AS 1145—1989

Australian Standard®

Determination of tensile properties of plastics materials

This Australian Standard was prepared by Committee PL/10, Methods of Testing Plastics. It was approved on behalf of the Council of Standards Australia on 12 December 1988 and published on 12 May 1989.

The following interests are represented on Committee PL/10:

CSIRO, Division of Building, Construction and Engineering

National Association of Testing Authorities

Plastics Institute of Australia

Telecom Australia

This Standard was issued in draft form for comment as DR 87072.

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First published as AS 1145 — 1972.
Second edition 1989.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140
ISBN 0 7262 5486 X

PREFACE

This Standard was prepared by Standards Australia's Committee on Methods of Testing Plastics, to supersede AS 1145—1972, *Method for determination of tensile properties of plastics materials*, as part of the organization's policy of revising older Standards.

In this edition the range of application has been extended to cover reinforced laminates, and account has been taken of BS 2782, *Methods of testing plastics, Part 3: Mechanical properties: Methods 320A to 320F. Tensile strength, elongation and elastic modulus*, and ISO/R527, *Plastics—Determination of tensile properties.*

Statements expressed in mandatory terms in Notes to Tables and Figures are deemed to be requirements of this Standard.

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FOREWORD

Tensile properties of plastics may vary with specimen preparation, speed of testing and environment of testing. Consequently, when precise comparative results are required, these factors should be carefully controlled. The sensitivity of plastics materials to rate of straining and environmental conditions necessitates testing over a broad load-time scale and range of environment, if tensile properties are to be used for engineering design.

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Determination of tensile properties of plastics materials

1 SCOPE. This Standard specifies a method for determining the tensile properties of plastics in the form of standard test specimens under defined conditions such as pretreatment, temperature, humidity and speed of testing.

The following range of materials may be tested in accordance with this Standard:

(a) Flexible thermoplastic sheet, extrusion and moulding compounds.

(b) Rigid thermoplastic and thermosetting sheet, extrusion and moulding compounds.

(c) Rigid thermoplastic materials for injection moulding, including filled or fibre-reinforced compounds.

(d) Reinforced thermoplastic sheet.

(e) Industrial and decorative laminates with reinforcement, in the form of sheet.

(f) Thermosetting composites with reinforcement in the form of random fibres, mat, woven coarse yarn cloth, woven fine yarn cloth or woven roving.

(g) Fibre reinforced materials with unidirectional reinforcing, including prepregs.

(h) Finished products made from these materials.

This Standard is not suitable for determining the tensile properties of plastics sheet or film, the thickness of which is less than 1 mm.

This Standard is not suitable for determining the tensile properties of cellular materials.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS	
1327	Standard environments for conditioning and testing plastics materials
1545	Methods for the calibration and grading of extensometers
1984	Vernier callipers
2102	External micrometers
2103	Dial gauges and dial test indicators
2193	Methods for calibration and grading of force-measuring systems of testing machines

3 DEFINITIONS. For the purpose of this Standard the definitions below apply:

NOTE: Appendix A explains the relationship of some of these definitions.

3.1 Flexible plastics—a plastics material that has a modulus of elasticity in tension of less than 700 MPa.

3.2 Gauge length—the original length between the gauge marks of the test specimen over which the change of length is determined.

3.3 Modulus of elasticity (Young's modulus)—the ratio of tensile stress to corresponding strain, when determined below the proportional limit.

NOTE: The stress/strain relationship of many plastics does not conform to Hooke's law throughout the elastic range, but deviates even at stresses well below the yield point. For such materials, the slope of the tangent to the stress/strain curve at a low strain is usually taken as the modulus of elasticity.

3.4 Offset yield point—the point on the tensile stress/strain curve at which the curve departs from initial linearity by a specified strain (see Figure A1, Appendix A).

3.5 Offset yield stress—the tensile stress on the stress/strain curve where the curve departs from initial linearity by a specified strain.

3.6 Percentage elongation—the elongation produced in the gauge length of the test specimen by a tensile stress, expressed as a percentage of the gauge length.

3.7 Percentage elongation at break or at maximum load—the elongation produced in the gauge length of the test specimen at break or at maximum load expressed as a percentage of the gauge length.

3.8 Percentage elongation at yield—the elongation produced in the gauge length of the test specimen at the yield point, expressed as a percentage of the gauge length.

3.9 Proportional limit—the greatest stress that a material is capable of supporting without any deviation from proportionality of stress to strain (Hooke's law).

3.10 Rigid plastics—a plastics material that has a modulus of elasticity in tension equal to or greater than 700 MPa.

3.11 Secant modulus—in general, the ratio of stress to strain at any given point on the stress/strain curve.

NOTE: See Figure A3, Appendix A for a diagrammatic representation of secant modulus.

3.12 Strain—the change in length per unit original length of the measured gauge length of the test specimen.

NOTE: Strain is a dimensionless ratio, and may be specified directly, or as a percentage of the original length.

3.13 Tangent modulus—instantaneous rate of change of stress as a function of strain. It is the slope at any point on a stress/strain diagram.

3.14 Tensile strength (nominal)—the maximum tensile stress (nominal) sustained by the test specimen during a tensile test.

3.15 Tensile stress at break—the tensile stress at which break of the test specimen occurs.

3.16 Tensile stress (nominal)—the tensile force per unit area of the original cross-section, within the gauge length, carried by the test specimen at any given moment.