Designation: A370 – 24

Standard Test Methods and Definitions for Mechanical Testing of Steel Products[1]

This standard is issued under the fixed designation A370; 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 U.S. Department of Defense.

1. Scope*

1.1 These test methods[2] cover procedures and definitions for the mechanical testing of steels, stainless steels, and related alloys. The various mechanical tests herein described are used to determine properties required in the product specifications. Variations in testing methods are to be avoided, and standard methods of testing are to be followed to obtain reproducible and comparable results. In those cases in which the testing requirements for certain products are unique or at variance with these general procedures, the product specification testing requirements shall control.

1.2 The following mechanical tests are described:

	Sections
Tension	7 to 14
Bend	15
Hardness	16
Brinell	17
Rockwell	18
Portable	19
Impact	20 to 30
Keywords	32

1.3 Annexes covering details peculiar to certain products are appended to these test methods as follows:

	Annex
Bar Products	Annex A1
Tubular Products	Annex A2
Fasteners	Annex A3
Round Wire Products	Annex A4
Significance of Notched-Bar Impact Testing	Annex A5
Converting Percentage Elongation of Round Specimens to Equivalents for Flat Specimens	Annex A6
Testing Multi-Wire Strand	Annex A7
Rounding of Test Data	Annex A8
Methods for Testing Steel Reinforcing Bars	Annex A9
Procedure for Use and Control of Heat-cycle Simulation	Annex A10

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 When these test methods are referenced in a metric product specification, the yield and tensile values may be determined in inch-pound (ksi) units then converted into SI (MPa) units. The elongation determined in inch-pound gauge lengths of 2 in. or 8 in. may be reported in SI unit gauge lengths of 50 mm or 200 mm, respectively, as applicable. Conversely, when these test methods are referenced in an inch-pound product specification, the yield and tensile values may be determined in SI units then converted into inch-pound units. The elongation determined in SI unit gauge lengths of 50 mm or 200 mm may be reported in inch-pound gauge lengths of 2 in. or 8 in., respectively, as applicable.

1.5.1 The specimen used to determine the original units must conform to the applicable tolerances of the original unit system given in the dimension table not that of the converted tolerance dimensions.

NOTE 1—This is due to the specimen SI dimensions and tolerances being hard conversions when this is not a dual standard. The user is directed to Test Methods A1058 if the tests are required in SI units.

1.6 Attention is directed to ISO/IEC 17025 when there may be a need for information on criteria for evaluation of testing laboratories.

1.7 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

[1] These test methods and definitions are under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and are the direct responsibility of Subcommittee A01.13 on Mechanical and Chemical Testing and Processing Methods of Steel Products and Processes.

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[2] For *ASME Boiler and Pressure Vessel Code* applications see related Specification SA-370 in Section II of that Code.

***A Summary of Changes section appears at the end of this standard**

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A623 Specification for Tin Mill Products, General Requirements

A623M Specification for Tin Mill Products, General Requirements [Metric]

A833 Test Method for Indentation Hardness of Metallic Materials by Comparison Hardness Testers

A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A956/A956M Test Method for Leeb Hardness Testing of Steel Products

A1038 Test Method for Portable Hardness Testing by the Ultrasonic Contact Impedance Method

A1058 Test Methods for Mechanical Testing of Steel Products—Metric

A1061/A1061M Test Methods for Testing Multi-Wire Steel Prestressing Strand

E4 Practices for Force Calibration and Verification of Testing Machines

E6 Terminology Relating to Methods of Mechanical Testing

E8/E8M Test Methods for Tension Testing of Metallic Materials

E10 Test Method for Brinell Hardness of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E23 Test Methods for Notched Bar Impact Testing of Metallic Materials

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E83 Practice for Verification and Classification of Extensometer Systems

E110 Test Method for Rockwell and Brinell Hardness of Metallic Materials by Portable Hardness Testers

E140 Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, Scleroscope Hardness, and Leeb Hardness

E190 Test Method for Guided Bend Test for Ductility of Welds

E290 Test Methods for Bend Testing of Material for Ductility

2.2 *ASME Document:*[4]

ASME Boiler and Pressure Vessel Code, Section VIII, Division I, Part UG-8

2.3 *ISO Standard:*[5]

ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

[3] 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.

