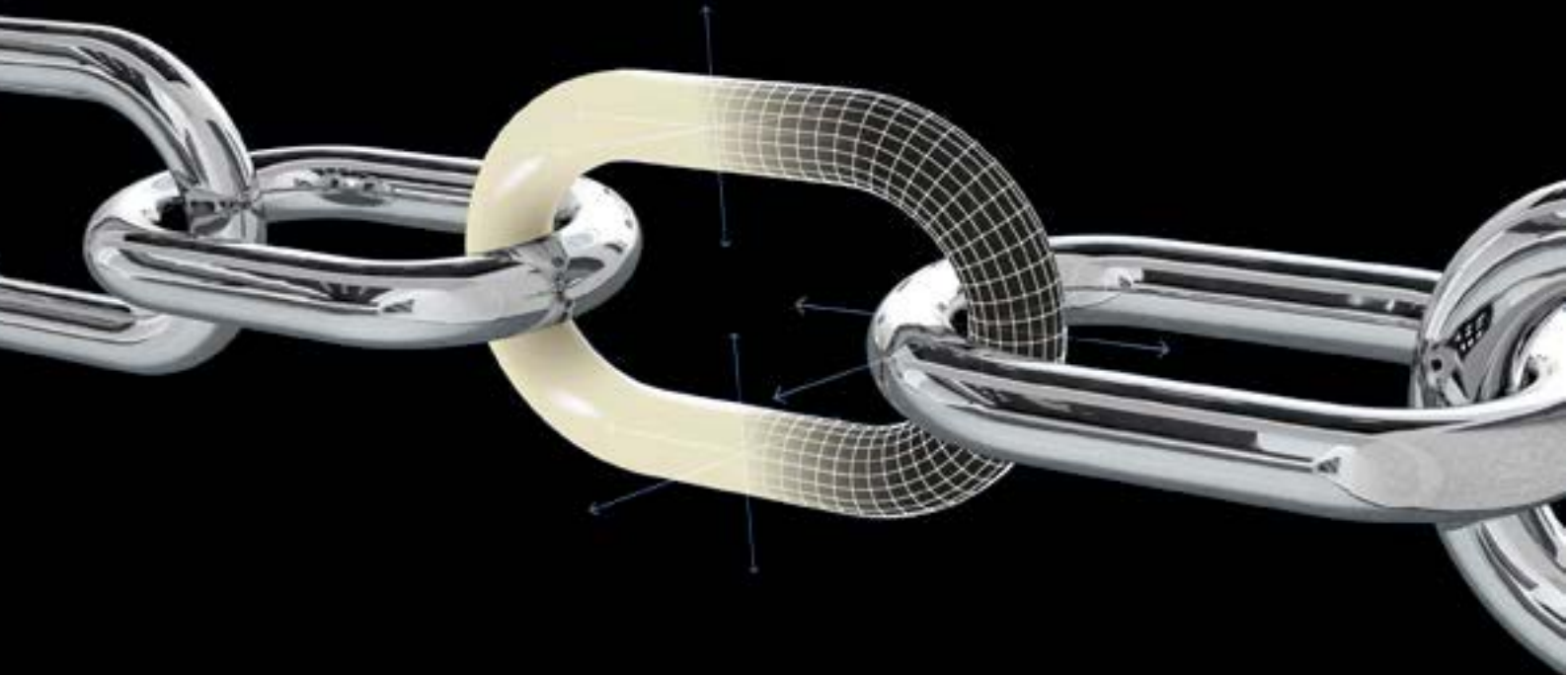


TEREZ® GT3 | GT3X

FOR THE HIGHEST STANDARDS IN METAL REPLACEMENT



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TEREZ® GT3 | GT3X

Unmatched in stiffness, strength and flowability

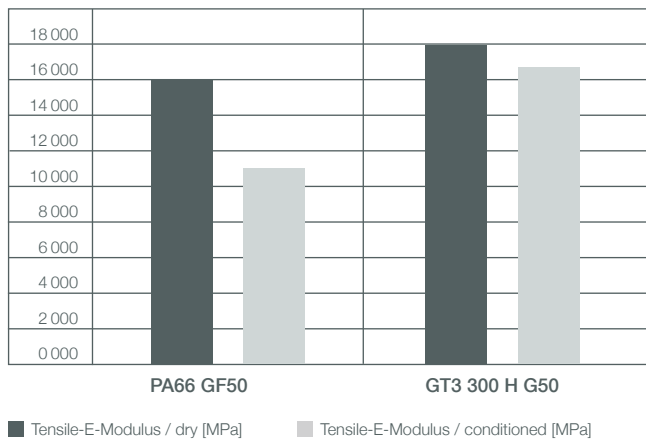
The subject of metal replacement already engages the plastics industry for many years; this is because the use of plastic instead of metal implies economical and ecological benefits. Plastics offer weight reduction, freedom of design, sustainability, and last but not least high stiffness and strength values.

The TER Plastics Polymer Group has a comprehensive product portfolio around the topic of metal replacement. Our product lines TEREZ® GT3/GT3X have been specially developed for the highest requirements of the automotive industry, mechanical and sanitary engineering.

TEREZ® GT3 - Glass fiber content up to 60%

The TEREZ® GT3 line complements high glass fiber reinforced PA6 and PA66 types and is based on PA66 + PA6I/6T with partially aromatic parts. Because of the potential glass fiber content of up to 60%, very high stiffness and strength are achieved that keep their outstanding level of strength even after absorbing humidity. Dimensional stability also is increased compared to conventional polyamides.

