



**PERFORMANCE ENERGIZED BY**

**LANXESS**  
Energizing Chemistry

EF, XF and high-modulus product lines: Easy-flow and high-strength

**X Durethan® X Pocan®**

## TAILORED FOR OPTIMAL CUSTOMER BENEFIT

Our engineering plastics are designed to support customers in achieving maximum component performance and efficient processing. To meet these objectives, we established our **Durethan®** and **Pocan®** EF and XF product lines, a broad range of easy-flow polyamide 6 and 66 grades, and polybutylene terephthalates (PBT). “EF” stands for “EasyFlow,” “XF” for “XtremeFlow.” In addition, based on our standard easy-flow grades, we have developed what are known as “high-modulus thermoplastics” with glass fiber contents of 50% and more. These products display unusually high stiffness and strength and, despite their high filler content, can still be processed as easily and efficiently as comparable standard materials. They offer designers entirely new options.

### More than twice the flowability

The melt flow of the EF and XF materials has been increased by a factor of two or more compared to the standard materials without compromising on the mechanical properties. The result is numerous advantages for processing that tangibly reduce manufacturing costs for molders. Because they make it possible to reduce wall thickness, our materials are very well suited to applications in lightweight design.

### Alternative to metals, thermosets and SMCs

Our high-modulus materials frequently serve as alternatives to die-cast metals or thermosets, such as sheet molding compounds (SMC), because they are lighter and offer processing advantages. They have excellent opportunities in the field of lightweight design. Thanks to their high content of reinforcing fibers, these materials display outstanding mechanical properties at a comparatively low density. For instance, we have polyamide 6 grades in our range with a glass fiber content of 60%, including a new variation that offers increased flowability for ultra-thin walls and very good surface quality.



## OVERVIEW ADVANTAGES OF EASY- FLOW THERMOPLASTICS

Our **Durethan®** and **Pocan®** EF and XF product lines display good flowability, which translates into a wider processing window. Molders gain four “control dials” that enable them to exploit all processing and cost advantages:

### 1 Reduction in injection pressure

A lower injection pressure reduces mold wear and maintenance efforts. Smaller injection molding machines with lower clamping forces can be used, which cuts costs and increases a processor’s flexibility. Molds can be equipped with several cavities to boost throughput. Thin and complex component geometries can be fabricated with lower stresses. Additionally extending the holding pressure minimizes both warping and the risk of sink marks.

### 2 Reduction in melt temperature

A lower melt temperature shortens cooling and thus cycle times too, which also increases productivity. In most cases, our easy-flow materials help to achieve 15 to 30% shorter cycle times than with standard grades.

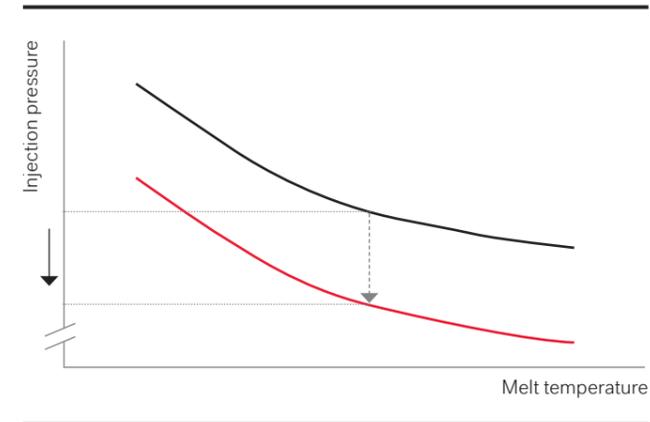
### 3 Increase in injection rate

Higher injection rates improve weld line strength and surface quality. Longer flow paths are possible, which permits the use of simpler molds, e.g. without hot runner technology.

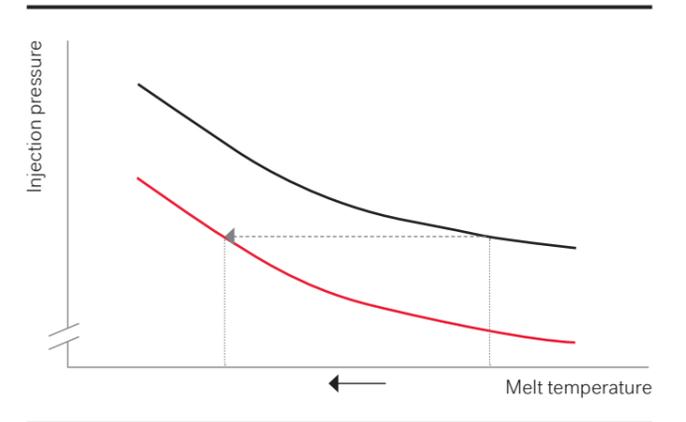
### 4 Extension of the flow path

With a longer flow distance, lower-cost molds with fewer gates can be used, resulting in fewer flow lines. Both wall thickness and material consumption can be reduced.

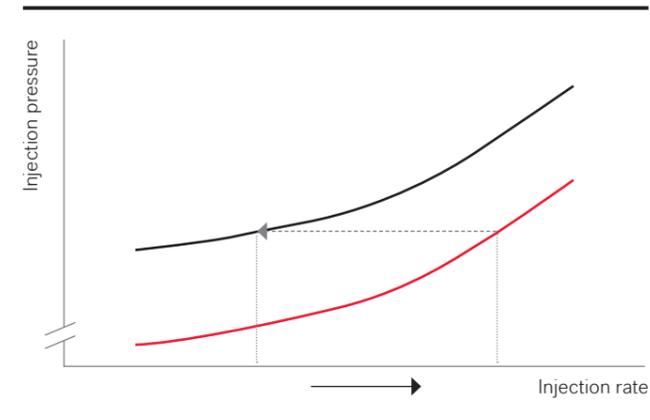
#### 1: Original processing parameters



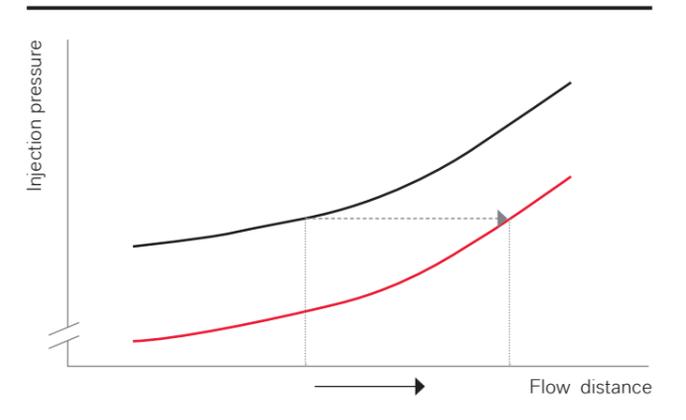
#### 2: Reduction in melt temperature



#### 3: Increase in injection rate



#### 4: Increase in flow distance



# OUR PRODUCT RANGE

## DURETHAN® EF AND XF

Our range of easy-flow Durethan® grades is highly diverse and grouped according to the main applications and processing methods. It includes products with a glass fiber content of between 20 and 60%, with mineral, glass sphere or chopped carbon fiber reinforcement, and with heat- and hydrolysis-stabilized properties.

### Durethan® EF and XF product range

Durethan EF/XF grade	Product characterization	Comparable standard grade
DP AKV 30 HR EF	PA 66, 30% glass fibers, hydrolysis stabilized, easy-flow	AKV 30 HR H2.0
BKV 30 H2.0 EF	PA 6, 30% glass fibers, easy-flow	BKV 30 H2.0
BKV 35 H2.0 EF	PA 6, 35% glass fibers, easy-flow	BKV 35 H2.0
BKV 50 H2.0 EF	PA 6, 50% glass fibers, easy-flow	BKV 50 H2.0
BKV 60 H2.0 EF DUS060	PA 6, 60% glass fibers, easy-flow	–
BKV 60 XF	PA 6, 60% glass fibers, extreme-flow	–
BM 29 X H2.0 EF	PA 6, 30% glass fibers/mineral, easy-flow	–
BM 40 X H2.0 EF	PA 6, 40% glass fibers/mineral, easy-flow	–
BG 30 X H2.0 XF	PA 6, 30% glass fibers/glass spheres, extreme-flow	BG 30 X H2.0

