.

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