



Designation: E1214 – 11

Standard Guide for Use of Melt Wire Temperature Monitors for Reactor Vessel Surveillance, E 706 (IIIE)¹

This standard is issued under the fixed designation E1214; 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 describes the application of melt wire temperature monitors and their use for reactor vessel surveillance of light-water power reactors as called for in Practices [E185](#) and [E2215](#).

1.2 The purpose of this guide is to recommend the selection and use of the common melt wire technique where the correspondence between melting temperature and composition of different alloys is used as a passive temperature monitor. Guidelines are provided for the selection and calibration of monitor materials; design, fabrication, and assembly of monitor and container; post-irradiation examinations; interpretation of the results; and estimation of uncertainties.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.4 *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. (See [Note 1](#).)*

2. Referenced Documents

2.1 *ASTM Standards:*^{2,3}

[E185 Practice for Design of Surveillance Programs for Light-Water Moderated Nuclear Power Reactor Vessels](#)

[E706 Master Matrix for Light-Water Reactor Pressure Vessel Surveillance Standards, E 706\(0\) \(Withdrawn 2011\)](#)⁴

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.

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² The reference Master Matrix designation in parentheses refers to Section 5, as well as Figs. 1 and 2 of Matrix [E706](#).

³ 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.

⁴ The last approved version of this historical standard is referenced on www.astm.org.

[E794 Test Method for Melting And Crystallization Temperatures By Thermal Analysis](#)

[E900 Guide for Predicting Radiation-Induced Transition Temperature Shift in Reactor Vessel Materials, E706 \(IIF\)](#)

[E2215 Practice for Evaluation of Surveillance Capsules from Light-Water Moderated Nuclear Power Reactor Vessels](#)

3. Significance and Use

3.1 Temperature monitors are used in surveillance capsules in accordance with Practice [E2215](#) to estimate the maximum value of the surveillance specimen irradiation temperature. Temperature monitors are needed to give evidence of overheating of surveillance specimens beyond the expected temperature. Because overheating causes a reduction in the amount of neutron radiation damage to the surveillance specimens, this overheating could result in a change in the measured properties of the surveillance specimens that would lead to an unconservative prediction of damage to the reactor vessel material.

3.2 The magnitude of the reduction of radiation damage with overheating depends on the composition of the material and time at temperature. Guide [E900](#) provides an accepted method for quantifying the temperature effect. Because the evidence from melt wire monitors gives no indication of the duration of overheating above the expected temperature as indicated by melting of the monitor, the significance of overheating events cannot be quantified on the basis of temperature monitors alone. Indication of overheating does serve to alert the user of the data to further evaluate the irradiation temperature exposure history of the surveillance capsule.

3.3 This guide is IIIE of Master Matrix [E706](#) that relates several standards used for irradiation surveillance of light water reactor vessel materials. It is intended primarily to amplify the requirements of Practice [E185](#) in the design of temperature monitors for the surveillance program. It may also be used in conjunction with Practice [E2215](#) to evaluate the post-irradiation test measurements..

4. Selection and Calibration of Monitor Materials

4.1 Selection of Monitor Materials: