

# Cellasto<sup>®</sup>

## A cellular polyurethane elastomer



Cellasto automobile auxiliary springs



Cellasto crane buffers



Cellasto seals, damping components and buffers



Cellasto bearings to isolate noise and vibration

# The characteristics

## Quasistatic progressive pressure-compression behaviour

Cellasto components are based on a cellular polyurethane elastomer. The moulded components are produced in a closed-mould foaming process. Depending on the amount of the material used the moulded components have densities of 350 to 650 kg/m<sup>3</sup>. The pore volume accounts for 50 – 63 % of the moulded volume.

The pore diameters lie in the tenth of a millimetre range and are mainly closed.

The graphs show experimental data that have been generated with standardized test specimen. When applying this data for product development it should be noted that the material properties further depend on installation conditions, dimensional factors and others.

During compression loading, first the pore volume and then the material itself is compressed. It therefore gains rigidity with increasing compression. The material is characterized by progressive pressure-compression behaviour.

The maximum compression of Cellasto moulded components depends on their density. The realizable spring excursion increases with decreasing density and can reach up to 80 % of the original length of the component.

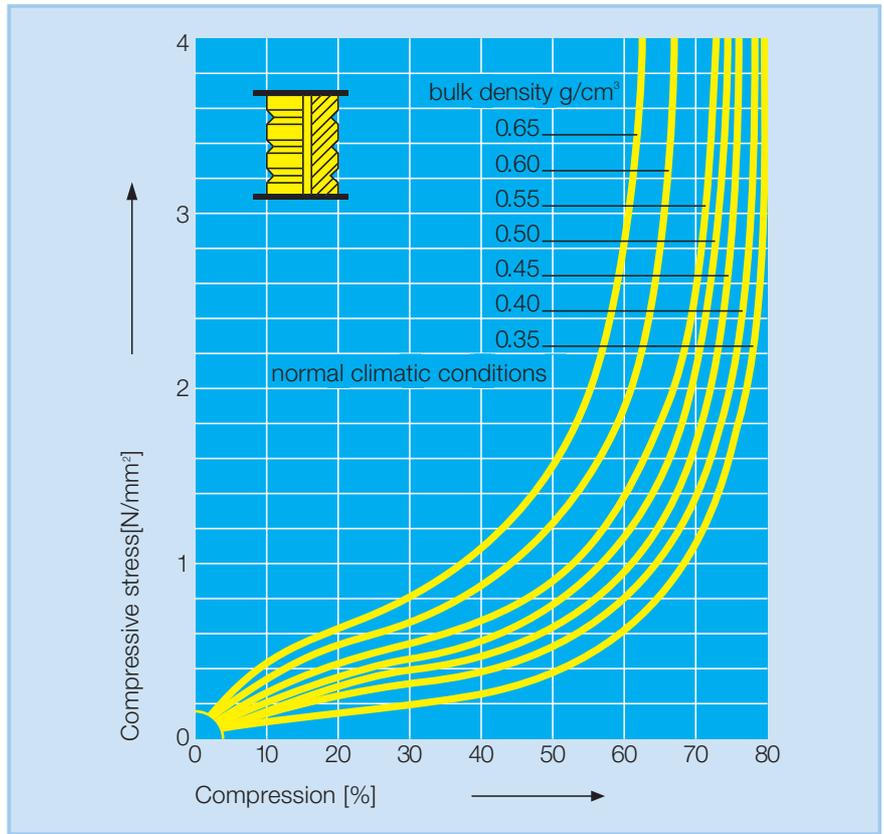
Large spring excursion and low block dimension characterize moulded components made of this material.

For Cellasto components a compressive strain of 4 N/mm<sup>2</sup> represents the dynamic continuous load limit. However, the material is not destroyed by single impacts generating stresses of up to 20 N/mm<sup>2</sup>.