Material Comparison



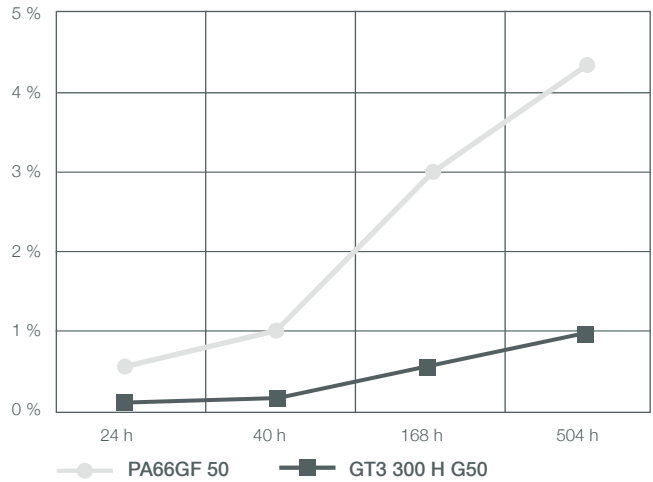
The reasons that speak for our products are as varied as their uses:

- High stiffness and strength even in the conditioned state
- Good surface quality
- Dimensional stability
- Thermal expansion comparable to aluminum
- Very good processability
- Excellent chemical resistance

Reduced tool wear

The volume increase is minimized due to reduced moisture absorption. Also, mold wear can be reduced significantly by using the new material, compared to zinc or aluminum die casting, so that the service life of the mold optimally improves by a factor of 5.

Moisture absorption by water immersion (23 °C / ISO 62)



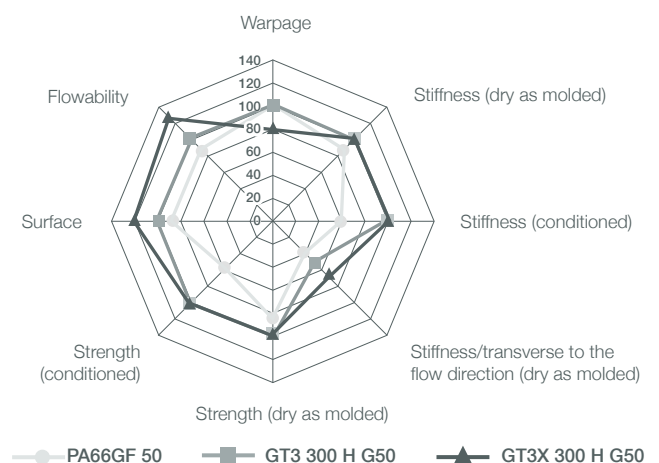
TEREZ® GT3X

The product line TEREZ® GT3X constitutes an advancement of the TEREZ® GT3 series and offers the following product benefits:

- Improved flowability
- Increased design freedom
- Improved surface quality
- Optimized transverse strength
- Decreased tendency to warp

This property profile was made possible through targeted product and process optimization.

