

# DuPont™ Hytrel® 4056

## THERMOPLASTIC POLYESTER ELASTOMER

### Product Information

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, .

General information	Value	Unit	Test Standard
Resin Identification	TPC-ET	-	ISO 1043
Part Marking Code	TPC-ET	-	ISO 11469
Rheological properties	Value	Unit	Test Standard
Melt volume-flow rate	5	cm <sup>3</sup> /10min	ISO 1133
Temperature	190	°C	ISO 1133
Load	2.16	kg	ISO 1133
Melt mass-flow rate	5.6	g/10min	ISO 1133
Melt mass-flow rate, Temperature	190	°C	ISO 1133
Melt mass-flow rate, Load	2.16	kg	ISO 1133
Molding shrinkage, parallel	0.2	%	ISO 294-4, 2577
Molding shrinkage, normal	0.4	%	ISO 294-4, 2577
Mechanical properties (TPE)	Value	Unit	Test Standard
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	26	MPa	ISO 527-1/-2
Strain at break	>300	%	ISO 527-1/-2
Nominal strain at break	500	%	ISO 527-1/-2
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
Shore D hardness, max	43	-	ISO 7619-1
Shore D hardness, 15s	37	-	ISO 7619-1
Mechanical properties	Value	Unit	Test Standard
Tensile Modulus	60	MPa	ISO 527-1/-2
Flexural Modulus	60	MPa	ISO 178
Tensile creep modulus			ISO 899-1
1h	54	MPa	
1000h	40	MPa	

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Charpy impact strength			ISO 179/1eU
73°F	N	kJ/m <sup>2</sup>	
-22°F	N	kJ/m <sup>2</sup>	
Charpy notched impact strength			ISO 179/1eA
73°F	N	kJ/m <sup>2</sup>	
-22°F	N	kJ/m <sup>2</sup>	
-40°F	N	kJ/m <sup>2</sup>	
Tensile notched impact strength, 73°F	230	kJ/m <sup>2</sup>	ISO 8256/1
Puncture - maximum force			ISO 6603-2
73°F	1500	N	
-22°F	2800	N	
Puncture energy			ISO 6603-2
73°F	19	J	
-22°F	37	J	
Brittleness temperature	-97	°C	ISO 974
Izod notched impact strength			ISO 180/1A
73°F	N	kJ/m <sup>2</sup>	
-40°F	N	kJ/m <sup>2</sup>	
<b>Thermal properties</b>	<b>Value</b>	<b>Unit</b>	<b>Test Standard</b>
Melting temperature, 18°F/min	152	°C	ISO 11357-1/-3
Glass transition temperature, 18°F/min	-50	°C	ISO 11357-1/-2
Temp. of deflection under load, 65 psi	48	°C	ISO 75-1/-2
Vicat softening temperature, 90°F, 2 lbf	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, 60mil	50	°C	UL 746B
RTI, impact, 60mil	50	°C	UL 746B
RTI, strength, 60mil	50	°C	UL 746B
<b>Flammability</b>	<b>Value</b>	<b>Unit</b>	<b>Test Standard</b>
Burning Behav. at 60mil nom. thickn.	HB	class	IEC 60695-11-10
Thickness tested	1.5	mm	IEC 60695-11-10
UL recognition	yes	-	UL 94
Oxygen index	20	%	ISO 4589-1/-2
FMVSS Class	SE	-	ISO 3795 (FMVSS 302)
<b>Electrical properties</b>	<b>Value</b>	<b>Unit</b>	<b>Test Standard</b>
Relative permittivity			IEC 60250
100Hz	5.2	-	
1MHz	4.7	-	
Dissipation factor			IEC 60250
100Hz	110	E-4	
1MHz	525	E-4	
Volume resistivity	7E10	Ohm*m	IEC 60093
Surface resistivity	2E14	Ohm	IEC 60093
Electric strength	18	kV/mm	IEC 60243-1
Comparative tracking index	600	-	IEC 60112
<b>Other properties</b>	<b>Value</b>	<b>Unit</b>	<b>Test Standard</b>
Humidity absorption, 80mil	0.2	%	Sim. to ISO 62
Water absorption, 80mil	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
<b>Film Properties</b>	<b>Value</b>	<b>Unit</b>	<b>Test Standard</b>
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

