



NYLAFORCE[®]

Glass fibre reinforced high performance plastics
manufactured using the feed up-process



NYLAFORCE[®]

CONTENT

- + product informations
- + range of products
- + properties
- + technical data
- + processing guidelines
- + applications
- + contact

- + glass fibre reinforced, stabilized and with nanoparticles modified polyamides [PA 6, PA 6.6]
- + extremely high glass fibre reinforcement from up to 70%
- + feed up-process enables the glass fibres to be orientated in the most effective way
- + ideally suited for technically functional parts with the highest demands on mechanical strength
- + high E-modulus from up to 25.000 Mpa
- + alternative to metallic materials such as aluminium and magnesium alloys
- + exceptional strength values, even at high temperatures
- + good chemical resistance to oils, greases and fuels

FEATURES

1

PRODUCT INFORMATION

NYLAFORCE®

Glass fibre reinforced high performance plastics manufactured using the feed up-process

The **NYLAFORCE®** group of materials is characterized by extremely high glass fibre reinforcement from up to 70%. **NYLAFORCE®** compounds are based upon an innovative manufacturing technology known as feed up-process. This enables the glass fibres to be orientated in the most effective way.

The E-modulus and therewith the form stability of **NYLAFORCE®** materials produced in this way are notably higher than those of conventionally manufactured compounds, both compared with semi-crystalline and partly aromatic polyamides. These differences become even clearer when the values are observed in relation to temperature.

PRODUCT INFORMATION

2

NYLAFORCE®

Especially the **NYLAFORCE®** A-types are distinguished that they exhibit enormous strength at high temperatures. Due to the manufacturing technology **NYLAFORCE®** is absorbing few moisture. From this follows a very high stability of dimensions and properties when subjected to changing environmental influences.

NYLAFORCE® is ideally suited for technically functional parts with the highest demands on mechanical strength. Its high E-modulus of up to 25.000 Mpa opens up new application areas, which have previously been beyond the scope of reinforced nylons.

In many areas **NYLAFORCE®** can be a sensible alternative to metallic materials such as aluminium and magnesium alloys.



3

RANGE OF PRODUCTS

NYLAFORCE® A

- + NYLAFORCE® A 50
- + NYLAFORCE® A 50 TS13
- + NYLAFORCE® A 60
- + NYLAFORCE® A 60 TW2

RANGE OF PRODUCTS

4

NYLAFORCE® B

- + NYLAFORCE® B 50
- + NYLAFORCE® B 50 Z
- + NYLAFORCE® B 60
- + NYLAFORCE® B 70



NYLAFORCE® A

property	standard	unit	A 50	A 50 TS13	A 60	A 60 TW2
density	ISO 1183	g/cm ³	1,57	1,54	1,70	1,71
tensile strength dry 23 °C	ISO 527	MPa	250	200	265	235
tensile strength cond. 23 °C ¹⁾	ISO 527	MPa	180	—	190	170
tensile strength 80 °C	ISO 527	MPa	155	—	150	—
tensile strength 120 °C	ISO 527	MPa	135	—	130	—
elongation at break dry 23 °C	ISO 527	%	2,9	2,3	2,5	2
elongation at break cond. 23 °C ¹⁾	ISO 527	%	4,5	—	3,5	3
elongation at break 80 °C	ISO 527	%	3,8	—	3,1	—
elongation at break 120 °C	ISO 527	%	6,2	—	5,2	—
tensile modulus dry 23 °C	ISO 527	MPa	18 000	16 000	2 500	20 600
tensile modulus cond. 23 °C ¹⁾	ISO 527	MPa	12 500	—	16 000	16 000
tensile modulus 80 °C	ISO 527	MPa	12 300	—	15 000	—
tensile modulus 120 °C	ISO 527	MPa	7 900	—	8 900	—
charpy impact strength unnotched dry	ISO 179/1eU	kJ/m ²	96	74	95	72
charpy impact strength cond. 23 °C ¹⁾	ISO 179/1eU	kJ/m ²	96	—	95	70
charpy impact strength notched dry	ISO 179/1eA	kJ/m ²	16	—	17	10
charpy impact strength not. cond. 23 °C ¹⁾	ISO 179/1eA	kJ/m ²	18	—	20	11
melt temperature	ISO 3146 (10K/min)	°C	260	260	260	260
heat deflection temperature HDT/A	ISO 75	°C	250	—	250	250
moulding shrinkage ²⁾	ISO 294-4	%	0,1-0,5	0,2-0,7	0,1-0,5	0,1-0,5

¹⁾ Conditioned based on EN ISO 1110.

²⁾ Internal test method (test specimen 60 mm x 60 mm x 2 mm).

