



# Hytrel® 4056

## THERMOPLASTIC POLYESTER ELASTOMER

Common features of Hytrel® thermoplastic polyester elastomer include mechanical and physical properties such as exceptional toughness and resilience, high resistance to creep, impact and flex fatigue, flexibility at low temperatures and good retention of properties at elevated temperatures. In addition, it resists many industrial chemicals, oils and solvents. Special grades include heat stabilised, flame retardant, food contact compliant, blow molding and extrusion grades. Concentrates offered include black pigments, UV protection additives, heat stabilisers, and flame retardants. Hytrel® thermoplastic polyester elastomer is plasticiser free.

The good melt stability of Hytrel® thermoplastic polyester elastomer normally enables the recycling of properly handled production waste. If recycling is not possible, DuPont recommends, as the preferred option, incineration with energy recovery (-24 kJ/g of base polymer) in appropriately equipped installations.

For disposal, local regulations have to be observed.

Hytrel® thermoplastic polyester elastomer typically is used in demanding applications in the automotive, fluid power, electrical/electronic, consumer goods, appliance and power tool, sporting goods, furniture, industrial and off-road transportation/equipment industry.

Hytrel® 4056 is a low modulus Hytrel® grade with nominal durometer hardness of 40D and with high impact resistance down to -40°C. It contains a non-discoloring stabilizer. It is recommended for extrusion and compounding.

Typical applications:

Hose and tubing, hose jackets, wire and cable jackets, film and sheeting, belting and seals, .

### Product information

Resin Identification	TPC-ET	ISO 1043
Part Marking Code	>TPC-ET<	ISO 11469

### Rheological properties

Melt volume-flow rate	5 cm <sup>3</sup> /10min	ISO 1133
Melt mass-flow rate	5.6 g/10min	ISO 1133
Temperature	190 °C	ISO 1133
Load	2.16 kg	ISO 1133
Melt mass-flow rate, Temperature	190 °C	ISO 1133
Melt mass-flow rate, Load	2.16 kg	ISO 1133
Moulding shrinkage, parallel	0.2 %	ISO 294-4, 2577
Moulding shrinkage, normal	0.4 %	ISO 294-4, 2577



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### Typical mechanical properties

Tensile Modulus	60 MPa	ISO 527-1/-2
Stress at 5% strain	2.4 MPa	ISO 527-1/-2
Stress at 10% strain	4.6 MPa	ISO 527-1/-2
Stress at 50% strain	8.4 MPa	ISO 527-1/-2
Stress at break	22 MPa	ISO 527-1/-2
Nominal strain at break	500 %	ISO 527-1/-2
Strain at break	>300 %	ISO 527-1/-2
Flexural Modulus	60 MPa	ISO 178
Tensile creep modulus, 1h	54 MPa	ISO 899-1
Tensile creep modulus, 1000h	40 MPa	ISO 899-1
Charpy impact strength, 23°C	N kJ/m <sup>2</sup>	ISO 179/1eU
Charpy impact strength, -30°C	N kJ/m <sup>2</sup>	ISO 179/1eU
Charpy notched impact strength, 23°C	N kJ/m <sup>2</sup>	ISO 179/1eA
Charpy notched impact strength, -30°C	N kJ/m <sup>2</sup>	ISO 179/1eA
Charpy notched impact strength, -40°C	N kJ/m <sup>2</sup>	ISO 179/1eA
Tensile notched impact strength, 23°C	230 kJ/m <sup>2</sup>	ISO 8256/1
Puncture - maximum force, 23°C	1500 N	ISO 6603-2
Puncture - maximum force, -30°C	2800 N	ISO 6603-2
Puncture energy, 23°C	19 J	ISO 6603-2
Puncture energy, -30°C	37 J	ISO 6603-2
Izod notched impact strength, 23°C	N kJ/m <sup>2</sup>	ISO 180/1A
Izod notched impact strength, -40°C	N kJ/m <sup>2</sup>	ISO 180/1A
Poisson's ratio	0.5 -	
Brittleness temperature	-97 °C	ISO 974
Shore D hardness, 15s	37 -	ISO 48-4
Shore D hardness, max	43 -	ISO 48-4
Tear strength, parallel	102 kN/m	ISO 34-1
Tear strength, normal	96 kN/m	ISO 34-1
Abrasion resistance	200 mm <sup>3</sup>	ISO 4649

### Tribological properties

Coefficient of static friction, against steel	0.6	ASTM 1894
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### Thermal properties

Melting temperature, 10°C/min	152 °C	ISO 11357-1/-3
Glass transition temperature, 10°C/min	-50 °C	ISO 11357-1/-2
Temp. of deflection under load, 0.45 MPa	48 °C	ISO 75-1/-2
Vicat softening temperature, 50°C/h 10N	109 °C	ISO 306
Coeff. of linear therm. expansion, parallel	130 E-6/K	ISO 11359-1/-2
Coeff. of linear therm. expansion, normal	160 E-6/K	ISO 11359-1/-2
Eff. thermal diffusivity	8.5E-8 m <sup>2</sup> /s	
RTI, electrical, 1.5mm	50 °C	UL 746B
RTI, impact, 1.5mm	50 °C	UL 746B



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RTI, strength, 1.5mm 50 °C UL 746B

### Flammability

Burning Behav. at 1.5mm nom. thickn.	HB class	IEC 60695-11-10
Thickness tested	1.5 mm	IEC 60695-11-10
UL recognition	yes -	UL 94
Burning Behav. at thickness h	HB class	IEC 60695-11-10
Thickness tested	0.8 mm	IEC 60695-11-10
UL recognition	yes -	UL 94
Oxygen index	20 %	ISO 4589-1/-2
FMVSS Class	SE -	ISO 3795 (FMVSS 302)