[4] Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, http://www.asme.org.

[5] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms pertaining to mechanical testing of steel products not otherwise listed in this section, reference shall be made to Terminology E6 and Terminology A941.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *fixed-location hardness testing machine, n*—a hardness testing machine that is designed for routine operation in a fixed-location by the users and is not designed to be transported, or carried, or moved.

3.2.1.1 *Discussion*—Typically due to its heavy weight and large size, a fixed-location hardness testing machine is placed in one location and not routinely moved.

3.2.2 *longitudinal test, n*—unless specifically defined otherwise, signifies that the lengthwise axis of the specimen is parallel to the direction of the greatest extension of the steel during rolling or forging.

3.2.2.1 *Discussion*—The stress applied to a longitudinal tension test specimen is in the direction of the greatest extension, and the axis of the fold of a longitudinal bend test specimen is at right angles to the direction of greatest extension (see Fig. 1, Fig. 2a, and Fig. 2b).

3.2.3 *portable hardness testing machine, n*—a hardness testing machine that is designed to be transported, carried, set up, and that measures hardness in accordance with the test methods in Section 19.

3.2.4 *radial test, n*—unless specifically defined otherwise, signifies that the lengthwise axis of the specimen is perpendicular to the axis of the product and coincident with one of the radii of a circle drawn with a point on the axis of the product as a center (see Fig. 2a).

3.2.5 *tangential test, n*—unless specifically defined otherwise, signifies that the lengthwise axis of the specimen perpendicular to a plane containing the axis of the product and

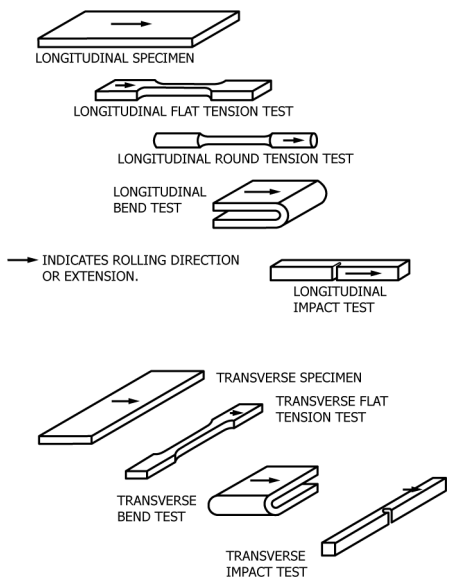

FIG. 1 Relation of Test Coupons and Test Specimens to Rolling Direction or Extension (Applicable to General Wrought Products)