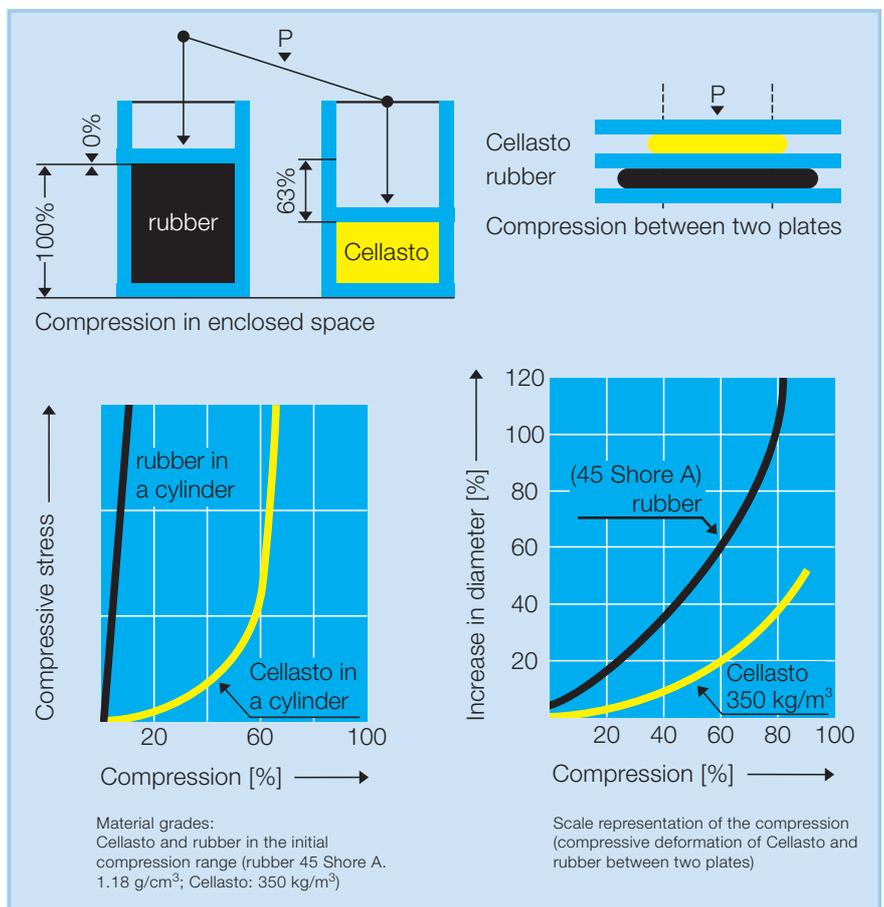
## Low transverse expansion and high volume compressibility

Compact elastomers show large transverse expansion when compressed. However, this is not the case with cellular polyurethane elastomers. They are characterized by low transverse expansion.

Cellasto spring elements are therefore suitable for applications where the surrounding structural space is confined. Cellasto components also act as springs in enclosed structural space.



