

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, we recommend, 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 ³ /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

Hytrel® 4056

THERMOPLASTIC POLYESTER ELASTOMER

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/m²	ISO 179/1eU
Charpy impact strength, -30°C	N kJ/m²	ISO 179/1eU
Charpy notched impact strength, 23°C	N kJ/m²	ISO 179/1eA
Charpy notched impact strength, -30°C	N kJ/m²	ISO 179/1eA
Charpy notched impact strength, -40°C	N kJ/m²	ISO 179/1eA
Tensile notched impact strength, 23°C	230 kJ/m²	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/m²	ISO 180/1A
Izod notched impact strength, -40°C	N kJ/m²	ISO 180/1A
Poisson's ratio	0.5	
Brittleness temperature	-97 °C	ISO 974
Shore D hardness, 15s	37	ISO 48-4 / ISO 868
Shore D hardness, max	43	ISO 868
Tear strength, parallel	102 kN/m	ISO 34-1
Tear strength, normal	96 kN/m	ISO 34-1
Abrasion resistance	200 mm³	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/-3
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 m²/s	
RTI, electrical, 1.5mm	50 °C	UL 746B
RTI, impact, 1.5mm	50 °C	UL 746B

Hytrel® 4056

THERMOPLASTIC POLYESTER ELASTOMER

RTI, strength, 1.5mm
TGA curve

50 °C
available

UL 746B
ISO 11359-1/-2

Flammability

Burning Behav. at 1.5mm nom. thickn.
Thickness tested
UL recognition
Burning Behav. at thickness h
Thickness tested
UL recognition
Oxygen index
FMVSS Class

HB class
1.5 mm
yes
HB class
0.8 mm
yes
20 %
SE

IEC 60695-11-10
IEC 60695-11-10
UL 94
IEC 60695-11-10
IEC 60695-11-10
UL 94
ISO 4589-1/-2
ISO 3795 (FMVSS 302)

Electrical properties

Relative permittivity, 100Hz
Relative permittivity, 1MHz
Dissipation factor, 100Hz
Dissipation factor, 1MHz
Volume resistivity
Surface resistivity
Electric strength
Comparative tracking index

5.2
4.7
110 E-4
525 E-4
7E10 Ohm.m
2E14 Ohm
18 kV/mm
600

IEC 62631-2-1
IEC 62631-2-1
IEC 62631-2-1
IEC 62631-2-1
IEC 62631-3-1
IEC 62631-3-2
IEC 60243-1
IEC 60112

Other properties

Humidity absorption, 2mm
Water absorption, 2mm
Water absorption, Immersion 24h
Density
Density of melt

0.2 %
0.7 %
0.6 %
1160 kg/m³
1020 kg/m³

Sim. to ISO 62
Sim. to ISO 62
Sim. to ISO 62
ISO 1183

Film Properties

WVTR, 23°C/85%r.h.
Oxygen transmission rate, 23°C/85%r.h.
Thickness of specimen

450 g/(m²*d)
14000 cm³/(m²*d*bar)
0.025 mm

DIS 15106-1/-2
DIS 15105-1/-2

Injection

Drying Recommended
Drying Temperature
Drying Time, Dehumidified Dryer
Processing Moisture Content
Melt Temperature Optimum
Min. melt temperature
Max. melt temperature

yes
80 °C
2 - 3 h
≤0.08 %
180 °C
170 °C
190 °C

Hytrel® 4056

THERMOPLASTIC POLYESTER ELASTOMER

Mold Temperature Optimum	40 °C
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

