

### Material: ZX-410

### EN 1.0

Properties	Symbol	Unit	Standard	Value
<b>Information</b>				
Material code	-	-	Internal Standard	A4A
Colour	-	-	-	Yellow
Density	$\rho$	kg/dm <sup>3</sup>	ISO 1183	1,33
<b>Mechanical</b>				
Compressive modulus	$E_c$	MPa	DIN EN ISO 604	4700
Elastic limit	$\sigma_{el}$	MPa	Internal Standard	111
Compressive stress at yield	$\sigma_y$	MPa	DIN EN ISO 604	142
Compressive strength	$\sigma_M$	MPa	DIN EN ISO 604	n.v.
Compressive stress at 3,5% strain	$\sigma_{3,5\%}$	MPa	DIN EN ISO 604	135
Compressive strength (0,01 h)	$\sigma_M$	MPa	Internal Standard	119
Compressive strength (100 h)	$\sigma_M$	MPa	Internal Standard	99
Compressive strength (10000 h)	$\sigma_M$	MPa	Internal Standard	54
Compressive stress at break	$\sigma_B$	MPa	DIN EN ISO 604	k.Br.
Elastic compression limit	$\epsilon_{el}$	%	Internal Standard	1,8
Nominal compressive yield strain	$\epsilon_{cy}$	%	DIN EN ISO 604	2,7
Nominal compressive strain at compressive strength	$\epsilon_{cM}$	%	DIN EN ISO 604	n.v.
Nominal compressive strain at break	$\epsilon_{cB}$	%	DIN EN ISO 604	k.Br.
Modulus in tension (tensile modulus)	$E_t$	MPa	DIN EN ISO 527	3368
Elastic limit	$\sigma_{el}$	MPa	Internal Standard	71
Tensile stress at yield	$\sigma_y$	MPa	DIN EN ISO 527	101
Tensile strength	$\sigma_M$	MPa	DIN EN ISO 527	101
Tensile stress at break	$\sigma_B$	MPa	DIN EN ISO 527	82
Elastic yield point	$\epsilon_{el}$	%	Internal Standard	1,5
Yield strain	$\epsilon_y$	%	DIN EN ISO 527	5,5
Elongation at maximum force	$\epsilon_M$	%	DIN EN ISO 527	5,5
Tensile elongation at break	$\epsilon_B$	%	DIN EN ISO 527	25
Modulus in flexure	$E_f$	MPa	DIN EN ISO 178	2900
Outer fibre stress at 3,5% outer fibre strain	$\sigma_{f3,5}$	MPa	DIN EN ISO 178	89
Flexural strength	$\sigma_{fM}$	MPa	DIN EN ISO 178	126
Flexural stress at break	$\sigma_{fB}$	MPa	DIN EN ISO 178	k.Br.
Elongation at flexural yield stress	$\epsilon_M$	%	DIN EN ISO 178	7,3
Flexural elongation at break	$\epsilon_B$	%	DIN EN ISO 178	k.Br.
Creep modulus at 1% deformation after 1000h	$E$	N/mm <sup>2</sup>	DIN 53444	4015
Stress at 1% deformation after 1000h	$\sigma_{1\%}$	N/mm <sup>2</sup>	DIN 53444	40
Creep resistance	-	-	Relative value	⊙
Ball indentation hardness H358/30 (H132/30) [H49/30]	HB	N/mm <sup>2</sup>	DIN 2039	159
Shore A hardness	-	Shore	DIN 53505	98
Shore D hardness	-	Shore	DIN 53505	85
Impact strength Charpy not notched	-	kJ/m <sup>2</sup>	EN ISO 179/1eU	k.Br.
Impact strength Charpy notched	-	kJ/m <sup>2</sup>	EN ISO 179/1eA	13,4
Loss tangent (1Hz)	$\tan\delta$	1	Internal Standard	0,055
Fatigue strength at 20°C, 106 stress cycles, 1 Hz	-	MPa	Internal Standard	33
<b>Thermal</b>				
Continuous operating temperature (long term)	RTi	°C	UL 746B	180
Short term operating temperature (3 h)	-	°C	Internal Standard	200
Maximum RTi temperature for bushings when pressed	-	°C	Internal Standard	150
Melting temperature	$T_m$	°C	DSC	320
Glass transition temperature	$T_g$	°C	DSC	210
Coefficient of thermal expansion up to 100°C	$\alpha$	10 <sup>-5</sup> /K	ISO E 830	4,0
Coefficient of thermal expansion up to 150°C	$\alpha$	10 <sup>-5</sup> /K	ISO E 831	5,8
Heat distortion temperature HDT/A 1,8 MPa	HDT(A)	°C	DIN EN ISO 75	195
Thermal conductivity	$\lambda$	W/(m*K)	DIN 52612	0,25
Specific heat capacity	$c_p$	kJ/(kg*K)	DSC	1,85
Fire behaviour (3,2mm) UL94	-	-	UL 94 HB	V-0
Limiting oxygen index (LOI)	%	LOI	DIN EN ISO 4589	47

