Designation: E2738 – 13ε1

Standard Practice for Digital Imaging and Communication Nondestructive Evaluation (DICONDE) for Computed Radiography (CR) Test Methods[1]

This standard is issued under the fixed designation E2738; 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.

ε[1] NOTE—Table 4 was corrected editorially in January 2014.

1. Scope*

1.1 This practice facilitates the interoperability of computed radiography (CR) imaging and data acquisition equipment by specifying image data transfer and archival storage methods in commonly accepted terms. This practice 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 computed radiography test methods.

1.2 This practice has been developed to overcome the issues that arise when analyzing or archiving data from CR 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 standard CR 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.

1.4 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 practice.

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

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

2.2 *Other Documentation:*

National Electrical Manufacturers Association Standard for Digital Imaging and Communication in Medicine (DICOM), 2011.

3. Terminology

3.1 *Definitions:*

3.1.1 Nondestructive evaluation terms used in this practice can be found in Terminology E1316.

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

[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.

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

TABLE 1 NDE CR Image Information Object Definition

DICOM Module	DICONDE Module	Reference	Usage
Patient	Component	E2339, Section 7	M
Clinical Trial Subject	Not Applicable		
General Study	Component Study	E2339, Section 7	M
Patient Study	Not Applicable		
Clinical Trial Study	Not Applicable		
General Series	Component Series	E2339, Section 7	M
CR Series	NDE CR Series	Section 7.1	M
Clinical Trial Series	Not Applicable		U
General Equipment	NDE Equipment	E2339, Section 7	M
Contrast/bolous	Not Applicable		U
CR image	NDE CR image	Section 7.3	M
	NDE Indication	E2339, Section 7	U
	NDE Geometry	E2339, Section 7	U
	NDE Source Radiography	Section 7.2	U

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 CR 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 CR inspection.

5. Significance and Use

5.1 Personnel that are responsible for the creation, transfer, and storage of computed radiography NDE data will use this practice. This practice will define a set of information modules that along with the Practice E2339 and the DICOM standard will provide a standard means to organize CR inspection data. The CR inspection data may be displayed and analyzed on any device that conforms to the standard. Personnel wishing to view any CR inspection data stored in accordance with Practice E2339 may use this practice to help them decode and display the data contained in the DICONDE compliant inspection record.

6. Information Object Definitions

6.1 *NDE Computed Radiography Image IOD Description:*

6.1.1 The NDE Computed Radiography (CR) Image Information Object Definition specifies an image that has been created by a computed radiography imaging device for NDE purposes. The IOD definition will follow that for CR Images found in Part 3, Section A.2 of the DICOM standard except as noted in Table 1. Table 1 is not stand-alone and must be used in conjunction with Part 3, Section A.2 of the DICOM standard to have a complete definition of the NDE CR information object.

6.1.2 This IOD will use the Service-Object Pair (SOP) class for the CR IOD as defined in Part 4, Section B.5 of the DICOM standard.

7. Information Modules

7.1 *NDE CR Series Module:*

7.1.1 Table 2 specifies the attributes that describe NDE Computed Radiography images.

7.2 *NDE Source Radiography Module:*

7.2.1 Table 3 specifies the attributes that describe NDE Source Radiography Module.

7.3 *NDE CR Image Module:*

7.3.1 Table 4 specifies the attributes that describe NDE CR Image Module.

8. Keywords

8.1 Computed Radiography; CR; database; DICOM; DICONDE; digital data storage; digital data transmission; file format

TABLE 2 NDE CR Series Module Attributes

Attribute Name	Tag	VR	VM	Type	Description
Part Examined	(0018,0015)	CS	1	2	Text description of the part examined
View Position	(0018,5101)	CS	1	2	Radiographic view. Defined Terms: FA = Forward/Aft AF = Aft/Forward LL = Left Lateral RL = Right Lateral RLD = Right Lateral Decubitus LLD = Left Lateral Decubitus
Filter Type	(0018,1160)	SH	1	3	Label for the type of filter inserted into the x-ray beam
Collimator/grid Name	(0018,1180)	SH	1	3	Label describing any grid inserted.
Focal Spot	(0018,1190)	DS	1-n	3	Size of the focal spot in mm. For devices with variable focal spot or multiple focal spots, small dimension followed by large dimension.
Plate Type	(0018,1260)	SH	1	3	Label of the type of storage phosphor plates used in this series
Phosphor Type	(0018,1261)	LO	1	3	Label of type of phosphor on the plates