5 PROPERTIES

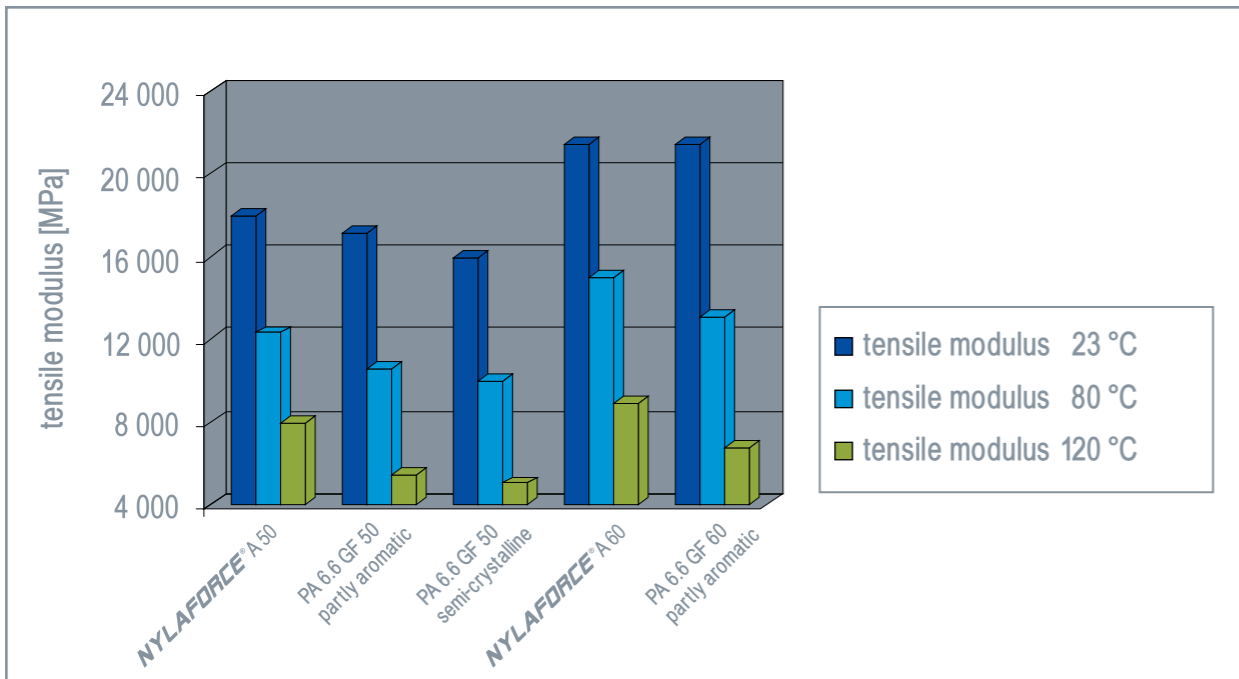
NYLAFORCE® A

NYLAFORCE® A-types are characterized by enormous strength at high temperatures. Therefore they are notably suited for high-strength parts with thermal stresses, e. g. in the car engine sector.

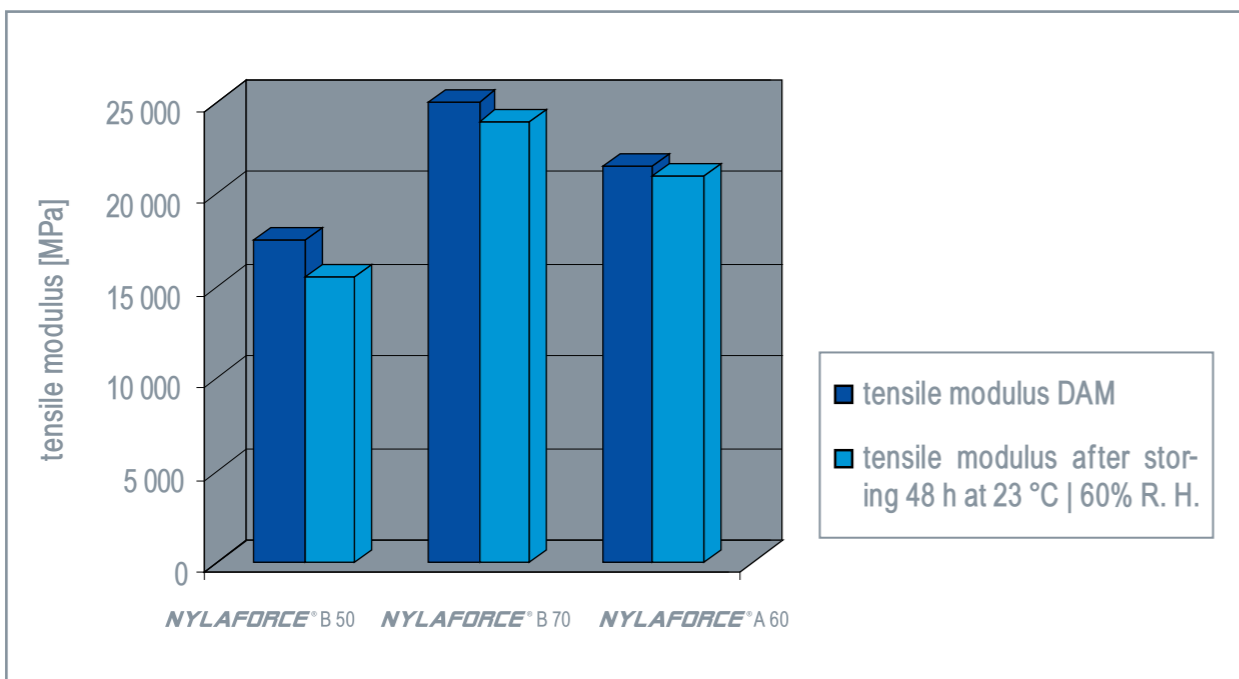
NYLAFORCE® A 60 TW2 was especially developed for applications in the drinking water sector. **NYLAFORCE® A 60 TW2**'s specific values like bursting pressure and fatigue strength - which are essential for this applications - are unbeatable. Therefore the new material is an excellent technical and economical alternative for metals, like for example brass.

