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Standard Guide for Building Information Models and Archiving for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE)[1]

This standard is issued under the fixed designation E3267; 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 The display, transfer, and storage of digital nondestructive evaluation data in a common, open format is necessary for the effective interpretation and preservation of evaluation results. ASTM International has developed common open standards for Digital Imaging and Communication in Nondestructive Evaluation (DICONDE) based on the ubiquitous healthcare industry standard Digital Imaging and Communication in Medicine (DICOM). This guide provides an overview of DICONDE data archiving considerations and building information models for the efficient storing and locating of such data.

1.2 This guide provides an overview of how to manage ASTM DICONDE data from standard practices found in 2.2 for the display, transfer, and storage of digital nondestructive test data.

1.3 This guide provides an overview of how to utilize the DICOM standard found in 2.4 for the display, transfer, and storage of digital nondestructive test data for test methods not explicitly addressed by a DICONDE standard practice but having an equivalent medical imaging modality.

1.4 This guide provides recommendations for the storage of nondestructive digital test data not addressed in 1.2 or 1.3.

1.5 *Units*—Although this guide 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 guide are to be regarded as standard. No other units of measurement are included in this guide.

1.6 *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.*

1.7 *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

E1453 Guide for Storage of Magnetic Tape Media that Contains Analog or Digital Radioscopic Data

2.2 *ASTM DICONDE Test Method Standards:*[2]

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

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

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

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

2.3 *ASTM DICONDE Interoperability Standard:*[2]

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

2.4 *DICOM Standard:*

DICOM 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/)

2.5 *ISO Standards:*[3]

ISO 8824 Information Technology — Abstract Syntax Notation One (ASN.1): Specification of Basic Notation

[1] This guide 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 International Organization for Standardization (ISO), ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, https://www.iso.org.

ISO 9834-1 Information Technology — Procedures for the Operation of Object Identifier Registration Authorities: General Procedures and Top Arcs of the International Object Identifier Tree — Part 1
ISO 10995 Information Technology — Digitally Recorded Media for Information Interchange and Storage — Test Method for the Estimation of the Archival Lifetime of Optical Media
ISO 16963 Information Technology — Digitally Recorded Media for Information Interchange and Storage — Test Method for the Estimation of Lifetime of Optical Disks for Long-term Data Storage
ISO 18938 Imaging Materials — Optical Discs — Care And Handling For Extended Storage

2.6 *NIST Documents:*[4]

NIST Special Publication 500-252 Care and Handling of CDs and DVDs — A Guide for Librarians and Archivists
NIST and Library of Congress NIST/Library of Congress (LC) Optical Disc Longevity Study

2.7 *CCI Document:*[5]

Canada Conservation Institute CCI Notes 19/1 Longevity of Recordable CDs and DVDs

2.8 *MAM-A Inc. Documents:*[6]

MAM Archive Grade Gold Media Longevity
Specifications for MAM-A CD-R Media
Product Specifications: DVD-R 16X Gold/Silver

2.9 Additional aggregate sources are included in Appendix X3.

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 can be found in Practices E2339 and E3147.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *archive, n*—a collection of records that has been selected for permanent or long-term preservation on grounds of some value.

3.2.2 *character, n*—a unit of information generally corresponding to a letter, glyph, numerical digit, punctuation mark, symbol, control mark, or whitespace.

3.2.3 *decimal string, n*—a computer memory storage object (variable type) that contains a value of a decimal number or a number in exponential scientific notation.

3.2.4 *integer string, n*—a computer memory storage object (variable type) that contains a value of a whole number only.

3.2.5 *linear tape-open (LTO), n*—a magnetic tape data storage technology developed as an open standards alternative to the proprietary magnetic tape; the LTO Consortium directs development and manages licensing and certification of media and mechanism manufacturers.

3.2.6 *mean time between failures (MTBF), n*—the predicted elapsed arithmetic mean (average) time between inherent failures of a mechanical or electronic system, during normal system operation

3.2.7 *metadata, n*—information that describes or provides additional information about other data.

3.2.8 *offline media, n*—any media not directly addressable by a computer system on-demand and requiring some form of import process.

3.2.9 *online media, n*—any media directly addressable by a computer system on-demand via a dedicated channel without requiring any external interaction.

3.2.10 *query, v*—the activity of requesting a DICONDE software to determine all objects known to it that match the criteria requested; query is also commonly referred to as Search.

3.2.11 *redundant array of independent disks (RAID), n*—a storage methodology in which multiple physical disk drives are combined into one or more logical drives for the purposes of data redundancy, performance improvement, or both.

3.2.12 *write once, read many (WORM), n*—media that can be written to only once and has either physical or logical properties to prevent the overwriting or removal of data.

4. Summary of Guide

4.1 DICONDE provides rich methods for managing the display, transfer, and storage of a wide variety of digital test data. As a framework, it provides all the tools necessary to handle the data in commonly accepted terms, but it does not and should not define a specific methodology for the long-term preservation of the test data. The individual cases vary from user to user and on a case-by-case basis. This guide is intended to provide the end-user a practical overview of the different methodologies and techniques of digital test data archival. The topics that are covered in this guide are:

4.1.1 *Data Lifecycle Considerations*—How to deal with data archival over time.

