



Designation: E 636 – 95 (Reapproved 2001)

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

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1. Scope

1.1 This guide covers test methods and 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 test methods 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 also is given for individual test methods. 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 Materials²
- E 23 Test Methods for Notched Bar Impact Testing of Metallic Materials²
- 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 Materials²
- 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 Testing²
- E 812 Test Method for Crack Strength of Slow-Bend Pre-

cracked Charpy Specimens of High-Strength Metallic Materials²

E 813 Test Method for J_{IC} , a Measure of Fracture Toughness²

E 992 Practice for Determination of Fracture Toughness of Steels Using Equivalent Energy Methodology²

E 1152 Test Method for Determining J-R Curves²

E 1221 Test Method for Determining Plane-Strain Crack-Arrest Fracture Toughness, K_{Ia} , of Ferritic Steels²

2.2 Other Standard:

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

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 where radiation space limitations are not overly stringent and where the inclusion of additional specimen types is desirable 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 Test Methods

4.1 *Compact Specimen Test*—This test involves the dynamic or static testing of a fatigue-precracked compact specimen during which a record of load 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}), and the J -R curve (see Test Methods E 399, E 813, and E 1152, respectively). These test methods generally apply to elastic, elastic-plastic, or fully plastic (upper shelf) 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.

4.2 *Precracked Charpy Impact Test*—This test involves impact testing of Charpy V-notch specimens that have been fatigue precracked. A load versus deflection or time record, or both, are obtained during the test to determine an estimate of

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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.