



Standard Guide for Reconstitution of Irradiated Charpy-Sized Specimens¹

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1. Scope

1.1 This guide covers procedures for the reconstitution of Test Methods E 23, Type A Charpy specimens and specimens suitable for testing in three point bending in accordance with Test Method E 1921. Materials from irradiation programs (principally broken specimens) are reconstituted by welding end tabs of similar material onto remachined specimen sections that were unaffected by the initial test. Guidelines are given for the selection of suitable specimen halves and end tab materials, for dimensional control, and for avoidance of overheating the notch area.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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

2. Referenced Documents

2.1 ASTM Standards:

E 23 Test Methods for Notched Bar Impact Testing of Metallic Materials²

E 185 Practice for Conducting Surveillance Tests for Light-Water Cooled Nuclear Power Reactor Vessels, E 706 (1 F)³

E 220 Test Method for Calibration of Thermocouples by Comparison Techniques⁴

E 1921 Test Method for the Determination of Reference Temperature, T_o , for Ferritic Steels in the Transition Range²

3. Significance and Use

3.1 Practice E 185 defines the minimum requirements for light-water reactor surveillance program Charpy V-notch specimens. It may be desirable to extend the original surveillance program beyond available specimens for plant lifetime extension, to better define existing data, or to determine fracture

toughness of a material when no standard fracture toughness test specimens are available. The ability to reconstitute the broken halves of existing specimens can provide such material.

3.2 Charpy-sized specimens are typically machined from virgin material, that is, material not previously mechanically tested. There are occasions that exist when either (1) no full size specimen blanks are available or (2) the material available with the desired history (such as having been subjected to irradiation) is not sufficient for the machining of full-size specimens, or both.

3.3 An approach to this problem, that is addressed in this guide, is to fabricate new specimens using the broken halves of previously irradiated and tested specimens. In this guide, the central segment of each new specimen utilizes a broken half of a previously tested specimen and end tabs that are welded to the central segment, or the central section may simply be a piece of virgin material shorter than a Charpy-sized specimen. While specifically addressing reconstitution of irradiated pressure vessel steel, this guide can also provide guidance for reconstitution of Charpy-sized specimens for other situations involving material availability.

4. Reconstitution Technique

4.1 Welding Process:

4.1.1 Any welding process may be chosen, provided that the heat input and dimensional constraints, as given in this guide, can be achieved. Work to date has indicated successful results with stud welding (1),⁵ electron beam welding (2, 3), and projection welding (4).

4.2 Specimen Preparation:

4.2.1 The specimen insert used for reconstitution and its orientation shall be identified such that it can be traced to the original specimen.

4.2.2 Each end face of the specimen insert and the selected extension tabs shall be prepared as required by the particular welding method selected.

4.2.3 If comparable data between the original and reconstituted tests are required, then the orientation of the reconstituted specimen and the original specimen must be identical.

4.2.4 The yield strength and the material type of the end tabs shall be similar to the specimen insert. The use of oversized tabs and subsequent machining is permitted.

¹ This guide is under the jurisdiction of ASTM Committee E-10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.02 on Behavior and Use of Nuclear Structural Materials.

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² Annual Book of ASTM Standards, Vol 03.01.

³ Annual Book of ASTM Standards, Vol 12.02.

⁴ Annual Book of ASTM Standards, Vol 14.03.

⁵ The boldface numbers in parentheses refer to the list of references at the end of this standard.