Properties	Symbol	Unit	Standard	Value
<b>Electrical</b>				
Volume resistivity	$R_D$	$\Omega \cdot \text{cm}$	IEC 60093	>10E15
Surface resistance	$R_C$	$\Omega$	IEC 60093	>10E15
Penetration resistance	$E$	kV/mm	IEC 243	30
Tracking resistance	-	V	IEC 112	150
Dielectric constant (110Hz)	-	1	IEC 250	3,15
Dissipation factor (110Hz)	$\tan\delta$	1	IEC 112	0,0005
<b>PV values</b>				
Max. surface pressure $v=1\text{m/min}$	$p_{zul}$	N/mm <sup>2</sup>	Internal test radial bushing	38,63
Max. surface pressure $v=10\text{m/min}$	$p_{zul}$	N/mm <sup>2</sup>		9,80
Max. surface pressure $v=100\text{m/min}$	$p_{zul}$	N/mm <sup>2</sup>		0,33
Max. surface pressure $v=200\text{m/min}$	$p_{zul}$	N/mm <sup>2</sup>		0,04
Evolution of heat with $v=1\text{m/min}$	-	°C		36
Evolution of heat with $v=10\text{m/min}$	-	°C		35
Evolution of heat with $v=100\text{m/min}$	-	°C		45
Evolution of heat with $v=200\text{m/min}$	-	°C		85
<b>Friction</b>				
$\mu$ static 20° C dry operation	$\mu_{stat}$	1	Internal Standard inclined plane	0,2
$\mu$ dynamic 20° C dry operation	$\mu_{dyn}$	1		0,16
$\mu$ dynamic 100° C dry operation	$\mu_{dyn}$	1		0,23
<b>Wear</b>				
Wear factor at 20°C	-	mm/100 km	Internal test periodic transla-tive movement under load	0,23
Wear factor at 100°C	-	mm/100 km		0,33
Wear factor at 200°C	-	mm/100 km		0,30
Wear factor at 240°C	-	mm/100 km		1,49
<b>Available as</b>				
Tubes (hollow rods) up to $\phi$ (de)	-	-	-	✓
Sheets up to max. thickness	-	-	-	✓
Rods up to $\phi$ (de)	-	-	-	✓
Plastic granules	-	-	-	✓
Injection moulded parts	-	-	-	✓
Machined parts	-	-	-	✓
<b>Precision</b>				
Dimensional stability with moisture absorption	-	-	Relative value	④
Water absorption 23°C / RMC 93%	-	%	DIN EN ISO 62	0,6
Water absorption until an equilibrium moisture content	-	%	DIN EN ISO 62	1,4
Dimensional stability with temperature variation	-	-	Relative value	⑥
High precision bushings (negative clearance)	-	-	-	✓
Alignment adjustment	-	-	Relative value	④
<b>Environmental influences</b>				
Suitable for use in water	-	-	-	✗
Resistance against hot water	-	°C	-	125
Resistance against dust, dirt, abrasive substances	-	-	Relative value	⑦
UV rays resistance	-	-	Relative value	⑨
Suitable for outdoor use	-	-	Relative value	⑧
Resistance to chemicals	-	-	Relative value	⑥
FDA compliant	-	-	-	-
Suitable for vacuum	-	-	-	✗
Rate of desorption	$a_{in}$	mbar*(l/(s*cm <sup>2</sup> ))	-	-
ROHS / WEEE	-	-	-	✓
Free from silicone	-	-	-	✓
Free from PTFE	-	-	-	✗
<b>Sterilization</b>				
Resistant against disinfectant	-	-	-	✓
Moist heat sterilization	-	-	Relative value	⑧
Gamma-rays radiation sterilization	-	-	Relative value	⑦
Chemical sterilization	-	-	Relative value	⑦
UV-sterilization	-	-	Relative value	⑩



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#### Legal Information

All the tests are been made with a standard conditioning atmosphere of 23°C (at the moment no other temperature is available). The specified values are established from average values of several tests and they correspond to our today's knowledge. They are only to be used as information about our products and as help for the material selection. With these values, we do not ensure specific properties, or the suitability for certain application, therefore we do not assume any legal responsibility for an improper usage. The used test pieces have been machined from extruded semi-finished material. Since the plastics' properties depend on the manufacturing process (extrusion, injection moulding), on the dimensions of the semi finished material and on the degree of crystallinity, the actual properties of a specific product may slightly deviate from the tested ones. For information about divergent properties do not hesitate to contact us. On request we advise you regarding the most appropriate component design and the definition of material specifications more suitable to your application data. Notwithstanding, the customer bears all the responsibility for the thorough examination of suitability, efficiency, efficacy and safety of the chosen products in pharmaceutical applications, medical devices or other end uses.

#### Legend

- ① Low
- ⑩ High
- ✓ Applicable
- ✗ Not applicable
- (✓) Limited
- k.Br. No break
- n.d. Not feasible
- Not determined
- n.v. Non-existent