Property profile



Tribological modifications

By combining the product lines TEREZ® GT3/GT3X with PTFE, excellent tribological properties can be achieved. The coefficient of friction and wear are significantly reduced. For this, the PTFE is chemically coupled with the TEREZ® GT3/GT3X, resulting in constant sliding properties and an extended life cycle.

Standard values of the materials at 23 °C	Test method	Unit	TEREZ® GT3 300 H G30	TEREZ® GT3 300 H G30 TF15	TEREZ® GT3 300 H G40
Mechanical properties			dry / conditioned	dry / conditioned	dry / conditioned
Charpy impact notched 23 °C	ISO 179-1eA	kJ/m ²	11 / 12	12 / 13	15 / 15
Charpy impact resistance 23 °C	ISO 179-1eU	kJ/m ²	80 / NB	85 / NB	NB / NB
Tensile-E-Modulus	ISO 527-1,-2	MPa	10800 / 11000	10500 / 10000	13500 / 12500
Elongation at break	ISO 527-1,-2	%	3 / 4	4 / 5	3 / 3
Tensile stress at break	ISO 527-1,-2	MPa	215 / 200	215 / 200	230 / 215
Thermal Properties			dry	dry	dry
HDT 0,45 MPa	ISO 75-1,-2	°C	245	245	248
HDT 1,81 MPa	ISO 75-1,-2	°C	235	235	238
Melting temperature (DSC)	ISO 11357-1,-3	°C	260	260	260
Vicat B/50	ISO 306	°C	207	207	210
Electrical properties					
CTI - Comparative tracking index	IEC 60112	V	600	600	600
Electric strength	IEC 60243-1	kV/mm	33	33	33
Volume resistivity	IEC 60093	Ohm·m	1E12	1E12	1E12
Surface resistivity	IEC 60093	Ohm	1E13	1E13	1E13
Classification of flammability					
Flammability at thickness h	UL 94	class	HB	HB	HB
Tested sample thickness	UL 94	mm	1,6	1,6	1,6
General features					
Density	ISO 1183	kg/m ³	1,34	1,42	1,46
Water absorption, water at 23 °C	ISO 62	%	4,8	4,5	4,5
Moisture absorption, 23 °C, 50 % (r.m).	ISO 62	%	1,8	1,6	1,5

Products for contact with drinking water (cold water)

Standard values of the materials at 23 °C	Test method	Unit	TEREZ GT3 300 H G30 W	TEREZ GT3 300 H G40 W	TEREZ GT3 300 H G50 W
Mechanical properties			dry / conditioned	dry / conditioned	dry / conditioned
Charpy impact notched 23 °C	ISO 179-1eA	kJ/m ²	11 / 12	15 / 15	17 / 17
Charpy impact resistance 23 °C	ISO 179-1eU	kJ/m ²	80 / NB	NB / NB	NB / NB
Tensile-E-Modulus	ISO 527-1,-2	MPa	10800 / 11000	13500 / 12500	17500 / 16500
Elongation at break	ISO 527-1,-2	%	3 / 4	3 / 3	3 / 3
Tensile stress at break	ISO 527-1,-2	MPa	215 / 200	230 / 215	245 / 220
Thermal Properties			dry	dry	dry
HDT 0,45 MPa	ISO 75-1,-2	°C	245	248	255
HDT 1,81 MPa	ISO 75-1,-2	°C	235	238	244
Melting temperature (DSC)	ISO 11357-1,-3	°C	260	260	260
Vicat B/50	ISO 306	°C	207	210	210
Electrical properties					
CTI - Comparative tracking index	IEC 60112	V	600	600	600
Electric strength	IEC 60243-1	kV/mm	33	33	33
Volume resistivity	IEC 60093	Ohm·m	1E12	1E12	1E12
Surface resistivity	IEC 60093	Ohm	1E13	1E13	1E13
Classification of flammability					
Flammability at thickness h	UL 94	class	HB	HB	HB
Tested sample thickness	UL 94	mm	1,6	1,6	1,6
General features					
Density	ISO 1183	kg/m ³	1,34	1,46	1,57
Water absorption, water at 23 °C	ISO 62	%	4,8	4,5	4
Moisture absorption, 23 °C, 50 % (r.m).	ISO 62	%	1,8	1,5	1,4