### Electrical properties

Relative permittivity, 100Hz	5.2 -	IEC 62631-2-1
Relative permittivity, 1MHz	4.7 -	IEC 62631-2-1
Dissipation factor, 100Hz	110 E-4	IEC 62631-2-1
Dissipation factor, 1MHz	525 E-4	IEC 62631-2-1
Volume resistivity	7E10 Ohm.m	IEC 62631-3-1
Surface resistivity	2E14 Ohm	IEC 62631-3-2
Electric strength	18 kV/mm	IEC 60243-1
Comparative tracking index	600 -	IEC 60112

### Other properties

Humidity absorption, 2mm	0.2 %	Sim. to ISO 62
Water absorption, 2mm	0.7 %	Sim. to ISO 62
Density	1160 kg/m <sup>3</sup>	ISO 1183
Density of melt	1020 kg/m <sup>3</sup>	
Water Absorption, Immersion 24h	0.6 %	Sim. to ISO 62

### Film Properties

WVTR, 23°C/85%r.h.	450 g/(m <sup>2</sup> *d)	DIS 15106-1/-2
Oxygen transmission rate, 23°C/85%r.h.	14000 cm <sup>3</sup> /(m <sup>2</sup> *d*bar)	DIS 15105-1/-2
Thickness of specimen	0.025 mm	

### Injection

Drying Recommended	yes
Drying Temperature	80 °C
Drying Time, Dehumidified Dryer	2 - 3 h
Processing Moisture Content	≤0.08 %
Melt Temperature Optimum	180 °C
Min. melt temperature	170 °C
Max. melt temperature	190 °C
Mold Temperature Optimum	40 °C



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Min. mould temperature 30 °C  
Max. mould temperature 40 °C

### Extrusion

Drying Temperature 70 - 90 °C  
Drying Time, Dehumidified Dryer 2 - 3 h  
Processing Moisture Content ≤0.06 %  
Melt Temperature Optimum 170 °C  
Melt Temperature Range 165 - 180 °C

### Additional Information

Injection molding

Snake Flow Test , mm

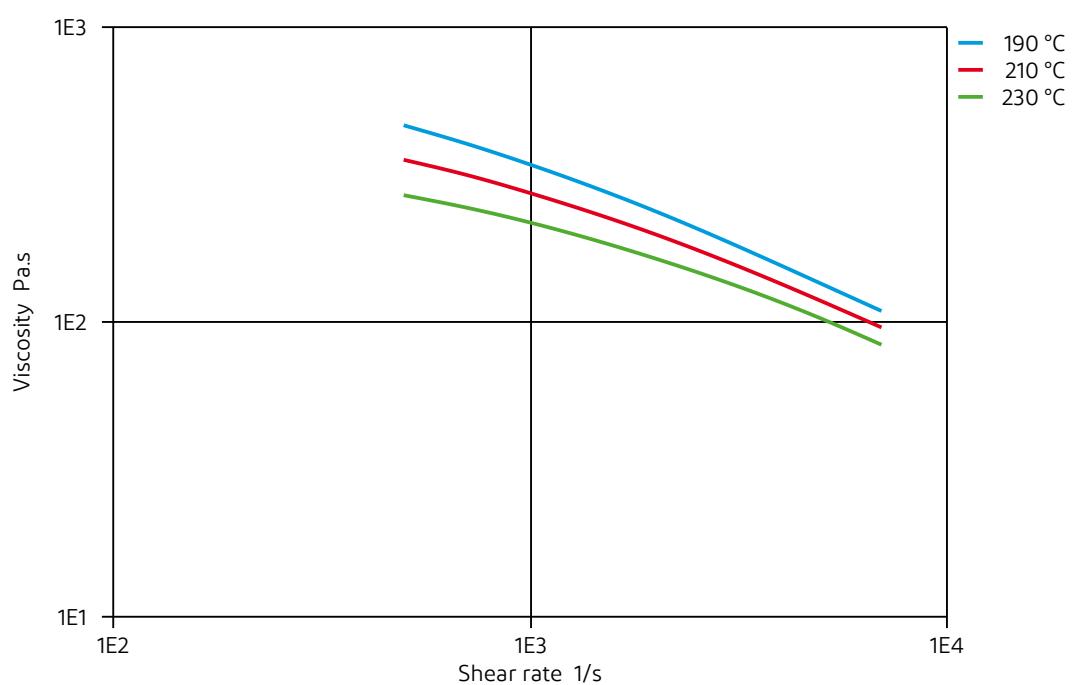
Inject press 62MPa, 1mm	80
Inject press 62MPa, 2.5mm	330
Inject press 83MPa(12,000psi), 1mm	95
Inject press 83MPa(12,000psi), 2.5mm	430



