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AMERICAN SOCIETY FOR TESTING AND MATERIALS
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Standard Practice for Design and Use of Ionizing Radiation Equipment for the Detection of Items Prohibited in Controlled Access Areas[1]

This standard is issued under the fixed designation F 792; 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.

ε1 NOTE—Keywords were added editorially in July 1993.

1. Scope

1.1 This practice covers the use of ionizing radiation imaging techniques for the detection of questionable items such as weapons and devices intended to trigger explosives, in order to determine their presence in hand-carried baggage, packages, checked or unaccompanied luggage, cargo, or mail at screening points for controlling access to secure areas.

1.2 This practice is intended to establish a method by which an ionizing radiation imaging system may be evaluated. It is not intended to set performance levels.

1.3 This practice specifies a broad range of health, safety, and human factors criteria pertaining to the use of this detection equipment.

1.4 The values as stated in inch-pound units are to be regarded as the standard. The values in parentheses are given for information only.

1.5 *This standard does not purport to address all of the safety problems, 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 *National Association of Photographic Manufacturers Standard:*[2]

NAPM Test Method for Determining Film Safety of Radiation Producing Equipment

2.2 *Underwriters Laboratories Standard:*[3]

UL 187 Standard for X-ray Equipment (Electrical)

2.3 *Military Standard:*[4]

MIL-STD-1472C Human Engineering Design Criteria for Military Systems, Equipment and Facilities (2 May 1981)

2.4 *Other Documents:*[5]

14 CFR 108.17—Use of Airport X-ray Security Systems (Domestic)

14 CFR 129.26—Use of Airport X-ray Security Systems (International)

21 CFR 1020.40 (c) Radiation Safety Requirements for Cabinet X-ray Systems

3. Significance and Use

3.1 This practice is meant to be used by the designers of and also those controlling the operation of ionizing radiation security equipment screening hand-carried items through security checkpoints at transportation terminals, nuclear power stations, correctional institutions, and other high security areas. It is also meant to be used by security equipment operators screening checked or unaccompanied luggage, packages, cargo, and mail at such locations. It may include corporate mail rooms, government offices, or other areas where the threat of receiving harmful devices is great enough to warrant the use of this type of equipment.

3.2 This practice is not intended to be used by police or bomb disposal experts for the disarming of letter or package bombs.

3.3 This practice relies upon the use of a test object to determine the applicable performance levels of the equipment. The specific test object subsequently described in Section 6 may not be appropriate for all types of ionizing radiation security screening systems such as those used for unusually large or dense objects or for those not dependent upon a visual image for making a determination.

3.4 The most significant attributes of this practice are the method for determining the detection capabilities of the equipment, the safety requirements of the equipment, and the training of the operators.

4. Terminology

4.1 *Definition:*

4.1.1 *weapon*—a device intended to do damage to personnel or equipment without intentionally harming the attacker, but requiring the attacker to physically activate the device. Examples include guns, knives, hand grenades, and similar items.

5. Radiation Levels

5.1 Radiation levels shall be as low as reasonably achievable, commensurate with the radiation source used (for example, pulse radiation or continuous radiation), the detection system used (for example, film, fluorescent screens, or electronic imaging systems), and the objects being screened (for example, briefcases, purses, suitcases, packages, or crates).

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[1] This practice is under the jurisdiction of ASTM Committee F-12 on Security Systems and Equipment and is the direct responsibility of Subcommittee F12.60 on Controlled Access Security, Search and Screening Equipment.

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[2] Available from National Association of Photographic Manufacturers, Inc., 600 Mamaroneck Ave., Harrison, NY 10528.

[3] Available from Underwriters Laboratories, Inc., Publication Stock, 333 Pfingsten Rd., Northbrook, IL 60062.

[4] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

[5] Available from Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

6. System Evaluation

6.1 *Test Step Wedge*—A standard step wedge made of ASTM No. 1100 aluminum or equivalent shall be 10 in. (254 mm) long by 4.0 in. (101.6 mm) wide and shall consist of ten 1.0 by 4.0-in. (25.4 by 101.6-mm) steps. The first step shall be 0.062 in. (1.59 mm) thick and each subsequent step shall be increased by an additional 0.062 in. The sides of each step shall be 90° to the face of the step and corners, and edges shall not be chamfered. The step wedge may be assembled from sheet stock or machined from solid material. If assembled from sheet stock, do not use glue or other adhesives to join the individual sheets.

6.1.1 Affix five separate wires, 0.5 in. (12.7 mm) apart, each forming three sinusoidal curves length-wise to the bottom of the step wedge on a 0.062 in. (1.59 mm) thick plastic sheet 4.0 in. (101.6 mm) wide by 11.0 in. (279.4 mm) long. The plastic sheet together with the ends of the five wires shall extend 1.0 in. (25.4 mm) out from the step wedge at the thin end. These wires shall be tinned solid copper with plastic insulation and shall be 22, 24, 26, 28, and 30 American Wire Gage (AWG) (0.643 mm, 0.511 mm, 0.404 mm, 0.320 mm and 0.254 mm) respectively in diameter as shown in Fig. 1.

