General Pricing for Elastomer Testing and Data Services

(Prices are shown in US Dollars)

	23C	-40C to 200C	37C in Saline
1 Basic Hyperelastic Properties (Total)	**1155**	**1710**	**2310**
3 Uniaxial Tension Tests	*210*	*315*	*420*
3 Planar Tension (Pure Shear) Tests	*315*	*450*	*630*
3 Equal Biaxial Tests	*630*	*945*	*1260*
2 Volumetric Compression (Bulk Modulus) 3 tests	**250**	**375**	n/a
3 Simple Compression 3 tests	210	315	420
4 Short Term Stress Relaxation (quasi-static)	210	315	420
3 Simple Tension Tests (2000 seconds, 1 strain level)			
5 Strain Rate Sensitivity	1200	2400	2400
3 tension tests at 0.1 s-1, 3 tests at 1 s-1, 3 tests at 50 s-1			
6 Static Tearing	315	450	630
3 Planar Tension Static Tear Tests			
7 Dynamic Short Term Stress Relaxation (up to 50 s-1)	440	660	880
3 Simple Tension Tests (500 seconds, 1 strain level)			
8 Expanded Short Term Stress Relaxation (quasi-static)	460	690	920
3 Simple Tension Tests (2000 seconds, 5-10 strain levels)			
9 Dynamic Mechanical Analysis (DMA) by Forced Vibration	2250	4500	n/a
3 Tests, 8 Mean Strain Levels, 3 Amplitudes, 11 Frequencies			

10 Material Model Calibration, Determine Model Coefficients	
10.1 Hyperelastic Fit and Verification at One Condition (Yeoh, Mooney Rivlin, Ogden ..)	**600**
10.2 Each Additional Condition for the Same Data Set	200
10.3 Hyperelastic Plus Mullins Softening Fit and Verification	750
10.4 Hyperelastic Plus Rate Effects Fit and Verification	850
10.5 Hyperelastic plus Mullins plus Plastic Fit and Verification	1200
11 Thermal Properties	
11.1 Thermal Conductivity, Diffusivity, Specific Heat at **1** temp between –40C and 150C, 3 reps	250
11.2 Thermal Conductivity, Diffusivity, Specific Heat at **5** temps between –40C and 150C, 3 reps	600
11.3 Thermal Expansion from –40C to 150C, 3 repetitions	275
12 Material Preparation Services, Cutting, Slicing, Sectioning of Parts	400

September 18, 2017. Pricing subject to change.

Purchase Order, VISA, MasterCard, AMEX, and Discover Card are accepted methods of payment.
Terms: NET 30 Days after Delivery of Data

a. Data is provided in SI units of MPa for stress and non-dimensional strain. The data is delivered via e-mail in ASCII format.
b. Customer data and materials will be retained for 1 year after initial data delivery.

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Elastomer Testing and Data Services

The objective of the testing services is to define the basic material properties of elastomeric materials.

1. Basic Hyperelastic Properties

3 simple tension specimens, 3 planar tension specimens and 3 equal biaxial specimens are cut from the provided slabs. The specimens are loaded slowly between zero force and a user defined stretch level for 5 loadings and unloadings at up to 4 maximum strain levels to examine the initial stress strain behavior and the “stabilized” stress strain behavior at each of the maximum strain conditions.

2. Volumetric Compression

A specimen is fully constrained and compressed for the purpose of determining the Bulk Modulus of the material. 6.35 mm diameter disks are cut from standard slabs and stacked. The initial slope of this curve is the Bulk Modulus.

3. Simple Compression

A specimen is compressed between zero force and set strain levels.

4. Short Term Stress Relaxation (quasi-static)

Stress and time data is collected continuously at a single set strain level for 2000 seconds.

5. Strain Rate Sensitivity

The rate or speed at which a stress is applied to an elastomer will alter the response of the material. This effect becomes measurable with order of magnitude rate changes.

6. Static Tearing

The static tearing experiment is a meaningful way to examine the failure of an elastomer in tearing. A sharp cut is introduced into a planar tension specimen and the specimen is stretched until the cut grows.

7. Dynamic Short Term Stress Relaxation (up to 50 s-1)

The elastomer is stretched at a high strain rate to a selected strain. Stress and time data is collected continuously for 500 seconds.

8. Expanded Short Term Stress Relaxation Properties (quasi-static)

Stress and time data is collected continuously at multiple set strain levels for 2000 seconds at each level.

9. Dynamic Mechanical Analysis (DMA) by Forced Vibration (0.1 Hz to 200 Hz. typical)

Test specimens are stepped to a mean strain and held. Sinusoidal vibrations are super-imposed on this mean strain and the stress reaction is measured. From this, the dynamic modulus, storage modulus and loss modulus of the material is determined.

10. Material Model Calibration, Determine Model Coefficients

The coefficients are determined for an appropriate elastomeric material model and the resulting fit is reported and compared with the experimental test data.

10.1 Hyperelastic Fit

The hyperelastic model is used to capture the incompressible and complex strain field of elastomeric structural loadings. Since softening and viscoelastic effects are not captured, one or more conditions must be selected to fit.

Multiple models are reviewed and the simplest math model with the best fit is selected. Models considered include Mooney-Rivlin, Neo-Hookean, Yeoh, Ogden, Gent, and Arruda-Boyce.

10.3 Hyperelastic with Mullins Softening Fit

The hyperelastic model is used to capture the incompressible and complex strain field of elastomeric structural loadings. The addition of Mullins to the Hyperelastic material model definition allows the material model to capture the softening resulting from the initial loading and unloading of the elastomer. Mullins in an analysis allows softening on an element-by-element basis so that highly strained regions soften more than lower strained regions. The overall strain range must be selected.

10.4 Hyperelastic with Rate Effects Fit

The hyperelastic model is used to capture the incompressible and complex strain field of elastomeric structural loadings. The addition of Viscoelasticity to the Hyperelastic material model definition allows the material model to capture the change in stiffness resulting from stress decay over time or the change in stiffness from rate of straining changes.

10.5 Hyperelastic plus Mullins plus Plastic Fit

The hyperelastic model is used to capture the incompressible and complex strain field of elastomeric structural loadings. The addition of Mullins to the Hyperelastic material model definition allows the material model to capture the softening resulting from the initial loading and unloading of the elastomer. Additionally, plastic strain effects are included to capture set and plasticity.

11. Thermal Properties

Thermal conductivity, thermal diffusivity and specific heat are determined using the transient plane source method.

Thermal expansion is determined by examining the dimensional change in a material specimen TMA.

12. Material Preparation Services, Cutting, Slicing, Sectioning of Parts

Preparing specimens from supplied material slabs is free of charge. To cut specimens from parts or slabs thicker than 2 mm, a fee for skiving services is involved.