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Viscosity-shear rate

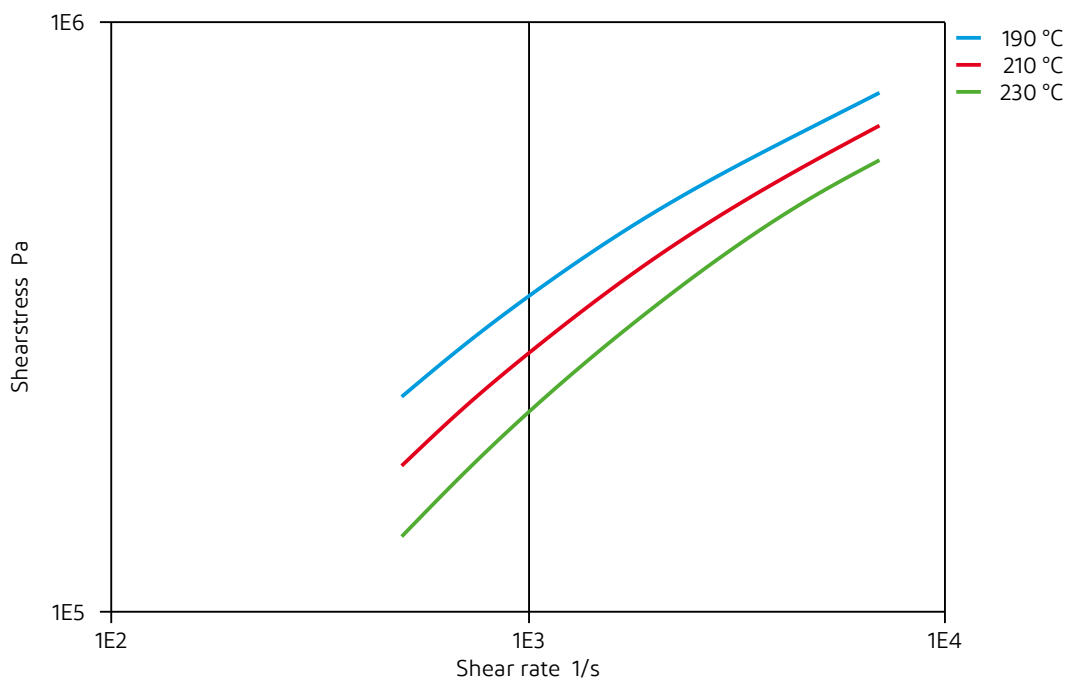




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THERMOPLASTIC POLYESTER ELASTOMER

Shearstress-shear rate

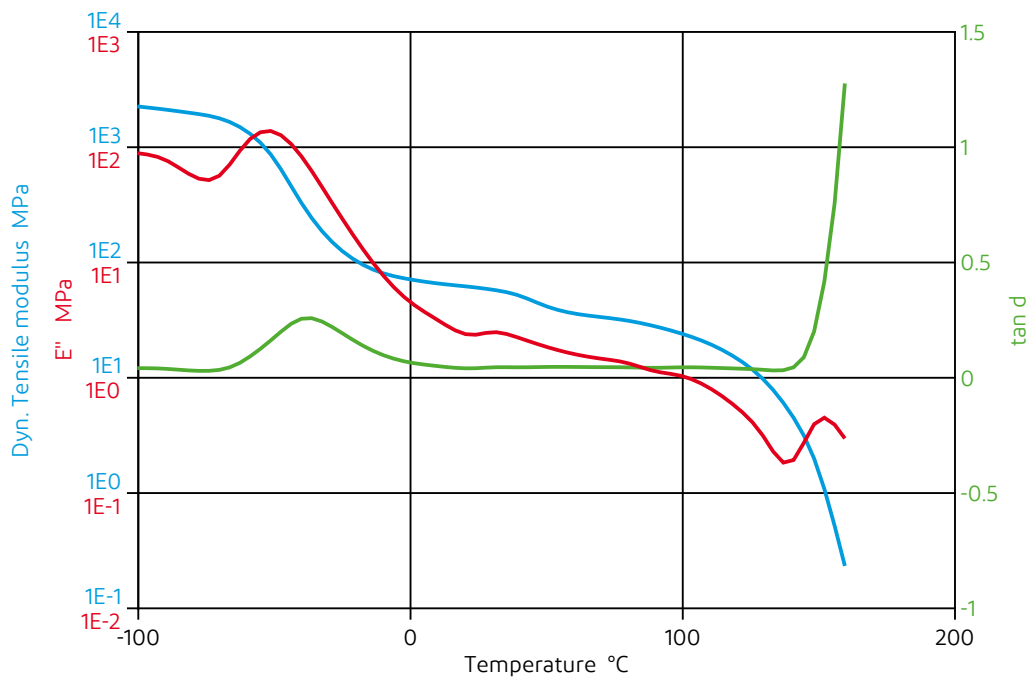




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Dynamic Tensile modulus-temperature