6.1.2 View the test step wedge in the mode in which suspect objects are normally viewed. For vertical beam units, place the step wedge as close to the centerline of the inspection area and as close to the image detector as practical at an angle approximately 45° to the edge of the conveyor belt. For horizontal beam units, place the 4 in. (101.6 mm) side parallel to and as close as practical to the center of the detector with the flat side of the step wedge facing the detector and the 10 in. (254 mm) side positioned diagonally approximately 45° from the surface of the conveyor belt. Record the steps through which each gage wire can be observed on a grid as illustrated in Fig. 2. Use this information to optimize system performance. It may be retained for future reference.

6.1.3 The wires used on the test step wedge are not intended to simulate those which may be used in explosive triggering devices but rather as indicators of the sensitivity of the equipment being evaluated. The maximum number of steps on which a given gage wire can be detected is a measure of the system's performance.

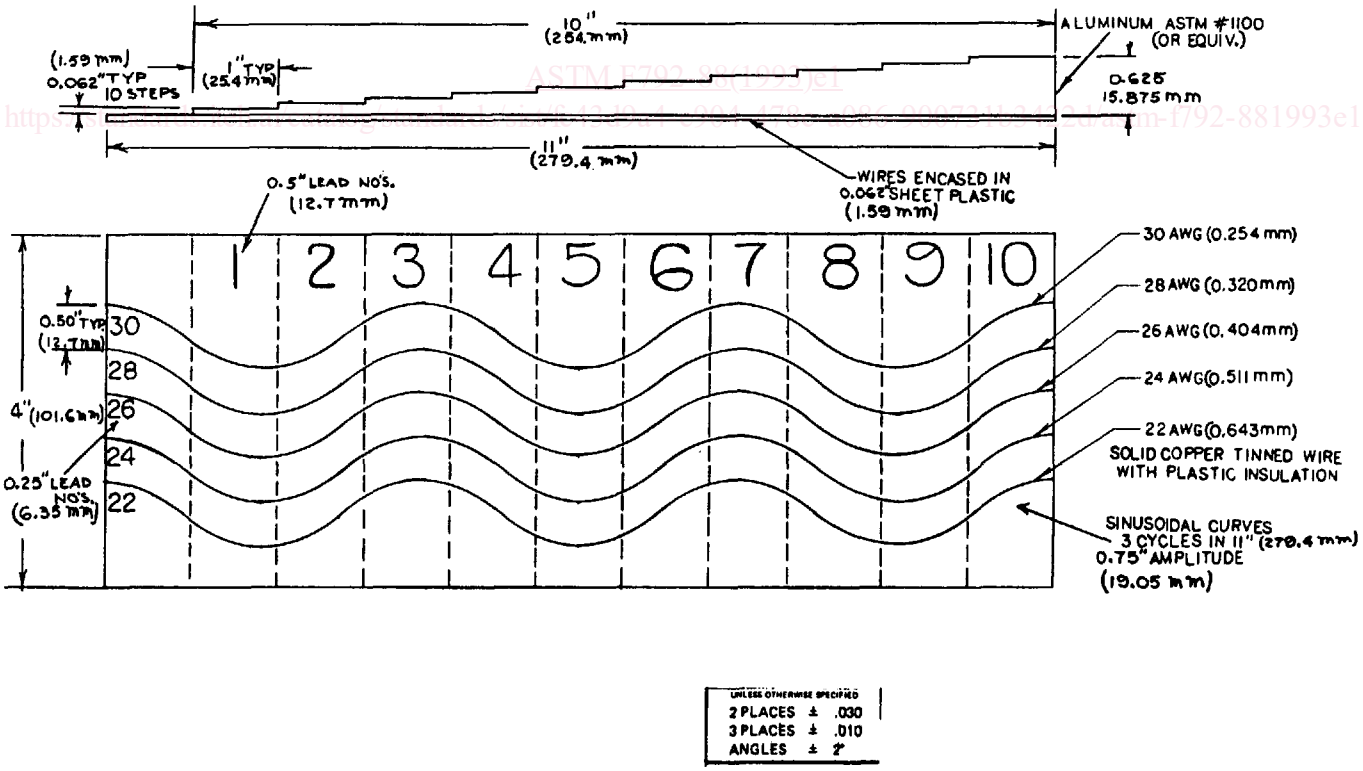
6.2 Make a test step wedge (Fig. 1) available for use at each security checkpoint.

7. System Safety Requirements

7.1 *Personal Health and Safety Requirements*—The health and safety of operators and other persons using or coming in contact with the equipment must be considered in the equipment design.

7.1.1 *Mechanical*—The equipment shall be free of sharp corners or protrusions that can puncture the skin or clothing or injure persons moving normally within the immediate area. All mechanically driven components shall be protected against accidental entrapment of, or attachment to any part of the human body or clothing which could be expected to come close to the moving component during normal operation.

7.1.2 *Electrical*—The equipment shall be free of potential electrical shock hazards during operation. For this purpose, the spirit and intent of UL187 shall apply.



NOTE—Aluminum step wedge can be made from sheet stock or machined from bar stock. If laminated from sheet stock, glue or other adhesives may not be used to join the sheets.

FIG. 1 Step Wedge for Testing X-Ray Security Screening Systems