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Standard Guide for Digital Detector Array Radiography¹

This standard is issued under the fixed designation E2736; 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 standard is a user guide, which is intended to serve as a tutorial for selection and use of various digital detector array systems nominally composed of the detector array and an imaging system to perform digital radiography. This guide also serves as an in-detail reference for the following standards: Practices E2597, E2698, and E2737.

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

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- E94 Guide for Radiographic Examination Using Industrial Radiographic Film
- E155 Reference Radiographs for Inspection of Aluminum and Magnesium Castings
- E192 Reference Radiographs of Investment Steel Castings for Aerospace Applications
- E1000 Guide for Radioscopy
- E1316 Terminology for Nondestructive Examinations
- E1320 Reference Radiographs for Titanium Castings
- E1815 Test Method for Classification of Film Systems for Industrial Radiography
- E1817 Practice for Controlling Quality of Radiological Ex-

amination by Using Representative Quality Indicators (RQIs)

- E2002 Practice for Determining Image Unsharpness and Basic Spatial Resolution in Radiography and Radioscopy
- E2422 Digital Reference Images for Inspection of Aluminum Castings
- E2445 Practice for Performance Evaluation and Long-Term Stability of Computed Radiography Systems
- E2446 Practice for Manufacturing Characterization of Computed Radiography Systems
- E2597 Practice for Manufacturing Characterization of Digital Detector Arrays
- E2660 Digital Reference Images for Investment Steel Castings for Aerospace Applications
- E2669 Digital Reference Images for Titanium Castings
- E2698 Practice for Radiographic Examination Using Digital Detector Arrays
- E2737 Practice for Digital Detector Array Performance Evaluation and Long-Term Stability

2.2 *ISO Document:*³

- ISO 17636-2 Non-Destructive Testing of Welds—Radiographic Testing - Part 2: X- and Gamma-Ray Techniques with Digital Detector

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *achievable contrast sensitivity (CS_a)*—best contrast sensitivity (see Terminology E1316 for a definition of contrast sensitivity) obtainable using a standard phantom with an X-ray technique that has little contribution from scatter.

3.1.2 *bad pixel*—a bad pixel is a pixel identified with a performance outside of the specification for a pixel of a DDA as defined in Practice E2597.

3.1.3 *burn-in*—change in gain of the scintillator or photoconductor that persists well beyond the exposure.

3.1.4 *efficiency*— SNR_n (see 3.1.6 of Practice E2597) divided by the square root of the dose (in mGy) and is used to measure the response of the detector at different beam energies and qualities.

¹ This guide 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 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.

³ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

3.1.5 *grooved wedge*—a wedge with one groove, that is 5 % of the base material thickness and that is used for achievable contrast sensitivity measurement in Practice E2597.

3.1.6 *internal scatter radiation (ISR)*—scattered radiation within the detector (from scintillator, photodiodes, electronics, shielding, or other detector hardware).

3.1.7 *lag*—residual signal in the DDA that occurs shortly after the exposure is completed.

3.1.8 *phantom*—a part or item being used to quantify DDA characterization metrics.

3.1.9 SNR_N —SNR, normalized by the basic spatial resolution SR_b as measured directly in the digital image and/or calculated from measured $SNR_{measured}$ by:

$$SNR_N = SNR_{measured} \times \left(\frac{88.6 \mu m}{SR_b} \right) \quad (1)$$

3.1.10 *specific material thickness range (SMTR)*—material thickness range within which a given image quality is achieved.

4. Significance and Use

4.1 This standard provides a guide for the other DDA standards (see Practices E2597, E2698, and E2737). It is not intended for use with computed radiography apparatus. Figure 1 describes how this standard is interrelated with the aforementioned standards.

4.2 This guide is intended to assist the user to understand the definitions and corresponding performance parameters used in related standards as stated in 4.1 in order to make an informed decision on how a given DDA can be used in the target application.