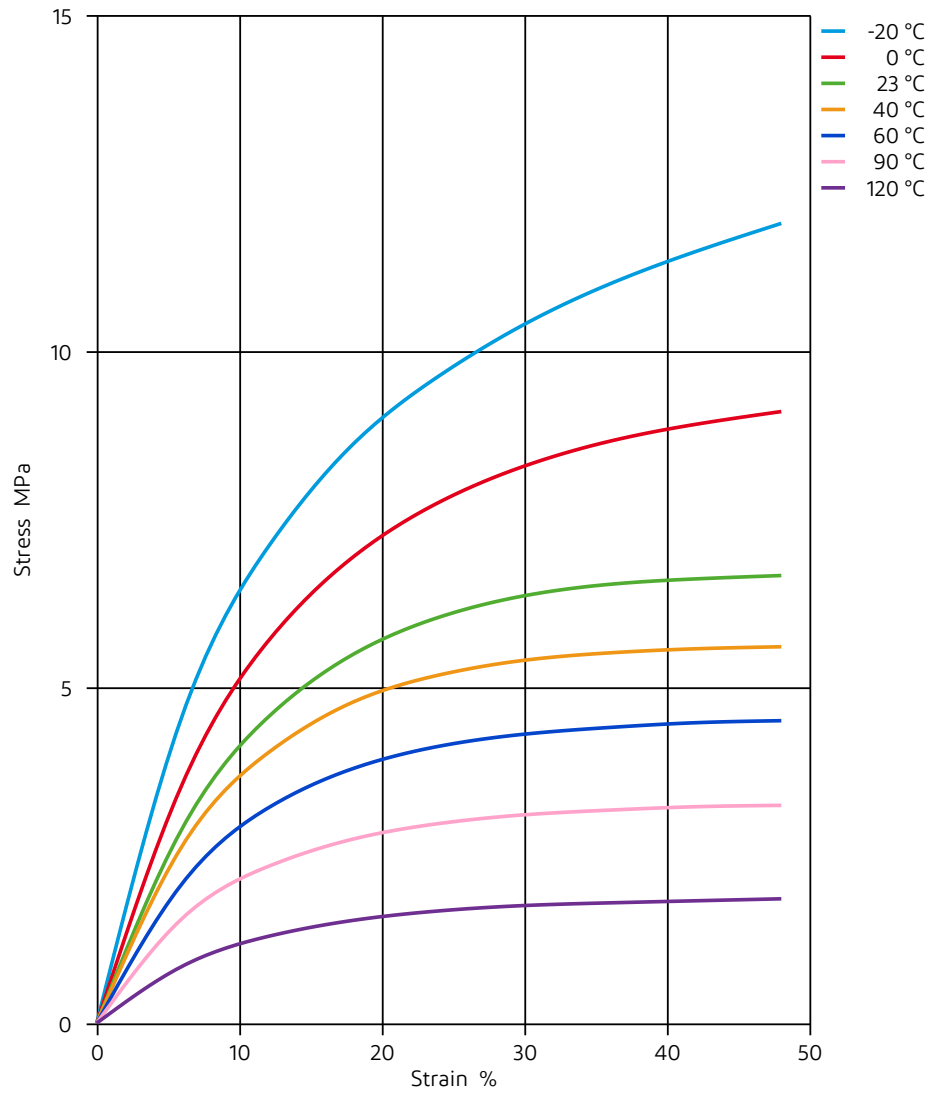




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## Stress-strain



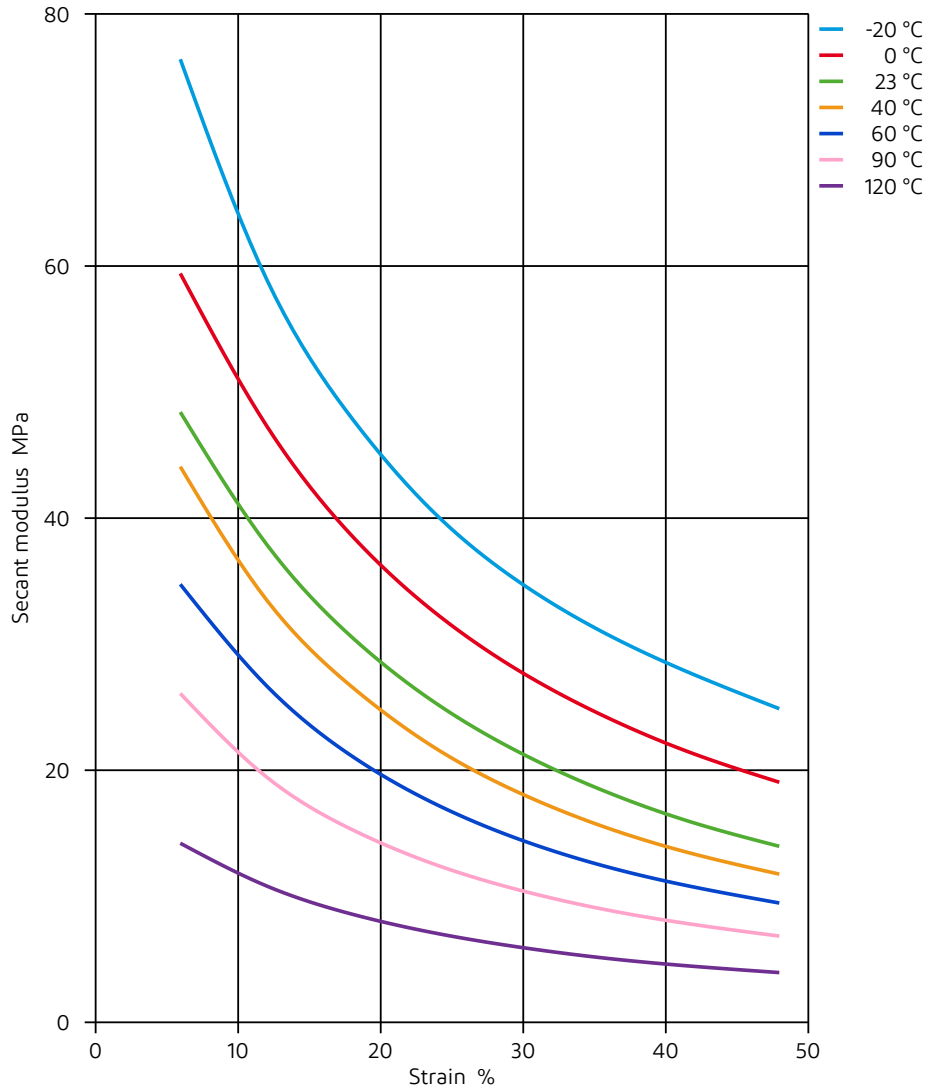




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## Secant modulus-strain

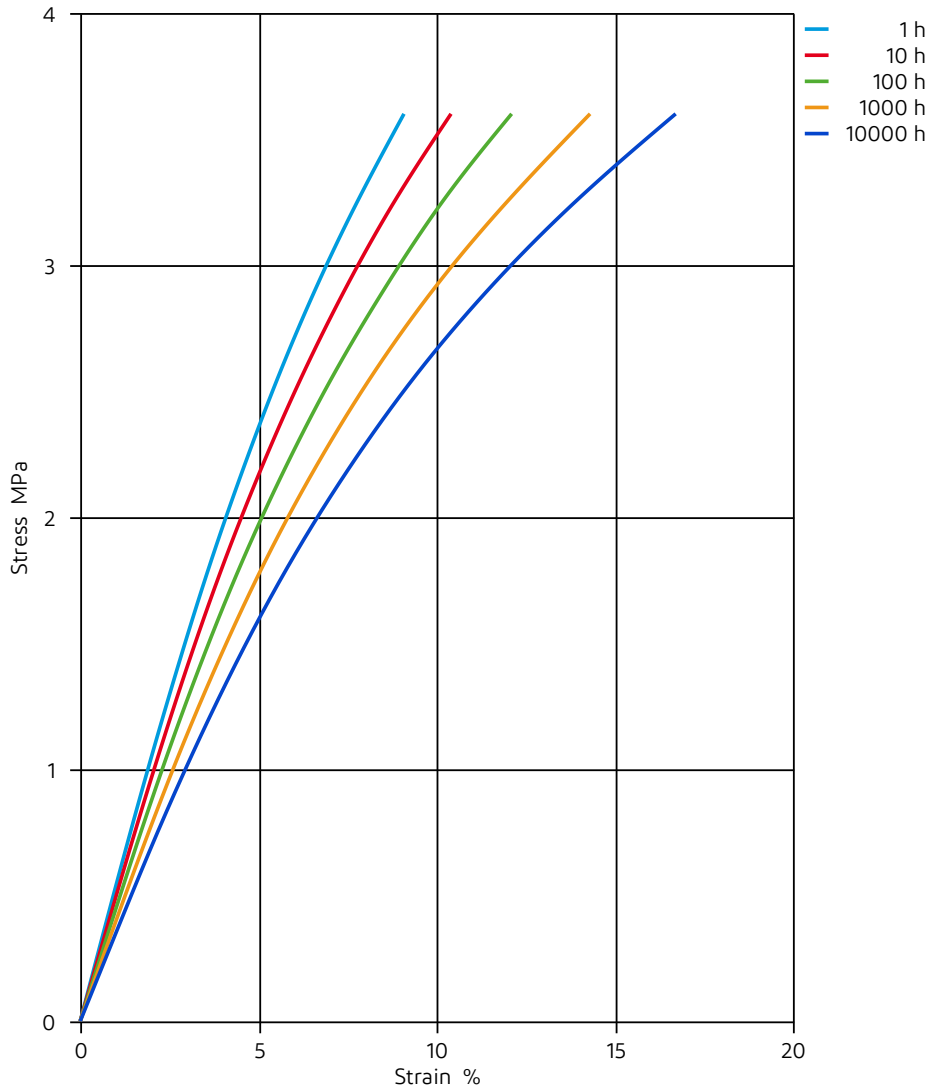