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Thickness of specimen	0.025	mm	-
Injection	Value	Unit	Test Standard
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	-
Min. mold temperature	30	°C	-
Max. mold temperature	40	°C	-
Extrusion	Value	Unit	Test Standard
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	-

Characteristics			
Processing	<ul style="list-style-type: none"> <li>• Injection Molding</li> <li>• Film Extrusion</li> <li>• Profile Extrusion</li> </ul>	<ul style="list-style-type: none"> <li>• Sheet Extrusion</li> <li>• Other Extrusion</li> <li>• Coating</li> </ul>	<ul style="list-style-type: none"> <li>• Calandring</li> <li>• Casting</li> <li>• Thermoforming</li> </ul>
Delivery form	<ul style="list-style-type: none"> <li>• Pellets</li> </ul>		
Special characteristics	<ul style="list-style-type: none"> <li>• Light stabilized or stable to light</li> </ul>		
Regional Availability	<ul style="list-style-type: none"> <li>• North America</li> <li>• Europe</li> </ul>	<ul style="list-style-type: none"> <li>• Asia Pacific</li> <li>• South and Central America</li> </ul>	<ul style="list-style-type: none"> <li>• Near East/Africa</li> <li>• Global</li> </ul>

### Processing Texts

#### 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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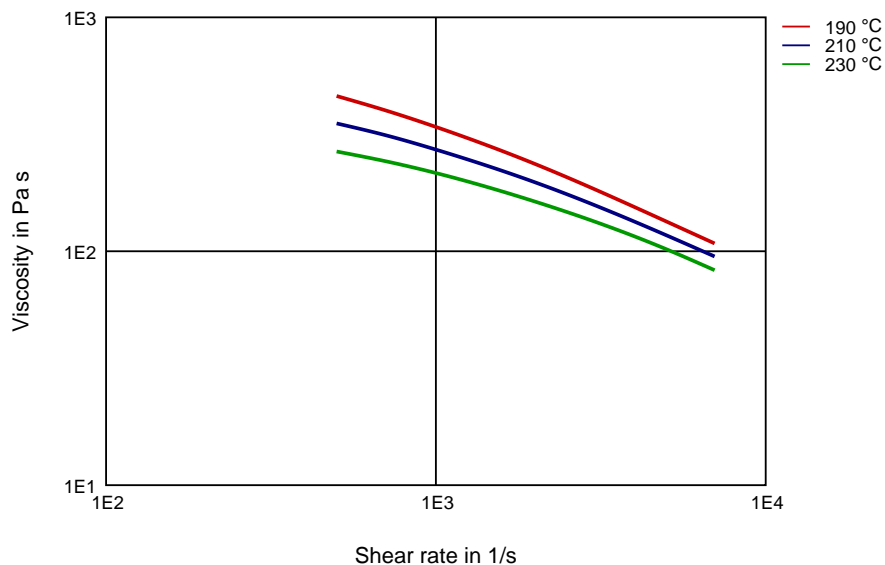


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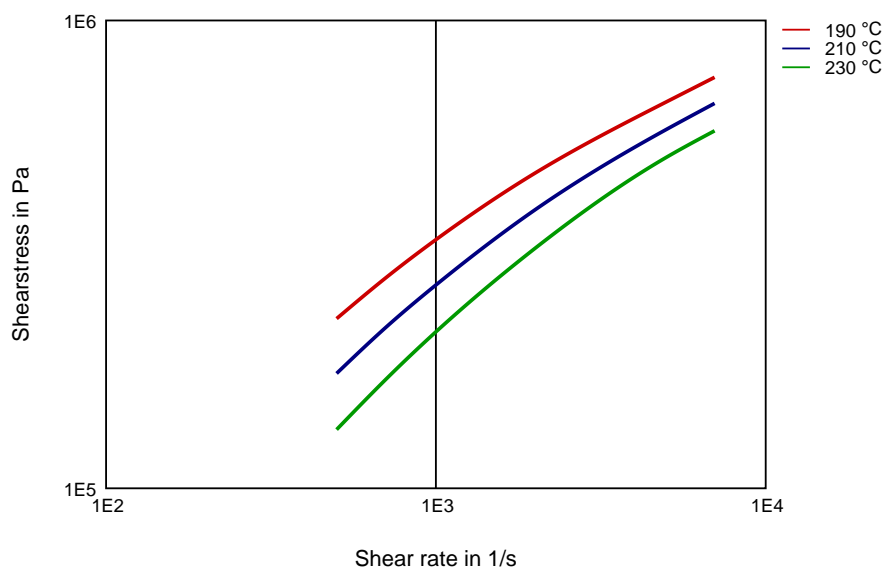
## THERMOPLASTIC POLYESTER ELASTOMER