### Very high coolant resistance

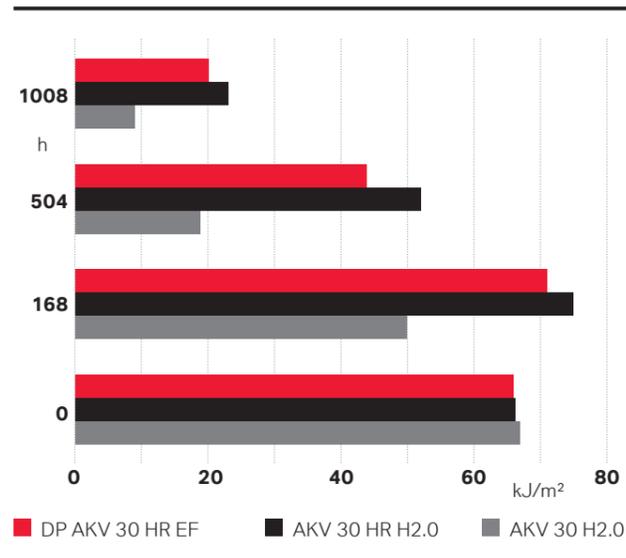
#### Durethan® DP AKV 30 HR EF

This polyamide 66 specialty grade from the Durethan® HR line was developed for applications in passenger car cooling systems. Its significantly higher flowability compared to Durethan® AKV 30 HR is not achieved at the cost of its hydrolysis resistance. The two display similarly good long-term resistance in hot water/glycol mixtures.



■ A coolant tube was fabricated in a water injection process for the first time from hydrolysis-stabilized, easy-flow Durethan®. A special glass fiber mixture makes the outer and inner surfaces of the tube very smooth.

### Izod impact strength to ISO 180-1U after storage in water/glycol at 130°C



### Durethan® BG 30 X H2.0 XF

#### For thin-walled electrical/electronic components

Reinforced with glass spheres and glass fibers, this polyamide 6 is optimized for components in automotive electrical systems, such as fuse boxes, central electronic control unit housings and multiway connectors. The flowability is about a third higher than the standard grade, Durethan® BG 30 X, which facilitates the low-warping fabrication of thin, complex component geometries.

### Durethan® BM 29 X H2.0 EF

#### Isotropic shrinkage, good surface quality

This heat-stabilized polyamide 6 targets visible, large-area components exposed to heat, such as engine covers. Thanks to the product's good flowability, such components can be fabricated on small injection molding machines. Reinforced with a mineral/glass fiber mixture, the advantages of this product are its isotropic shrinkage and good component surface quality.

# OUR PRODUCT RANGE

## POCAN® XF



Our range of easy-flow Pocan® XF products encompasses unreinforced variations, material grades with glass fiber reinforcement from 10 to 55% and one grade filled with glass spheres. Apart from purely PBT compounds, we also offer blends with polyethylene terephthalate (PET) and polycarbonate (PC). The various members of the Pocan® XF family – despite the significantly higher flowability of some – are all considerably more hydrolysis-resistant than the comparable standard grades. Many molders choose them over the standard materials for this reason, additionally benefiting in the process from a density advantage of up to 5%, meaning they can also reduce material consumption.

