



Modified Engineering Plastics

2017

**PENTALLOY**



Modified Engineering Plastics

Otto-Hahn-Straße 12  
D-64823 Groß-Umstadt

Phone: + 49 (0) 6078.9323-0  
Fax: + 49 (0) 6078.9323-99  
info@pentac.de

[www.pentac.de](http://www.pentac.de)



## Contents

<b>PENTAC</b> since 1988	2
Passion   Mission   Vision	3
Polyamides   Polyamide Alloys	4
Portfolio and Product positioning PENTALLOY®	6
Nomenclature	7

### **PENTALLOY®**

Table of material characteristics	8
<ul style="list-style-type: none"><li>▪ non-reinforced</li><li>▪ non-reinforced, impact modified</li><li>▪ glass fiber reinforced</li><li>▪ glass bead-, mineral-, hybrid reinforced</li></ul>	
Quality	10
Processing   Handling   Service	11

# PENTALLOY

PENTAC since 1988



PENTAC Polymer GmbH, a mid-sized, independent and family owned company, is known for innovation, reliability and quality of their engineering plastics.

PENTAC develops and manufactures tailor made products for a wide range of applications. Especially the automotive industry has certified and approved our materials for high end use.

Our customers benefit from our longterm experience in high end compounds fulfilling all requirements of a challenging market.

Polyamide injection molding compounds form the core of our business model.

Significant growth of our business during the last years were the base for substantial investments in our production and logistics facilities. PENTAC's actual capacity adds up to about 30,000 tons of compounds annually.



## Passion Mission Vision

### ▪ Innovation

Innovation begins in our minds. PENTAC's working culture is oriented to new ideas and developments. Together with our customers we create future solutions and answers to new requirements.

### ▪ Performance

Average quality was yesterday's standard. We are focussed on specialties with superior performance in nowadays markets. Our compounds are the result of long intense work.

### ▪ Reliability

A modern quality management system contributes significantly to our success. Process control and steady improvement allow consistent conformity with customers' requirements.

PENTAC's vision is based on six pillars, that determine our processes, communication, focus and objectives.

### ▪ Satisfaction

The customer stands in the focus of all our activities. Compliance with ambitious specifications and customer satisfaction are our ultimate aims. PENTAC always makes an additional effort to improve products and services.

### ▪ Competence

Finding the best individual solution for our customer is PENTAC's challenging business venture. Excellent education of our staff and many years of experience enable us to guarantee the best possible technical service and after sales support.

### ▪ Improvement

Stagnation means regression and does not fit into PENTAC's business model. Our philosophy demands continuous improvement process for products, processes, employees' expertise.

## Polyamides are:

- semi-crystalline
- tough
- abrasion resistant
- moisture absorbing
- chemical resistant
- temperature resistant
- insulating

## Applications

- Housing parts for vehicles
- Bumpers
- Housing parts for electrical tools
- Covers under stress
- Parts for sports and leisure

# Polyamides Polyamide Alloys

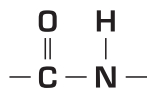
# PENTALLOY® BS

## At the beginning there was the protein!

### Polyamides – an engineering plastic family making history.

Already in the early 1930's the first polyamides have been used industrially by polycondensation of dicarbonic acid with diamine and hydrolytic polymerization of circular polylactame.

Despite many possible other molecules with a theoretical chance, the market was conquered by Polyamide 6 and Polyamide 6.6 with their well-balanced properties and their convenient feedstock and production costs. The replicated amide group is characteristic for all types of polyamides.



Properties of thermoplastic molding materials are affected by the used monomers.

## Combine benefits

What is more reasonable than blend the known construction material polyamide with other polymers, to generate additional interesting property profiles?