Due to an integrated lubrication system **NYLAFORCE® A 50 TS13** ist particularly suitable for tribological applications. More special types are available on request.

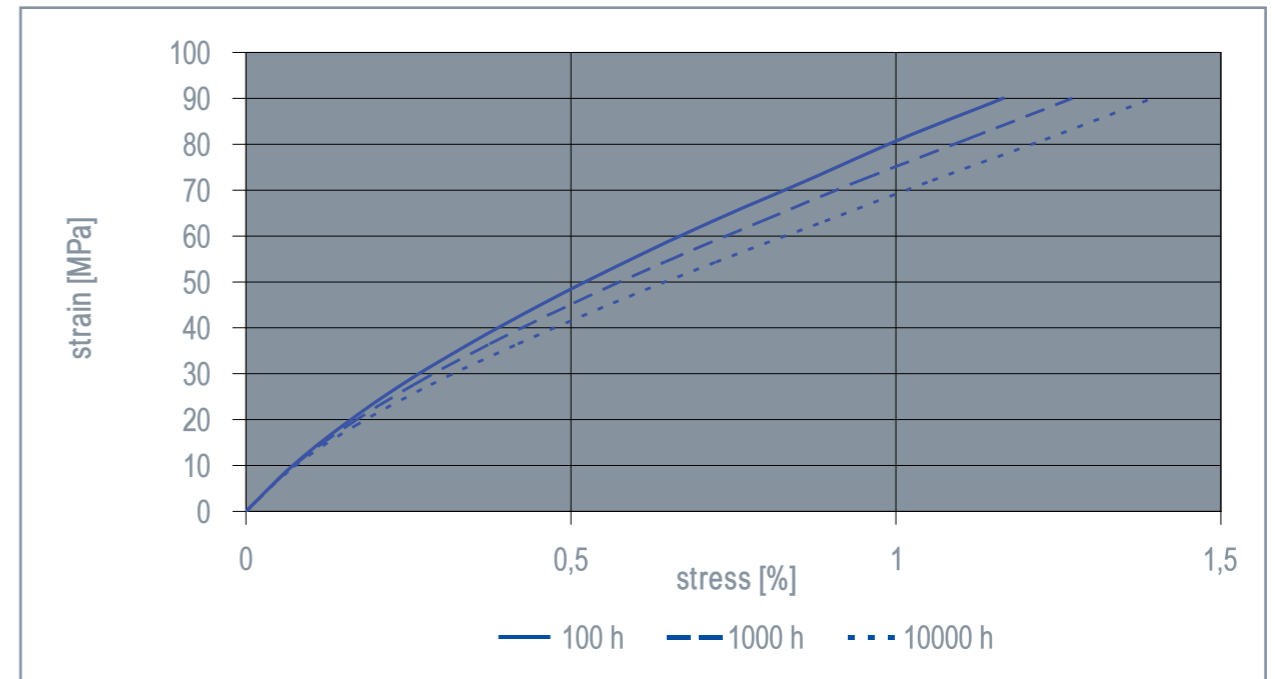
TENSILE MODULUS OF SELECTED POLYAMIDES



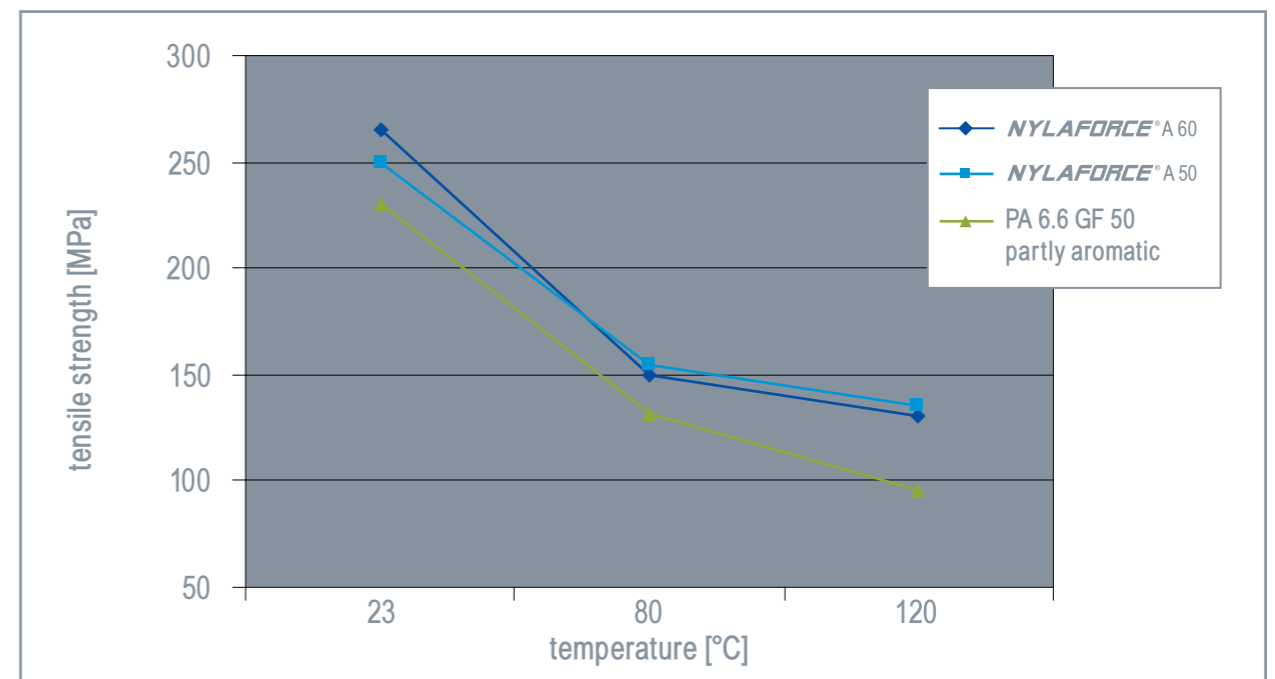
TENSILE MODULUS OF SELECTED NYLAFORCE® TYPES



STRAIN-STRESS CURVES (ISOCHRONIC) NYLAFORCE® A 60 AT 23 °C



TENSILE STRENGTH OF NYLAFORCE® A 50 AS A FUNCTION OF TEMPERATURE





NYLAFORCE® B

property	standard	unit	B 50	B 50 Z	B 60	B 70
density	ISO 1183	g/cm ³	1,57	1,56	1,70	1,85
tensile strength dry 23 °C	ISO 527	MPa	250	220	255	255
tensile strength cond. 23 °C ¹⁾	ISO 527	MPa	180	145	185	180
tensile strength 80 °C	ISO 527	MPa	140	—	145	140
tensile strength 120 °C	ISO 527	MPa	105	—	110	100
elongation at break dry 23 °C	ISO 527	%	3	2,6	3	2,5
elongation at break cond. 23 °C ¹⁾	ISO 527	%	5	5	4,8	3