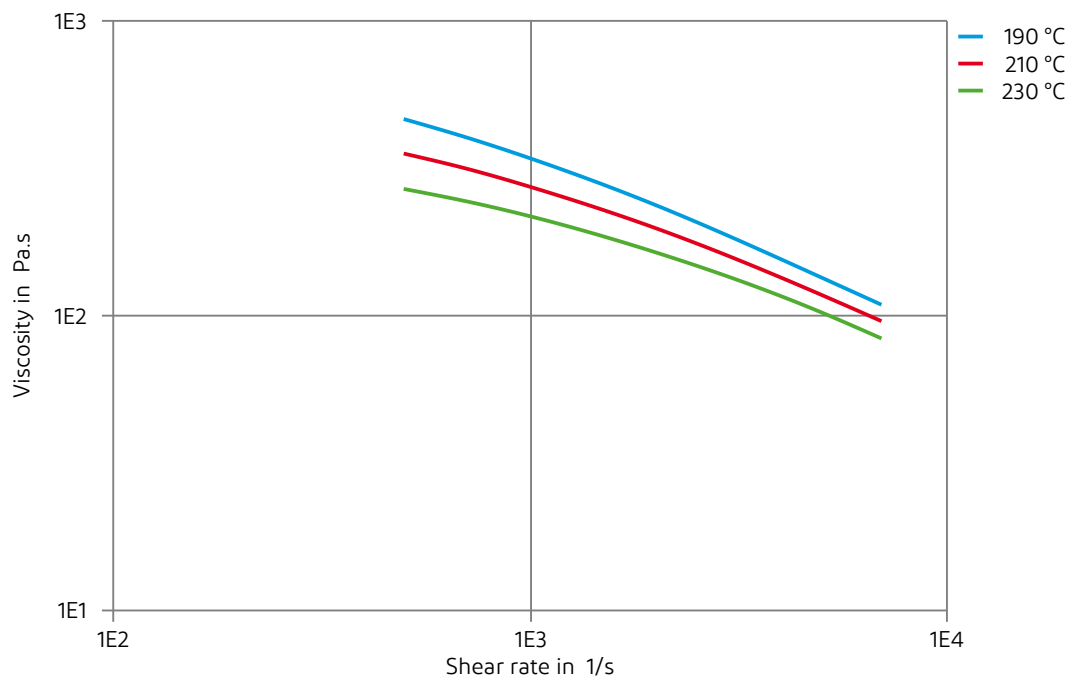
Snake Flow Test , mm

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

Hytrel® 4056

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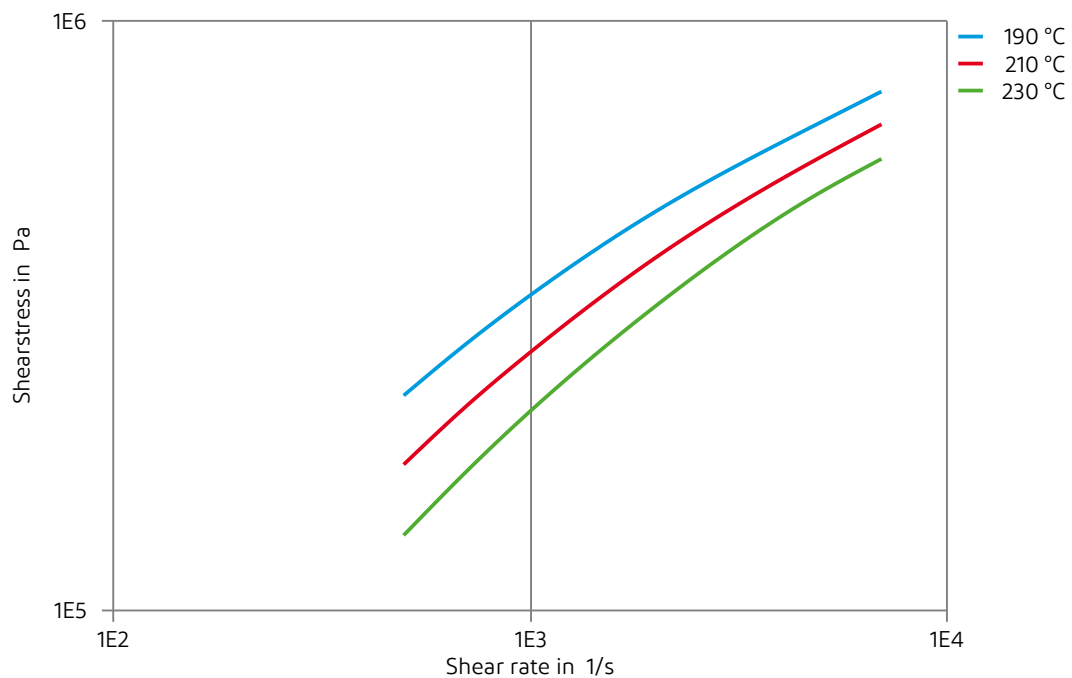
Viscosity-shear rate