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THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain (isochronous) 23°C

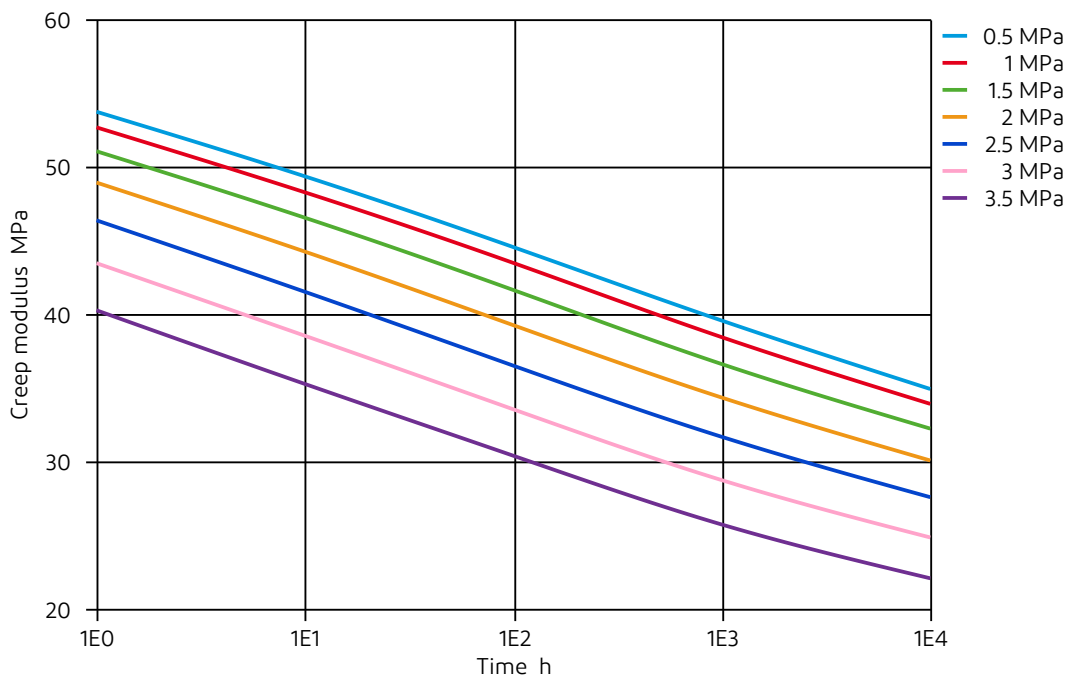




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THERMOPLASTIC POLYESTER ELASTOMER

