Designation: E468/E468M – 23a

# Standard Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials[1]

This standard is issued under the fixed designation E468/E468M; 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.

## 1. Scope

1.1 This practice covers the desirable and minimum information to be communicated between the originator and the user of data derived from constant-force amplitude axial, bending, or torsion fatigue tests of metallic materials tested in air and at room temperature.

NOTE 1—Practice E466, although not directly referenced in the text, is considered important enough to be listed in this standard.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

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

1.4 *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]

E6 Terminology Relating to Methods of Mechanical Testing

E8/E8M Test Methods for Tension Testing of Metallic Materials

E466 Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials

E467 Practice for Verification of Constant Amplitude Dynamic Forces in an Axial Fatigue Testing System

E739 Guide for Statistical Analysis of Linear or Linearized Stress-Life (*S-N*) and Strain-Life (ε-*N*) Fatigue Data (Withdrawn 2024)[3]

E1823 Terminology Relating to Fatigue and Fracture Testing

2.2 *Special Technical Publications:*

STP 91–A A Guide for Fatigue Testing and the Statistical Analysis of Fatigue Data[4]

STP 588 Manual on Statistical Planning and Analysis[5]

## 3. Terminology Definitions and Nomenclature

3.1 The terms and abbreviations used in this practice are defined in Terminology E6 and in Terminology E1823.

## 4. Significance and Use

4.1 Fatigue test results may be significantly influenced by the properties and history of the parent material, the operations performed during the preparation of the fatigue specimens, and the testing machine and test procedures used during the generation of the data. The presentation of fatigue test results should include citation of basic information on the material, specimens, and testing to increase the utility of the results and to reduce to a minimum the possibility of misinterpretation or improper application of those results.

## 5. Listing of Basic Information About Fatigue Test Specimen

5.1 *Specification and Properties of Material:*

5.1.1 *Material Prior to Fatigue Test Specimen Preparation*—The minimum information to be presented should include the designation or specification (for example, A441, SAE 1070, and so forth) or proprietary grade; form of product (for example, plate, bar, casting, and so forth); heat number; melting practice; last mechanical working and last

[1] This practice is under the jurisdiction of ASTM Committee E08 on Fatigue and Fracture and is the direct responsibility of E08.05 E08.05 on Cyclic Deformation and Fatigue Crack Formation.

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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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] *A Guide for Fatigue Testing and the Statistical Analysis of Fatigue Data*, ASTM International, 1963.

[5] *Manual on Statistical Planning and Analysis*, ASTM International, 1975.,

heat treatment that produced the material in the "as-received" condition (for example, cold-worked and aged, annealed and rolled, and so forth); chemical composition; and surface condition (for example, rolled and descaled, ground, and so forth).

5.1.1.1 It is desirable but not required (unless by mutual consent of the originator and user of the data) to list the raw material production sequence, billet preparation, results of cleanliness analysis, or a combination thereof, when applicable.

5.1.2 *Material in the Fatigue Test Specimen:*

5.1.2.1 *Mechanical Properties*—The minimum data on the mechanical properties of the material in a condition identical to that of the fatigue test specimen should include the tensile strength, yield point or yield strength at a specified onset; elongation in a specified gage length; reduction of area when applicable; and the designation of the test used to procure the mechanical properties (for example, Test Methods E8/E8M, Tension Testing of Metallic Materials, and so forth). If notched fatigue tests were conducted, the notched tensile strength also should be listed.

5.1.2.2 *Metallography*—It is desirable but not required (unless by mutual consent of the originator and user of the data) to list the grain size (when applicable), phases, and dispersions characteristic of the fatigue test specimen in the "ready-to-test" condition.

5.1.2.3 It is desirable but not required (unless by mutual consent of the originator and user of the data) to show the locations, in the parent material, from which the specimens were taken.

5.2 *Minimum Information to Be Presented on Design of Fatigue Test Specimen in the "Ready-To-Test" Conditions:*

5.2.1 *Shape, Size, and Dimensions*—A drawing showing shape, size, and dimensions of the fatigue test specimen should be presented including details on test section, grip section, fillets, radii, swaged portions, holes, and orientation of the fatigue test specimen with respect to the direction of maximum working of the material. When reporting the test results of notched fatigue specimens, the geometry of the notch, its dimensions and stress concentration factor, the method of derivation of the stress concentration factor, and whether the stress concentration factor is based on the gross or net area of the test section should be presented.

5.3 *Listing of Information on Specimen Preparation:*

5.3.1 The minimum information to be presented should list, in chronological order, the operations performed on the fatigue test specimen, including the type of process used to form the specimen (for example, milling, turning, grinding, etc.), thermal treatment (for example, stress relieving, aging, etc.), and surface treatment (for example, shot-peening, nitriding, coating, etc.). If the final specimen surface treatment is polishing, the polishing sequence and direction should be listed. If deterioration of the specimen surface is observed during storage, after preparation but prior to testing, the procedures that were used to eliminate the defects and changes, if any, in shape, dimensions, or mechanical properties should be listed.

5.3.1.1 It is desirable but not required (unless by mutual consent of the originator and user of the data) to include details of the operations performed (for example, feed, speed, depth of cut and coolants, thermal cycles, etc.), and the surface residual stresses of the specimen, if measured.

5.3.2 *Condition of Specimens Prior to Fatigue Testing*—It is desirable but not required to list the environment in which the specimens were stored, type of protection applied to the specimens, and method used to remove that protection. It is desirable but not required to list the average and range of surface roughness, surface hardness, out-of-flatness, out-of-straightness or warpage, or a combination thereof, of all fatigue specimens.

## 6. Listing of Information on Test Procedures

6.1 *Design of the Fatigue Test Program:*

6.1.1 If statistical techniques were used to design the fatigue test program, the design plan and list of statistical techniques (for example, randomization of test sequence, blocking, etc.) used to accommodate expected or observed heterogeneities should be presented. Some statistical techniques are described in STP 91–A, STP 588, and Guide E739.

6.2 *Fatigue Testing Machine:*

6.2.1 Minimum information to be presented shall include the type of testing machine, the functional characteristic (for example, servohydraulic, electro-mechanical, etc.), frequency of force application, and forcing function (for example, sine, square, etc.). If tests were performed on more than one machine, the number of testing machines used should be listed.

6.2.2 Minimum information should include the method of dynamic force verification and force monitoring procedures.

NOTE 2—For guidance on axial fatigue testing systems, refer to Practice E467.

6.3 *Fatigue Test:*

6.3.1 Minimum information to be presented shall include the type of test (axial, rotary bending, plane bending, or torsion), the derivation (or method of computation) of the test section dynamic stresses, and, when applicable, the experimental stress analysis techniques (for example, electric resistance strain gages, photoelastic coating, etc.) used. The failure criterion and number of cycles to run-out used in the test program shall be presented.

6.3.1.1 It is desirable but not required (unless by mutual consent of the originator and user of the data) to include the procedure for mounting the specimen in the testing machine, grip details, and precautions taken to ensure that stresses induced by vibration, friction, eccentricity, etc., were negligible.

6.4 *Ambient Conditions During the Fatigue Test*—Minimum information to be presented shall include the average value and ranges of both temperature and relative humidity that were observed in the laboratory during the test program.

6.5 *Results of Post-Test Examination*—Minimum information to be presented for each fatigue test specimen should include the reason for test termination, either achievement of