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Standard Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Digital Radiographic (DR) Test Methods[1]

This standard is issued under the fixed designation E2699; 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 facilitates the interoperability of digital X-ray imaging equipment by specifying image data transfer and archival methods in commonly accepted terms. This document is intended to be used in conjunction with Practice E2339 on Digital Imaging and Communication in Nondestructive Evaluation (DICONDE). Practice E2339 defines an industrial adaptation of the NEMA Standards Publication titled Digital Imaging and Communications in Medicine (DICOM, see http://medical.nema.org), an international standard for image data acquisition, review, storage and archival storage. The goal of Practice E2339, commonly referred to as DICONDE, is to provide a standard that facilitates the display and analysis of NDE results on any system conforming to the DICONDE standard. Toward that end, Practice E2339 provides a data dictionary and a set of information modules that are applicable to all NDE modalities. This practice supplements Practice E2339 by providing information object definitions, information modules and a data dictionary that are specific to digital X-ray test methods.

1.2 This practice has been developed to overcome the issues that arise when analyzing or archiving data from digital X-ray ~~equipment~~ test equipment using proprietary data transfer and storage methods. As digital technologies evolve, data must remain decipherable through the use of open, industry-wide methods for data transfer and archival storage. This practice defines a method where all the digital X-ray technique parameters and test results are communicated and stored in a standard manner regardless of changes in digital technology.

1.3 This practice does not specify:

1.3.1 A testing or validation procedure to assess an implementation's conformance to the standard.

1.3.2 The implementation details of any features of the standard on a device claiming conformance.

1.3.3 The overall set of features and functions to be expected from a system implemented by integrating a group of devices each claiming DICONDE conformance.

~~1.3.4Although~~1.4 Although this practice contains no values that require units, it does describe methods to store and communicate data that do require units to be properly interpreted. The SI units required by this practice are to be regarded as standard. No other units of measurement are included in this standard.

~~1.4~~1.5 *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:*[2]

E1316 Terminology for Nondestructive Examinations

E1475 Guide for Data Fields for Computerized Transfer of Digital Radiological Examination Data

E2339 Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)

E2597 Practice for Manufacturing Characterization of Digital Detector Arrays

2.2 *Other Standard:*[3]

DICOM National Electrical Manufacturers Association Standard for Digital Imaging and Communications in Medicine (DICOM), ~~2008~~2011

[1] This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.11 on Digital Imaging and Communication in Nondestructive Evaluation (DICONDE).

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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 National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1752, Rosslyn, VA 22209, http://www.nema.org.

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

3. Terminology

3.1 *Definitions*:

3.1.1 Nondestructive evaluation terms used in this practice can be found in Standard Terminology for Nondestructive Examinations, E1316.

3.1.2 DICONDE terms used in this practice are defined in Practice E2339.

3.1.3 Digital detector array terms used in this practice are defined in Practice E2597.

4. Summary of Practice

4.1 A fundamental principle of DICONDE is the use of standard definitions and attribute formats for data communication and storage. This means all systems that are DICONDE compliant use a common data dictionary and common communication protocols. To further standardization, the elements in the data dictionary are organized into common groups referred to as information modules. The data dictionary and information modules common to all NDE modalities are defined in Practice E2339.

4.2 The data dictionary and information modules specified in Practice E2339 do not cover the information storage requirements for each individual modality (CT, DR, CR, UT, etc.). Additions to the data dictionary and information modules are required to support the individual modalities. This practice contains the additions to the DICONDE data dictionary and information modules necessary for digital X-ray inspection.

4.3 The highest organizational level in the DICONDE information model is the information object definition (IOD). An information object definition is a collection of the information modules necessary to represent a set of test results from a specific modality. This practice contains information object definitions for digital X-ray inspection.

5. Significance and Use

5.1 Personnel that are responsible for the creation, transfer, and storage of digital X-ray test results will use this standard. This practice defines a set of information modules that along with Practice E2339 and the DICOM standard provide a standard means to organize digital X-ray test parameters and results. The digital X-ray test results may be displayed and analyzed on any device that conforms to this standard. Personnel wishing to view any digital X-ray inspection data stored according to Practice E2339 may use this document to help them decode and display the data contained in the DICONDE-compliant inspection record.

