

ASTM D5992 Dynamic Testing of Vulcanized Rubber (Elastomer) and Rubber-Like Materials

TEST METHOD SUMMARY

ASTM D5992 describes several methods for evaluating the dynamic properties of vulcanized rubber (elastomer) and rubber-like materials, and also the products that leverage the properties of these materials in their applications. These often include automotive and related transportation industry functionality performed by tires, springs, dampers, and vibration isolation components such as those used in motor mounts and suspension systems. Other applications with critical mechanical requirements include power transmission couplings, and many flexible, load-carrying devices utilized in a wide variety of industrial, medical, and consumer applications

While ASTM D5992 can be used as a reference standard for general R&D characterization of new materials, it is also frequently used for end-of-line quality control (QC) measurements of stiffness, modulus or damping to ensure production specifications have been achieved. This latter scenario demands quick and accurate dynamic measurements, and the ability to rapidly process pass / fail decision-making.

NOTE: Dynamic test result accuracy of viscoelastic materials is mostly influenced by three factors: (1) thermodynamic, the changing internal temperature of the specimen; (2) mechanical, the physical setup of test apparatus; and (3) instrumentation and electronics, the ability to measure and produce signals proportional to the needed physical parameters. It is also important to recognize that (a) the accuracy of a stiffness measurement can be no better than the accuracy of measurement of force and deflection, (b) the accuracy of a modulus measurement can be no better than the accuracy of measurement of the dimensions of the specimen, and (c) the accuracy of a damping measurement can be no better than the excellence of the attachment between specimen and test machine.

Solutions for ASTM D5992 typically include these types of components:

LOAD FRAME OPTIONS*

Both the MTS Acumen® and the tabletop MTS Landmark® test systems are ideal for conducting dynamic mechanical testing of rubber, elastomer and related polymer materials and components according to ASTM D5992 or similar tests. They offer a variety of force capacities and deliver up to 100 Hz of precise, controlled test protocols to accommodate a wide variety of tests to serve both R&D and QC production lines with manual or automated testing.

The compact MTS Acumen systems' electrodynamic test and measurement system consumes less energy than other technologies, and provides a clean, quiet, and cost-effective system operation as a true plug-and-play system. The MTS Landmark 100 Hz Elastomer Test System is a tabletop system that features MTS servohydraulic actuation technology, and may be the preferred test system when testing requirements demand higher force capacities.

FIXTURE OPTIONS*



MTS Acumen®
 Electrodynamic Test System



MTS Landmark®
 Servohydraulic Test System

Compression/Extension	Bending	Double Lap Shear	Torsion
<p>There are many MTS grips and fixtures that can be used to satisfy the testing requirements of ASTM-D5992 depending on the material, its application, and the force, frequency and temperature expectations of the testing. The ones shown here are intended only as examples.</p>			

CHAMBER OPTIONS*

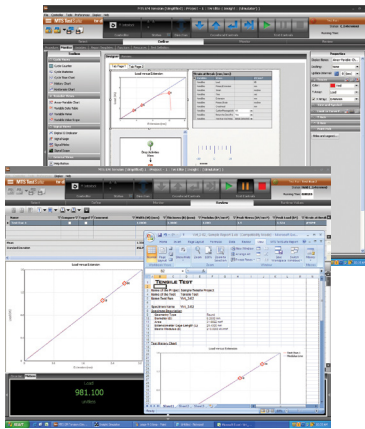
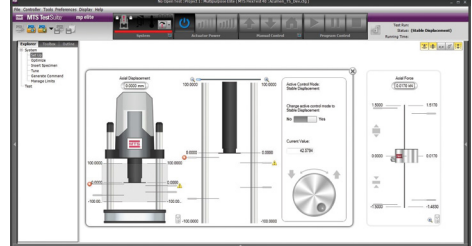
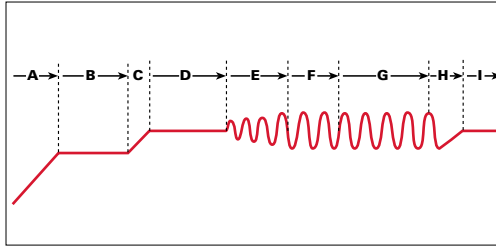
651.05F-01 Chamber



To ensure accurate and consistent results, the MTS 651.05F-01 Environmental Chamber is designed to maintain a constant temperature with very little temperature gradient across the specimen. Heating is achieved with electrical heating elements and a motor-driven fan for diffused convection heat. Cooling is accomplished with liquid nitrogen. It also has a built-in temperature controller, all-welded construction, and Fiberglas™ insulation.

SOFTWARE OPTIONS*

- A. Ramp to zero
- B. Relax at zero
- C. Ramp to mean or set point
- D. Dwell at mean
- E. Converge dynamic amplitude
- F. Precycle
- G. Acquire data cycles
- H. Return to base or mean level
- I. Process data



Dynamic Testing Application Software

To test per ASTM D5992, there are two levels of application software packages available. MTS Model 793.31 (and 793.32) Dynamic Characterization software allows the R&D user to conduct robust dynamic characterization testing with up to four channels of control. The software measures Stiffness (K), Phase Angle, Damping (C), Modulus (E or G), Tan Delta, Glass Transition (Tg), and much more is possible when needed.

Conversely, the ElastomerExpress and MTS Model 793.35 software packages allows operators to easily define and perform tests. Basic laboratory testing profiles minimize the complex layers of setup and decision making into an easy-to-use interface, but still contain the flexibility you need for most dynamic measurements. Production line QC testing profiles are designed specifically for conditional testing and automated decision making, maximizing your throughput and efficiency.

TestSuite Multipurpose System Software

MTS TestSuite Multipurpose Software delivers the test definition, execution, analysis and reporting capabilities required for dynamic testing of rubber (elastomer) and rubber-like materials and components. The intuitive user interface shown here is optimized for MTS Acumen systems. The software lets you graphically build and run tensile, compression, bend, fatigue and fracture, multiaxial, block loading and custom profile tests with efficiency. With its easy-to-use interface, you can test to industry standards or pursue your own interpretation of a standard with customizable "plug-and-play" test methods. The software also captures all setup data and test results, allowing you to quickly repeat tests, analyze data with the stand-alone Analysis Software, and design and create reports with the convenient Excel Add-In.

*NOTE: This technical note is intended to show some of the popular and more common solutions used for this particular application. Most often, additional options are available and necessary to accomplish your more comprehensive test objectives.

APPENDIX - TEST STANDARD REPORTING

Because there are several methods for testing rubber, it is essential that the report state clearly the nature of the test and apparatus employed, the test specimen and its geometry, and the test conditions. A significant part of the description of test conditions involves stating the number of cycles of motion imposed, their frequency, the mean and dynamic strain amplitudes, and any time between test segments during which heat flow out of the rubber and reduction in temperature may occur.



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