△ Quasistatic progressive pressure-compression behaviour



△ Low transverse expansion and high volume compressibility

# The characteristics

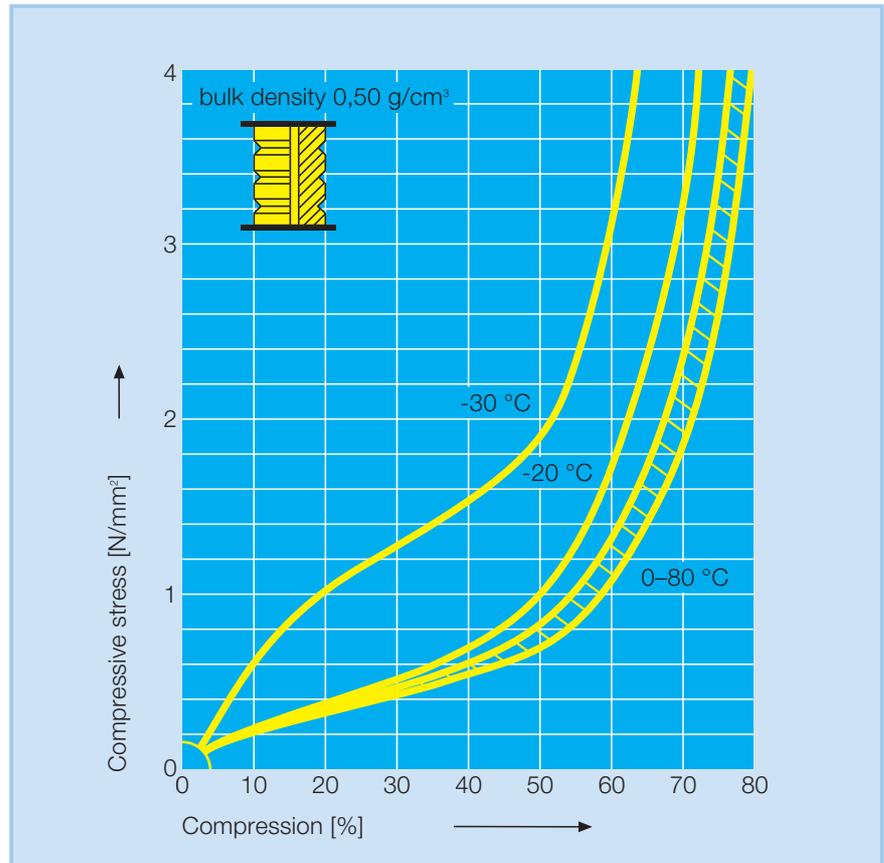
## Characteristic curves as a function of temperature

The mechanical properties of plastics are temperature dependent. They are subject to temperature limits.

Moulded Cellasto components gradually harden with decreasing temperature. They are suitable for applications down to about -30°C.

Moulded Cellasto components that also have to maintain their elasticity at low temperatures can be manufactured from special cryo-flexible Cellasto types. They are then suitable for applications down to about -40°C.

Moulded Cellasto components gradually soften with increasing temperature. The characteristic curve for Cellasto only changes slightly up to a temperature of approx. 80°C, so that moulded Cellasto components can be used in ambient temperatures of up to 80°C without losses in elasticity behaviour.



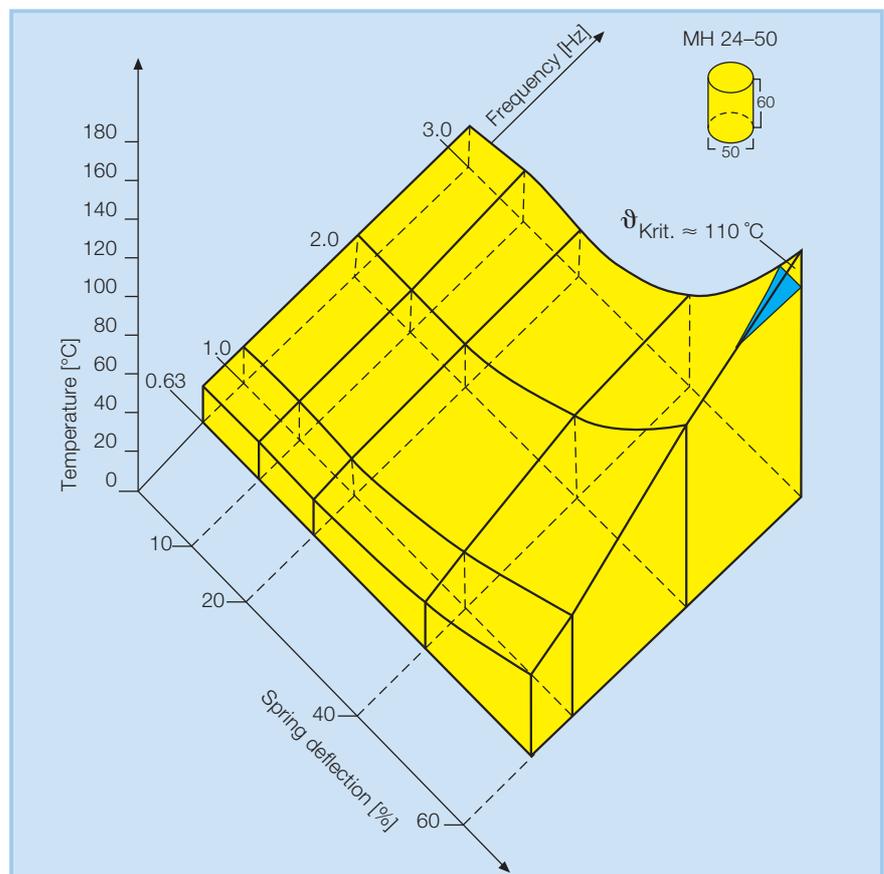
△ Characteristic curves as a function of temperature

