



Designation: E21 – 17^{ε1}

Standard Test Methods for Elevated Temperature Tension Tests of Metallic Materials¹

This standard is issued under the fixed designation E21; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

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

^{ε1} NOTE—Section 3 was editorially updated in April 2019.

1. Scope*

1.1 These test methods cover procedure and equipment for the determination of tensile strength, yield strength, elongation, and reduction of area of metallic materials at elevated temperatures.

1.2 Determination of modulus of elasticity and proportional limit are not included.

1.3 Tension tests under conditions of rapid heating or rapid strain rates are not included.

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 *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.*

1.6 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

E4 Practices for Force Verification of Testing Machines

E6 Terminology Relating to Methods of Mechanical Testing

¹ These test methods are under the jurisdiction of ASTM Committee E28 on Mechanical Testing and are the direct responsibility of Subcommittee E28.04 on Uniaxial Testing.

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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.

E8/E8M Test Methods for Tension Testing of Metallic Materials

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

E74 Practices for Calibration and Verification for Force-Measuring Instruments

E83 Practice for Verification and Classification of Extensometer Systems

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E220 Test Method for Calibration of Thermocouples By Comparison Techniques

E633 Guide for Use of Thermocouples in Creep and Stress-Rupture Testing to 1800°F (1000°C) in Air

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 Definitions of terms relating to tension testing which appear in Terminology E6, apply to this test method. These terms include alignment, axial strain, bending strain, gauge length, elongation, elongation after fracture, extensometer system, necking, reduction of area, tensile strength, yield strength. In addition, the definitions of the following terms relating to tension testing are included.

3.2 Definitions:

3.2.1 *reduced section, n*—the central portion of the specimen that has a cross section smaller than the gripped ends.

3.2.1.1 *Discussion*—The cross section is uniform within prescribed tolerances.

3.2.2 *length of the reduced section*—the distance between the tangent points of the fillets that bound the reduced section.

3.2.3 *adjusted length of the reduced section*—the length of the reduced section plus an amount calculated to compensate for strain in the fillet region.

4. Significance and Use

4.1 The elevated-temperature tension test gives a useful estimate of the ability of metals to withstand the application of applied tensile forces. Using established and conventional

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