Designation: E2934 – 23

Standard Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Eddy Current (EC) Test Methods[1]

This standard is issued under the fixed designation E2934; 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 interoperability of eddy current imaging and data acquisition equipment by specifying the image data transfer and archival storage 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 NEMA PS3 / ISO 12052, 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 eddy current test methods.

1.2 This practice has been developed to overcome the issues that arise when analyzing or archiving data from eddy current 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 eddy current technique parameters and inspection data 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, or

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 *Units*—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 values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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

1.6 *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]

E1316 Terminology for Nondestructive Examinations

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

2.2 *NEMA Standard:*[3]

NEMA PS3 / ISO 12052 Digital Imaging and Communications in Medicine (DICOM)

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.

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

[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).

Current edition approved June 15, 2023. Published July 2023. Originally approved in 2013. Last previous edition approved in 2022 as E2934 – 22. DOI: 10.1520/E2934-23.

[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.dicomstandard.org/

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

TABLE 1 EC Image Information Object Information

DICOM Module	DICONDE Module	Reference	Usage[A]
	Component	E2339, Section 7	M
	Component Study	E2339, Section 7	M
	Component Series	Section 7.1	M
Frame of Reference		DICOM Part 3 Section C.7.4.1	U
Synchronization		DICOM Part 3 Section C.7.4.2	U
	NDE Equipment	E2339, Section 7	M
General Image		DICOM Part 3 Section C.7.6.1	M
Image Pixel		DICOM Part 3 Section C.7.6.3	M
Palette Color Lookup Table		DICOM Part 3 Section C.7.9	C – Required if Photometric Interpretation (0028,0004) has a value of PALETTE COLOR
Device		DICOM Part 3 Section C.7.6.12	U
	NDE EC Image	Section 7.2	M
Overlay Plane		DICOM Part 3 Section C.7.9.2	U
VOI LUT		DICOM Part 3 Section C.7.11.2	U
SOP Common		DICOM Part 3 Section C.7.12.1	M
	NDE EC Equipment	Section 7.3	U
	NDE EC Equipment Settings	Section 7.4	U
	NDE Indication	E2339, Section 7	U
	NDE Geometry	E2339, Section 7	U
	NDE Data Element Label Dictionary	E2339, Section 7	U
	NDE Geolocation	E2339, Section 7	U

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

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 (Computed Tomography, Digital Radiography, Computed Radiography, Ultrasonic, 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 eddy current inspection.

4.3 The highest organizational level in the DICONDE information model is the information object definition (IOD). The information object definition is a collection of information modules necessary to represent a set of examination results from a specific modality. This practice contains information object definitions necessary for eddy current inspection.

5. Significance and Use

5.1 Personnel that are responsible for the creation, transfer, and storage of eddy current NDE 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 eddy current test parameters and results. The eddy current examination results may be displayed or analyzed on any device that conforms to the standard. Personnel wishing to view any eddy current examination 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 *Eddy Current Image IOD Description*

6.1.1 The Eddy Current (EC) Image Information Object Definition specifies an image that has been created by an Eddy Current imaging device for NDE purposes. The IOD definition is found in Table 1. Note that eddy current has no equivalent medical imaging modality. While the IOD definition utilizes standard information modules from the DICOM standard, there exists no EC IOD within the DICOM standard.

6.1.2 Since there is no EC IOD within the DICOM standard, the option of using a DICOM Standard Extended Service-Object Pair (SOP) Class does not exist. A SOP Class Name and Unique Identifier (UID) have been provided to the EC IOD in Table 2. Note that since this is not a DICOM SOP Class, many standard DICOM image display and storage tools may not accept these images.

6.2 *Eddy Current Multi-Frame Image*

6.2.1 The Eddy Current Multi-Frame (EC-MF) Image Information Object Definition specifies a multi-frame image that has been created by an Eddy Current imaging device for NDE purposes. This includes data that have been collected for multifrequency combinations or harmonic analyses. The IOD definition is found in Table 3. Note that eddy current multi-frame has no equivalent medical imaging modality. While the IOD definition utilizes standard information modules from the DICOM standard, there exists no EC-MF IOD within the DICOM standard.

TABLE 2 SOP Class Definitions

SOP Class Name	SOP Class UID	IOD Specification
Eddy Current Image Storage	1.2.840.10008.5.1.4.1.1.601.1	EC IOD (See 6.1)
Eddy Current Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.601.2	EC-MF IOD (See 6.2)
Eddy Current Waveform Storage	1.2.840.10008.5.1.4.1.1.601.3	EC-WF (See 6.3)