



Designation: F2895 – 20

Standard Practice for Digital Radiography of Cast Metallic Implants¹

This standard is issued under the fixed designation F2895; 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 practice covers the procedure for digital radiographic testing of cast metallic surgical implants and related weldments.

1.2 Digital X-ray is an alternative method for radiography of cast metallic surgical implants and related weldments (see Practice F629).

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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

E192 Reference Radiographs of Investment Steel Castings for Aerospace Applications

E746 Practice for Determining Relative Image Quality Response of Industrial Radiographic Imaging Systems

¹ This practice is under the jurisdiction of ASTM Committee F04 on Medical and Surgical Materials and Devices and is the direct responsibility of Subcommittee F04.12 on Metallurgical Materials.

Current edition approved Feb. 1, 2020. Published April 2020. Originally approved in 2010. Last previous edition approved in 2015 as F2895 – 15. DOI: 10.1520/F2895-20.

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.

E1030/E1030M Practice for Radiographic Examination of Metallic Castings

E1316 Terminology for Nondestructive Examinations

E1742/E1742M Practice for Radiographic Examination

E2007 Guide for Computed Radiography

E2033 Practice for Radiographic Examination Using Computed Radiography (Photostimulable Luminescence Method)

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

F629 Practice for Radiography of Cast Metallic Surgical Implants

2.2 *ASNT Standard:*

SNT-TC-1A Personnel Qualification and Certification in Nondestructive Testing³

2.3 *Aerospace Industry Association (AIA/NAS) Standard:*
NAS410 NAS Certification & Qualification of Nondestructive Test Personnel⁴

2.4 *European Standard:*

EN 4179 Aerospace series—Qualification and approval of personnel for non-destructive testing⁵

3. Terminology

3.1 *Definitions*—For additional terminology, consult Terminology E1316.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *contrast, n*—difference in gray scale level between an area and its immediate surroundings as presented on the final digital radiographic image.

3.2.2 *digital image contrast, n*—range of gray scale values in an image in which a high contrast indicates that the image contains largely black-and-white brightness values with a wide range of gray shades.

³ Available from the American Society for Nondestructive Testing, Inc., PO Box 28518, Columbus, OH 43228-0518, <http://www.asnt.org>.

⁴ Available from Aerospace Industries Association (AIA), 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209, <http://www.aia-aerospace.org>.

⁵ Available from European Standards (EN) store, Krimicka 134 318 13 Pilsen Czech Republic, <http://en-standard.eu>.

*A Summary of Changes section appears at the end of this standard

3.2.3 *electronic imaging, v*—means of converting the image stored on the imaging plate or detector into a standard video output format.

3.2.4 *electronic imaging system, n*—system that takes data from a storage imaging plate or detector and converts it into a standard analog or digital electronic signal.

3.2.5 *gray scale, n*—numeric values representing display brightness.

3.2.6 *gray scale range, n*—range of numeric values representing the brightest and darkest portion of the image display.

3.2.7 *image display parameters, n*—all variables necessary to standardize the video image.

3.2.7.1 *Discussion*—These include, but are not limited to, brightness, contrast, and linearity.

3.2.8 *image processing, v*—electronic enhancement of the raw image signal to improve fine-detail detectability in the test object and achieve required sensitivity.

3.2.8.1 *Discussion*—These include, but are not limited to, techniques such as noise reduction, contrast enhancement, and spatial filtering.

3.2.9 *image quality level, n*—ability of the inspection system to demonstrate a specific relative image quality indicator (RIQI) sensitivity.

3.2.10 *imaging plate, IP, n*—radiation sensitive detector that is capable of detecting and storing input signal information that can subsequently be converted into a corresponding optical signal.

3.2.11 *IP reader, n*—device capable of retrieving stored information from the imaging plate and converting this information into digital data for subsequent viewing on a video monitor.

3.2.12 *masking, n*—lead or other high-density material placed on or around a test object during exposure for the purpose of minimizing the effect of secondary or scattered radiation.

3.2.13 *material thickness, n*—shall be the nominal thickness or actual thickness if measured at the area being radiographed.

3.2.14 *National Institute of Standards and Technology, NIST, n*—federal technology agency that develops and promotes measurements, standards, and technology.

3.2.15 *nondestructive inspection (NDI) procedure, n*—written set of instructions that identify equipment standardization, parameters, and setup for conducting a non-destructive test or inspection.

3.2.15.1 *Discussion*—The procedure may be broken into the following two parts: a general procedure that has the basic instructions on performing an inspection and a technique sheet that has the detailed instructions for specific parts.

3.2.16 *penetrameter, n*—strip of material of the same or similar composition as that of the material being examined representing a percentage of section thickness and provided with a combination of steps, holes, or quality levels.

3.2.16.1 *Discussion*—When placed in the path of radiation, the resultant radiographic image demonstrates the quality of the radiographic technique. It is also known as an image

quality indicator (IQI). It is not intended for use in judging the size or for establishing acceptance limits of discontinuities.

3.2.17 *penetrameter sensitivity, n*—indication of the ability of the radiographic process to show: (1) the difference in material thickness by exhibiting a difference of radiographic contrast and (2) detail definition by the resolution of holes of a specific size.

3.2.18 *quality level 2, n*—quality level designation in which the 2T hole is visible in a 2 % penetrameter; previously known as 2–2T sensitivity.

3.2.19 *radiation source, n*—machine or radioisotope that emits penetrating radiation.

3.2.20 *radiographic image, n*—visible image produced by the penetration of radiation through the material being tested.

3.2.21 *radiographic quality level, n*—ability of a radiographic procedure to demonstrate a certain penetrameter sensitivity.

3.2.22 *recording media, n*—recording media and storage format for mandatory radiographic image storage.

3.2.23 *recording medium, n*—detector that converts radiation into a visible image or a signal that can be transformed into a visible image at a later date.

3.2.23.1 *Discussion*—Also known as an *imaging plate*.

3.2.24 *relative image quality indicator, RIQI, n*—image quality measuring device that is capable of determining meaningful differences between two or more radiographic imaging systems or changes of individual components of radiographic imaging systems.

3.2.25 *technique, n*—category within a method, for example, digital radiographic testing or fluorescent penetrant inspection.

3.2.26 *technique card, n*—detailed, written instructions (may be in the form of a sheet, card, or other documentation) that supplement the instructions of a general procedure.

3.2.27 *test object, n*—material, component, or assembly that is the subject of the radiographic examination.

3.2.28 *X-ray control number, n*—inspection serial numbers or code letters used to provide traceability.

4. Significance and Use

4.1 The requirements expressed in this practice are intended to control the quality of the digital radiographic image of cast metallic surgical implants.

5. Radiographic Methods

5.1 The radiographic method shall be agreed upon between the purchaser and supplier but should be in accordance with Practice E1030/E1030M, Guides E94 and E2007, and Practice E2033.

5.2 *Frequency and Coverage*—The number of components inspected (frequency) and the coverage of each component shall be mutually agreed upon between the supplier and the customer. If the amount of inspection is not specified, all castings requiring radiographic inspection shall receive 100 % radiographic coverage. The orientation of the radiation beam