elongation at break 80 °C	ISO 527	%	7,4	—	6,4	4,1
elongation at break 120 °C	ISO 527	%	7,6	—	5,4	3,1
tensile modulus dry 23 °C	ISO 527	MPa	17 500	16 500	21 000	25 000
tensile modulus cond. 23 °C ¹⁾	ISO 527	MPa	12 500	11 500	14 500	18 000
tensile modulus 80 °C	ISO 527	MPa	7 600	—	9 800	12 100
tensile modulus 120 °C	ISO 527	MPa	7 400	—	9 600	11 600
charpy impact strength unnotched dry	ISO 179/1eU	kJ/m ²	100	85	95	87
charpy impact strength cond. 23 °C ¹⁾	ISO 179/1eU	kJ/m ²	—	86	—	90
charpy impact strength notched dry	ISO 179/1eA	kJ/m ²	19	14	19	16
charpy impact strength not. cond. 23 °C ¹⁾	ISO 179/1eA	kJ/m ²	29	26	29	24
melt temperature	ISO 3146 (10K/min)	°C	221	221	221	221
heat deflection temperature HDT/A	ISO 75	°C	> 200	—	> 200	> 200
moulding shrinkage ²⁾	ISO 294-4	%	0,1-0,5	—	0,1-0,4	0,1-0,3

¹⁾ Conditioned based on EN ISO 1110.

