



Designation: E2339 – 21

## Standard Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)<sup>1</sup>

This standard is issued under the fixed designation E2339; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope\*

1.1 This practice facilitates the interoperability of NDE imaging and data acquisition equipment by specifying the image data in commonly accepted terms. This practice represents a harmonization of NDE imaging systems, or modalities, with 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. In addition, this practice will provide a standard set of industrial NDE specific information object definitions, which travel beyond the scope of standard DICOM modalities. The goal of this practice is to provide a standard by which NDE image/signal data may be displayed on by any system conforming to the ASTM DICONDE format, regardless of which NDE modality was used to acquire the data.

1.2 This practice has been developed to overcome the issues that arise when archiving or analyzing the data from a variety of NDE techniques, each using proprietary data acquisition systems. As data acquisition modalities evolve, data acquired in the past must remain decipherable. This practice proposes an image data file format in such a way that all the technique parameters, along with the image file, are preserved, regardless of changes in NDE technology. This practice will also permit the viewing of a variety of image types (CT, CR, Ultrasonic, Infrared, and Eddy Current) on a single workstation, maintaining all of the pertinent technique parameters along with the image file. This practice addresses the exchange of digital information between NDE imaging equipment.

1.3 This practice does not specify:

1.3.1 A complete description of all the information necessary to implement the DICONDE standard for an imaging modality. This document must be used in conjunction with one of the method-specific DICONDE Standard Practice documents

and the DICOM Standard to completely describe all the requirements necessary to implement the DICONDE standard for an imaging modality. See 2.1 of this document for a current list of the method-specific standard practice documents.

1.3.2 A testing or validation procedure to assess an implementation's conformance to the standard. Best practices for demonstrating conformance can be found in Practice E3147.

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

1.3.4 The overall set of features and functions to be expected from a system implemented by integrating a group of devices each claiming DICONDE or DICOM 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 SI units required by this practice 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:*<sup>2</sup>

E1316 Terminology for Nondestructive Examinations

E2663 Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Ultrasonic Test Methods

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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

**E2699** Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Digital Radiographic (DR) Test Methods

**E2738** Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Computed Radiography (CR) Test Methods

**E2767** Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for X-ray Computed Tomography (CT) Test Methods

**E2934** Practice for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) for Eddy Current (EC) Test Methods

**E3147** Practice for Evaluating DICONDE Interoperability of Nondestructive Testing and Inspection Systems

**E3169** Guide for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)

## 2.2 Other Documentation:<sup>3</sup>

**NEMA PS3 / ISO 12052**, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://www.dicomstandard.org/>)

**ACR-NEMA 300–1998** Digital Imaging and Communication in Medicine

## 3. Terminology

### 3.1 Definitions:

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

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *AE*, *n*—application entity

3.2.2 *attribute*, *n*—a property of an information object. An attribute has a name and a value, which are independent of any encoding scheme.

3.2.3 *attribute tag*, *n*—a unique identifier for an *attribute* of an *information object* composed of an ordered pair (gggg, eeee), where gggg represents the group number and eeee represents the data element.

3.2.4 *conformance statement*, *n*—a formal statement associated with a specific implementation of the standard, specifying the service class, information objects, and communications protocols supported by the implementations.

3.2.5 *data dictionary*, *n*—a registry of data elements, which assigns a unique tag, a name, value characteristics, and semantics to each data element.

3.2.6 *data element*, *n*—a unit of information as defined by a single entry in the *data dictionary*. An encoded IOD attribute that is composed of, at a minimum, three fields: a *data element tag*, a *value length*, and a *value field*.

3.2.7 *data element tag*, *n*—a unique identifier for a *data element* composed of an ordered pair of numbers (a *group number* followed by an *element number*).

3.2.8 *data element type (type)*, *n*—used to specify whether an *attribute* of an IOD is required and must have a non-zero

value (Type 1), required but may have a zero value (Type 2), required only under certain conditions (Type 1C and 2C), or optional (Type 3). See Part 5, Section 7.4 of the DICOM standard for additional details.

3.2.9 *DICONDE version identifier*, *n*—unique string placed in the DICONDE object to identify the version of DICONDE used to create the object.

3.2.10 *element number*, *n*—the second number in the ordered pair of numbers that make up a *data element tag*.

3.2.11 *group number*, *n*—the first number in the ordered pair of numbers that makes up a *data element tag*.

3.2.12 *information object definition (IOD)*, *n*—a data abstraction of a class of similar *real-world objects* which defines the nature and *attributes* relevant to the class of *real-world object* represented.

3.2.13 *module*, *n*—a set of *attributes* with an *Information Object Definition*.

3.2.14 *private data element*, *n*—additional *data element*, defined by an implementer, to communicate information that is not contained in standard *data elements*. Private *data elements* have odd *group numbers*.

3.2.15 *service-object pair class (SOP class)*, *n*—the union of a service class and an information object definition. SOP Classes are the building blocks that support the interaction between two DICOM application entities.

3.2.16 *unique identifier (UID)*, *n*—a numeric identifier that is guaranteed to be unique among all DICOM numeric identifiers.

3.2.17 *usage*, *n*—used to specify whether an information module is Mandatory (M), Conditional (C), or User Optional (U). See Part 3, Section A.1.3 of the DICOM standard for additional details.

3.2.18 *value*, *n*—a component of a *value field*. A *value field* may consist of one or more of these components.

3.2.19 *value field*, *n*—the field within a *data element* that contains the *value(s)* of that *data element*.

3.2.20 *value length*, *n*—the field within a *data element* that contains the length of the *value field* of the *data element*.

3.2.21 *value multiplicity (VM)*, *n*—specifies the number of *values* contained in the *value field* of a *data element*.

3.2.22 *value representation (VR)*, *n*—specifies the data type and format of the *value(s)* contained in the *value field* of a *data element*. A complete list of all the VR's can be found in Part 5, subsection 6.2 of the DICOM standard.

## 4. Summary of Practice

4.1 Guide **E3169** provides an overview of the ASTM International standard practices that address DICONDE and assistance in identifying the correct standard practices needed to implement specific use cases. That document should be the first document utilized for any DICONDE application.

4.2 The basic concept of DICOM and DICONDE is the use of standardized data identifiers. This means all participants are using the standardized data identifiers to represent the same

<sup>3</sup> Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1752, Rosslyn, VA 22209, <http://www.nema.org>.