### Diagrams

#### Viscosity-shear rate



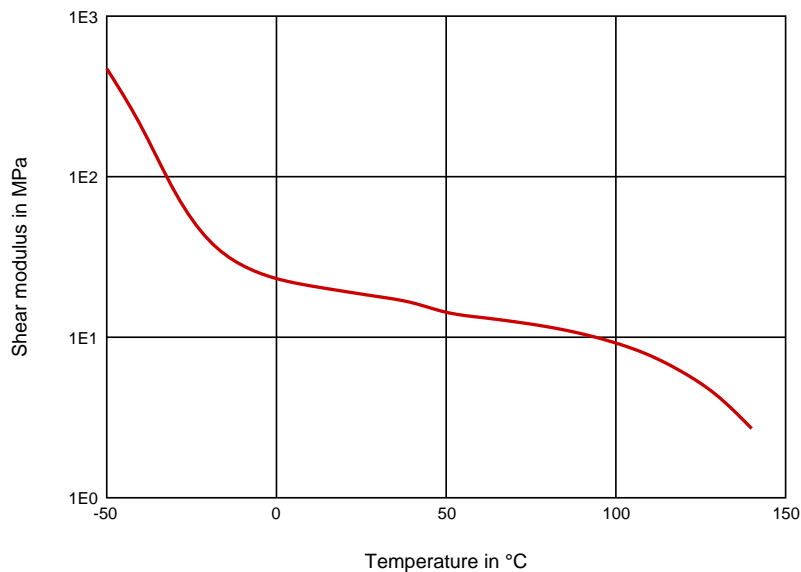
#### Shearstress-shear rate



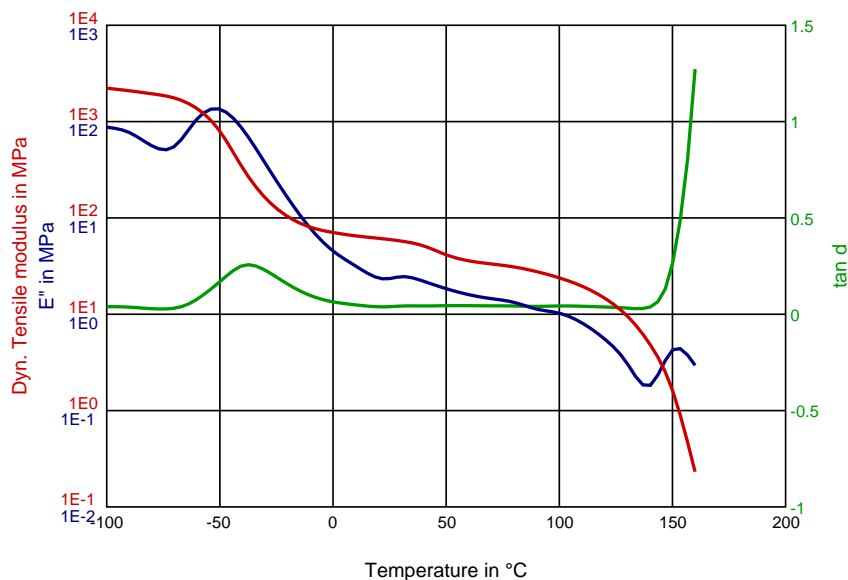
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## THERMOPLASTIC POLYESTER ELASTOMER