Creep modulus-time 23°C

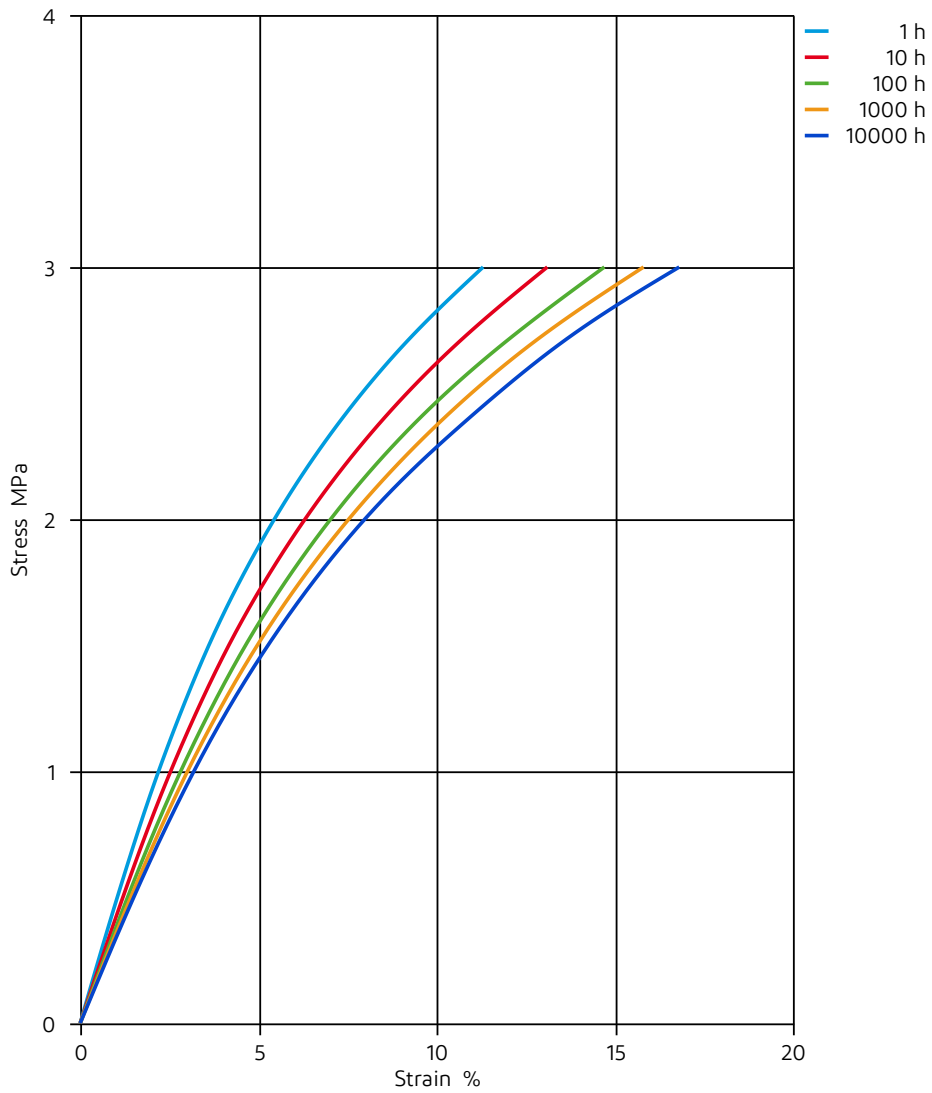




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THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain (isochronous) 40°C

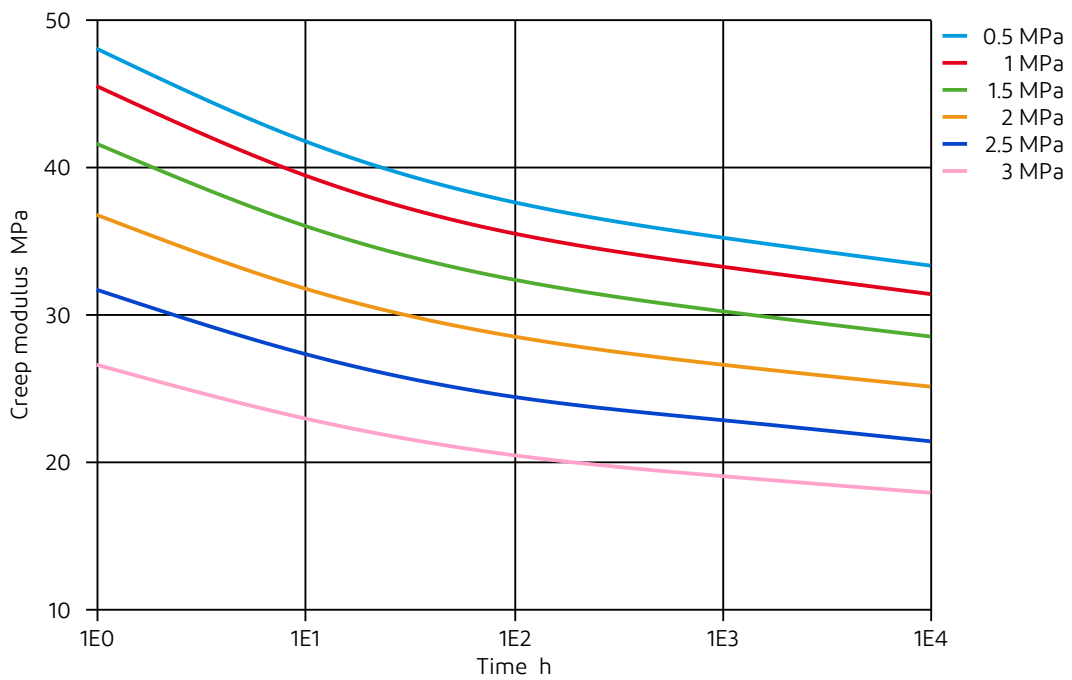




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THERMOPLASTIC POLYESTER ELASTOMER