²⁾ Internal test method (test specimen 60 mm x 60 mm x 2 mm).

9

PROPERTIES

NYLAFORCE® B

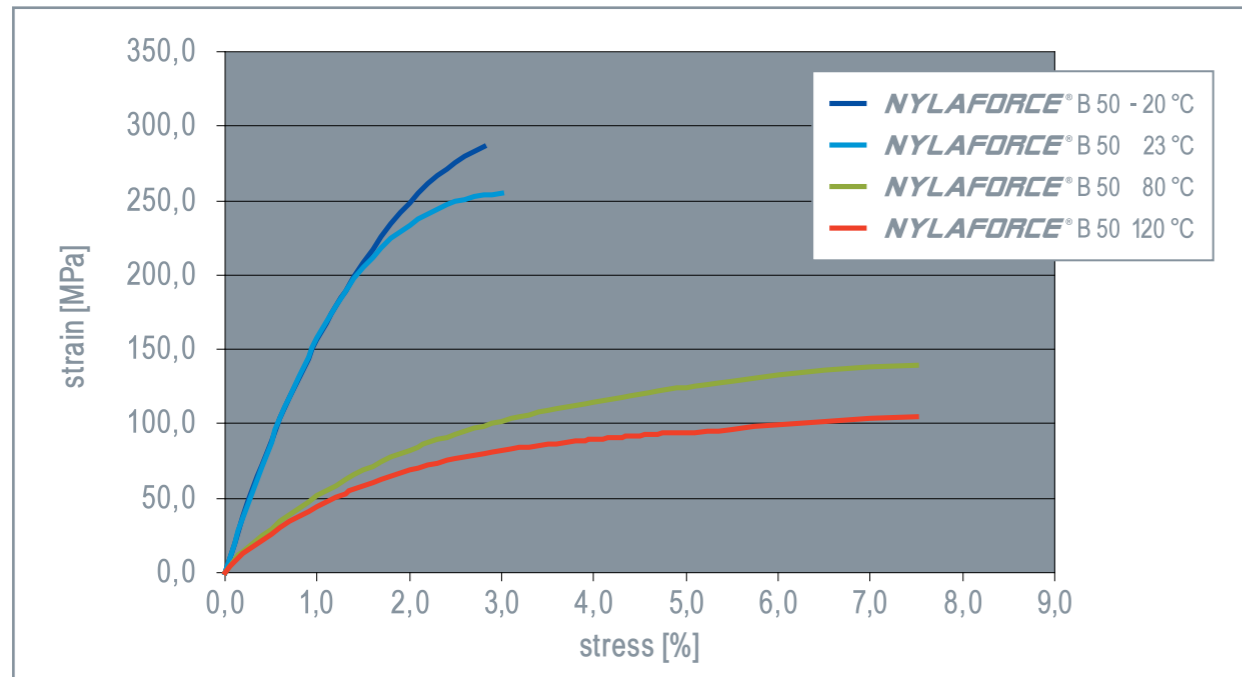
NYLAFORCE® B-types convince with their excellent behaviour at dynamical stress. Its high capacity to absorb kinetic energy and enormous mechanical strength properties at the same time makes this construction material to a real alternative to metallic materials. Further significant characteristics are an excellent surface quality of the injection-moulded parts and simple processing.

NYLAFORCE® dynamic is the latest product development of the **NYLAFORCE®** group of products and the second generation of the feed up-polyamides. It was especially developed for dynamical applications.