### Dynamic Shear modulus-temperature



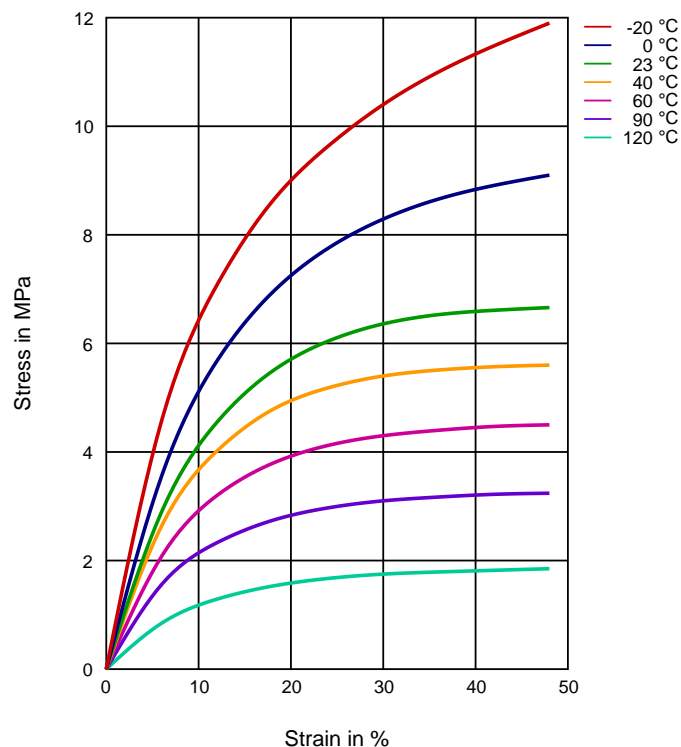
### Dynamic Tensile modulus-temperature



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## THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain



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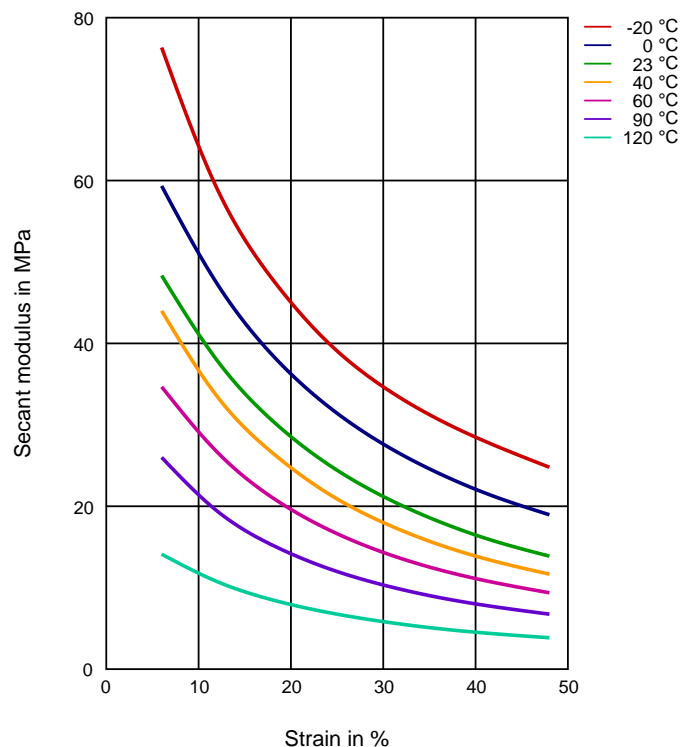
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## THERMOPLASTIC POLYESTER ELASTOMER