Creep modulus-time 40°C

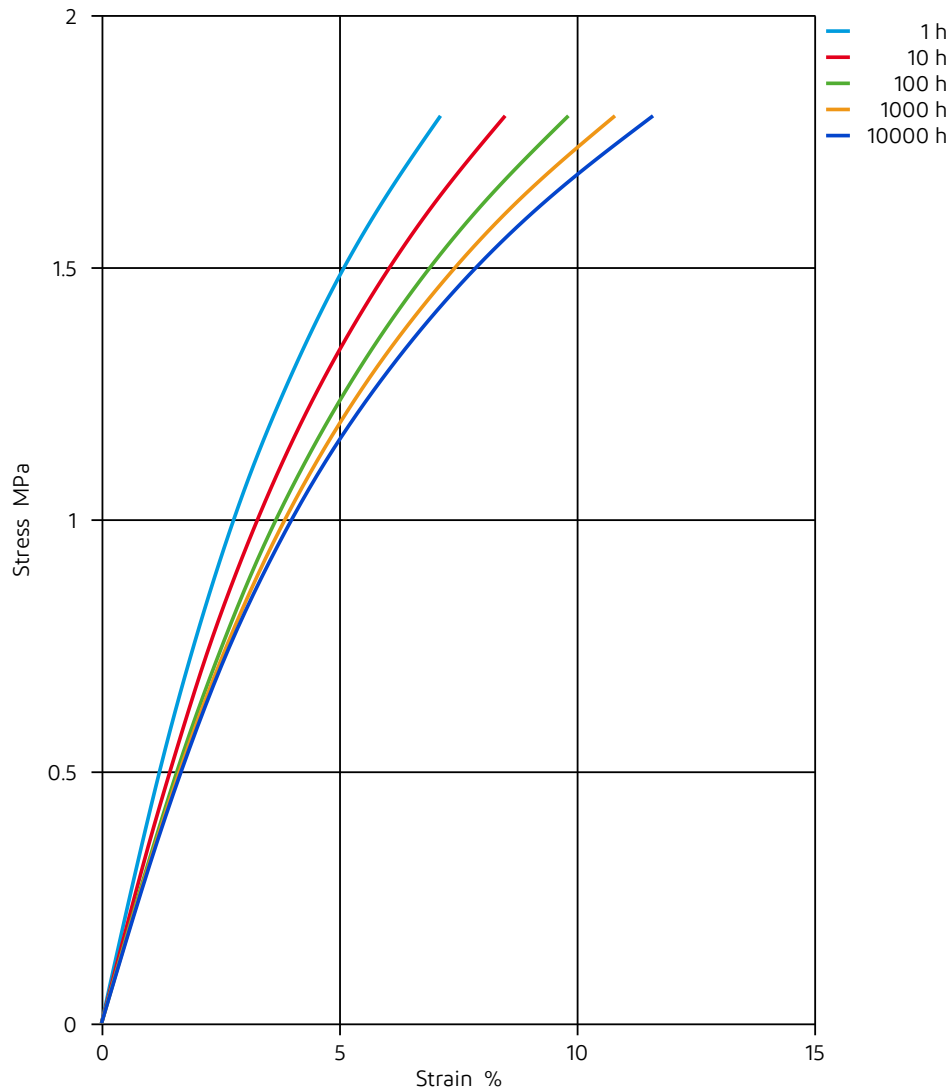




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THERMOPLASTIC POLYESTER ELASTOMER

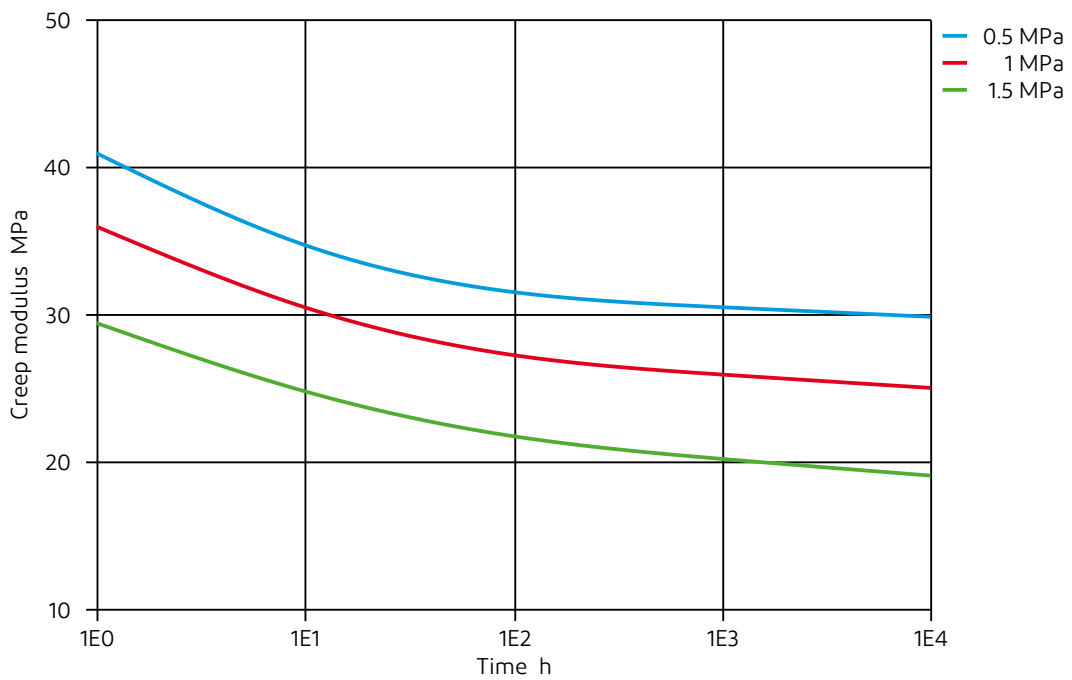
Stress-strain (isochronous) 80°C



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THERMOPLASTIC POLYESTER ELASTOMER