TEREZ® GT3 300 H G40 TF15	TEREZ® GT3 300 H G50	TEREZ® GT3 300 H G60	TEREZ® GT3X 300 H G50	TEREZ® GT3X 300 H G60
dry / conditioned	dry / conditioned	dry / conditioned	dry / conditioned	dry / conditioned
12 / 13	17 / 17	18 / 18	16 / 16	18 / 18
85 / NB	NB / NB	85 / 85	NB / NB	85 / 85
13500 / 13000	17500 / 16500	21500 / 20000	17500 / 16500	21500 / 20000
2 / 3	3 / 3	2 / 2	2;5 / 2;5	2 / 2
215 / 200	245 / 220	260 / 250	245 / 220	260 / 250
dry	dry	dry	dry	dry
245	255	255	255	255
235	244	244	244	244
260	260	260	260	260
207	210	210	210	210
600	600	600	600	600
33	33	33	33	33
1E12	1E12	1E12	1E12	1E12
1E13	1E13	1E13	1E13	1E13
HB	HB	HB	HB	HB
1,6	1,6	1,6	1,6	1,6
1,48	1,57	1,68	1,57	1,68
4	4	3,5	4	3,5
1,3	1,4	1,2	1,4	1,2

Chemical Stability

The GT3 and GTX3 product lines are generally resistant against a variety of organic solvents and alkalis. Also benzene, oils and fats do not affect the GT3 and the GT3X. Strong acids cause a relatively rapid hydrolytic degradation of all polyamides; against diluted organic acids GT3 and GT3X are resistant when exposed short-term. Polyamides are completely dissolved by certain aggressive chemicals such as concentrated mineral acids, phenols and methanolic calcium chloride solution as well as highly halogenated acetic acid. At elevated temperatures also glycols and various other alcohols affect the material strongly.

TEREZ GT3 300 H G60 W

dry / conditioned
18 / 18
85 / 85
21500 / 20000
2 / 2
260 / 250
dry
255
244
260
210
600
33
1E12
1E13
HB
1,6
1,68
3,5
1,2

Aceton	●●	Uric acid	●●	Pyridine	●●●
Aluminum salts	●●●	Urea	●●●	Crude oil	●●●
Ammonia	●●●	Heptane	●●●	Salicylic acid	●●●
Amyl acetate	●●●	Hydraulic oil	●●●	Hydrochloric acid 1 %	●
Aniline	●●	Isooctane	●●●	Sulfur	●●●
Gasoline	●●●	50 % potassium hydroxide solution	●●●	Sulfuric acid 10 %	●
Benzene	●●●	Saturated potassium carbonate	●●●	Hydrogen sulfide	●●●
Benzyl alcohol	●	Kerosene	●●●	Soapsuds	●●●
Bromine	●	Copper sulphate	●●●	Silicone oil	●●●
Butane	●●●	Magnesium chloride saturated	●●	Styrene	●●●
Butanol	●●	Saltwater	●●●	Turpentine	●●●
Calcium chloride saturated	●●	Methane	●●●	Carbon tetrachloride	●●●
Chlorobenzene	●●●	Methanol	●●	Tetralin	●●●
Chloroform	●	Lactic acid	●	Toluene	●●●
Diesel	●●●	Mineral oil	●●●	Transformer oil	●●●
Diethyl ether	●●●	Engine oil	●●●	Trichloroethane	●●
Acetate	●●	Saturated sodium carbonate	●●●	Trichlorethylene	●●
Acetic acid	●	Sodium chloride saturated	●●●	Water (23 °C)	●●●
Ethanol	●●	Sodium sulfate saturated	●●●	Hydrogen peroxide 20 %	●
Ethylene oxide	●●●	Nitrobenzene	●●	Wine	●●●
Lipids	●●●	Oxalic acid	●●	Tartaric acid	●●
Formaldehyde	●	Ozone	●	Xylene	●●●
Liquid Freon F12	●●●	Perchlorethylene	●●●	Zinc chloride	●●
Liquid Freon F22	●	Petroleum ether	●●●	Citric acid	●●
Cryoprotectant	●●	Phenol	●		
Glycerol	●●●	Propane	●●●		