## Temperature increase caused by damping

The material damps a portion of the mechanical energy input and converts it to heat. The dissipating heat thereby increases the temperature in the stressed moulded component. This temperature should not exceed 110°C.

For moulded components subject to stresses of constant frequency and constant spring deflection an equilibrium temperature, which has been determined on the basis of standardized form components, is reached. The resultant family of curves – the figure on the right is an example – enables, already in the moulded component development phase, a prediction as to whether the critical thermal damage temperature would be reached in the foreseen application.

Cellasto components which have hardened at low temperatures regain their elastic properties in the course of mechanical stresses and associated warming up.



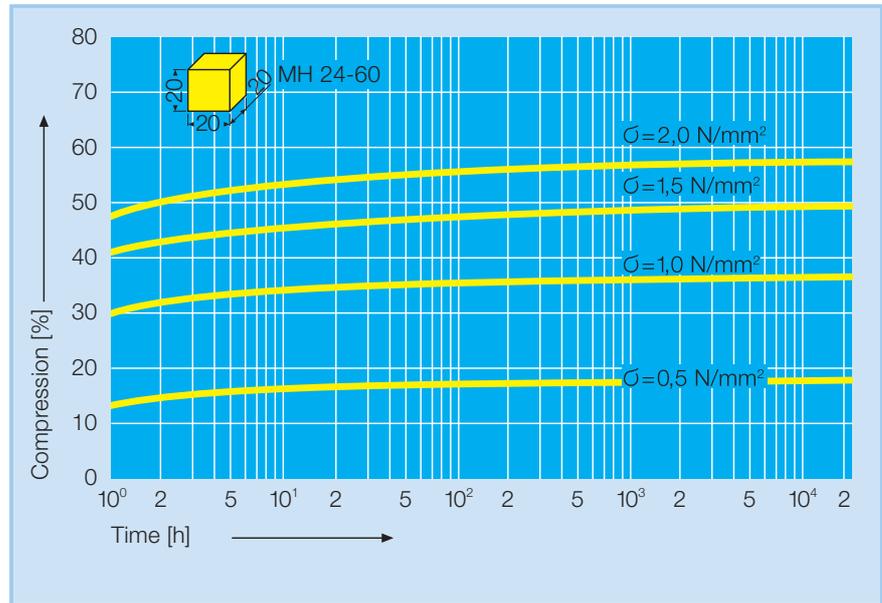
△ Temperature increase caused by damping

# The characteristics

## Static load-related creep

When dimensioning moulded Cellasto components the increased compression over time at constant load – creep – must be considered from the outset. The scale of creep, in comparison with reversible compression, is extremely slight and can generally be neglected in standard applications.

The measurements performed on test specimens – the diagram is but one example of many – are carried out over a period of years. Moreover, extrapolation beyond the time of the measurements is possible due to the linearity of the creep curves.