Secant modulus-strain



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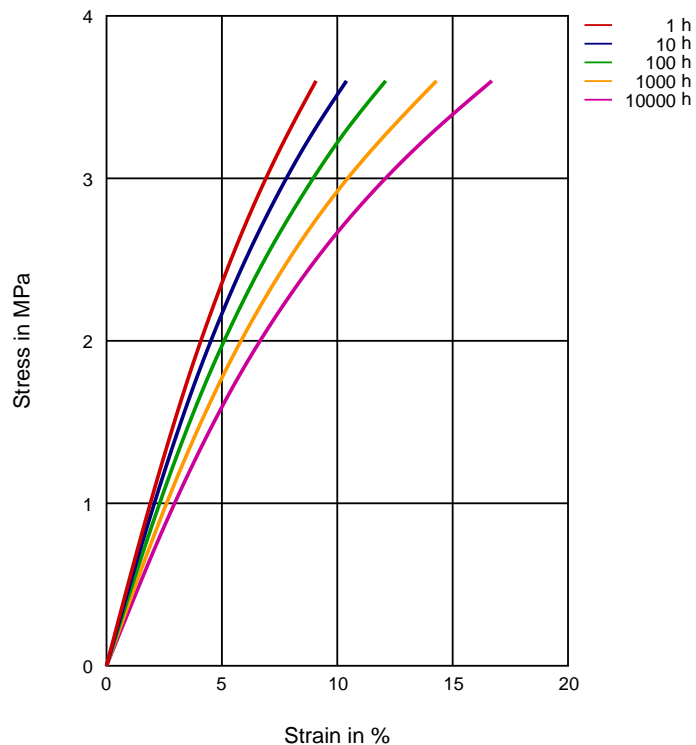
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## THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain (isochronous) 23°C



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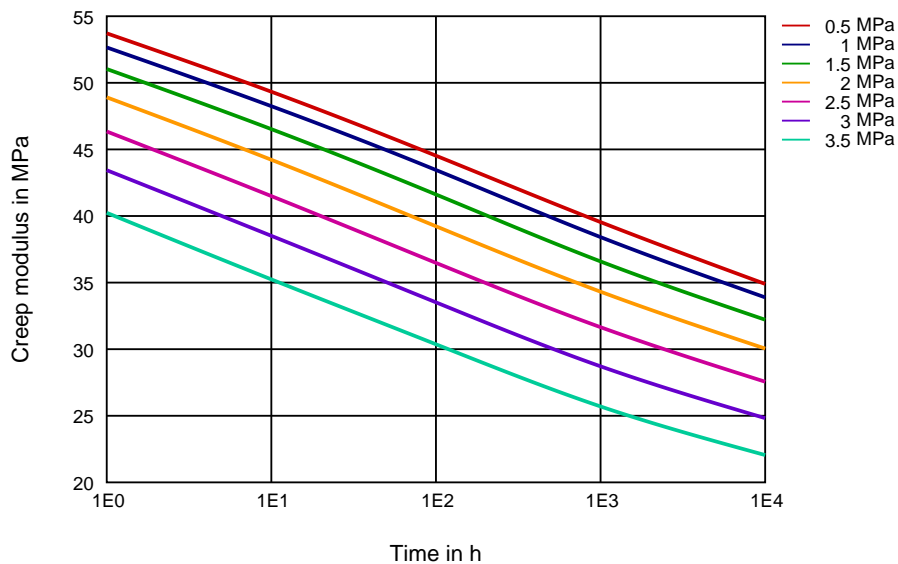




# DuPont™ Hytrel® 4056

## THERMOPLASTIC POLYESTER ELASTOMER

Creep modulus-time 23 °C



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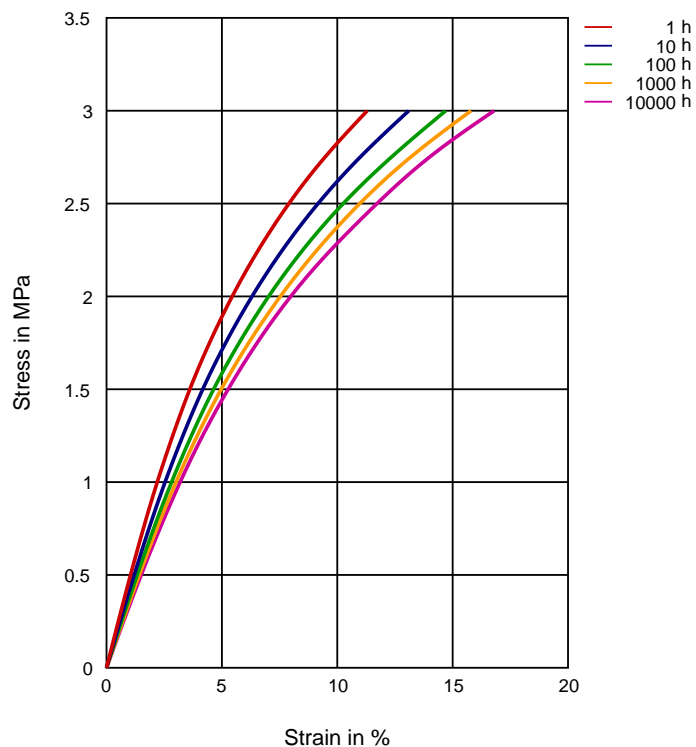
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# DuPont™ Hytrel® 4056

## THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain (isochronous) 40°C



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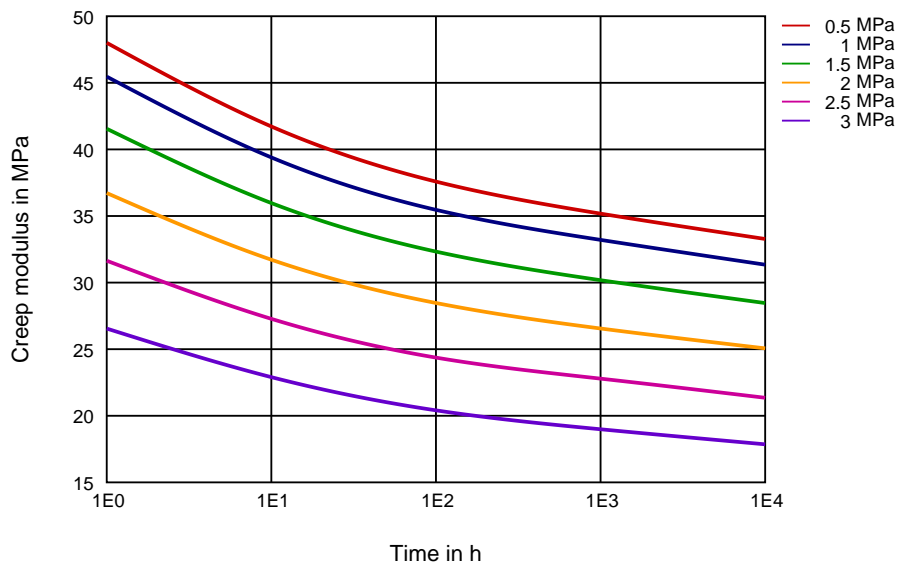
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# DuPont™ Hytrel® 4056

## THERMOPLASTIC POLYESTER ELASTOMER

Creep modulus-time 40 °C



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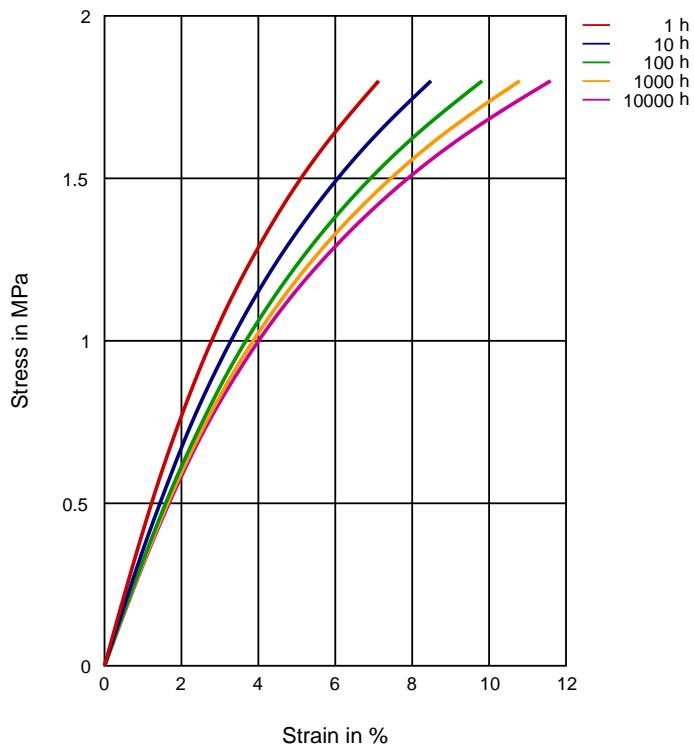
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## THERMOPLASTIC POLYESTER ELASTOMER