Hytrel® 4056

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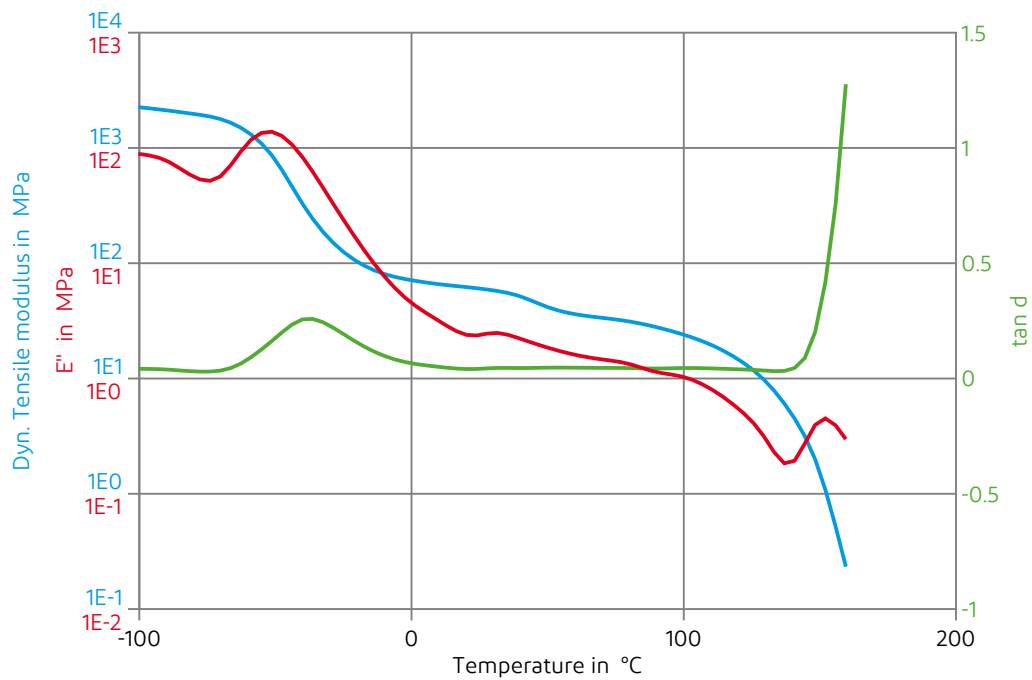
Shearstress-shear rate



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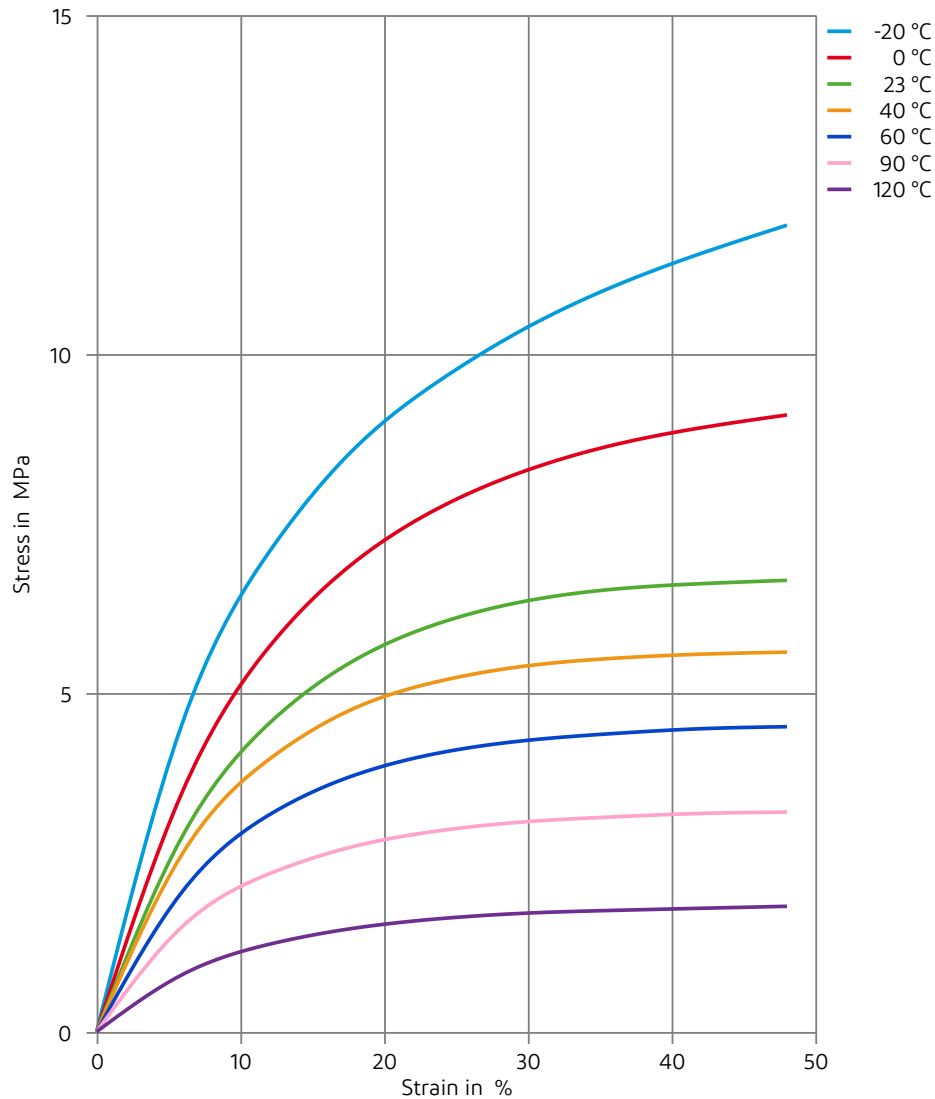
Dynamic Tensile modulus-temperature