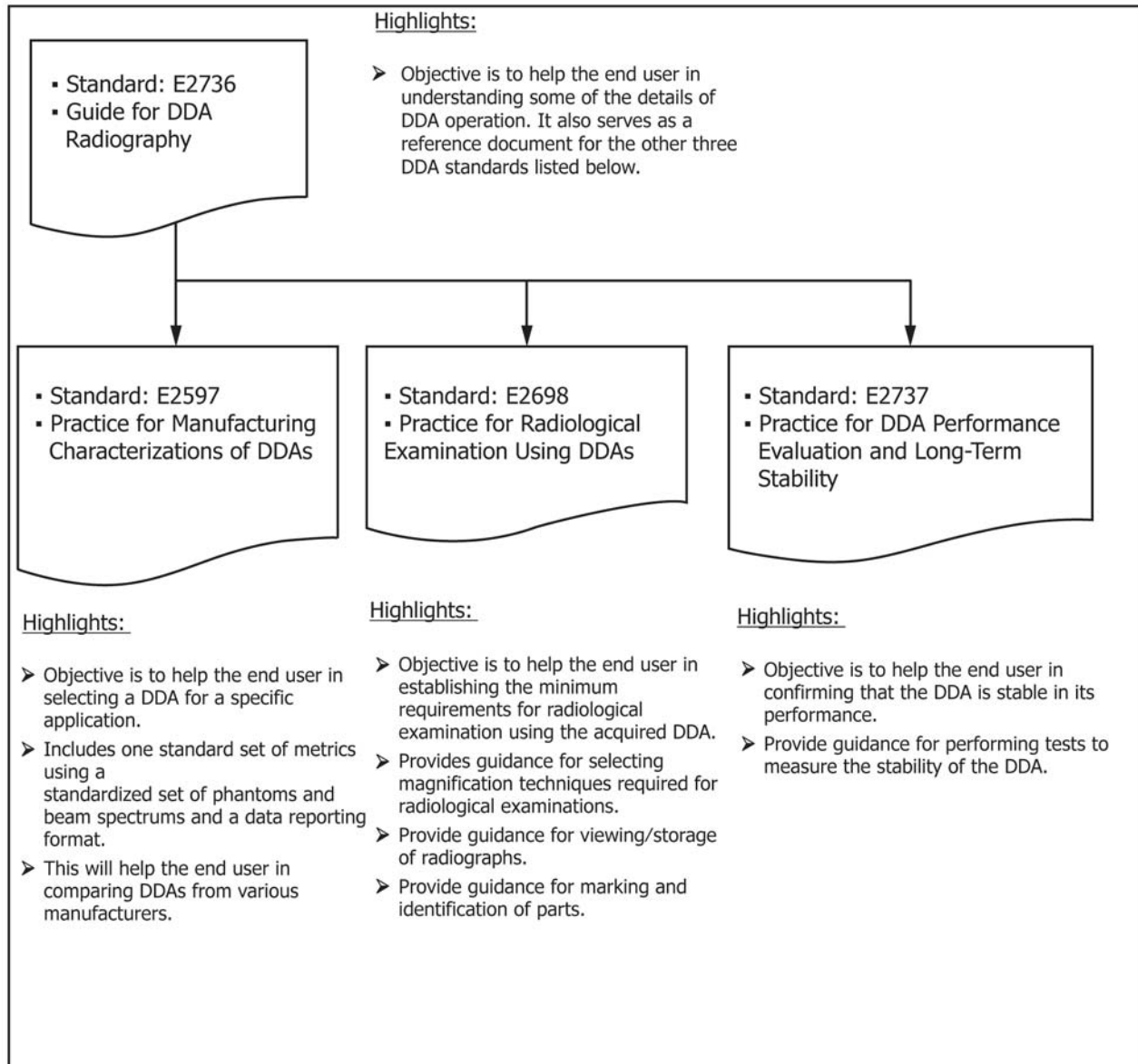


FIG. 1 Flow Diagram Representing the Connection Between the Four DDA Standards