Stress-strain (isochronous) 80 °C



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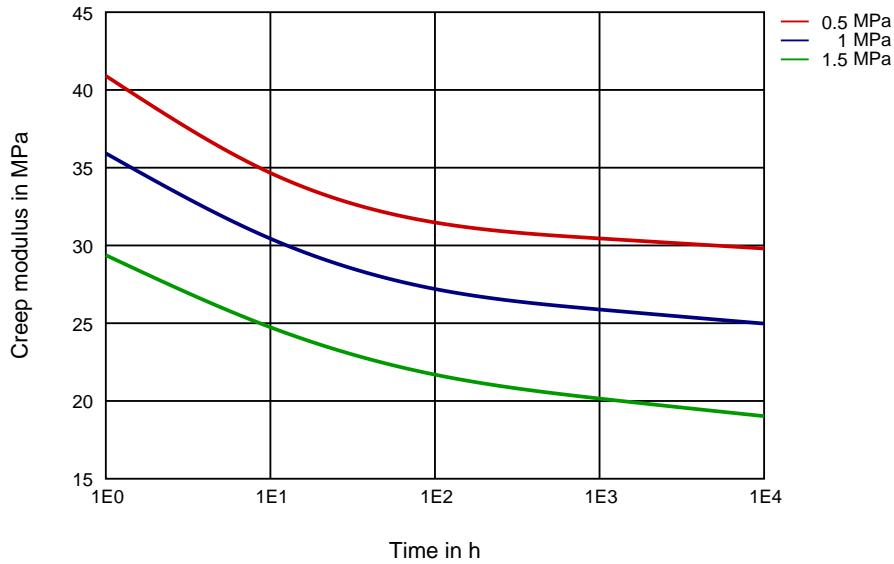
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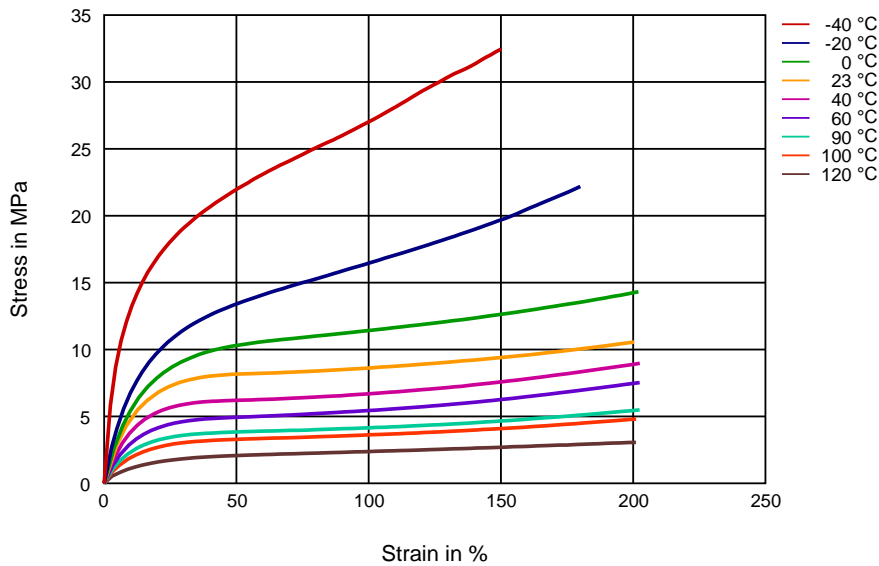
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## THERMOPLASTIC POLYESTER ELASTOMER

### Creep modulus-time 80 °C



### Stress-Strain (TPE)



# DuPont™ Hytrel® 4056

## 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)

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- ✓ 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)
- ✓ 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).

Contact DuPont for Material Safety Data Sheet, general guides and/or additional information about ventilation, handling, purging, drying, etc. ISO Mechanical properties measured at 160 mil (Hytrel® measured at 80 mil), IEC Electrical properties measured at 80 mil, all ASTM properties measured at 120 mil, and test temperatures are 73°F unless otherwise stated.

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