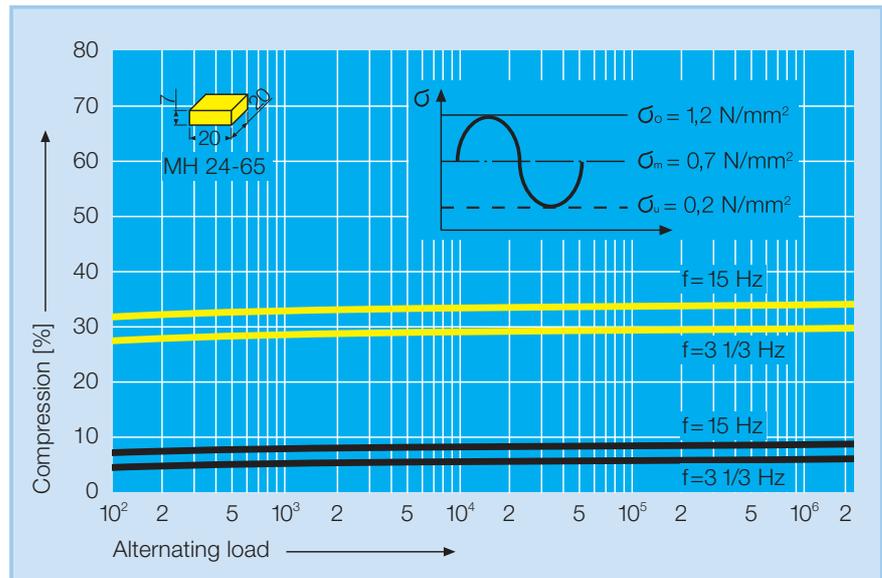


△ Static load-related creep

## Dynamic load-related creep

Under dynamic loading, in addition to the initial load and load amplitude, the frequency and number of load alternations crucially determine deformation. For otherwise identical loads, compression increases with increasing load frequency. The diagrams above indicate the reason for this. Increasing frequency raises the temperature of the Cellasto specimen; the material becomes softer.

The curve in the diagram showing deformation as a function of load alternations flattens out in the force-controlled test. The low increase in deformation accords with the remaining compression set. Hence the specimen approximately returns to its original height at the end of the test.



△ Dynamic load-related creep

## Material characteristics

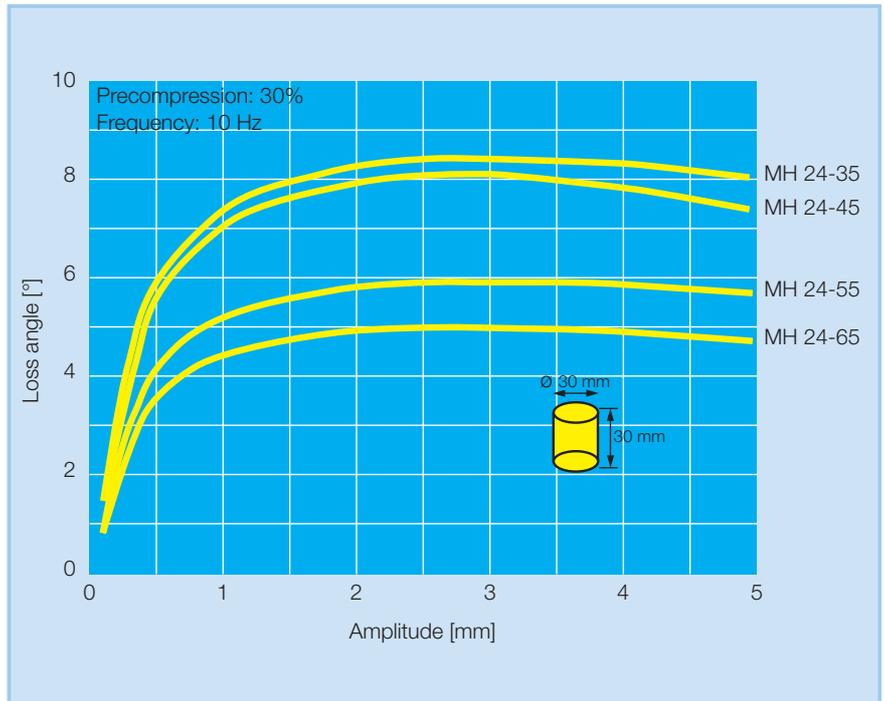
Property	Tested in accordance with	Material designation: Cellasto MH24							Dimension
		-35	-40	-45	-50	-55	-60	-65	
Bulk density	DIN 53 240	350	400	450	500	550	600	650	kg/m <sup>3</sup>
Tensile strength	DIN 53 571 Specimen A	3.0	3.5	4.0	4.5	5.5	6.5	7.0	N/mm <sup>2</sup>
Breaking strength	DIN 53 571 Specimen A	350	350	400	400	400	400	400	%
Tear growth resistance	DIN 53 515	8.0	10.0	12.0	14.0	16.0	18.0	20.0	N/mm
Residual compressive deformation at 50%/70h/20°C	DIN 53 572	3.5	3.5	3.5	3.5	3.5	3.5	3.5	%
	DIN 53 572	5.0	5.0	5.0	5.0	5.0	5.5	5.5	%