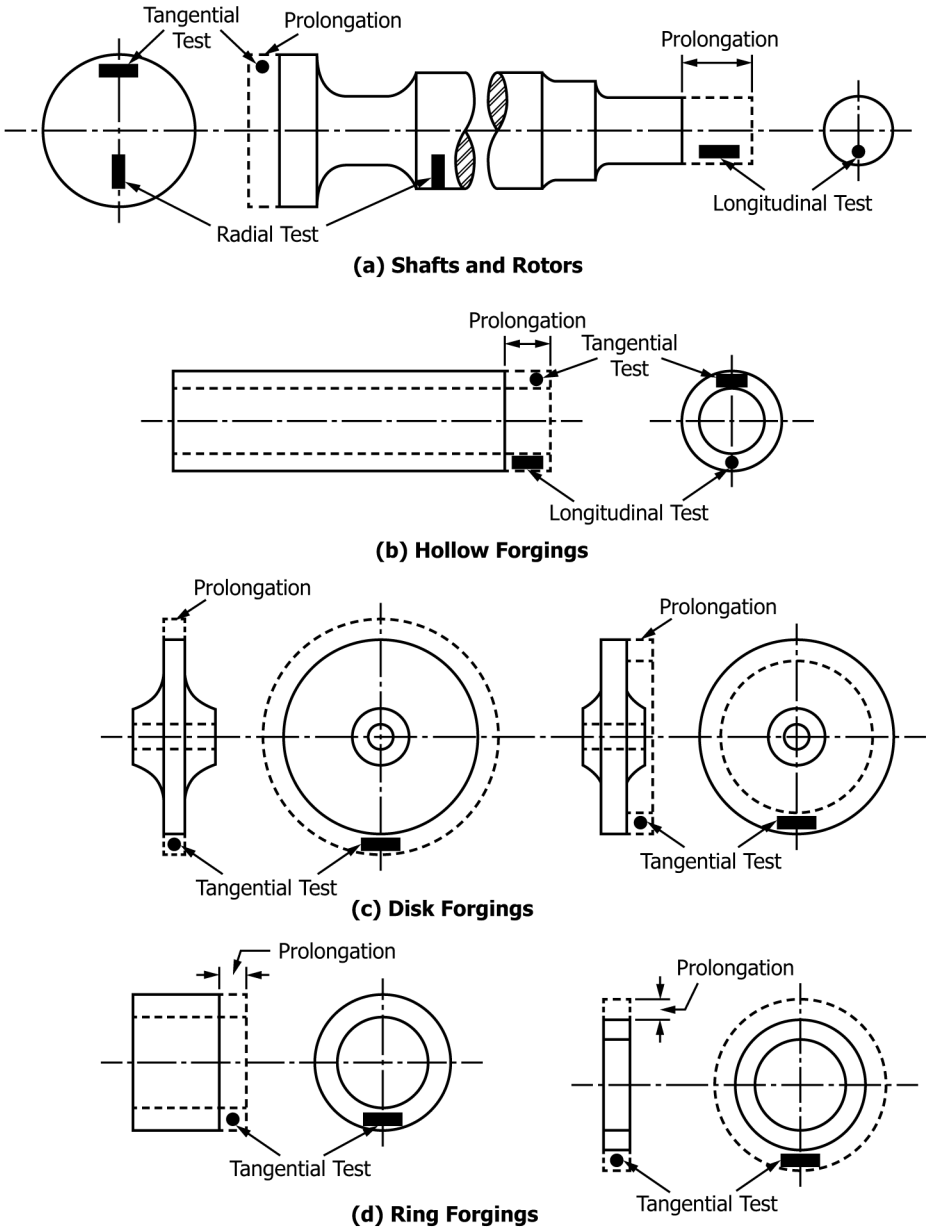

FIG. 2 Location of Longitudinal Tension Test Specimens in Rings Cut From Tubular Products

tangent to a circle drawn with a point on the axis of the product as a center (see Fig. 2a, Fig. 2b, Fig. 2c, and Fig. 2d).

3.2.6 *transition temperature, n*—for specification purposes, the transition temperature is the temperature at which the designated material test value equals or exceeds a specified minimum test value.

3.2.6.1 *Discussion*—Some of the many definitions of transition temperature currently being used are: (*1*) the lowest temperature at which the specimen exhibits 100 % fibrous fracture, (*2*) the temperature where the fracture shows a 50 % crystalline and a 50 % fibrous appearance, (*3*) the temperature corresponding to the energy value 50 % of the difference between values obtained at 100 % and 0 % fibrous fracture, and (*4*) the temperature corresponding to a specific energy value.

3.2.7 *transverse test, n*—unless specifically defined otherwise, signifies that the lengthwise axis of the specimen is right angles to the direction of the greatest extension of the steel during rolling or forging.

3.2.7.1 *Discussion*—The stress applied to a transverse tension test specimen is at right angles to the greatest extension, and the axis of the fold of a transverse bend test specimen is parallel to the greatest extension (see Fig. 1).