

ASTM D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

TEST METHOD SUMMARY

Because the flexural properties of plastics are critical in so many applications, ASTM D790 is one of the most commonly utilized test methods in the plastics industry. It measures the flexural strength and flexural modulus of both reinforced and unreinforced plastics, which also includes high-modulus composites and electrical insulating materials. Determining these mechanical characteristics will allow the proper selection and quality control of plastic materials that undergo bending forces when in operation. As usual, because these materials are sensitive to changes in temperature, testing at application temperature may be necessary.

In this procedure, a three- or four-point loading scheme is applied to a rectangular bar test specimen using a universal test machine and a three- or four-point bend fixture. The strain rate applied depends on the relative amount of specimen deflection, with a faster rate being applied to higher bending materials. The test continues until either the specimen breaks or it reaches 5% deflection. ASTM D790 is very similar to ISO 178, except that the ISO standard test continues until the specimen breaks.

Solutions for ASTM D790 typically include these types of components;

LOAD FRAME OPTIONS*

Both the premium MTS Criterion® and the economical MTS Exceed® universal testing machines are ideal for flexural testing of unreinforced and reinforced plastics and electrical insulating materials per ASTM D790. These test systems come in a variety of force capacities and frame styles, ranging from 1-column tabletops to larger 2-column floor-standing models. The 30kN and 100kN models also have dual zone test spaces to reduce set-up times if you frequently change test requirements. And as an alternative to a new load frame, you can modernize the software and controls of your old test system with an MTS ReNew™ Upgrade.



MTS Criterion®
 Electromechanical Universal Test Systems



MTS Exceed®
 Electromechanical Universal Test Systems



BEND FIXTURE OPTIONS*

Room Temperature Testing		Temperature Testing	
Bend fixtures are generally selected based on the size of the intended test specimen. As examples, the bend fixture on the left is designed for specimens up to 25 mm in width while the bend fixture on the right is suitable for larger specimens, up to 45 mm (1.8 in) in width.		Flexural testing of plastics is often performed at the temperatures that are expected during the end-use applications. As examples, the bend fixture on the left is rated at -50° C to 150° C (-58° F to 302° F) and the bend fixture on the right is rated at -129° C to 177° C (-200° F to 350° F).	

EXTENSOMETRY OPTIONS*

632.06 Displacement Gage	Non-contacting - Video
The versatile 632.06 displacement gage extensometer is ideal for testing plastics and composites according to ASTM D790. It is designed for use where small deformations must be measured and it is protected from overtravel in all directions. The gage arm releases in either a positive or negative overtravel situation or when a side load is applied. This unit also comes with an adjustable mounting block. When properly positioned, the unit can be locked in place.	MTS Advantage™ Video Extensometer (AVX) delivers the highest quality in non-contact strain measurement.

CHAMBER OPTIONS*

	
Advantage Environmental Chamber	FEC 1200 or 1300
The Advantage™ Environmental Chamber designed for Criterion load frames is ideal for testing of elastomeric components, tire cords, plastics, composites, and laminates. It has a temperature range from -129° C to 315° C (-200°F to 600°F), and is compatible with either video or laser extensometers.	The Fundamental™ Environmental Chamber designed for Exceed load frames is also ideal for testing these same thermoplastic and composite materials. It has a temperature range from -70°C to 350°C (-94°F to 662°F) and is likewise compatible with either video or laser extensometers.

SOFTWARE OPTIONS*



ASTM D790 Flexural Properties Test Template	About TestSuite™ TW
<p>To simplify testing to ASTM D790, MTS has developed a TestSuite™ TW test template that will set up and run the recommended flexural tests. After the test data has been collected, reports can display all of the required calculations including flexural stress, flexural strength, flexural strain, stress at break, stress at a given strain, secant and chord modulus, and more.</p> <p>MTS consultants are also available to support any of your plastic thin film / sheeting test applications, test method set-up, and data collection and integration requirements.</p>	<p>This flexible and versatile software application comes in three versions so that you can choose exactly which one best fits your requirements. Lab managers and test creators like TW Elite since it includes all the test definition capacity and flexibility needed to create and edit custom test sequences while accommodating the specific runtime needs of lab personnel. Test operators prefer the simplicity and intuitive nature of TW Express. This software allows operators to easily execute tests and monitor data or calculated values in runtime views. For QA/QC labs that prefer the MTS Exceed universal test machine, TW Essential will provide both the test creation and test operation capabilities, combining efficiency and productivity in one software application.</p>

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

APPENDIX - TEST SPECIMEN DETAIL

<p>Flexural test specimens are in the form of rectangular bars and may be cut from sheets, plates, or molded shapes, or may be molded to the desired finished dimensions. ASTM D790 segments these materials and provides significant specimen size guidance according to the categories listed on the right.</p> <p>MTS recommends that you test a consistent size specimen bar when possible. Varying test specimen sizes not only require unique dimensional recording for each test that you run, but generally also requires adjustment to the 3-point bend span length and the speed of each test. This will prolong your test time and potentially introduce testing errors.</p>	Laminated Thermosetting Materials and Sheet and Plate Materials Used for Electrical Insulation
	Molding Materials (Thermoplastics and Thermosets)
	High-Strength Reinforced Composites, including Highly Orthotropic Laminates
	Sheet Materials Not Listed Above



MTS Systems
 14000 Technology Drive
 Eden Prairie, MN 55344-2290 USA
 Telephone: 1-952-937-4000
 Toll Free: 1-800-328-2255
 E-mail: info@mts.com
 www.mts.com

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