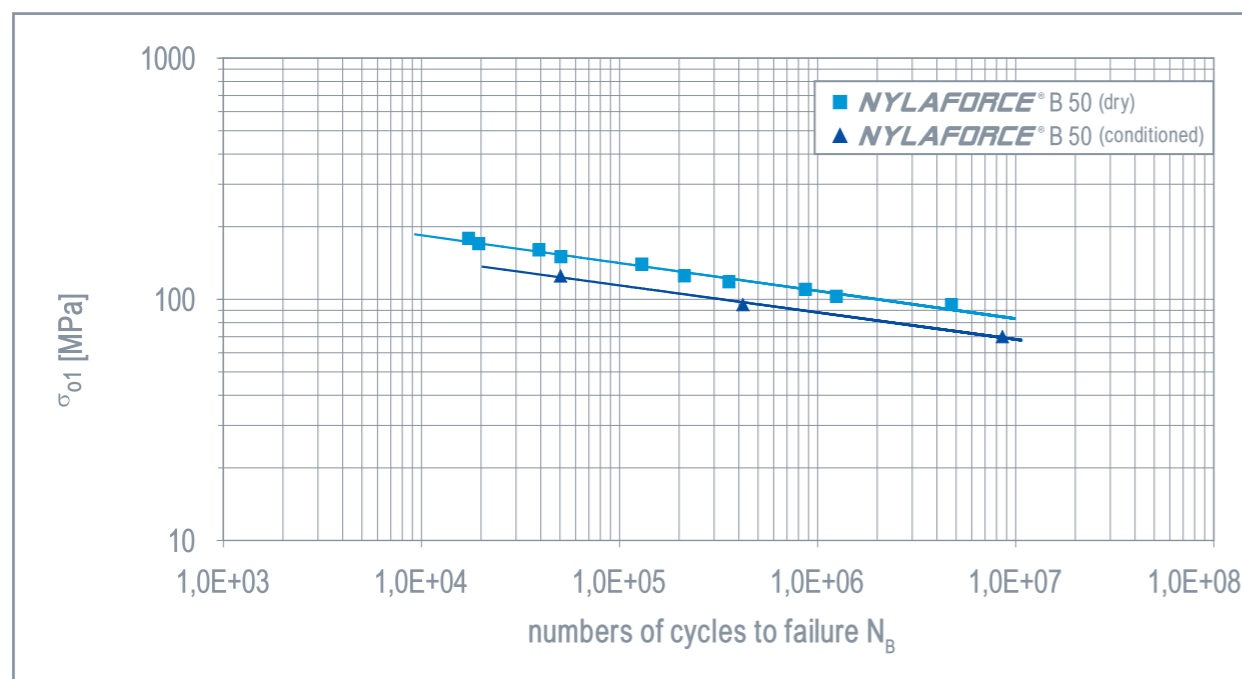
NYLAFORCE® B 50 Z is an impact resistant optimized type. The exceptional behaviour of this material first becomes apparent in use, under the impact of extensive stress conditions. More special types are available on request.

These property values are guide values and should only inform about application possibilities. The suitability for concrete application purposes will not be assured. It must be examined for each individual case. We also refer to our terms of sale and supply.

TENSILE TEST *NYLAFORCE*[®] B50 (DRY)



FLEXURAL FATIGUE TEST *NYLAFORCE*[®] B 50



NYLAFORCE[®]

NYLAFORCE[®] can be processed on all the usual injection moulding machines. The same processing conditions apply as for standard polyamides. It is essential for the plasticising unit to be made of a wear-resistant material because of the heavy abrasion caused by the glass fibres. In order to achieve an even temperature throughout the solid mass and consistent geometry of components, the injection volume may only be a maximum of 70% of the machine's capacity. Open nozzles are preferable to closed nozzles. *NYLAFORCE*[®] is dry packed in moisture-proof packaging after manufacture. It should be stored in a dry, protected place.