TABLE 3 NDE Source Radiography Module Attributes

Attribute Name	Tag	VR	VM	Type	Description
Source Type	(300A,0214)	CS	1	1	Type of Source: Defined Terms: POINT LINE CYLINDER SPHERE
Source Manufacturer	(300A,0216)	LO	1	3	Manufacturer of Source
Active Source Diameter	(300A,0218)	DS	1	3	Diameter of active Source (mm)
Active Source Length	(300A,0220)	DS	1	3	Length of active Source (mm)
Material ID	(300A,00E1)	DS	1	3	User-supplied identifier for encapsulation material of active Source
Source Encapsulation Nominal Thickness	(300A,0222)	DS	1	3	Nominal thickness of wall of encapsulation (mm)
Source Encapsulation Nominal Transmission	(300A,0224)	DS	1	3	Nominal transmission through wall of encapsulation (between 0 and 1)
Source Isotope Name	(300A,0226)	LO	1	1	Name of Isotope
Source Isotope Half-Life	(300A,0228)	DS	1	1	Half-life of Isotope (days)
Source Strength Units	(300A,0229)	CS	1	1C	Measurement of Source Strength Required if the source is not a gamma-emitting (photon) source. May be present otherwise. Enumerate values: AIR Kerma Rate = Air Kerma Rate if Source is Gamma-emitting Isotope
Reference Air Kerma Rate	(300A,022A)		1	1	Air Kerma Rate in air of Isotope specified at Source Strenth Reference Date (300A,022C) and Source Strength Reference Time (300A,022E) (in μGy h^{-1} at 1 m). Values shall be zero for non-gamma sources.
Source Strength	(300A,022B)		1	1C	Source Strength of Isotope at Source Strength Reference Date (300A,022C) and Source Strength Reference Time (300A,022E), in units specified in Source Strength Units (300A,0229). Required if the source is not a gamma-emitting (photon) source.
Source Strength Reference Date	(300A,022C)	DT	1	1	Reference date for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.
Source Strength Reference Time	(300A,022E)	TM	1	1	Reference time for Reference Air Kerma Rate (300A,022A) or Source Strength (300A,022B) of Isotope.

TABLE 4 NDE CR Image Module Attributes

Attribute Name	Tag	VR	VM	Type	Description
Photometric Interpretation	(0028,0004)	CS	1	1	Specifies the intended interpretation of the pixel data. Shall have one of the following enumerated values: MONOCHROME 1 MONOCHROME 2
KVP	(0018,0060)	DS	1	3	Peak kilo voltage output of the x-ray generator used.
Plate ID	(0018,1004)	LO	1	3	The ID or serial number of the sensing plate upon which the image was acquired.
Distance Source to Detector	(0018,1110)	DS	1	3	Distance in mm from source to detector center
Distance Source to Part	(0018,1111)	DS	1	3	Distance in mm from the source to isocenter (center of field of view).
Exposure Time	(0018,1150)	IS	1	3	Time of X-ray exposure in msec
X-ray Tube Current	(0018,1151)	IS	1	3	X-ray Tube Current in mA
Exposure	(0018,1152)	IS	1	3	The exposure expressed in mAs, for example calculated from Exposure Time and X-ray Tube Current.
Exposure in µAs	(0018,1153)	IS	1	3	The exposure expressed in µAs, for example calculated from Exposure Time and X-ray Tube Current.
Image Pixel Spacing	(0018,1164)	DS	2	3	Physical distance measured at the front plane of the Image Receptor housing between the center of each pixel. Specified by a numeric pair – row spacing value (delimiter) column spacing value – in mm. In the case of CR, the front plane is defined to be the external surface of the CR plate closest to the part and radiation source.
Generator Power	(0018,1170)	IS	1	3	Power in kW to the X-ray generator.
Acquisition Device Processing Description	(0018,1400)	LO	1	3	Describes device-specific processing associated with the image.
Acquisition Device Processing Code	(0018,1401)	LO	1	3	Code representing the device-specific processing associated with the image.
Cassette Orientation	(0018,1402)	CS	1	3	Orientation of the cassette used to properly position the image for display. Enumerated Values: LANDSCAPE PORTRAIT
Cassette Size	(0018,1403)	CS	1	3	Size of the cassette. Defined terms 18 cm × 24 cm 8 in × 10 in 24 cm × 30 cm 10 in × 12 in 30 cm × 35 cm 30 cm × 40 cm 11 in × 14 in 35 cm × 35 cm 14 in × 14 in 35 cm × 43 cm 14 in × 17 in
Exposures on Plate	(0018,1404)	US	1	3	Total number of X-ray exposures that have been made on the plate identified in Plate ID. (0018,1004)
Relative X-ray Exposure	(0018,1405)	IS	1	3	Relative X-ray exposure on the plate. Meaning of values is implementation specific.
Sensitivity	(0018,6000)		1	3	Read out sensitivity.
X-ray Tube Current in µA	(0018,8151)	DS	1	3	X-ray Tube Current in µA.
Image Quality Indicator Type	(0014,40A0)	LO	1-n	3	Description of the type of Image Quality Indicator used.
Image Quality Indicator Material	(0014,40A1)	LO	1-n	3	Description of the material used to manufacture the Image Quality Indicator.
Image Quality Indicator Size	(0014,40A2)	LO	1-n	3	Designation for the size of the Image Quality Indicator used. A typical size designation is '2-2T' where the first number indicates that the IQI thickness is two percent of the test material thickness and second number defines the hole diameter as twice the IQI thickness.

SUMMARY OF CHANGES

Committee E07 has identified the location of selected changes to this standard since the last issue (E2738 - 11) that may impact the use of this standard. (December 15, 2013)

(1) Added Section 7.2 to describe the NDE Source Radiography module.
(2) Added 7.3 to add NDE-specific attributes to the CR Image module. The attributes added were for X-ray Current in μA and IQI description.

(3) Updated Table 1 to reflect the addition of Section 7.2 and 7.3.