AS 2291—1979

Australian Standard®

METHODS FOR THE TENSILE TESTING OF METALS AT ELEVATED TEMPERATURES

The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Aluminium Development Council

Australasian Institute of Metals

Bureau of Steel Manufacturers of Australia

Commonwealth Scientific and Industrial Research Organization

Confederation of Australian Industry

Department of Defence

Federal Chamber of Automotive Industries

Metal Trades Industry Association of Australia

National Association of Testing Authorities

Railways of Australia Committee

Society of Automotive Engineers — Australasia

University of Melbourne

University of Sydney

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PREFACE

This standard was prepared by the Association's Committee on the Mechanical Testing of Metals under the direction of the Metal Standards Board.

During preparation of the standard, the committee considered BS 3688: 1963, Methods for Mechanical Testing of Metals at Elevated Temperatures, Part 1 — Tensile Testing, and ASTM E21, Recommended Practice for Elevated Temperature Tension Tests for Metallic Materials.

As far as practicable the standard has been aligned with AS 1391, Methods for Tensile Testing of Metals.

Generally, proof stress and yield stress are the most important properties of metals determined at high temperatures. However, as many laboratories carry out tests to determine the tensile strength, the elongation and the percentage reduction of area, provisions for determining these properties have been included in the standard.

This standard requires reference to the following Australian and British standards:

AS 1545 Methods for the Calibration and Grading of Extensometers

AS 2193 Methods for Calibration and Grading of Force-measuring Systems of Testing Machines

BS 1041 Code for Temperature Measurement

BS 3894 Method for Converting Elongation Values for Steel.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

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FOREWORD

Dimensions for test pieces specified in this standard have been selected in the interests of standardization. It should not be assumed that geometrically similar round test pieces or rectangular test pieces always give comparable values of ductility.

METHODS

1 SCOPE. This standard sets out methods by which a test piece of metal is strained in uni-axial tension at elevated temperature in order to determine one or more of its tensile properties. It defines the properties to be determined and the terms used in describing tests and test pieces. It specifies the dimensions of standard test pieces, temperature requirements and methods of tensile testing.

This standard does not specify the properties to be determined; these are stated in the product specification.

2 DEFINITIONS. For the purpose of this standard, the following definitions apply (see also Clause 3 and the appropriate figures):

2.1 Test sample—a portion of material or product or a group of items selected from a batch or consignment by a sampling procedure.

2.2 Test specimen—a portion or a single item taken from the test sample for the purpose of applying a particular test.

2.3 Test piece—a prepared piece for testing, made from a test specimen by some mechanical operation.

2.4 Gauge length—the prescribed part of the cylindrical or prismatic portion of the test piece, i.e. test section, on which extension is measured.

2.4.1 *Original gauge length* (L_o)—the gauge length at room temperature before the test piece is strained.

2.4.2 *Final gauge length* (L_u)—the gauge length at room temperature after the test piece has been fractured and the fractured parts have been carefully fitted together so that they lie in a straight line.

2.4.3 *Extensometer gauge length* (L_e)—the original length at room temperature of the parallel portion of the test piece used for the measurement of the extension by means of an extensometer.

NOTE: The length may differ from L_o and may be of any value greater than b or 2*d* (see Clause 3), but must not be more than $L_e - 0.5\sqrt{S_o}$.

2.4.4 *Extensometer equivalent elastic gauge length* (L_q)—the parallel length at room temperature which would give the same elastic extension as that determined experimentally by an extensometer attached to the reference marks on the enlarged ends of the test piece.

2.4.5 *Modified parallel gauge length* (L_m)—the length of the reduced section of the test piece between the points on the transition radii at which the mean diameter (or width) is 1.05 times the mean diameter (or mean width) of the parallel section.

2.5 Strain—the increase of length per unit length.

2.5.1 *Nominal strain*—the increase in length, at any moment during the test, divided by the original unit length.

NOTE: Strain does not include thermal expansion.

2.6 Extension—the increase of the gauge length.

NOTE: Extension does not include thermal expansion.

2.7 Elongation—extension expressed as a percentage of the original gauge length (see Clause 7.4).

2.7.1 *Percentage elongation after fracture (A)*—the extension after fracture (L_u–L_o), expressed as a percentage of the original gauge length (L_o).

2.8 Percentage reduction of area after fracture (Z)—the maximum change in cross-sectional area (S_o–S_u) measured after fracture, expressed as a percentage of the original cross-sectional area (S_o), where (S_u) is the minimum cross-sectional area after fracture, the measurements being made at room temperature.

2.9 Maximum force (F_m)—the greatest force which the test piece withstands during the test.