



Standard Test Method for Determining the Focal Size of Iridium-192 Industrial Radiographic Sources¹

This standard is issued under the fixed designation E 1114; 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 test method covers the determination of the focal size of an iridium-192 radiographic source. The determination is based upon measurement of the image of the iridium metal source in a projection radiograph of the source assembly and comparison to the measurement of the image of a reference sample in the same radiograph.

1.2 *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 999 Guide for Controlling the Quality of Industrial Radiographic Film Processing²

E 1316 Terminology for Nondestructive Examinations²

E 1815 Test Method for Classification of Film Systems for Industrial Radiography²

3. Terminology

3.1 For definitions of terms relating to this test method, refer to Terminology **E 1316**.

4. Significance and Use

4.1 One of the factors affecting the quality of a radiographic image is geometric unsharpness. The degree of geometric unsharpness is dependent upon the focal size of the source, the distance between the source and the object to be radiographed, and the distance between the object to be radiographed and the film. This test method allows the user to determine the focal size of the source and to use this result to establish source to

object and object to film distances appropriate for maintaining the desired degree of geometric unsharpness.

5. Apparatus

5.1 *Subject Iridium-192 Source*, the focal size of which is to be determined. The appropriate apparatus and equipment for the safe storage, handling, and manipulation of the subject source, such as a radiographic exposure device (also referred to as a gamma ray projector or camera), remote control, source guide tube, and source stop are also required.

5.2 *Reference Sample* (see **Figs. 1-3**)—The reference sample shall be of material which is not radioactive. The recommended material is iridium. However, substitutes such as platinum, tungsten or other material of similar radiopacity may be used. The sample should be of the same geometric shape as the subject source, should be approximately the same size as the subject source, and should be positioned on or within a shim or envelope to simulate the source capsule wall. The resulting radiographic contrast, with reference to adjacent background density of the image of the reference sample, should be approximately the same as that of the subject source. The actual dimensions of the reference sample should be determined to the nearest 0.025 mm [0.001 in.].

5.3 *X-ray Generator*, capable of producing a radiation intensity (roentgen per hour at one metre) at least ten times greater than that produced by the subject source. Examples of typical X-ray generator output requirements that satisfy this criterion are presented in **Table 1**.

5.4 *Film systems*—Only film systems having cognizant engineering organization approval or meeting the system class requirements of Test Method **E 1815**, for system classes I, II or Special, shall be used. Selection of film systems should be determined by such factors as the required radiographic quality level, equipment capability, materials and so forth. The film system selected shall be capable of demonstrating the required image quality. No intensifying screens shall be used. Radiographic films shall be processed in accordance with Guide **E 999**.

¹ This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.01 on Radiology (X and Gamma) Method.

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² *Annual Book of ASTM Standards*, Vol 03.03.

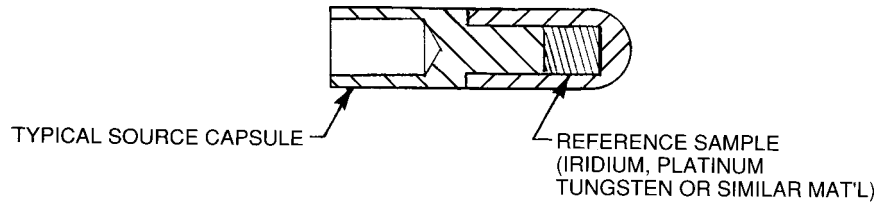


FIG. 1 Reference Sample in Standard Source Encapsulation

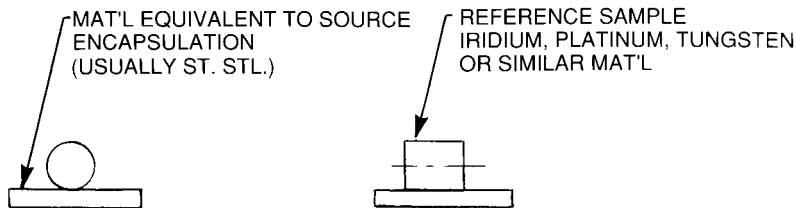
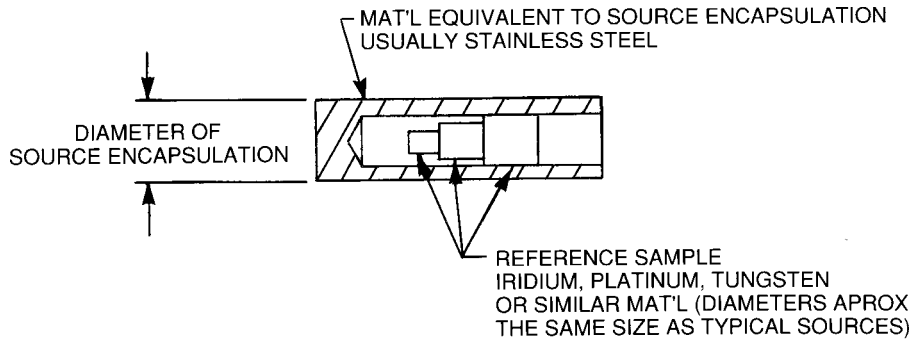


FIG. 2 Alternate Reference Sample Arrangement

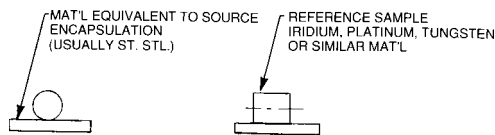


FIG. 3 Alternate Reference Sample Arrangement

TABLE 1 Examples of Typical X-ray Generator Output Requirements for Related Iridium¹⁹² Source Activities

Subject Iridium ¹⁹² Source Radiation		Typical X-ray Generator Output Requirements	
Activity (Curie)	Output (R/h at 1 m)	Potential	Current
30	14.4	160 kV	5 mA
		200 kV	3 mA
100	48.0	160 kV	10 mA
		250 kV	4 mA
200	96.0	160 kV	20 mA
		250 kV	8 mA
		300 kV	6 mA

5.5 *Image Measurement Apparatus*—This apparatus is used to measure the size of the image of the focal spot. The apparatus shall be an optical comparator with built-in graticule with 0.1 mm divisions or 0.001 in. divisions and magnification of 5× to 10×.

6. Procedure

6.1 Set up the exposure arrangement as shown in Figs. 4-7. Position the X-ray tube directly over the center of the film. The film plane must be normal to the central ray of the X-ray beam. The X-ray focal spot should be 0.90 m [36 in.] from the film. Position the reference sample and apparatus used to locate the subject source (source stop) as close together as possible and directly over the center of the film. The plane of the source stop and reference sample must be parallel to the film and normal to the central ray of the X-ray beam. The source stop and reference sample should be 0.15 m [6 in.] from the film. The source stop should be connected to the radiographic exposure device by the shortest source guide tube practicable in order to minimize fogging of the film during source transit.

6.2 Place identification markers to be imaged on the film to identify, as a minimum, the identification (serial number) of the subject source, the size of the reference sample, the identification of the organization performing the determination, and