

Tensile Properties

ASTM D638 vs. ASTM D3039

As Leaders of Plastics and Composites Testing, Intertek experts are often asked when it is appropriate to perform tensile testing to ASTM D638 (Standard Test Method for Tensile Properties of Plastics) vs. ASTM D3039 (Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials). In summary, ASTM D3039 is recommended for highly oriented and/ or high tensile modulus fiber reinforced polymer composites. ASTM D638 is recommended for randomly oriented, discontinuous, moldable, or low reinforcement volume composites or composites with tensile modulus less than 3 MSI.





Please note: This reference guide is generic in nature and aimed at providing a descriptive summary to enhance test understanding. For more information please contact an Intertek PTL Technical Representative (iptl@intertek.com). Due to copyright restrictions, we are not able to provide copies of standards. Standards can be obtained from appropriate standards authorities.

At Intertek PTL we have the ability to provide rapid data to assist with material selection and quality control for a variety of industries including aerospace, automotive, building, energy and medical.

Quick Reference Guide to Determining Appropriate Tensile Testing Methods for Polymer and Composites Materials ASTM D638 vs ASTM D3039

Grips:

Both ASTM D638 and D3039 require fixed or self aligning, however for ASTM D3039 alignment highly recommended, < 3 to 5% bending considered good testing practice due to the fact that it has been generally shown that over 5% bending decreases ultimate failure strength. Intertek PTL performs ASTM D3039 on a universal testing with state of the art alignment fixture and up to 100 kN capacity.

Extension Indicators:

ASTM D638 uses extensometers exclusively; however D3039 allows for strain gages and more accurate extensometers for more accurate ultimate strength measurement.

- ASTM D638 Extensometers measures Elastic Modulus by ASTM E83 B2; Low extension measurements by Class C or +/- 1% of the indicated value — whichever is better; and for High extension: +/- 10% of the indicated value or better.
- ASTM D3039 Extensometers measures Elastic Modulus by ASTM E83 B1, Transverse Strain: ASTM E83 B1 or A1 for stiff materials. Strain Gage recommendations are 0.250" active gage length, 350 Ohm, ±3%, 1 to 2 V excitation, Linear or Poisson's ratio Rosette. Wire and gage material based on test conditions.

Specimen Types:

- ASTM D638 outlines a variety of specimens for Sheets, Plates, & Molded Plastics- check material specifications!
- ASTM D3039 uses a rectangular cross section with tabbing recommended for unidirectional material.

Conditioning:

- ASTM D638 follows ASTM D618 procedure A and section 7, 40+ hours 23 ± 2°C at 50 ± 10% RH. However, material specification may instruct otherwise.
- For ASTM D3039, ASTM D5229/D5229 M recommended (Standard Test Method for Moisture Absorption Properties and Equilibrium Conditioning of Polymer Matrix Composite Materials). However it is not required if not instructed by requestor. Exposure conditions and moisture content to be reported.

Recommended Test Speeds:

- ASTM D638 is 5 to 500 mm/min (0.2 to 20 in/min) using the lowest speed that ruptures the specimen within ½ to 5 minutes.
- ASTM D3039 is 2 mm/min (0.05 in/min), 0.1 min⁻¹ using the lowest speed that ruptures the specimen within 1 to 10 minutes.

Data report:

- ASTM D638 and ASTM D3039 record load versus extension curves and other data points of interest, however ASTM D3039 also records failure mode.

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Intertek PTL (Pittsfield MA) is A2LA (ISO 17025) Accredited to perform ASTM D638 and ASTM D3039 and has a Nadcap Accreditation AC7122/1 for Testing Aerospace and Automotive Composites. Learn more at <http://www.intertek.com/polymers/composites/nadcap/>

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