- **PENTALLOY® BS = Polyamide 6 + ABS**
- This blends combines properties of semi-crystalline polyamide and amorphous ABS. By addition of a compatibiliser a homogenous, finely dispersed polymer blend is generated. ABS fraction provides increased impact strength already after injection, reduced moisture absorption results in good dimensional stability.
- The most important properties:
- high (notched) impact strength
  - low moisture absorption
  - excellent dimensional stability
  - good processability
  - good chemical resistance
  - superior paintability and printability without pre-treatment
  - high sound insulation
  - weight reduction of 7% versus PA

**PENT[AMID] + ALLOY = PENTALLOY®**



Optimisation of performance data



## Applications

- Components in contact with fluids
- Tubes and cables
- Fixation parts
- Housings
- Plugs
- Parts for furniture
- Covers for automotive

**PENTALLOY® BP**  
**PENTALLOY® AP**

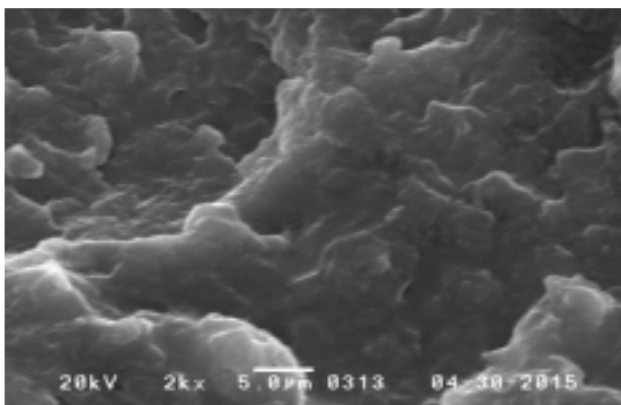
- **PENTALLOY® BP = Polyamide 6 + PP**
- **PENTALLOY® AP = Polyamide 6.6 + PP**

Blends of classic PENTAMID® grades with PP (polypropylene) are the logical conclusion to obtain low density materials, that are requested e.g. by the automotive industry to reduce weight. Polyamide typical moisture absorption is reduced in combination with improved flow and notched impact strength. Lower volume costs induce cost-efficient parts.

Polyamide and its mechanical strength and temperature stability is combined with polypropylene's excellent chemical resistance and lower density.

The most important properties are:

- lower density vs. PA 6 and PA 6.6 (7%)
- low moisture absorption
- good chemical resistance
- good dimensional stability
- favorable flow behaviour



SEM picture of a PA + PP alloy.

Change of material properties of PENTALLOY® (PA + PP) depending on composition.

density | surface quality  
 moisture absorption  
 stiffness | heat distortion temperature  
 volume price