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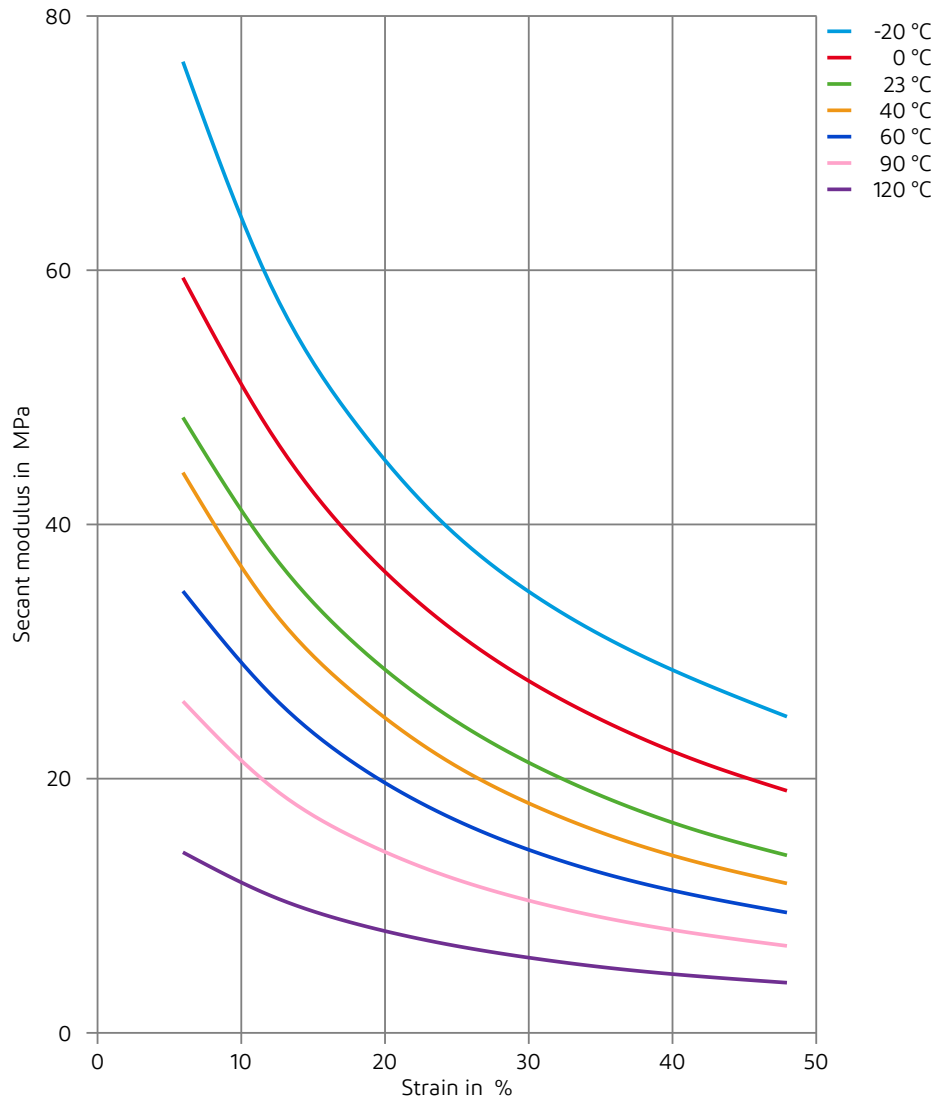
Stress-strain



