



Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials¹

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1. Scope

1.1 This practice covers the procedure for the performance of axial force controlled fatigue tests to obtain the fatigue strength of metallic materials in the fatigue regime where the strains are predominately elastic, both upon initial loading and throughout the test. This practice is limited to the fatigue testing of axial unnotched and notched specimens subjected to a constant amplitude, periodic forcing function in air at room temperature. This practice is not intended for application in axial fatigue tests of components or parts.

NOTE 1—The following documents, although not directly referenced in the text, are considered important enough to be listed in this practice:

E739 Practice for Statistical Analysis of Linear or Linearized Stress-Life (S-N) and Strain-Life (ϵ -N) Fatigue Data

STP 566 Handbook of Fatigue Testing²

STP 588 Manual on Statistical Planning and Analysis for Fatigue Experiments³

STP 731 Tables for Estimating Median Fatigue Limits⁴

2. Referenced Documents

2.1 *ASTM Standards*:⁵

E3 Guide for Preparation of Metallographic Specimens

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

E468 Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials

E606/E606M Test Method for Strain-Controlled Fatigue Testing

E739 Practice for Statistical Analysis of Linear or Linearized Stress-Life (S-N) and Strain-Life (ϵ -N) Fatigue Data

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

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² *Handbook of Fatigue Testing*, ASTM STP 566, ASTM, 1974.

³ Little, R. E., *Manual on Statistical Planning and Analysis*, ASTM STP 588, ASTM, 1975.

⁴ Little, R. E., *Tables for Estimating Median Fatigue Limits*, ASTM STP 731, ASTM, 1981.

⁵ 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.

E1012 Practice for Verification of Testing Frame and Specimen Alignment Under Tensile and Compressive Axial Force Application

E1823 Terminology Relating to Fatigue and Fracture Testing

3. Terminology

3.1 *Definitions*:

3.1.1 The terms used in this practice shall be as defined in Terminology E1823.

4. Significance and Use

4.1 The axial force fatigue test is used to determine the effect of variations in material, geometry, surface condition, stress, and so forth, on the fatigue resistance of metallic materials subjected to direct stress for relatively large numbers of cycles. The results may also be used as a guide for the selection of metallic materials for service under conditions of repeated direct stress.

4.2 In order to verify that such basic fatigue data generated using this practice is comparable, reproducible, and correlated among laboratories, it may be advantageous to conduct a round-robin-type test program from a statistician's point of view. To do so would require the control or balance of what are often deemed nuisance variables; for example, hardness, cleanliness, grain size, composition, directionality, surface residual stress, surface finish, and so forth. Thus, when embarking on a program of this nature it is essential to define and maintain consistency a priori, as many variables as reasonably possible, with as much economy as prudent. All material variables, testing information, and procedures used should be reported so that correlation and reproducibility of results may be attempted in a fashion that is considered reasonably good current test practice.

4.3 The results of the axial force fatigue test are suitable for application to design only when the specimen test conditions realistically simulate service conditions or some methodology of accounting for service conditions is available and clearly defined.

5. Specimen Design

5.1 The type of specimen used will depend on the objective of the test program, the type of equipment, the equipment