**PENTAMID® [PA]**

**PENTALLOY® [PA + PP]**

**Polypropylene [PP]**

chemical resistance  
 flow behaviour  
 notched impact strength

# Portfolio and product positioning PENTALLOY®



**BS**  
PA 6 + ABS

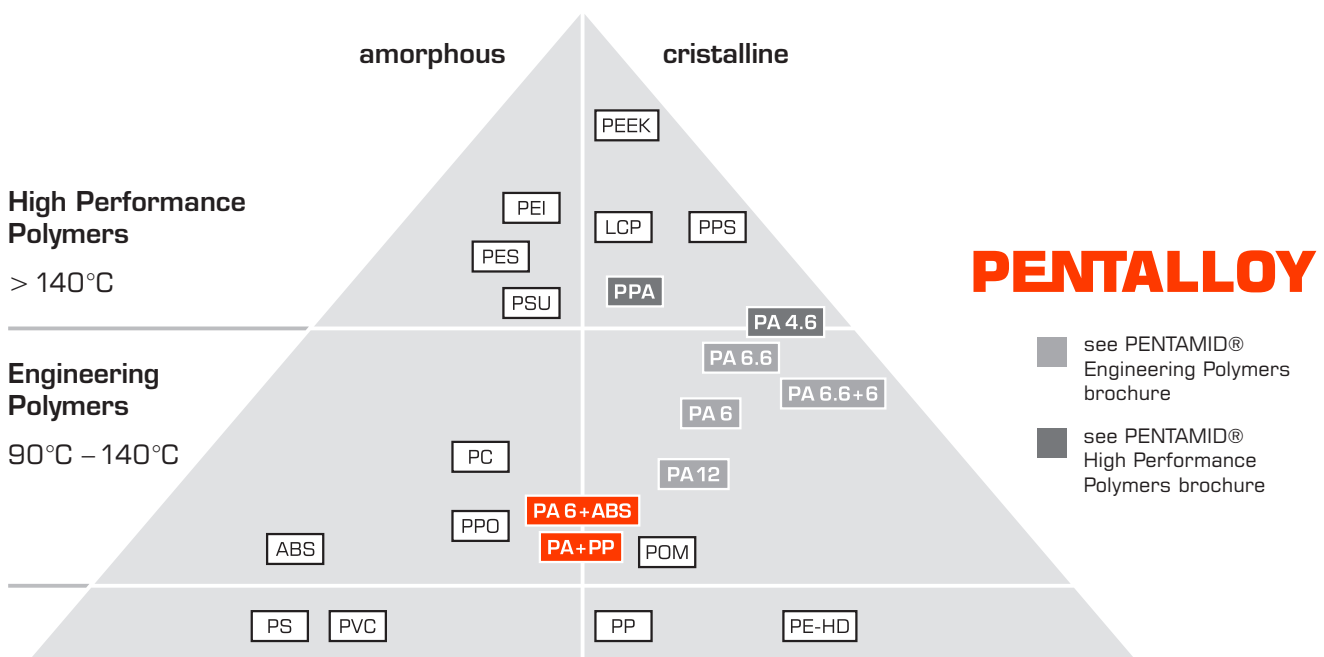
**BP**  
PA 6 + PP

**AP**  
PA 6.6 + PP

## Product family

non-reinforced	•	•	
non-reinforced, impact modified		•	
glass fiber reinforced	•	•	•
glasbead-, mineral-, hybrid reinforced	•	•	