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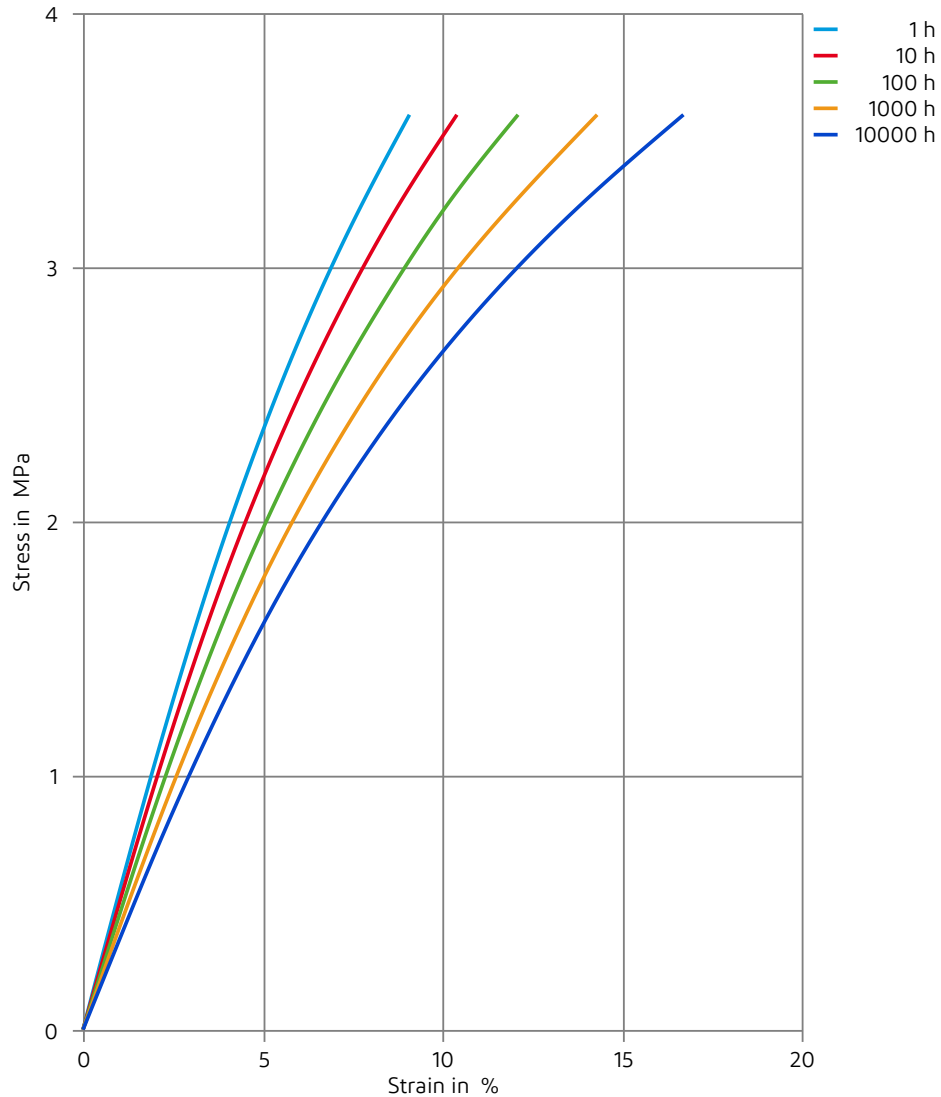
Secant modulus-strain



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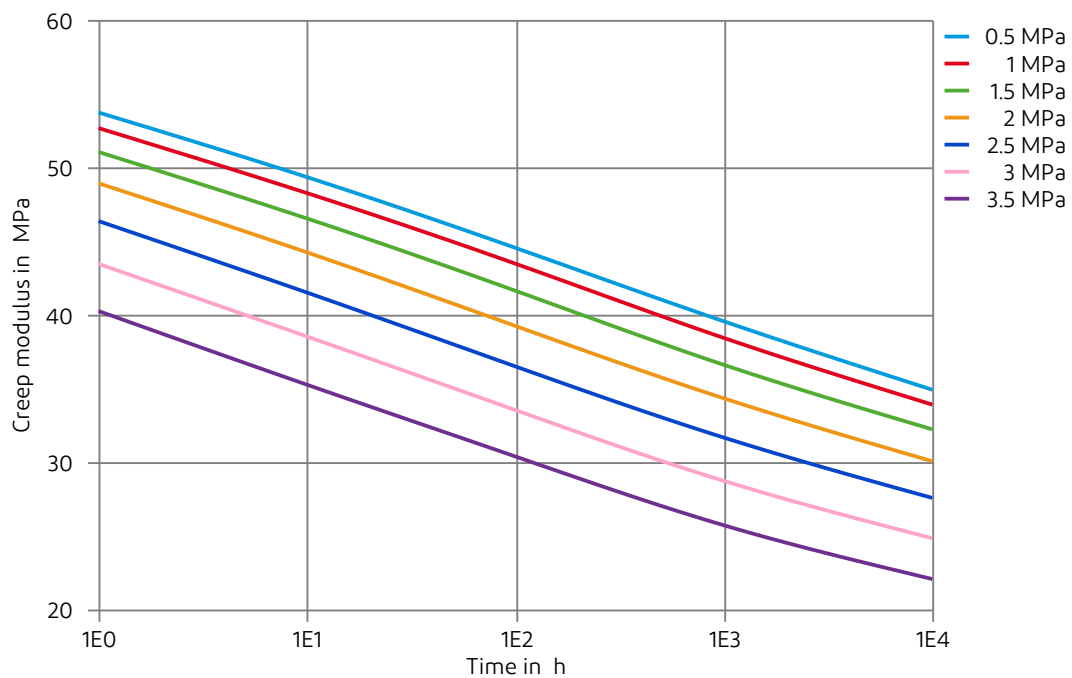
Stress-strain (isochronous) 23°C