### Pocan® EF and XF product range

Pocan easy-flow	Product characterization	Comparable standard grade
B 1205 XF	PBT, unreinforced	B 1305
B 3215 XF	PBT, 10% glass fibers	B 3215
B 3217 XF	PBT, 16% glass fibers	KL 1-7265
B 3225 XF	PBT, 20% glass fibers	B 3225
B 5220 XF	PBT, 20% glass spheres	–
B 3235 XF	PBT, 30% glass fibers	B 3235
B 3233 HR	PBT, 30% glass fibers hydrolysis stabilized	B 3235
C 3230 XF	PBT+PC, 30% glass fibers	KU 1-7635 POS151
T 3150 XF	PBT+PET, 55% glass fibers	–

### Pocan® B 5220 XF

#### Effectively coatable surfaces

Reinforced with glass spheres, this compound shrinks very isotropically and has only a very minimal tendency to warp. It results in smooth, easy-to-coat surfaces. Another advantage is the high thermal stability expressed among other things by a deflection temperature under load of 170°C (0.45 MPa, ISO 75-1, -2). The material is ideal for large automotive body parts coated in an in-line process.

### Pocan® C 3230 XF

#### Low warpage, isotropic shrinkage

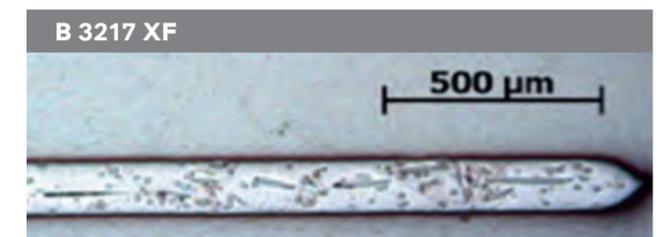
The strengths of this (PBT+PC) blend reinforced with 30% glass fibers are low warpage and virtually isotropic shrinkage. It displays 40% better flowability, but a 30% higher toughness than the standard blend Pocan® KU 1-7635, which is unusual because both properties usually have a negative effect on one another. The material yields excellent surfaces and is ideal for components that need to have very accurate dimensions, such as lamp housings or large panels.

### Pocan® B 3217 XF

#### Uniform fiber distribution

Reinforced with 16% glass fibers, this PBT has better flowability by approximately one-quarter than the standard material Pocan® KL 1-7265. Particularly in the case of thin-wall applications, it displays outstanding mold filling behavior, resulting in very uniform distribution of the glass fibers. Virtually no sink marks form in the process. Further advantages include its high toughness and hydrolysis resistance.

### Pocan® B 3217 XF: Cross-section showing the distribution of glass fibers



■ Multiway connectors of complex geometry can be designed with Pocan® B 3217 XF, because it results in uniformly oriented glass fibers, lending even very thin-walled regions of a component good mechanical stability.

# HIGH-MODULUS THERMOPLASTICS FOR THE MOST MECHANICALLY DEMANDING APPLICATIONS

Our high-modulus thermoplastics differ by the matrix used, the type and volume of reinforcing materials and the respective, optimized properties. The effective and efficient use of such high filler contents was first made possible by the technological advancements in improving flow described above.

They generally are characterized by very high strength and stiffness ratings. In terms of weight, they often are in the same league as metals. Compared to SMCs or die-cast zinc and aluminum, they offer greater freedom in component design and reduce overall weight due to their low density. Furthermore, the components do not require any reworking. In the case of high-volume production in particular, the injection molding method pays off thanks to the lower process costs. Integrating functions, such as mounts and guides, can further reduce manufacturing costs and simplify subsequent assembly steps. The high reinforcing filler content means higher thermal conductivity. In other words, the components can be removed from the mold sooner.



# OUR HIGH-MODULUS THERMOPLASTICS DURETHAN®



As our Durethan® high-modulus thermoplastics, we offer polyamide 6 and 66 grades with a glass fiber content of 50 or 60%. Our range further includes polyamides reinforced with chopped carbon fiber contents of 20 to 40%. What is more, we have developed hydrolysis-stabilized products and others optimized for high weather resistance. For “hot”

applications, heat-stabilized materials are available that can withstand continuous operating temperatures of up to 200°C. Our reinforced polyamides have elasticity modulus values ranging from 10,000 to 14,500 MPa (conditioned).