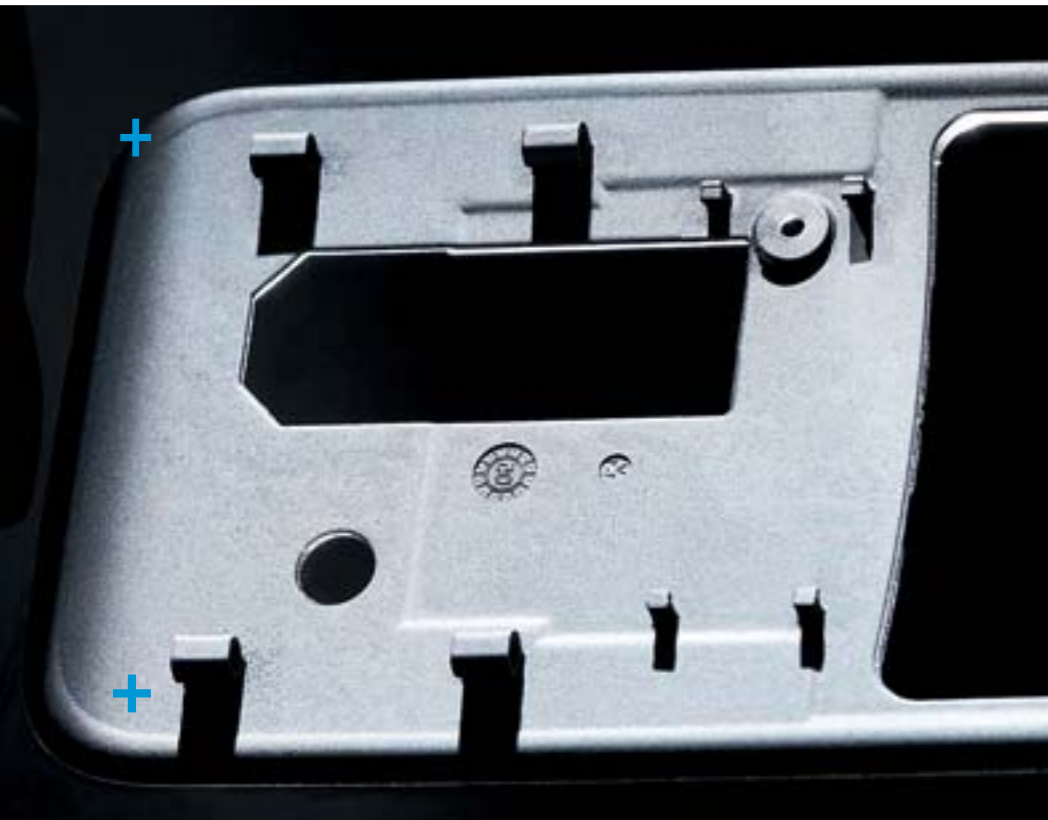
Material drying

For *NYLAFORCE*[®] we recommend drying in a vacuum or dry air oven. The drying time should be about 4 hours at a temperature of 80 to 90 °C betragen.

Recommended machine parameters | tool temperature

parameter	range	recommendation
solid mass temperature <i>NYLAFORCE</i> [®] A	280 to 310 °C	290 °C
solid mass temperature <i>NYLAFORCE</i> [®] B	250 to 320 °C	290 °C
filling pressure	800 to 1500 bar	1200 bar
injection speed	high	high
tool temperature	80 to 140 °C	140 °C

The technical data is only for orientation and advice. For any construction and especially for the required grade of part quality the necessary adjustments have to be done. Therefore no obligation can be derived from this data.



- + tensile strength at rt 200 MPa
- + tensile modulus at rt 16 000 MPa
- + temperature application area:
- 40 °C to + 120 °C, at specific
stabilisation up to + 160 °C
- + highly weathering resistance
- + highly abrasion resistance
- + dyeable



FEATURES

13

APPLICATIONS

NYLAFORCE® A 50 TS13

NYLAFORCE® A 50 TS13 is a material specially developed for tribological applications. Outstanding strength characteristics combined with great toughness are achieved by means of reinforcement with 50% glass fibres and production with the feed up-process.

The use of glass fibre reinforced polymer systems for tribological applications has been unsuccessful in many cases to date because of the strongly abrasive nature of the glass fibres. Our **NYLAFORCE® A 50 TS13** product development lessens this problem with the aid of a new kind of lubricant system. Unlike with the use of PTFE as lubricant, the mechanical properties are not significantly adversely affected.

Typical areas of application for **NYLAFORCE® A 50 TS13** are bearing elements and gears with special requirements in terms of mechanical strength. The first applications using **NYLAFORCE® A 50 TS13** are thread guides for textile machines, gears for electronic parking brakes for cars and hardware for mobile phones (see photo).