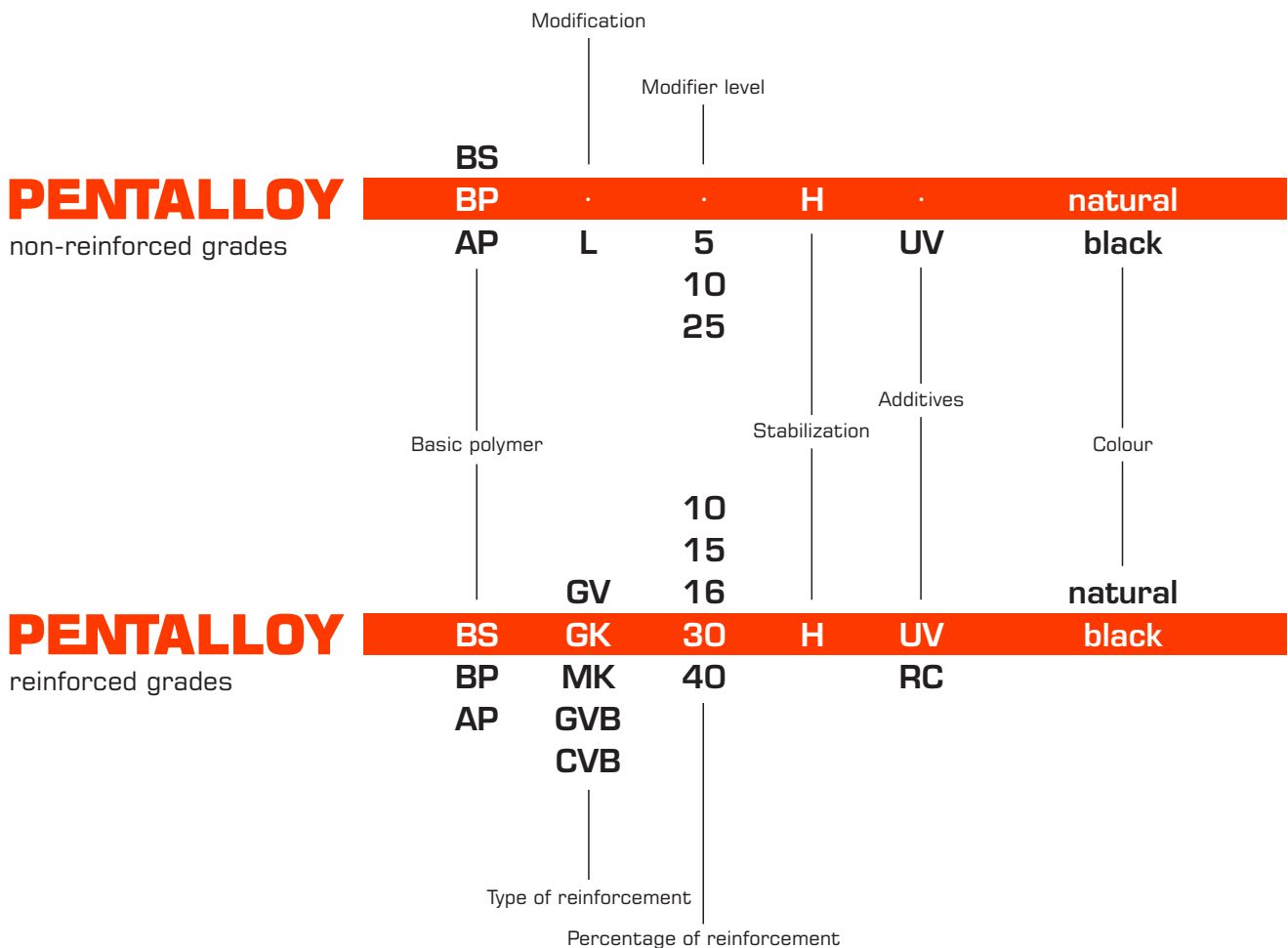
• available







# Nomenclature



- Modification: **L** dry impact modified
- Modifier level: **5** slightly modified | **10** medium modified | **25** highly modified
- Type of reinforcement: **GV** glass fiber reinforced | **GK** glass bead reinforced | **MK** „classic“ mineral reinforced  
**GVB** glass fiber / hollow glass spheres reinforced | **CVB** carbon fiber / hollow glass spheres reinforced
- Percentage: **10 - 40** amount of reinforcement from 10 up to 40 wt.-%
- Stabilization: **H** heat stabilized
- Additives: **UV** UV-stabilized | **RC** recyclate

non-reinforced

non-reinforced, impact modified

glass fiber reinforced

glass bead-, mineral, hybrid reinforced

Quality	Standards	Unit
Color		

#### Physical properties

Density	ISO 1183	g/cm <sup>3</sup>	d. a. m.
Water absorption (saturation)	ISO 62	%	-
Moisture absorption (23°C   50% r.h.)	ISO 62	%	-
Molding shrinkage parallel	ISO 294-4	%	d. a. m.
Molding shrinkage normal	ISO 294-4	%	d. a. m.

#### Mechanical properties

Tensile modulus	ISO 527-2 (1 mm/min)	MPa	d. a. m. cond.
Tensile strength at yield	ISO 527-2 (50 mm/min)	MPa	d. a. m. cond.
Elongation at yield	ISO 527-2 (50 mm/min)	%	d. a. m. cond.
Stress at break	ISO 527-2 (5 mm/min)	MPa	d. a. m. cond.
Strain at break	ISO 527-2 (5 mm/min)	%	d. a. m. cond.
Impact strength (Charpy @ 23°C)	ISO 179/1eU	kJ/m <sup>2</sup>	d. a. m. cond.
Notched impact strength (Charpy @ 23°C)	ISO 179/1eA	kJ/m <sup>2</sup>	d. a. m. cond.

#### Thermal and other properties

Melting point (DSC)	ISO 11357	°C	d. a. m.
Heat deflection temperature HDT/A	ISO 75 (1.80 MPa)	°C	d. a. m.
Heat deflection temperature HDT/B	ISO 75 (0.45 MPa)	°C	d. a. m.
Flammability class (UL 94)	ISO 1210 (1.6 mm)	Rating	d. a. m.