	Elasticity modulus		Tensile stress at break		Izod impact strength		Density	Comment
	Dry MPa	Conditioned MPa	Dry MPa	Conditioned MPa	Dry kJ/m <sup>2</sup>	Conditioned kJ/m <sup>2</sup>		
Durethan AKV 50 H2.0 (PA 66 GF50)	16,000	10,200	230	155	85	85	1,570	Standard
Durethan DP AKV 50 HR H2.0 (PA 66 GF50)	15,500	10,600	220	159	100	95	1,565	Hydrolysis-stabilized
Durethan BKV 50 H2.0 EF (PA 6 GF50)	16,200	10,000	215	140	85	80	1,570	Easy-flow
Durethan BKV 60 H2.0 EF DUS060 (PA 6 GF60)	20,000	12,000	225	145	90	90	1,700	Easy-flow
Durethan BKV 60 XF (PA 6 GF60)	20,200	14,200	215	140	80	75	1,693	Extremely good flowability
Durethan BG 60 X XF (PA 6 (GF+GB) 60)	19,000	12,300	210	135	80	70	1,665	Isotropic shrinkage
Durethan TP 038-001 Durethan „BCF 30 H2.0 EF“ (PA 6 CF30)	23,000	12,500	230	145	52	70	1,262	Carbon fibers
Durethan TP 038-002 Durethan „BCF 40 H2.0 EF“ (PA 6 CF40)	28,600	14,500	230	165	50	55	1,318	Carbon fibers



■ The front end carrier of the Škoda Octavia is made entirely of Durethan® DP BKV 60 EF H2.0. Thanks to the extremely high stiffness and strength of the polyamide, even the top cross-member of the component, extending all the way to the fender carriers, contains no sheet-metal reinforcements.

**Lightweight design reaches perfection**

With their high strength and stiffness, our high-modulus materials are the preferred choice when it comes to the lightweight design of structural components exposed to high stresses. The opportunities they offer in this connection are demonstrated by the automotive front end mentioned above, which is mass produced from a high-modulus grade. Compared to a virtual carrier designed by LANXESS from a standard polyamide 6 with 30 percent glass fibers, it is about 1.2 kilograms or 25 percent lighter. Responsible for these results are not only the significantly better mechanical properties, but also the good flow behavior of the material, which enables very thin walls. In fact, the wall thickness in areas subject to lower stresses was reduced to just 1.8 millimeters.

**Durethan® BKV 60 XF**  
**Extremely thin walls, excellent surfaces**

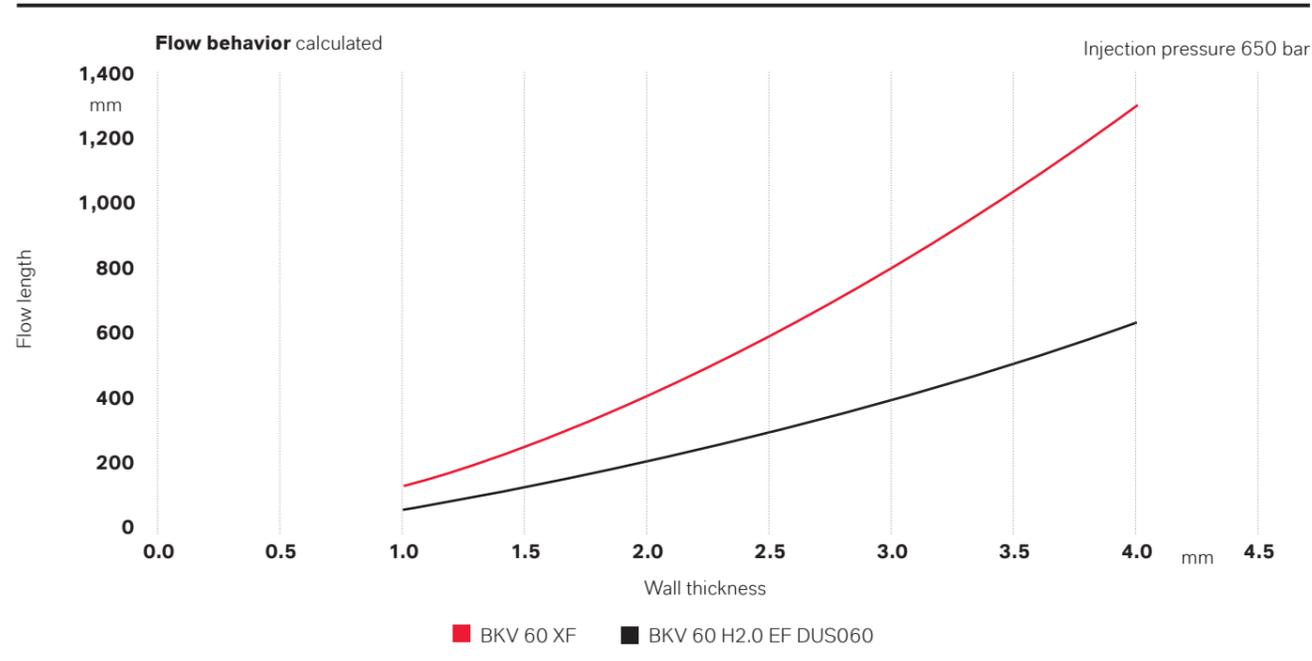
A special material innovation for lightweight design and “ultra-thin-wall technology” is Durethan® BKV 60 XF. The polyamide 6 is an advancement of our very successful product Durethan® DP BKV 60 EF H2.0. Its flowability has been boosted by another 30%, although it otherwise still has comparable, high-performance, mechanical properties.