Creep modulus-time 80°C

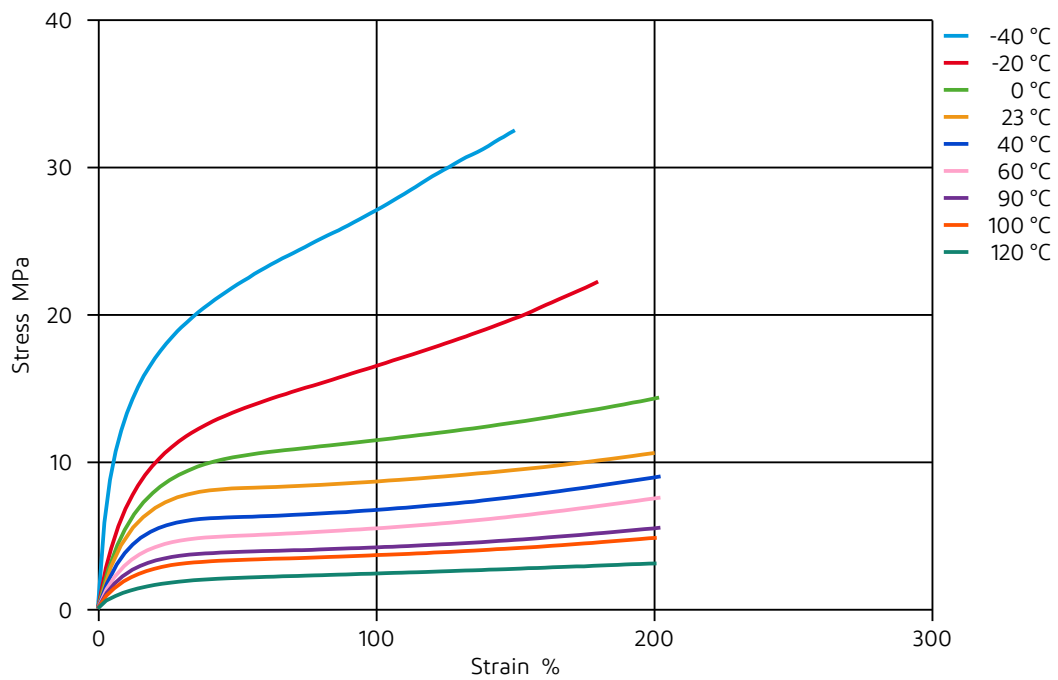




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THERMOPLASTIC POLYESTER ELASTOMER

Stress-Strain (Flexible Materials)





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## THERMOPLASTIC POLYESTER ELASTOMER

### Chemical Media Resistance

#### Acids

- ✓ Acetic Acid (5% by mass), 23°C
- ✓ Citric Acid solution (10% by mass), 23°C
- ✓ Lactic Acid (10% by mass), 23°C
- ✗ Hydrochloric Acid (36% by mass), 23°C
- ✗ Nitric Acid (40% by mass), 23°C
- ✗ Sulfuric Acid (38% by mass), 23°C
- ✓ Sulfuric Acid (5% by mass), 23°C
- ✗ Chromic Acid solution (40% by mass), 23°C

#### Bases

- ✓ Sodium Hydroxide solution (35% by mass), 23°C
- ✓ Sodium Hydroxide solution (1% by mass), 23°C
- ✓ Ammonium Hydroxide solution (10% by mass), 23°C

#### Alcohols

- ✓ Isopropyl alcohol, 23°C
- ✓ Methanol, 23°C
- ✓ Ethanol, 23°C

#### Hydrocarbons

- ✓ n-Hexane, 23°C
- ✓ Toluene, 23°C
- ✓ iso-Octane, 23°C

#### Ketones

- ✗ Acetone, 23°C

#### Ethers

- ✗ Diethyl ether, 23°C

#### Mineral oils

- ✓ SAE 10W40 multigrade motor oil, 23°C
- ✗ SAE 10W40 multigrade motor oil, 130°C
- ✗ SAE 80/90 hypoid-gear oil, 130°C
- ✓ Insulating Oil, 23°C
- ✗ Motor oil OS206 304 Ref.Eng.Oil, ISP, 135°C
- ✗ Automatic hypoid-gear oil Shell Donax TX, 135°C

#### Standard Fuels

- ✗ ISO 1817 Liquid 1 - E5, 60°C
- ✗ ISO 1817 Liquid 2 - M15E4, 60°C
- ✗ ISO 1817 Liquid 3 - M3E7, 60°C
- ✗ ISO 1817 Liquid 4 - M15, 60°C
- ✓ Standard fuel without alcohol (pref. ISO 1817 Liquid C), 23°C
- ✓ Standard fuel with alcohol (pref. ISO 1817 Liquid 4), 23°C
- ✓ Diesel fuel (pref. ISO 1817 Liquid F), 23°C

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## THERMOPLASTIC POLYESTER ELASTOMER

- ✓ Diesel fuel (pref. ISO 1817 Liquid F), 90°C
- ✗ Diesel fuel (pref. ISO 1817 Liquid F), >90°C

### Salt solutions

- ✓ Sodium Chloride solution (10% by mass), 23°C
- ✗ Sodium Hypochlorite solution (10% by mass), 23°C
- ✓ Sodium Carbonate solution (20% by mass), 23°C
- ✓ Sodium Carbonate solution (2% by mass), 23°C
- ✓ Zinc Chloride solution (50% by mass), 23°C

### Other

- ✓ Ethyl Acetate, 23°C
- ✗ Hydrogen peroxide, 23°C
- ✗ DOT No. 4 Brake fluid, 130°C
- ✗ Ethylene Glycol (50% by mass) in water, 108°C
- ✓ 1% nonylphenoxy-polyethyleneoxy ethanol in water, 23°C
- ✓ 50% Oleic acid + 50% Olive Oil, 23°C
- ✓ Water, 23°C
- ✓ Water, 90°C
- ✓ Phenol solution (5% by mass), 23°C
- ✗ Coolant Glysantin G48, 1:1 in water, 125°C

### Symbols used:

- ✓ possibly resistant  
Defined as: Supplier has sufficient indication that contact with chemical can be potentially accepted under the intended use conditions and expected service life. Criteria for assessment have to be indicated (e.g. surface aspect, volume change, property change).
- ✗ not recommended - see explanation  
Defined as: Not recommended for general use. However, short-term exposure under certain restricted conditions could be acceptable (e.g. fast cleaning with thorough rinsing, spills, wiping, vapor exposure).

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