



Standard Test Methods for Impact Testing of Cast Irons¹

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1. Scope

1.1 These test methods for impact testing cover the details of apparatus, test specimens and procedures for cast iron, including gray iron, white iron, malleable iron, ductile iron, and austempered ductile iron, but not including chilled rolls or rolls with white iron skins.

1.2 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.3 *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.*

2. Referenced Documents

- 2.1 *ASTM Standards*:²
 - [A327M Test Methods for Impact Testing of Cast Irons \(Metric\)](#)
 - [E23 Test Methods for Notched Bar Impact Testing of Metallic Materials](#)

TEST METHOD A—ROUND BAR CHARPY-TYPE IMPACT TEST FOR GRAY AND WHITE IRONS

3. Scope

3.1 The Charpy-type impact test shall be employed for testing gray and white irons.

4. Apparatus

4.1 The single-blow Charpy impact test for gray and white irons shall be carried out in a pendulum-type impact machine

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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.

with a capacity of at least 150 J [110 ft · lbf] as used for the simple beam test for steel described in Test Methods E23.

5. Test Specimens

5.1 The test specimens shall have a plain cylindrical form, machined or ground to a smooth finish and shall conform to the following dimensions:

	Type A	Type M
Diameter	28.572 ± 0.050 mm [1.125 ± 0.002 in.]	20.00 ± 0.03 mm [0.787 ± 0.001 in.]
Length	200 ± 13 mm [8.0 ± 0.5 in.]	120 ± 2 mm [4.73 ± 0.08 in.]
Span	152.0 ± 0.7 mm [6.00 ± 0.03 in.]	100.0 ± 0.5 mm [3.937 ± 0.020 in.]

6. Procedure

6.1 Test the bars on the spans indicated in the tabular data of 5.1. In all other respects, the test shall conform to the appropriate requirements of Test Methods E23.

6.2 Make the test at room temperature.

6.3 Characterization of the fracture toughness of any cast iron should be based upon testing at least three specimens.

NOTE 1—Care should be taken to examine broken specimens for indication of anvil interference which will give erroneous results.

7. Report

7.1 The results shall be reported as ____J [ft · lbf] cast iron Charpy impact with ____ mm [in.] diameter bar.

TEST METHOD B—STANDARD CHARPY-TYPE IMPACT TEST FOR MALLEABLE AND DUCTILE IRONS

8. Scope

8.1 Either the standard notched or unnotched Charpy impact test shall be employed in testing of malleable or ductile irons. Selection of the type bar is dependent upon the specific material to be evaluated as defined in Section 9.

8.2 Both types of charpy bars have been designated to characterize the fracture toughness of irons. The unnotched Charpy bar, when tested, will produce substantially higher energy values than the notch bar type. The unnotched bar is therefore specified for testing irons that have low fracture toughness characteristics.

9. Charpy Test Bar Type

9.1 Unless specified otherwise, the notched bar type specimens in Fig. 1 or Fig. 2 (for pipe type products) shall be employed. Exceptions are defined in 9.2 and 9.3.

9.2 The unnotched Charpy type specimen in Fig. 3 shall be employed for testing of all grades of austempered ductile iron. These irons are tested after the austempering heat treatment.

9.3 The unnotched Charpy test specimen may be specified for other types of irons or irons that have been heat treated in various ways other than austempering, by specific agreement between producer and purchaser.

10. Apparatus

10.1 The single-blow Charpy test for ductile and malleable iron shall be carried out in a pendulum-type impact machine with a capacity of at least 150 J [110 ft · lbf] as used for the simple beam test for steel described in Test Methods E23.

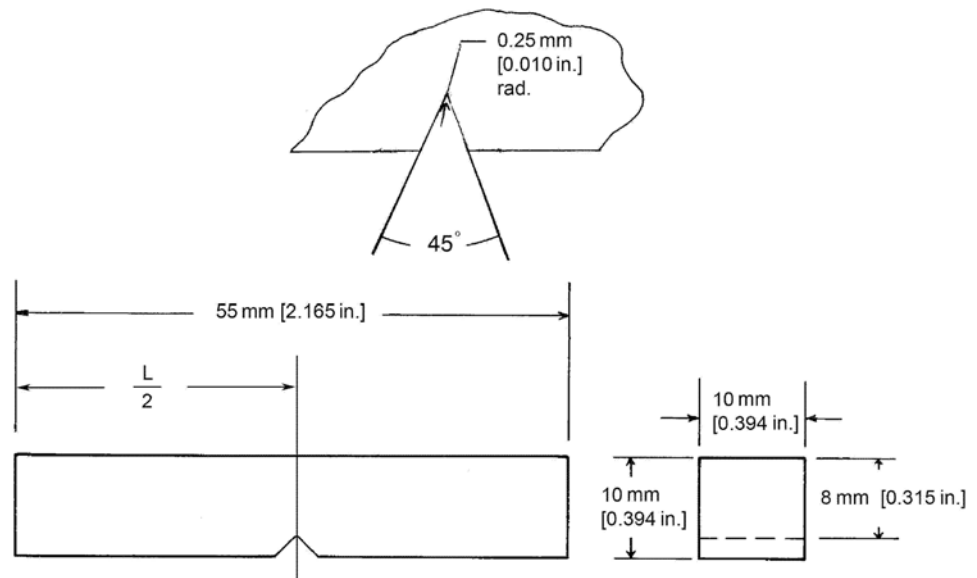
10.2 Standard machines may be modified by using a more sensitive scale, or pendulum machines of a lower capacity may be used where values of less than 34 J [25 ft · lbf] will be obtained.

11. Test Specimens

11.1 Except for pipe, the test specimen shall have the shape and dimensions as shown in Fig. 1 for notch Charpy bars and Fig. 3 for unnotched Charpy bars. Bars must have a smooth machined or ground surface finish. The notched area of notch type bars shall be free of any burrs or machining marks that could adversely influence test values.

11.2 In the case of malleable or ductile irons that are to be tested after heat treatment, such as austempered ductile irons, final finish grinding of longitudinal faces and cutting of the notch must be performed after completion of all heat treatment operations.

11.3 Test specimens taken from ductile iron pipe shall be 0.500 in. wide, measured from the notched face. The thickness of the notched face shall be equal to the full wall thickness of the pipe (*t*), except that specimens in which the pipe wall specimen thickness exceeds the maximum height accommodated by the impact test machine shall be machined to a thickness that can be accommodated by the machine. Specimens shall be machined in accordance with Fig. 2.



NOTE 1—Permissible variations shall be as follows:

Adjacent sides shall be at	90° ± 10 min
Cross section dimensions	±0.03 mm [±0.001 in.]
Length of specimen, <i>L</i>	±0, -2.5 mm [±0, -0.100 in.]
Angle of notch	±1°
Radius of notch	±0.03 mm [±0.001 in.]
Dimension to bottom of notch	±0.03 mm [±0.001 in.]
Distance to notch, <i>L</i> / ₂	±1 mm [±0.040 in.]

FIG. 1 Standard Vee Notch Charpy Bar Impact Test Specimen