It therefore is suitable for applications involving extremely thin walls of 1 mm or less. The surface qualities have also been significantly improved based on an optimized crystallization process and higher injection rates, which are possible thanks to the high flowability. Even with low injection rates and pressures, the advantages of a wide processing window can be fully exploited. Another advantage of this engineering material – which also permits laser marking – is its improved resistance to thermal aging.

**Further improvement in flowability**



**Flow distance versus wall thickness for different PA 6 GF60 products**



**Durethan® TP038-001 “BCF 30 H2.0 EF”**  
**As strong as die-cast aluminum**

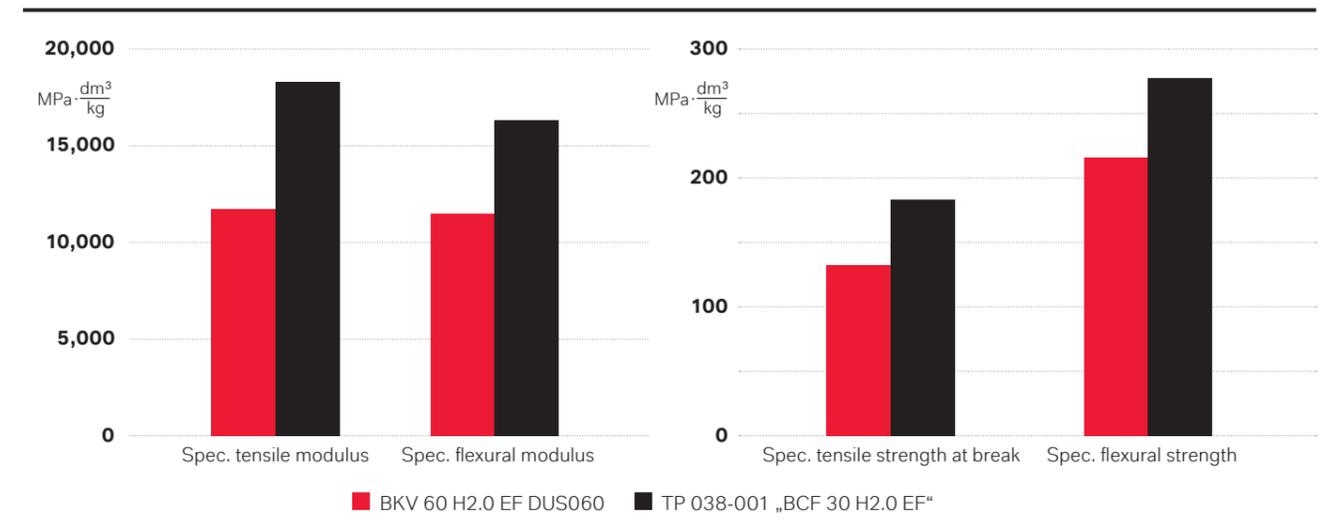
This polyamide 6 grade contains 30% carbon fibers. Thanks to its low density, its specific strength (adjusted for weight) is approximately twice as high as most commonly used steel and die-cast zinc materials, putting the material on a par with die-cast aluminum. This material therefore is ideal for high-stress components that must be particularly thin-walled because of small installation spaces, but at the same time extremely stiff and strong.

