



Standard Test Methods for Notched Bar Impact Testing of Metallic Materials¹

This standard is issued under the fixed designation E 23; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

^{e1} NOTE—Editorial changes made throughout in September 2007.

1. Scope

1.1 These test methods describe notched-bar impact testing of metallic materials by the Charpy (simple-beam) test and the Izod (cantilever-beam) test. They give the requirements for: test specimens, test procedures, test reports, test machines (see [Annex A1](#)) verifying Charpy impact machines (see [Annex A2](#)), optional test specimen configurations (see [Annex A3](#)), pre-cracking Charpy V-notch specimens (see [Annex A4](#)), designation of test specimen orientation (see [Annex A5](#)), and determining the percent of shear fracture on the surface of broken impact specimens (see [Annex A6](#)). In addition, information is provided on the significance of notched-bar impact testing (see [Appendix X1](#)), methods of measuring the center of strike (see [Appendix X2](#)).

1.2 These test methods do not address the problems associated with impact testing at temperatures below $-196\text{ }^{\circ}\text{C}$ ($-320\text{ }^{\circ}\text{F}$, 77 K).

1.3 The values stated in SI units are to be regarded as the standard. Inch-pound units are provided for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in [Section 5](#).

2. Referenced Documents

2.1 ASTM Standards:²

¹ These test methods are under the jurisdiction of ASTM Committee E28 on Mechanical Testing and are the direct responsibility of Subcommittee E28.07 on Impact Testing.

Current edition approved June 1, 2007. Published July 2007. Originally approved in 1933. Last previous edition approved 2007 as E 23 – 07.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

B 925 Practices for Production and Preparation of Powder Metallurgy (P/M) Test Specimens

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E 399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials

E 604 Test Method for Dynamic Tear Testing of Metallic Materials

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E 1313 Guide for Recommended Formats for Data Records Used in the Computerization of Mechanical Test Data for Metals

3. Summary of Test Method

3.1 The essential features of an impact test are: a suitable specimen (specimens of several different types are recognized), a set of anvils, and specimen supports on which the test specimen is placed to receive the blow of the moving mass, a moving mass that has sufficient energy to break the specimen placed in its path, and a device for measuring the energy absorbed by the broken specimen.

4. Significance and Use

4.1 These test methods of impact testing relate specifically to the behavior of metal when subjected to a single application of a force resulting in multi-axial stresses associated with a notch, coupled with high rates of loading and in some cases with high or low temperatures. For some materials and temperatures the results of impact tests on notched specimens, when correlated with service experience, have been found to predict the likelihood of brittle fracture accurately. Further information on significance appears in [Appendix X1](#).

5. Precautions in Operation of Machine

5.1 Safety precautions should be taken to protect personnel from the swinging pendulum, flying broken specimens, and hazards associated with specimen warming and cooling media.

6. Apparatus

6.1 General Requirements:

6.1.1 The testing machine shall be a pendulum type of rigid construction.

6.1.2 The testing machine shall be designed and built to conform with the requirements given in **Annex A1**.

6.2 Inspection and Verification

6.2.1 Inspection procedures to verify impact machines directly are provided in **A2.2** and **A2.3**. The items listed in **A2.2** must be inspected annually.

6.2.2 The procedures to verify Charpy V-notch machines indirectly, using verification specimens, are given in **A2.4**. Charpy impact machines must be verified directly and indirectly annually.

7. Test Specimens

7.1 Configuration and Orientation:

7.1.1 Specimens shall be taken from the material as specified by the applicable specification. Specimen orientation should be designated according to the terminology given in **Annex A5**.