Hytrel® 4056

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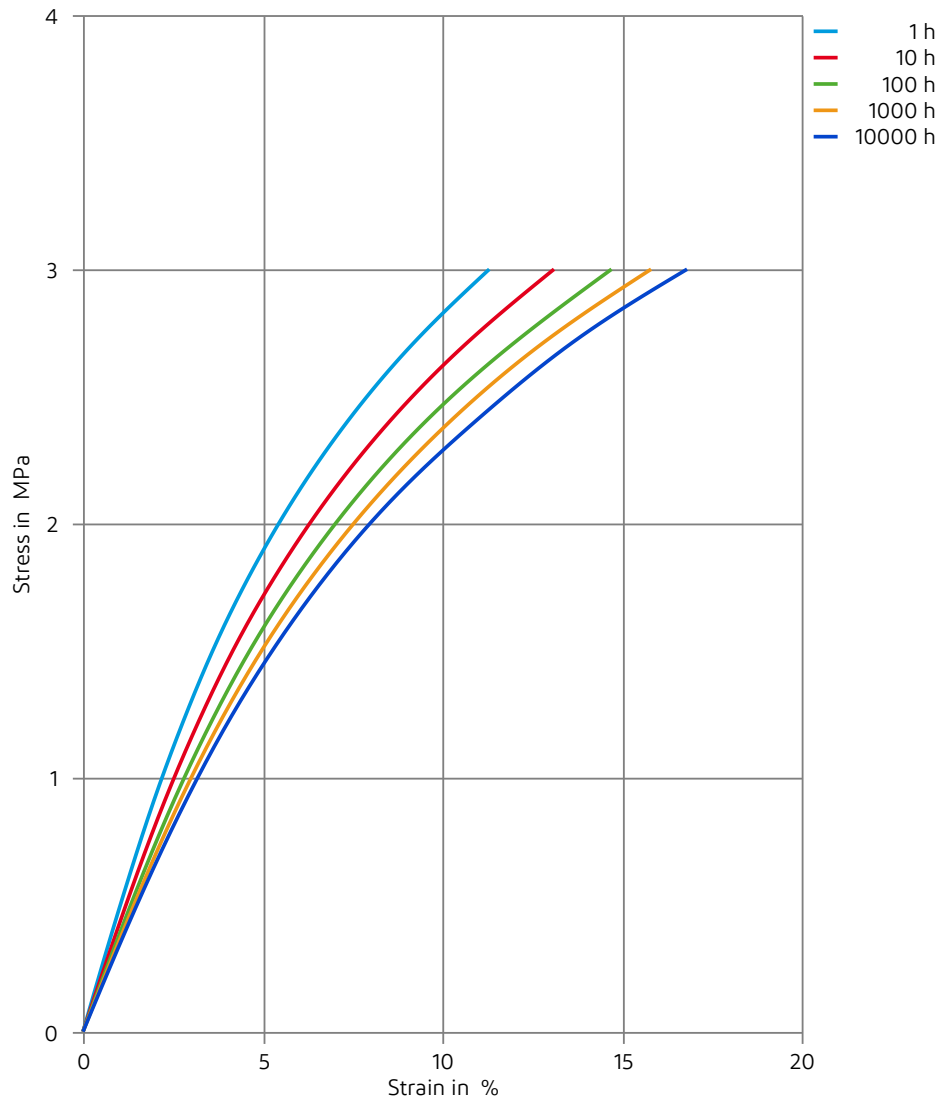
Creep modulus-time 23°C



Hytrel® 4056

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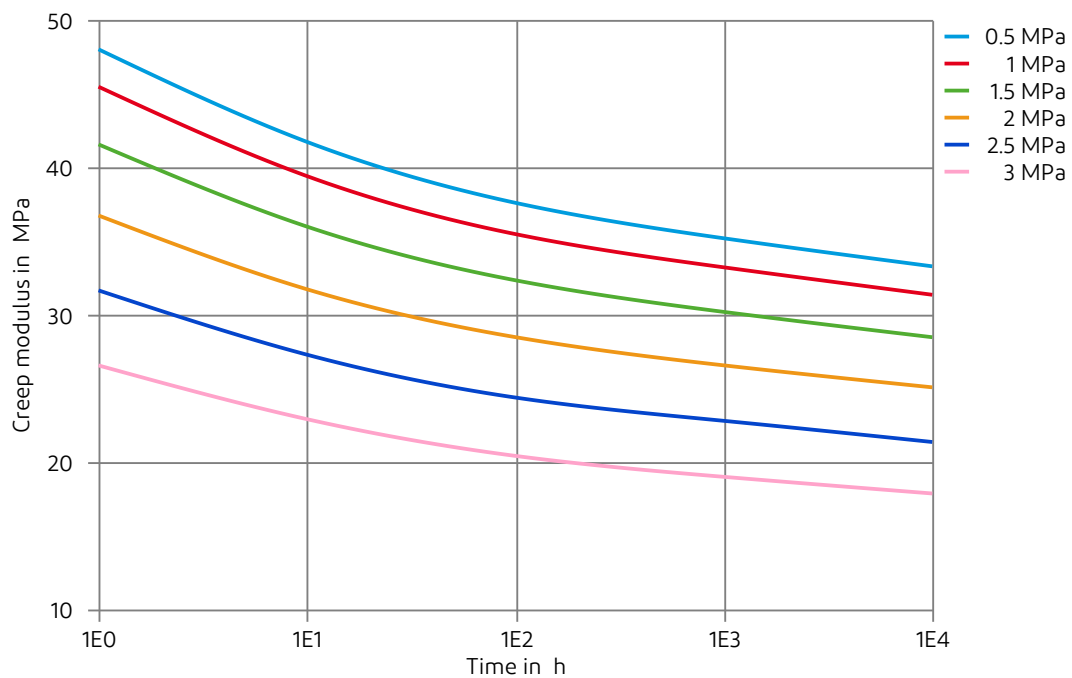
Stress-strain (isochronous) 40°C