●●● Resistant, only slight, reversible dimensional change ●● conditionally resistant; after a long time appreciable change of dimensions
● impermanent, under certain conditions still usable; soluble or in a short time strong degradation

PROCESSING GUIDELINES

Recommended Screw Design

TEREZ® GT3/GT3X grades can be processed on all standard injection molding machines. The commercially available universal screws can be used with non-return valves. The L/D ratio should be 18 - 24 D and the compression ratio 2,5 - 3,5 : 1. For the processing of high-fiber reinforced TEREZ® GT3/GT3X the use of wear-proof screws and cylinders is recommended.

Recommended Temperature Settings

At least three separately controllable heating zones should be able to reach cylinder temperatures of up to 320 °C. A separate nozzle heating is necessary. The cylinder flange must be temperature-controlled. During processing an open nozzle can be used as it is very aerodynamic and durable due to its construction. However, should molten material drool out of the nozzle, needle valve nozzles have been proven in practice.

Processing Temperatures

Product	Unreinforced	GF, GK, GF, MF
GT3	–	270 - 300 °C
GT3X	–	270 - 300 °C

The maximum peripheral speed of the screw is 0.3 m/s

Mold Wall Temperatures

Higher mold temperatures result in lower stress injection molded parts, better finishes, better embedding of glass fibers and/or glass beads, higher degrees of crystallinity and lower shrinkage. The hoses and fittings used for mold temperature control must be designed to the required temperatures.

Product	Mold temperature
GT3	80 - 120 °C
GT3X	80 - 120 °C

Pre-drying Condition

Basically, a dessicant dryer should be used. For molded parts with very demanding surfaces a residual moisture content of ≤ 0.05 % is recommended. For the production of mechanically and optically perfect injection molded parts, we recommend a pre-drying at 80 °C for at least 4 hours. With an open container (wet granules) the pre-drying time can be extended up to 8 hours.

Residual Moisture Content	Time	Temperature
0,05 - 0,2 %	4 h	80 °C
0,2 - 0,5 %	8 h	80 °C

Instructions for cleaning injection units

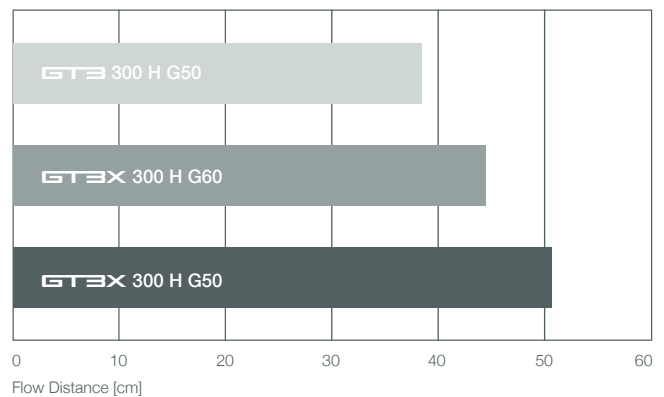
For cleaning using polypropylene, the unit can be flushed with low MFI PP. Commercial cleaning granules can also be used.

General Processing Data

GT3 GT3X		
Hopper	°C	40 - 80
Zone 1 - Zone 4	°C	270 - 300
Nozzle	°C	290 - 305
Melt	°C	290 - 300
Cavity wall	°C	80 - 120
Drying	°C / h	80 / 4 - 8
Molding pressure, spec.	bar	300 - 850
Back pressure	bar	5 - 20
Injection speed		medium - high

The values given are guide values, with increased filling the higher values should be aimed for. For drying, we recommend using only a dessicant dryer.

Flow Distance Comparison



Product comparison TEREZ® GT3/GT3X
Flow-spiral with 2 mm wall thickness

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