



Standard Test Methods for Determining Hardenability of Steel¹

This standard is issued under the fixed designation A 255; 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.

1. Scope

1.1 These test methods cover the identification and description of test methods for determining the hardenability of steels. The two test methods include the quantitative end-quench or Jominy Test and a method for calculating the hardenability of steel from the chemical composition based on the original work by M. A. Grossman.

1.2 The selection of the test method to be used for determining the hardenability of a given steel shall be agreed upon between the supplier and user. The Certified Material Test Report shall state the method of hardenability determination.

1.3 The calculation method described in these test methods is applicable only to the range of chemical compositions that follow:

Element	Range, %
Carbon	0.10–0.70
Manganese	0.50–1.65
Silicon	0.15–0.60
Chromium	1.35 max
Nickel	1.50 max
Molybdenum	0.55 max

1.4 Hardenability is a measure of the depth to which steel will harden when quenched from its austenitizing temperature (Table 1). It is measured quantitatively, usually by noting the extent or depth of hardening of a standard size and shape of test specimen in a standardized quench. In the end-quench test the depth of hardening is the distance along the specimen from the quenched end which correlates to a given hardness level.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *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:

¹ These test methods are under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and are the direct responsibility of Subcommittee A01.15 on Bars.

Current edition approved March 10, 1999. Published June 1999. Originally published as A 255–42. Last previous edition A 255–96.

TABLE 1 Normalizing and Austenitizing Temperatures^A

Steel Series	Ordered Carbon Content, max, %	Normalizing Temperature, °F (°C)	Austenitizing Temperature, °F (°C)
1000, 1300, 1500, 3100, 4000, 4100	0.25 and under	1700 (925)	1700 (925)
4300, 4400, 4500, 4600, 4700, 5000, 5100, 6100, ^B 8100, 8600, 8700, 8800, 9400, 9700, 9800	0.26 to 0.36, incl	1650 (900)	1600 (870)
	0.37 and over	1600 (870)	1550 (845)
2300, 2500, 3300, 4800, 9300	0.25 and under	1700 (925)	1550 (845)
	0.26 to 0.36, incl	1650 (900)	1500 (815)
	0.37 and over	1600 (870)	1475 (800)
9200	0.50 and over	1650 (900)	1600 (870)

^A A variation of $\pm 10^{\circ}\text{F}$ (6°C) from the temperatures in this table is permissible.

^B Normalizing and austenitizing temperatures are 50°F (30°C) higher for the 6100 series.

E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials²

E 112 Test Methods for Determining the Average Grain Size²

END-QUENCH OR JOMINY TEST

3. Description

3.1 This test method covers the procedure for determining the hardenability of steel by the end-quench or Jominy test. The test consists of water quenching one end of a cylindrical test specimen 1.0 in. in diameter and measuring the hardening response as a function of the distance from the quenched end.

4. Apparatus

4.1 *Support for Test Specimen*—A fixture for supporting the test specimen vertically so that the lower end of the specimen is a distance of 0.5 in. (12.7 mm) above the orifice of the water-quenching device. A satisfactory type of support for the standard 1.0-in. (25.4-mm) specimen is shown in Fig. 1.

NOTE 1—A suitable support for other sizes and shapes of specimens is shown in Fig. X1.1.

4.2 *Water-Quenching Device*—A water-quenching device of suitable capacity to provide a vertical stream of water that

² Annual Book of ASTM Standards, Vol 03.01.