Hytrel® 4056

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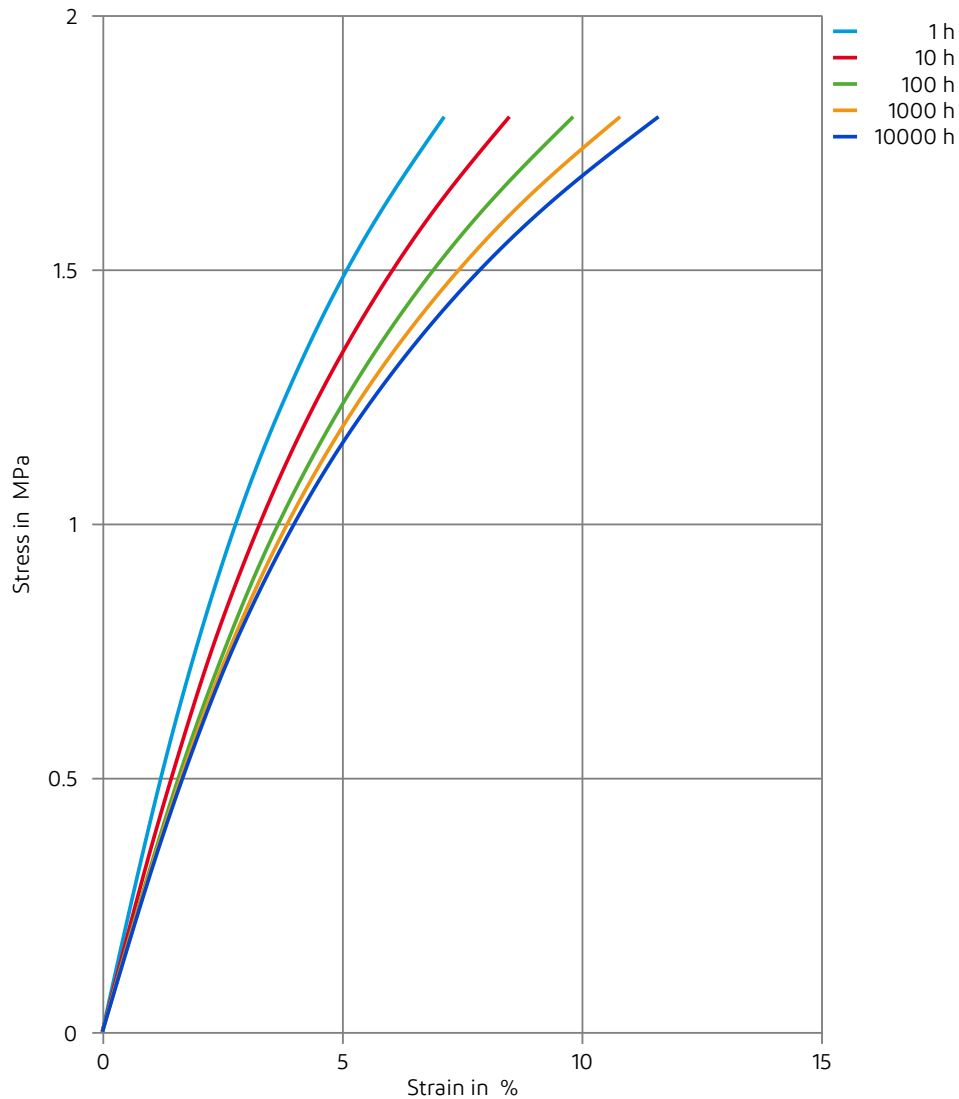
Creep modulus-time 40°C