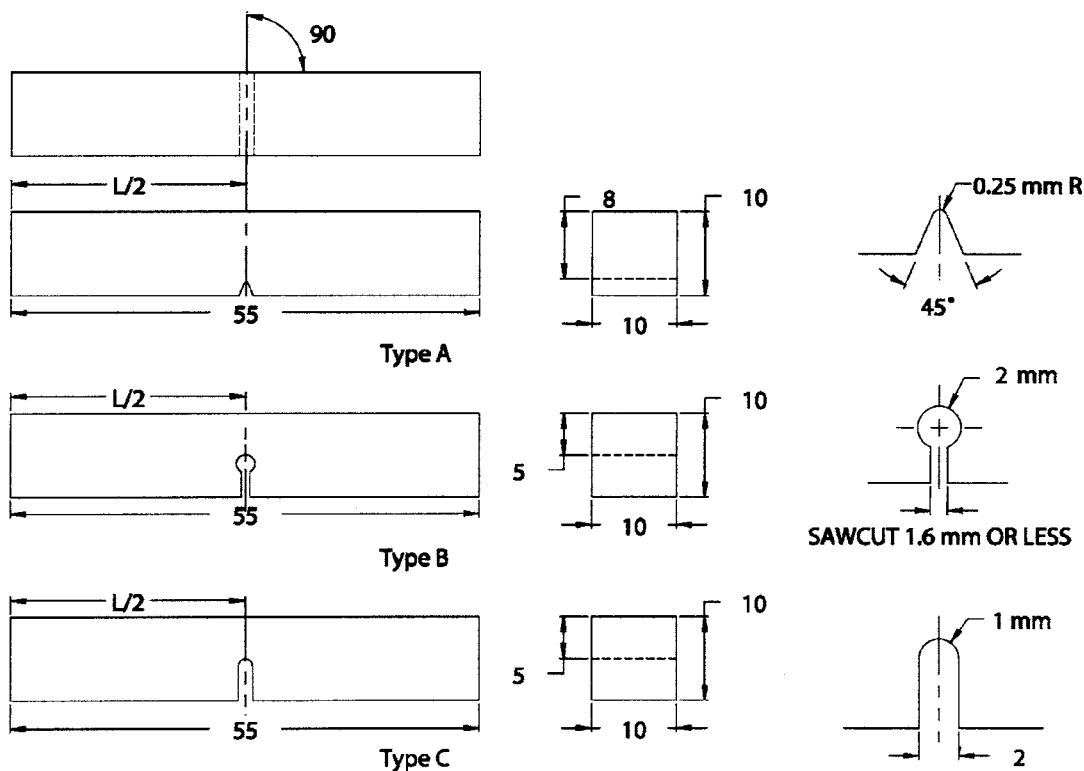
7.1.2 The type of specimen chosen depends largely upon the characteristics of the material to be tested. A given specimen may not be equally satisfactory for soft nonferrous metals and hardened steels; therefore, many types of specimens are recognized. In general, sharper and deeper notches are required to distinguish differences in very ductile materials or when using low testing velocities.

7.1.3 The specimens shown in **Figs. 1 and 2** are those most widely used and most generally satisfactory. They are particularly suitable for ferrous metals, excepting cast iron.³

7.1.4 The specimen commonly found suitable for die-cast alloys is shown in **Fig. 3**.

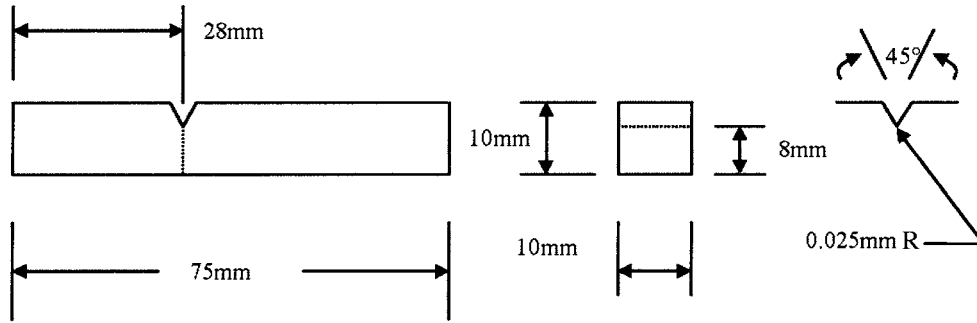
7.1.5 The specimens commonly found suitable for Powder Metallurgy (P/M) materials are shown in **Figs. 4 and 5**. P/M impact test specimens shall be produced following the procedure in Practice **B 925**. The impact test results of these materials are affected by specimen orientation. Therefore,

³ Report of Subcommittee XV on Impact Testing of Committee A-3 on Cast Iron, Proceedings, ASTM, Vol 33 Part 1, 1933.



Notch length to edge	90 ± 2°
Adjacent sides shall be at	90° ± 10 min
Cross-section dimensions	± 0.075 mm
Length of specimen (L)	+0, -2.5 mm
Centering of notch (L/2)	± 1 mm
Angle of notch	± 1°
Radius of notch	± 0.025 mm
Ligament Length:	± 0.025 mm
Type A specimen	± 0.025 mm
Type B and C specimen	± 0.075 mm
Finish requirements	2 μm on notched surface and opposite face; 4 μm on other two surfaces

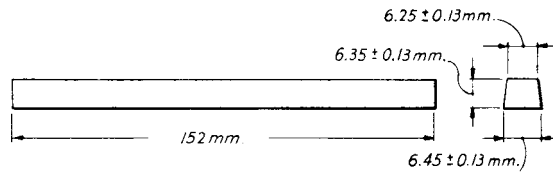
FIG. 1 Charpy (Simple-Beam) Impact Test Specimens, Types A, B, and C



NOTE 1—Permissible variations shall be as follows:

Notch length to edge	90 ± 2°
Cross-section dimensions	± 0.025 mm
Length of specimen	+0, -2.5 mm
Angle of notch	± 1°
Radius of notch	± 0.025 mm
Ligament Length	± 0.025 mm
Adjacent sides shall be at	90° ± 10 min
Finish requirements	2 μm on notched surface and opposite face; 4 μm on other two surfaces

FIG. 2 Izod (Cantilever-Beam) Impact Test Specimen, Type D



NOTE 1—Two Izod specimens may be cut from this bar.

NOTE 2—Blow shall be struck on narrowest face.

FIG. 3 Izod Impact Test Bar for Die Castings Alloys