# The characteristics

## Amplitude selective damping

For many applications in the field Noise, Vibration and Harshness (NVH) a small damping at low amplitudes of high frequencies is necessary for a good isolation. This is the opposite to large movements where the requirement is rapid damping for dynamic and safe driving purposes. These seemingly contrasting requirements are met equally well with the use of Cellasto.

The diagram clearly shows the steep rise in "loss angle" (a measurement of damping), with the increasing amplitudes for all material densities.

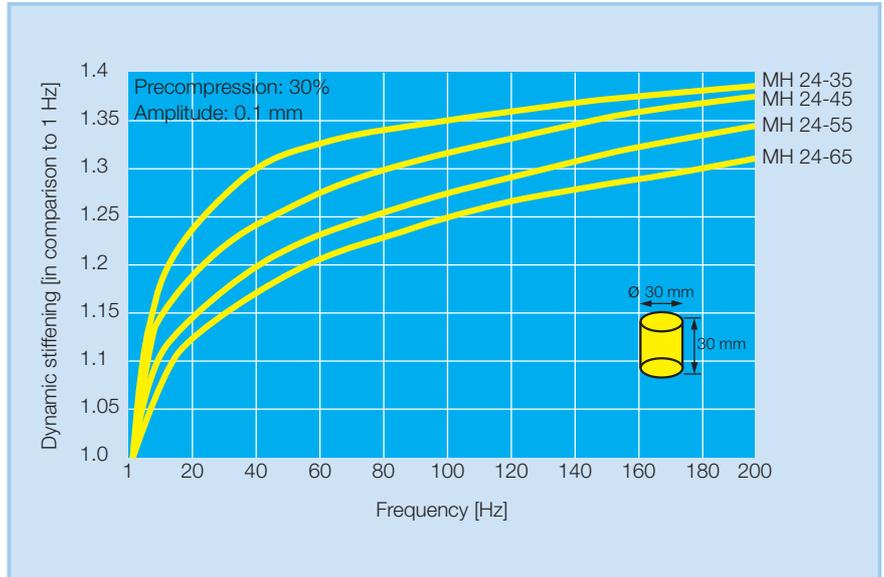


△ Amplitude selective damping

## Dynamic stiffening

Cellasto demonstrates a very low stiffening up to high frequencies. The diagram shows the dynamic stiffening values at high frequencies in comparison to 1 Hz. These values are measured at a precompression of 30 % and an amplitude of 0,1 mm deflection. The stiffening will reduce with the increase of material density.

These qualities show Cellasto as the ideal material for use against vibration and to improve noise isolation when used in the construction of many load carrying bearings.



△ Very low dynamic stiffening

# BASF Polyurethanes GmbH

The semifinished products and components division processes cellular polyurethane elastomers to Cellasto semifinished products and moulded components. This starts with processing the reactive base materials, through the foaming process, to the moulded Cellasto components. Sophisticated process assurance guarantees a high quality standard.

The semifinished products and components division develops the moulded components to customer specifications. Moreover, the company has the backup of wide-ranging experience, up-to-date vibration simulation, CAD technology, tried and tested inspection methods and practice-oriented component testing facilities.

In product development the company has access to the whole research and development potential of the parent company.

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