Designation: E 636 – 02

Standard Guide for Conducting Supplemental Surveillance Tests for Nuclear Power Reactor Vessels, E 706 (IH)[1]

This standard is issued under the fixed designation E 636; 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 guide discusses test procedures that can be used in conjunction with, but not as alternatives to, those required by Practice E 185 for the surveillance of nuclear reactor vessels. The supplemental mechanical property tests outlined permit the acquisition of additional information on radiation-induced changes in fracture toughness, notch ductility, and tensile strength properties of the reactor vessel steels.

1.2 This guide provides recommendations for the preparation of test specimens for irradiation, and identifies special precautions and requirements for reactor surveillance operations and postirradiation test planning. Guidance on data reduction and computational procedures is also given. Reference is made to other ASTM test methods for the physical conduct of specimen tests and for raw data acquisition.

2. Referenced Documents

2.1 *ASTM Standards:*

E 8 Test Methods for Tension Testing of Metallic Materials[2]

E 23 Test Methods for Notched Bar Impact Testing of Metallic Materials[2]

E 184 Practice for Effects of High-Energy Neutron Radiation on the Mechanical Properties of Metallic Materials, E 706 (IB)[3]

E 185 Practice for Conducting Surveillance Tests for Light Water Cooled Nuclear Power Reactor Vessels, E 706 (IF)[3]

E 399 Test Method for Plane-Strain Fracture Toughness of Metallic Materials[2]

E 482 Guide for Application of Neutron Transport Methods for Reactor Vessel Surveillance, E 706 (IID)[3]

E 560 Practice for Extrapolating Reactor Vessel Surveillance Dosimetry Results, E 706 (IC)[3]

E 616 Terminology Relating to Fracture Testing[2]

E 706 Master Matrix for Light-Water Reactor Pressure Vessel Surveillance Standards, E 706 (0)[3]

E 1221 Test Method for Determining Plane-Strain Crack-Arrest Fracture Toughness, K_{1a}, of Ferritic Steels[2]

E 1253 Guide for Reconstitution of Irradiated Charpy-Sized Specimens[3]

E 1820 Test Method for Measurement of Fracture Toughness[3]

E 1921 Test Method for Determination of Reference Temperature, T_0, for Ferritic Steels in the Transition Range[3]

2.2 *Other Standards:*

ASME Boiler and Pressure Vessel Code, Section III, Subsection NB (Class 1 Components)[4]

ISO 14556 Steel Charpy V-notch Pendulum Impact Test-Instrumented Test Method[5]

3. Significance and Use

3.1 Practice E 185 describes a minimum program for the surveillance of reactor vessel materials, specifically mechanical property changes that occur in service. Guide E 636 may be applied in order to generate additional specific fracture toughness property information on radiation-induced property changes to better assist the determination of the optimum reactor vessel operation schemes.

4. Supplemental Mechanical Property Test

4.1 *Fracture Toughness Test*—This test involves the dynamic or static testing of a fatigue-precracked specimen during which a record of force versus displacement is used to determine material fracture toughness properties such as the plane strain fracture toughness (K_{Ic}), the *J*-integral fracture toughness (J_{Ic}), the *J-R* curve, and the reference temperature (T_0) (see Test Methods E 399, E 1820, and E 1921, respectively). These test methods generally apply to elastic, elastic-plastic, or fully plastic behavior. The rate of specimen loading or stress intensity increase required for test classification as static or dynamic is indicated by the referenced test methods. Presently, only Test Methods E 399 and E 1820 specify a lower limit on loading rate for dynamic test performed in the linear elastic regime.

[1] This guide is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.02 on Behavior and Use of Nuclear Structural Materials.

Current edition approved June 10, 20025. Published September 2002. Originally published as E 636 – 83. Last previous edition E 636 – 95.

[2] *Annual Book of ASTM Standards,* Vol 03.01.

[3] *Annual Book of ASTM Standards,* Vol 12.02.

[4] Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

[5] Available from International Organization for Standardization (ISO), 1 rue de Varembe, Case postale 56, CH-1211, Geneva 20, Switzerland.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States.