Australian Standard®

Methods for impact tests on metals

Part 2: Charpy V-notch

This Australian Standard was prepared by Committee MT/6, Mechanical Testing of Metals. It was approved on behalf of the Council of Standards Australia on 10 November 1988 and published on 13 March 1989.

The following interests are represented on Committee MT/6:

Aluminium Development Council
Bureau of Steel Manufacturers of Australia
CSIRO, Division of Applied Physics
Confederation of Australian Industry
Department of Defence
Federal Chamber of Automotive Industries
Metal Trades Industry Association of Australia
National Association of Testing Authorities, Australia
Railways of Australia Committee
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PREFACE

This Standard was prepared under the direction of the Standards Australia Committee on Mechanical Testing of Metals to supersede AS 1544.2—1975.

This Standard is one in the AS 1544 series of Standards covering impact testing of metals. Others in the series are as follows:

AS
1544.1 *Izod*

1544.3 *Charpy U-notch and keyhole notch*

1544.4 *Calibration of the testing machine*

1544.5 *Assessment of fracture surface appearance of steel*

This edition introduces two technical changes to the Standard. These are as follows:

1. The introduction of a requirement for dynamic validation using standardized test pieces to verify the calibration procedure. This has been shown to be necessary from the results of a proficiency testing program conducted by the National Association of Testing Authorities during October 1986.

   For many years, verification using standardized test pieces has been a requirement of ASTM E23, *Methods for notched bar impact testing of metallic materials*, for the calibration of Charpy machines. These test pieces are obtained from sources which are nationally recognized. The principal known recognized source is the USA, through ASTM, although standardized test pieces are becoming more widely available from other countries.

   The verification requirements for this Australian Standard are not as stringent as those required by ASTM E23. It is expected that this situation will be reconsidered in the next revision. This edition allows the use of secondary standard test pieces for verification after replacement of striker or anvil parts, as would occur when changing the machine from the Izod to Charpy mode.

2. The acceptance of test results from machines complying to ASTM E23 as being at least equivalent to those obtained when testing to this Standard; such results are accepted as complying with this Standard.

   The major difference between testing machines conforming to this Australian Standard and those conforming to ASTM E23 is in the radius of curvature of the tip of the striker. This Standard specifies a nominal 2 mm radius, while ASTM E23 specifies a nominal 8 mm radius. It has been shown that these differences cause a negligible effect on the test results.

   Draft ISO document N20, *Verification of pendulum impact testing machines for testing metallic materials*, allows the optional use of either the 2 mm or the 8 mm striker radius. This ISO draft also introduces requirements for dynamic verification.

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FOREWORD

The Charpy V-notch Impact Test is a pendulum-type single-blow impact test in which the test piece, V-notched in the middle and supported at both ends as a simple beam, is broken by a falling pendulum which strikes the test piece opposite the notch. The energy absorbed is determined from the subsequent rise of the pendulum.

It should be noted that no trustworthy relationship has been found between the energies absorbed in breaking test pieces of different dimensions, and comparison of results is valid only where considering test pieces of identical form and dimensions.

It is known that energy is absorbed other than by fracturing the test piece. It is assumed that this energy is absorbed by items such as the test piece supports, the machine foundation and framework, the pendulum and striker, translation to the broken part of the test piece, and drag of a partially broken test piece. No allowance is made for this energy, as suitable methods and apparatus have not yet been developed for measuring either its total value or the values of its constituent parts.

STANDARDS AUSTRALIA

Australian Standard
Methods for impact tests on metals

Part 2: Charpy V-notch

1 SCOPE. This Standard specifies the conditions for performing the Charpy V-notch impact test on metals, with particular reference to ferrous metals. It also includes requirements for the installation of the testing machine, its initial and periodic calibration, and recommendations for its maintenance by the user.

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

AS
1544 Methods for impact tests on metals
1544.4 Part 4: Calibration of the testing machine
1544.5 Part 5: Assessment of fracture surface appearance

ASTM
E23 Standard methods for notched bar impact testing of metallic materials

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

3.1 Centre of percussion—that point in a pendulum at which a blow, delivered in a tangential direction, will cause no reaction at the centre of rotation.

3.2 Initial potential energy—the energy theoretically available in a pendulum-type impact testing machine when the pendulum is returned from its striking position to its initial release position.

3.3 Length of pendulum—the distance from the axis of rotation of the pendulum to the impact point of the pendulum, on a standard test piece.

3.4 Point of impact—the midpoint of the line of contact between the striking edge and the test piece.

3.5 Sample—a portion of material or a group of items selected from a batch or consignment by a sampling procedure.

3.6 Secondary standard test pieces—Charpy test pieces having an assigned impact value obtained from tests performed upon a verified testing machine.

3.7 Standardized test pieces—Charpy test pieces from a nationally recognized source which have certified impact values for testing machine verification purposes.

3.8 Striking energy—the kinetic energy of the pendulum of the testing machine at the instant of impact.

3.9 Striking velocity—the linear velocity of the striking edge at the instant of impact.

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

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

3.12 Verification—proving of calibration procedures by testing of standardized test pieces.

4 TESTING MACHINE.

4.1 General. The testing machine shall be of the pendulum type, and shall be so constructed that the loss of energy (such as from translation, rotation or vibration) in the machine framework and pendulum during a test, is negligible.

Charpy machines meeting the requirements of ASTM E23 shall be deemed to comply with this Standard (see Preface).

4.2 Installation, calibration and maintenance. The machine shall be installed and calibrated in accordance with Clauses A1 and A2 of Appendix A. It shall be recalibrated periodically, and when otherwise necessary, in accordance with Clause A2 of Appendix A.

The machine should be maintained in satisfactory working order and condition in the intervals between successive recalibrations, in accordance with Clause A3 of Appendix A.

4.3 Test piece supports. The test piece supports consist of two mutually perpendicular surfaces extending on each side of, and normal to, the plane of swing of the pendulum. Essentially, one of these divided surfaces supports the weight of the test piece and the other takes the reaction from the impact blow on the test piece. The corresponding parts of the divided surfaces are coplanar. The level of the supports shall be such that the longitudinal axis of a supported test piece is parallel within 2:1000 to the reference surface of the machine.

The supports shall be of hardened steel. They shall be attached rigidly to the frame of the machine and shall satisfy the following conditions (see Figure 1):

(a) Distance between supports . . . . 40 +0.5, –0 mm.

(b) Radius of curvature . . . . . 1.0 mm to 1.5 mm.

(c) Taper of supports (see Note 1) . . . . 1 ±0.1, in 5.

(d) Angle of supports (see Note 2) . 90 ±0.1 degrees.

NOTES:

1. Machines manufactured with supports having an included angle of 78 degrees to 80 degrees are acceptable.
2. A relieving recess is provided at the junction of the two support surfaces.