<b>BS H</b>	<b>BP H</b>	<b>BP (HV) H</b>	<b>BP L5 H</b>	<b>BP L10 H</b>	<b>BP L25 H</b>	<b>BS GV10 H</b>	<b>BS GV30 H</b>	<b>BP GV15 H</b>	<b>BP GV30 H</b>	<b>AP GV30 H</b>	<b>BS GK30 H</b>	<b>BP CVB10 H</b>	<b>BP GVB16 H</b>	<b>BP MK30 E H</b>
virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin	virgin
★★	★★	★★	★	★	★	★★★	★★	★★	★★	★★★	★	★★★	★★★	★★★
1.07	1.04	1.04	1.03	1.02	0.98	1.15	1.33	1.14	1.27	1.28	1.33	1.03	1.08	1.25
3.5	5	5	4.1	4	3.8	3.2	3.7	4.5	4	3.7	3.8	5	4.4	4
1.4	1.5	1.5	1.2	1.1	0.8	1.2	1.6	1.4	1.2	1.1	1.7	1.4	1.3	1.2
1.4	1.4	1.4	1.4	1.4	1.4	0.55	0.4	0.6	0.4	0.75	0.6	0.4	0.7	0.9
1.6	1.8	1.9	1.8	1.8	1.8	0.8	0.7	1	0.8	1	0.6	0.5	1	1.1
1850	2800	2700	2500	2200	1100	3850	8500	6200	9300	9500	4150	6700	5300	4100
1350	1800	1800	1600	1400	900	2900	6000	4500	7200	7700	2300	5000	4000	3000
50	65	61	60	51	35									
43	50	46	47	42	30									
3.5	5	4.4	5	5	7.5									
12	10	9	11	12	15									
						65	120	100	135	145	65	94	95	50
						50	85	75	100	125	60	75	75	40
>70	>40	26	>40	>40	>40	4.5	3	3	2.4	3	10	2.1	3	9
>90	>40	>40	>40	>40	>40	7	5	5	3.8	4.5	>25	3.2	4.5	13
n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	50	n.b.	56	60	75	n.b.	35	50	100
n.b.	n.b.	n.b.	n.b.	n.b.	n.b.	65	n.b.	58	62	77	n.b.	39	55	n.b.
85	12	13	15	20	n.b.	13	18	8	10	13	8	5	7	7
90	24	25	35	48	n.b.	20	25	10	11	14	8	6	8	7.5
222	222	222	222	222	222	222	222	222	222	262	222	222	222	222
80	75	80	65	60	50	110	135	190	195	235	70	180	180	90
110	135	140	130	125	100	125	190	215	210	250	170	210	210	165
HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB	HB

# Quality



Our customers expect the best quality from us. Therefore a complete and accurate analysis of the used raw materials is essential. Defined effective control procedures for incoming raw materials and production parameters secure high quality standards for our clients.

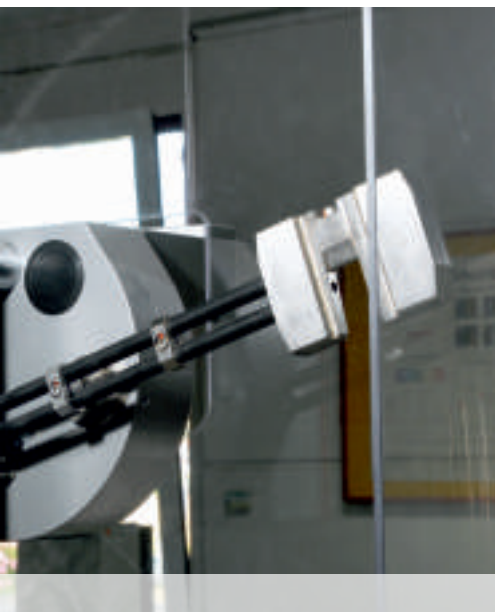
Compliance with European standards (ISO 9001, ISO 14001, ISO 50001) guarantee quality as well as responsible handling of environment and resources.

To cope with the high standards of our customers, we are using state of the art technologies in our plant. A very well equipped laboratory with fully automatic analysis devices and a continuous control system, as well as a quick and easy recording of all data by using high-tech communication devices provides the basis for an extensive and complete control and documentation system.

Certificates of analysis acc. EN 10204 3.1, permanent evaluation of suppliers and regular audits are part of our regular work.

Last but not least the longtime experience of our staff supports the consequent quality-, environment- and energy policy of PENTAC.





## Processing Handling Service

### Processing recommendations for PENTALLOY®

#### ■ Preparation | Drying

PENTALLOY® will be delivered for immediate use. To avoid moisture condensation on the pellets you should store the product 24 hours before processing at ambient temperature. It is recommended to dry the pellets at a temperature of 80°C for 3 hours in a dry air dryer. Please carefully attend to the recommended moisture level between 0.05% and 0.13%. In case of open or destroyed packaging a pre-drying is mandatory.

#### ■ Plasticizing | Dosing

Polymers should always be plasticized as gently as possible. For this, adjust the screw speed at such a level, that the available cooling time is used by about 80% to allow the polymer to be molten by the heaters.