APPLICATIONS

14

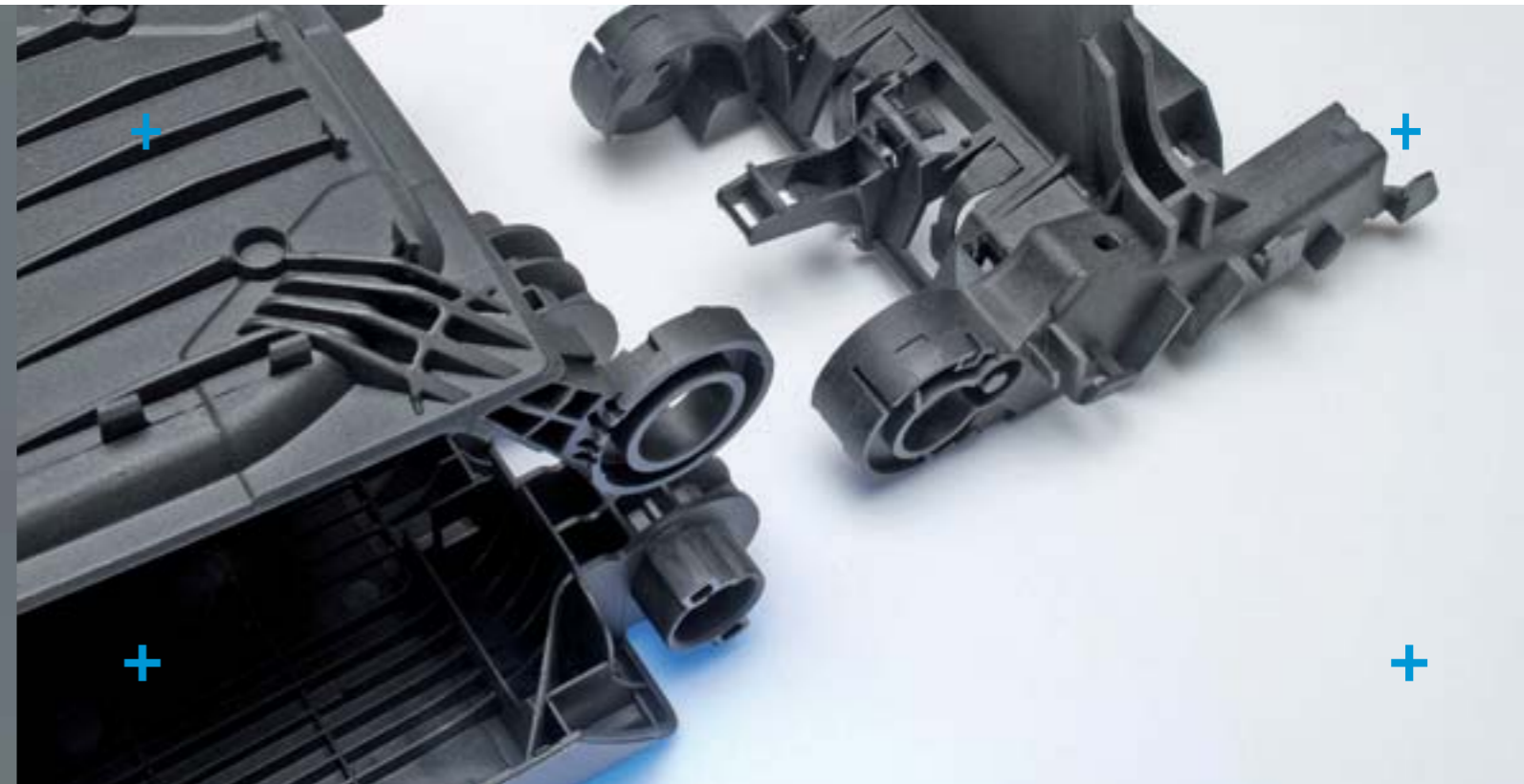
NYLAFORCE® A 60 TW2

The exceptional mechanical properties of **NYLAFORCE®** can now also be used for applications in the drinking water sector. After thorough tests, drinking water type **NYLAFORCE® A 60 TW2** was first certified to be compliant with ACS's approved list in France. Then TZW (Water Technology Centre) Karlsruhe also certified that the material was compliant with the BfR "Plastics in the food trade" approved lists and, from a microbiological point of view, also meets the requirements of DVWG (German Association of the Gas and Water Sector) Worksheet W 270.

Its properties predestines **NYLAFORCE® A 60 TW2** as a structural material for technical functional parts; in particular its outstanding mechanical properties prove themselves useful with parts subjected to pressure. Therefore the new material is an excellent technical and economical alternative for metals, like e. g. brass. Renowned manufacturers of water meters have tried **NYLAFORCE® A 60 TW2** and they are already using it for various parts (photo: Caps for water meters made of **NYLAFORCE® A 60 TW2**).



- + very high strength and form stability
- + excellent surface quality
- + high capacity to absorb kinetic energy under dynamic stress
- + extremely high fatigue resistance to bending
- + simple processing



FEATURES

15 APPLICATIONS

NYLAFORCE® B 50 Z

NYLAFORCE® B 50 Z was specially developed for car seat backs and seat shells. In this application, special demands were made in terms of shape stability and the material's fragmentation characteristics. A further basic requirement for realising this application was the outstanding quality of the surface of this highly-reinforced polyamide since the components are not further painted or coated.

Chair backs are subjected to extreme stress tests. Besides front and rear crash tests, they must also pass the critical „Protection from Loads“ test. In this test the impact on the front seats of objects in the back of the car is simulated. And this is done at a temperature of - 30 °C. All forces generated in a crash must be taken up and absorbed by the seat back and bottom or be conducted via the bolt connections to the body-work since the bottom and back components contain no additional metal supports.

APPLICATIONS 16

NYLAFORCE® B 60

For the manufacture of the central armrest on the BMW 1 series, the decision was made for **NYLAFORCE® B 60**. During the selection process, **NYLAFORCE® B 60** clearly stood out against other highly reinforced materials such as long glass fibre reinforced polyamides and highly reinforced, partly aromatic plastics. In particular, its good toughness combined with the highest strength was decisive in selecting **NYLAFORCE® B 60**. It even met the requirement for a material with good paintability without any problem.



- + very high strength
- + high form stability
- + high capacity to absorb kinetic energy under dynamic stress
- + high fatigue resistance to bending
- + excellent surface quality
- + simple processing

FEATURES



17 APPLICATIONS

NYLAFORCE® B 60

Door handles for cars have to withstand a practical test, in which a force of 2000 N is applied to the handles. They may not break under the test. Alongside the mechanical function, good paintability is also required.

NYLAFORCE® B 60 easily meets these requirements. Despite being reinforced with 60% glass fibre, the surface is totally smooth and clean. The photo shows an untreated doorhandle in the background, the doorhandle in the fore is coated.

CONTACT 18

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