MTS Landmark®
Servohydraulic Test Systems

MTS Criterion®
Electromechanical Universal Test Systems

ASTM D3518 In-Plane Shear Response of Polymer Matrix Composite Materials

TEST METHOD SUMMARY

The tensile test of a ±45° laminate is used to determine the in-plane shear response of polymer matrix composite materials. Uniaxial tensile force is applied in accordance to ASTM D3039, to a flat test specimen up to 5% shear strainstrain to investigate the in-plane shear stress/strain response, and critical mechanical materials properties including shear modulus and shear strength. Composite materials addressed in this standard include reinforced by continuous high-modulus fibers in the form of unidirectional layers with the fibres oriented at ± 45° symmetrical to the specimen main axis.

The ± 45° in-plane shear test is performed by placing a test specimen in the grips of either a servohydraulic or an electromechanical testing machine and subjecting it to controlled tension load up to 5% shear strain. The specimen response can be measured with a contacting or non-contacting extensometer, or strain gages.

Solutions for ASTM D3518 typically include these types of components:

LOAD FRAME OPTIONS*

The MTS Landmark servohydraulic test systems and MTS Criterion electromechanical universal test systems are ideal for performing accurate and repeatable monotonic testing of polymer matrix composite materials per ASTM D3518.

The MTS Landmark system's innovative test frame design exhibits superior stiffness and alignment capabilities. The test system integrates the latest MTS servohydraulic technology including precision-machined columns for consistently tight alignment, fatigue-rated MTS actuators with low-friction bearings, smooth-ramping hydraulic service manifolds, and SilentFlo™ hydraulic power units that are quiet enough to be located directly in the laboratory.

The compact MTS Criterion test system features high-resolution MTS digital controls, linear motion guides for superior alignment, high-speed, low vibration MTS electromechanical drives, optional Dual Zone test space for maximizing efficiency and anti-rotation grip/fixture mounting to minimize shear stresses on the specimen.

CHAMBER OPTIONS*

MTS Series 651 Environmental Chamber

» Temperature range of -150°C to 540°C (-240°F to 1000°F)
» Designed for MTS Landmark systems
» Compatible with video extensometers

MTS Advantage™ Environmental Chamber

» Temperature range of -129° C to 315° C (-200°F to 600°F)
» Designed for MTS Criterion systems
» Compatible with video extensometers

EXTENSOMETRY OPTIONS*

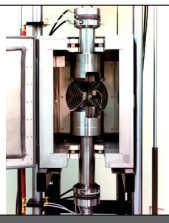
MTS Advantage Video Extensometer (AVX)

» Delivers the highest quality in non-contact axial and cross-sectional strain measurement
» Multiple camera option to support strain averaging of opposite sides of the specimen

MTS Contact Extensometers (Axial Model 634.31 & Transverse Model 632.18)

» Temperature range of -100°C to 175 °C (-150°F to 350°F)
» Repeatable strain measurement devices with quick attach fixture
» Ideal for measuring axial & transverse strain on specimens with rectangular cross sections

GRIP OPTIONS*

		
Model 647 Side-Loading Hydraulic Wedge Grips	**Model 647 All-Temperature Side-Loading Hydraulic Grips**	**MTS Advantage Side-loading Mechanical Wedge Grips**
» Temperature range of -40°C to 175°C (-40°F to 350°F) » Stiff mounting ensures superior alignment capabilities and repeatable gripping to minimize bending strains » Tension, Compression & Fatigue capability » Adjustable gripping force to prevent slippage and squashing of the test specimen	» Temperature range of -130°C to 315°C or 540°C (200°F to 600°F or 1000°F) » Thermal gradients as low as 1.6°C (3°F) ensure reduced variability » Remotely operated grips support rapid specimen change without cooling for increased productivity	» Temperature range of -130°C to 315°C (-200°F to 600°F) » Easy installation and removal with standard pinned adapter » Self-tightening during test reduces slipping » The gripping force is applied perpendicular to the specimen for smooth application of the gripping force and minimal pulling » Tension grips

GRIP FACE OPTIONS*

	
Model 647 Grip Faces	**MTS Advantage Grip Faces**
» Surfalloy finish provides rough surface for firm gripping of composite specimen without tabs » Diamond-tipped for increased holding capacity of composite specimen with tabs » Water-cooled and extra wide options available	» Surfalloy finish provides rough surface for firm gripping of composite specimen without tabs » Serrated for secure gripping of soft composite specimen with tabs

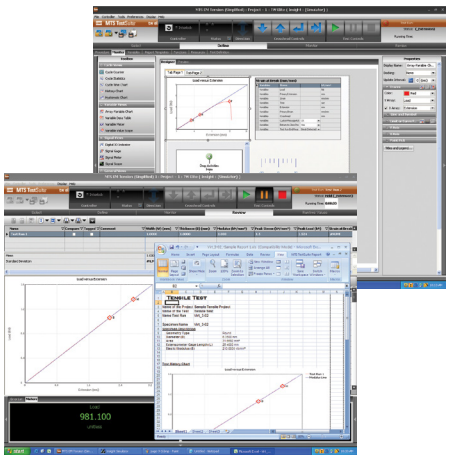
ALIGNMENT OPTIONS*

MTS Alignment Solutions

Specimen misalignment introduces data scatter, which forces the need to test larger batches of specimens and increases the operational cost. Both test systems can be equipped with stiff-mounted grips and an easy-to-implement load frame alignment solution to help drive test machine variability out of the material testing equation.

SOFTWARE OPTIONS*

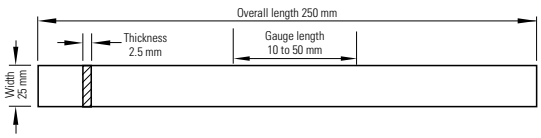
ASTM D3518 In-Plane Shear Response Test Template	About MTS TestSuite™ TW
To simplify testing to ASTM D3518, MTS has developed a TestSuite TW test template that will set up and run the recommended tensile ± 45° in-plane shear tests. The templates support the use of strain gages or extensometers for strain measurement. Reports can display all of the required calculations including in-plane shear stress / strain plot, shear modulus and shear strength. MTS consultants are also available to support your composite applications, test method set-up, and data collection and integration requirements	The efficient MTS TestSuite TW software provides the versatility required to address unique and complex testing requirements. twe TestSuite TW Elite includes all the test definition capacity and flexibility test designers need to create and edit custom test sequences while accommodating the specific runtime needs of lab personnel. twx TW Express is designed for the test operator and is used to run tests created with TW Elite. This application allows the operator to easily execute even the most complex tests and monitor data or calculated values in runtime views that can be tailored by both test designers and operators.



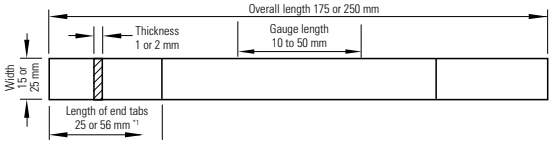
*NOTE: This technical note is intended to show some of the popular and more common solutions used for this particular application. Most often, additional options are available and necessary to accomplish your more comprehensive test objectives.

APPENDIX - TEST SPECIMEN DETAIL

Specimen without tabs



Specimen with tabs



*1 Thickness of end tabs 1.5 mm

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