**Durethan® BG 60 X XF**  
**Tailored for tablet PC back shells**

This polyamide 6 was tailored for the thin, but very stiff back shells on tablet PCs. It is reinforced with a special mixture of glass fibers and glass spheres. Its stiffness and strength are about as high as those of Durethan® BKV 60 H2.0 EF DUS060, although it shrinks very isotropically and displays only a low tendency to warp. It results in excellent surface qualities.



**The significantly lower density of carbon-fiber-reinforced Durethan® “BCF 30 H2.0 EF” compared to Durethan® BKV 60 H2.0 EF DUS060 results in improved weight-specific characteristics, such as much higher specific stiffness and strength (values dry as molded).**



# OUR HIGH-MODULUS THERMOPLASTICS

## POCAN®

Our range of Pocan® high-modulus thermoplastics encompasses product grades with glass fiber reinforcement from 45 to 55%, including one grade with a high content of post-consumer recycled material. The Young's modulus values range from 16,000 to 18,500 MPa depending on the grade. Tensile modulus, tensile strength at break and elongation at break are at a similarly high level as our polyamides reinforced with 60% glass fibers. As is typical for PBT, these high-performance materials absorb virtually no water. Their mechanical properties therefore are constant regardless of moisture. In addition, another one of the strengths of these materials is their high dimensional stability.

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	Elasticity modulus	Tensile stress at break	Izod impact strength	Density
	MPa	MPa	kJ/m <sup>2</sup>	kg/m <sup>3</sup>
Pocan T 7391 (PBT+PET GF45)	16.000	160	55	1.690
Pocan T 3150 XF (PBT+PET GF55)	18.500	160	45	1.770
Pocan ECO T 3240 (PBT+PET GF45)	16.000	160	55	1.690



■ Thanks to its unusually high stiffness, Pocan® T 7391 was used to fabricate a large junction box for trucks. Subject to strong vibration, this component used to be welded from sheet metal. With our PBT, however, this complex, three-dimensional part can be fabricated more simply and cost-efficiently, and is significantly lighter.

### Pocan® T 3150 XF

#### Very strong and weather resistant

Reinforced with 55% chopped glass strands, this (PBT+PET) blend is formulated for easy-flow characteristics. With an elasticity modulus of 18,500 MPa, it displays very high stiffness and is very tough. Its strength is somewhat higher than that of Durethan® DP BKV 60 EF H2.0 (60% glass-fiber reinforcement) in a conditioned state. This low-warp, high-tech thermoplastic therefore is ideal for replacing metal. Its unique feature is its good weather resistance despite the high glass fiber content.

### Pocan® T 7391

#### Withstands high continuous static stresses

This (PBT+PET) blend displays unusually high stiffness and strength; its elasticity modulus is almost 16,000 MPa. It is ideal for components that are subject to continuous dynamic load and must absorb high forces. Despite its high glass fiber content of 45%, it results in very good surface qualities. The engineering material is dimensionally stable, displays low warpage and does not tend to creep. Its high thermal stability is expressed in a deflection temperature under load of 225°C (0.45 MPa, ISO 75-1, -2). Pocan® ECO T 3240 is a particularly sustainable version of this product, because it contains at least 25% post-consumer recycled material from PET beverage bottles, while otherwise offering the same properties.



■ Stator and rotor of a forced induction engine made of Pocan® T 7391, which can withstand very high dynamic stresses. Manufacturing these two engine components using a die-cast metal process would have involved considerable reworking due to the component's complex



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