6. Information Object Definitions

6.1 *Digital X-ray Image IOD Description*:

6.1.1 The digital X-ray (DX) Image Information Object Definition specifies an image that has been created by a direct digital X-ray imaging device for NDE purposes. To avoid duplication of relevant material from the DICOM standard, the IOD definition will follow that for DX Images found in Part 3, ~~section~~Section A.26 of the DICOM standard except as noted below in Table 1. Table 1 is not stand-alone and must be used in conjunction with Part 3, ~~section~~Section A.26 of the DICOM standard to have a complete definition of the NDE DX information object.

6.1.2 This IOD will use the Service-Object Pair (SOP) Classes for the DX IOD as defined in Part 4, Section B5 of the DICOM standard.

6.2 *Digital X-ray Multi-Frame Image IOD Description*:

6.2.1 The digital X-ray (DX) Multi-frame (MF) Image Information Object Definition specifies an image that has been created by a direct digital X-ray imaging device for NDE purposes. To avoid duplication of relevant material from the DICOM standard, the IOD definition will follow that for Enhanced X-ray Angiographic (Enhanced XA) Images found in Part 3, ~~section~~Section A.47

TABLE 1 DX Image Information Object Definition

DICOM Module	DICONDE Module	Reference	Usage[A]	
Patient	Component	Practice E2339, Section 7	M	
Specimen Identification	Not Applicable			
Clinical Trial Subject	Not Applicable			
General Study	Component Study	Practice E2339, Section 7	M	
Patient Study	Not Applicable			
Clinical Trial Study	Not Applicable			
General Series	Component Series	Practice E2339, Section 7	M	
Clinical Trial Series	Not Applicable			
General Equipment	NDE Equipment		M	
Contrast/Bolus	Not Applicable			
DX Anatomy Imaged	Needed for DICOM compatibility			
~~DX Detector~~	~~NDE DX Detecto~~	~~7.1~~	~~M~~	
	DX Detector	NDE DX Detector	7.1	M
		NDE Indication	Practice E2339, Section 7	U
		NDE Geometry	Practice E2339, Section 7	U
		NDE DX Calibration	7.2	U
Data Acquisition Content	Needed for DICOM compatibility			

[A] Definition of usage codes can be found in Part 3, ~~s~~ Section A.1.3 of the DICOM standard.

of the DICOM standard except as noted below in Table 2. Table 2 is not stand-alone and must be used in conjunction with Part 3, ~~section~~Section A.47 of the DICOM standard to have a complete definition of the NDE DX-MF information object.

6.2.2 This IOD will use the Service-Object Pair (SOP) Classes for the Enhanced XA IOD as defined in Part 4, Section B5 of the DICOM standard.

7. Information Modules

7.1 *NDE DX Detector Module*:

7.1.1 Table 3 specifies the Attributes that describe NDE Direct Digital X-ray (DX) Detectors.

7.1.1.1 For NDE DX Images, Detector Type (0018,7004) is specified to use the following defined terms.

DIRECT

SCINTILLATOR

7.1.1.2 For NDE DX Images, Detector Configuration (0018,7005) is specified to use the following defined terms.

AREA

LINEAR

7.2 *NDE DX Calibration Data Module*:

7.2.1 Table 4 specifies the Attributes that describe NDE direct digital X-ray calibration data.

8. Keywords

~~8.1DICOM; DICONDE; direct digital X-ray; DX; digital data transmission; digital data storage; database; file format~~

TABLE 2 DX MF Image Information Object Definition

DICOM Module	DICONDE Module	Reference	Usage[A]
Patient	Component	Practice E2339, Section 7	M
Specimen Identification	Not Applicable		
Clinical Trial Subject	Not Applicable		
General Study	Component Study	Practice E2339, Section 7	M
Patient Study	Not Applicable		
Clinical Trial Study	Not Applicable		
General Series	Component Series	Practice E2339, Section 7	M
Clinical Trial Series	Not Applicable		
General Equipment	NDE Equipment	Practice E2339, Section 7	M
Enhanced Contrast/Bolus	Not Applicable		
Acquisition Context	Needed for DICOM compatibility		
Cardiac Synchronization	Not Applicable		
Respiratory Synchronization	Not Applicable		
X-Ray Detector	NDE DX Detector	7.1	M
	NDE Indication	E2339, Section 7	U
	NDE Geometry	Practice E2339, Section 7	U
	NDE DX Calibration Data	7.2	U

[A] Definition of usage codes can be found in Part 3, ~~s~~ Section A.1.3 of the DICOM standard.