Hytrel® 4056

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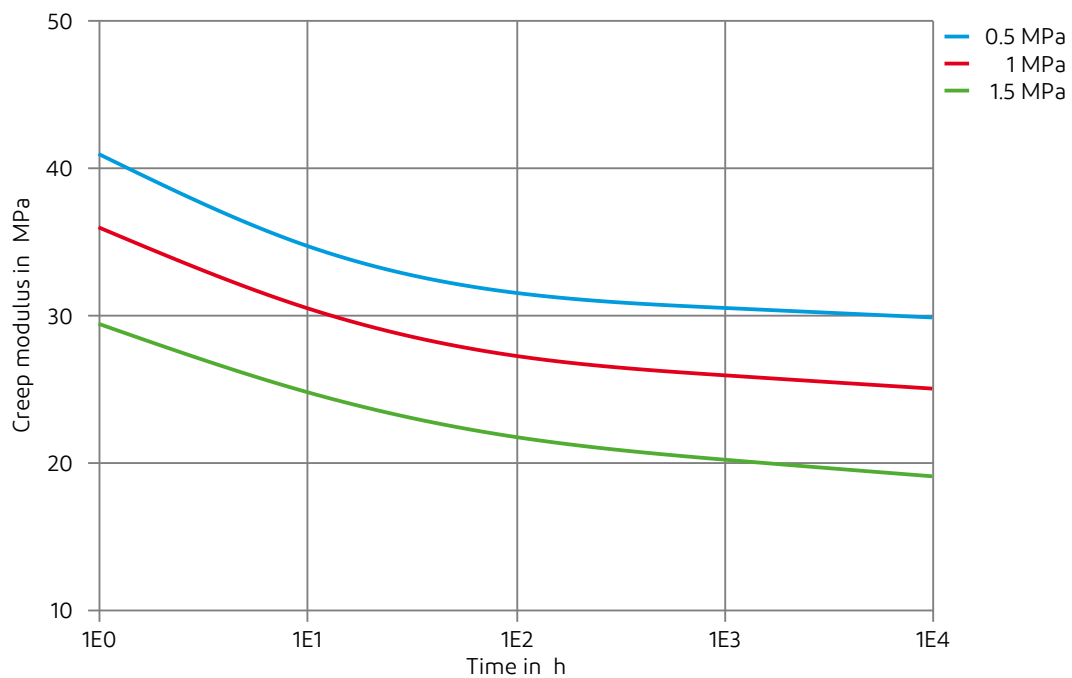
Stress-strain (isochronous) 80°C



Hytrel® 4056

THERMOPLASTIC POLYESTER ELASTOMER

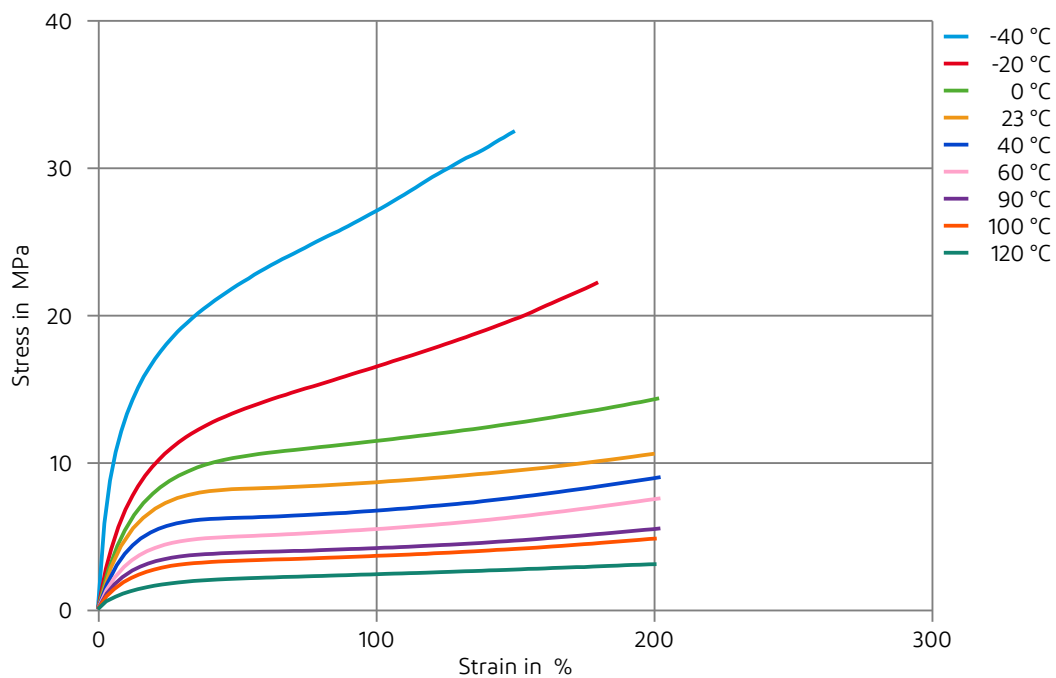
Creep modulus-time 80°C



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Stress-Strain (Flexible Materials)



Hytrel® 4056

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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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- ✓ 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).

Mobility & Materials

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