For processing our engineering resins, we recommend dosing screws with a compression ratio of about 1:2.2 – 2.8. The feeding zone should be relatively long (50 – 60% L), compression zone rather short (20 – 25% L), to avoid excessive wear in the compression zone itself (L/D-ratio  $20 \pm 2$ ).

We also recommend the use of high-alloy steels which are corrosion resistant. A regular maintenance of the check-valve is recommended.

PENTALLOY® should be processed at a mold temperature of  $80 \pm 20^\circ\text{C}$ . The higher the temperature of the mold the higher the crystallinity and therefore the higher the dimension stability and smoother the surface quality.

Please find all relevant data for our process parameters on our recommendations at [www.pentac.de](http://www.pentac.de).

#### ■ Recommended processing parameters

Please find the recommended melt temperatures ( $T_M$ ) for our different PENTALLOY® grades in the following table:

PENTALLOY®	Basis	$T_M$	Recommended processing temperatures					
			Zone 5	Zone 4	Zone 3	Zone 2	Zone 1	Feed zone
BS	PA 6 + ABS	222°C	265°C	270°C	265°C	260°C	255°C	80°C
BP	PA 6 + PP	222°C	260°C	270°C	260°C	255°C	250°C	80°C
AP	PA 6.6 + PP	260°C	275°C	280°C	280°C	275°C	270°C	80°C



### ▪ Shrinkage

The shrinkage of polymer material is no constant value. Besides the formulation, the shrinkage depends on:

- Wall thickness of the part
- Holding pressure
- Cooling time
- Mold temperature
- Fiber orientation

Therefore stated shrinkage data are only indicative.

Please find additional and individual information on our technical data sheets at [www.pentac.de](http://www.pentac.de).

### Post-processing recommendations for PENTALLOY®

---

There are different possibilities to finish parts made of PENTALLOY®. We want to give a basic recommendation for that:

#### ▪ Painting

Polyamides are usable for painting due to their excellent resistance against most solvents. As usually the procedure of post-processing have to be adjusted to the respective PENTALLOY®-grade.

Most PENTALLOY®-grades cannot be powder coated; in those cases we recommend our conductive PENTALLOY®-grades.

#### ▪ Printing

Contrary to the painting process PENTALLOY®-grades are easy to imprint with most common print technologies without any pretreatment. The molded parts must be free of any mold release agent.

#### ▪ Welding

Parts made from PENTALLOY® can be welded by all known and common methods, e.g. ultrasonic-, diode-, friction-, and infrared-welding. The best method depends mainly on the geometry of the part, mechanical strength is excellent.

#### ▪ Plating

Mineral reinforced PENTALLOY® with their outstanding surface quality can be easily galvanized. Mechanical properties might be changed in the process.

#### ▪ Laser marking

One of the smartest labeling procedures is the marking of our laser sensitive and markable polyamides. PENTAC also offers PENTALLOY®-grades, which can be labeled permanently and fraud resistant by controlled laser beams. Due to the contactless labeling there is no negative influence on the mechanical properties.

It is our specialty to label bright surfaces as well as dark surfaces made of reinforced PA 6 and PA 6.6.



### ▪ Bonding

Because of their outstanding chemical resistance polyamides and polyamide alloys do not respond well to bonding. Special surface treatments can facilitate adhesion.

Reactive adhesives (e.g. multi-component systems) are preferred versus solvent adhesive glues due to their very aggressive and harmful ingredients.

### Imprint

#### Publisher

PENTAC Polymer GmbH, Groß-Umstadt  
[www.pentac.de](http://www.pentac.de)



**Rights reserved for errors, changes and improvements!**

© PENTAC Polymer GmbH | 2017  
All rights reserved



Modified Engineering Plastics

**Disclaimer**  
September | 2017

Although all statements, information, and data given herein are believed to be accurate, they are presented without guarantee, warranty, or responsibility of any kind, express or implied. Statements or suggestions concerning possible use of our products are made without representation or warranty that any such use is free of patent infringement and are not suggestion to infringe any patent. The user should not assume that all safety measures are indicated, or that other measures are indicated, or that other measures may not be required.



Modified Engineering Plastics

Otto-Hahn-Straße 12  
D-64823 Groß-Umstadt

Phone: + 49 (0) 6078.9323-0  
Fax: + 49 (0) 6078.9323-99  
info@pentac.de

[www.pentac.de](http://www.pentac.de)