4.1.2 *Personnel Considerations*—The people involved with archive management.

4.1.3 *Identification Usage*—How to use DICONDE tags to identify data for storage and later recall (building an information model).

4.1.4 *Storage Selection*—Selecting the appropriate type of storage methodology.

5. Significance and Use

5.1 5.1 This guide is intended to assist and provide recommendations for an end-user of NDE imaging systems by providing an introduction to the basic principles of DICONDE for the control and maintenance of electronic NDE data. This guide is not intended to control the acceptability of the materials or components examined.

5.2 *Recommended End-users:*

[4] Available from National Institute of Standards and Technology (NIST), 100 Bureau Dr., Stop 1070, Gaithersburg, MD 20899-1070, http://www.nist.gov.

[5] Available from Canada Conservation Institute (CCI), 1030 Innes Road, Ottawa ON, K1A 0M5, Canada, www.canada.ca.

[6] Available from MAM-A Inc., 10045 Federal Drive, Colorado Springs, CO 80908-4509, www.mam-a.com.

5.2.1 Personnel responsible for the creation, display, transfer, or storage of digital nondestructive evaluation results will use this guide.

5.2.2 Personnel responsible for the purchase and implementation of NDT systems conforming to the DICONDE standard will use this guide.

6. Procedure

6.1 Before implementation of a digital NDE solution of any type, the personnel responsible for the management of the solution need to have considered and made decisions around four fundamentals: data lifecycle management, identification of the data, personnel responsible for the data, and storage technology for the data.

6.2 *Data Lifecycle Management:*

6.2.1 The "Data Lifecycle" is the most important element of managing any data, whether for NDT or any other discipline. Rarely is data created that needs to survive forever. Data generated in NDE processes are almost always tied to a physical object, be it a pipe weld under inspection or a cast part being verified before use. Those physical objects have an operational lifespan, either individually or collectively in a system, and their related inspection data should be no different.

6.2.2 There are several reasons to maintain such historic inspection data. A few examples include:

(1) The data is directly useful for root-cause analysis in case of unexpected part/repair failures or Quality Management System (QMS) audit.

(2) The data can provide visual or algorithmic trends on wear and fatigue (providing statistically significant data for future failure predictions or service cycles).

(3) Quality control comparison across a part from multiple manufacture facilities or over a period of manufacture time to compare processes, materials, or technique changes.

(4) Verifying part specification conformance.

6.2.3 Inspection data typically needs to be preserved at most for the lifetime of the component family, but it can also be shortened to the life of the particular part inspected or even to a specific timeframe. For instance, once a part is no longer manufactured or no longer in service, maintaining this data generally loses value, and data can quickly turn from an asset into an expense. Keeping track of what data should remain archived and what can be dispensed with is another task of the archival process. The specific rules for each end-user may vary, but there are certain criteria that should be considered and maintained for the best results:

(1) What is the lifespan of the data or the revalidation period?

(2) Are there other non-time based criteria for retention/disposal?

(3) Who are the responsible parties to review the data for revalidation or to be removed before final disposal?

(4) Does the information require multiple authorizations before disposal?

6.2.4 The lifecycle of data is not limited only to the disposal, but also to the management of disclosures and assignments. After some criteria, data may need to be transferred from one responsible party to another. This process should be tracked and maintained during the life of the data to ensure the appropriate access is maintained and that data doesn't become orphaned. The specific rules for each end-user may vary, but there are certain criteria that should be considered:

(1) Data owner parties

(2) Data classification level(s)

(3) Responsible parties to change classification level

(4) Reassignment date and proposed new responsible parties

6.3 *Data Management Personnel/Roles:*

6.3.1 Technology plays a critical role in the management of data, but it isn't all just up to the computers: people are important parts of the process. Just as the Level III is responsible for reviewing inspection data and providing a result, there are other individuals who help to make a successful digital NDT workflow. For example, it is typically neither efficient nor best practice to make the Level III responsible for management of the related IT equipment, just as IT personnel often do not have experience in interpreting NDT results. Having the right people from various disciplines is essential to maintain a proper digital inspection workflow. Additionally, each role should also be accounted for within an organization's ISO processes regarding NDT operations.

6.3.2 *NDT Equipment Vendor*—One role that, while not a direct member of the organization, should not be overlooked is that of the support personnel from the equipment vendor. Vendor personnel, working on behalf of their company, can provide specialized knowledge of the product, tips and hints for getting the most from the equipment, and a deep understanding of features. They are also able to provide their users with specifics on the level of DICONDE conformity provided by their solutions, specifically with regard to the version of the standard implemented by version, the technologies (modalities) supported, and support services for process planning and troubleshooting.

6.3.3 *Information Technology (IT)*—The IT team is responsible for the standard off-the-shelf computer hardware, operating systems, and security management. These tasks are part of the normal duties of IT personnel, and these systems are generally no different. What is of critical importance is that there are often special requirements or certain security exemptions that may be necessary for the NDT software and hardware to function and that IT staff must take these exceptions into considerations. An open dialog between IT and the NDT product support team is of critical importance, especially starting early on in the adoption process.

6.3.4 *Digital Archive Manager*—The archive manager is the key operator for the archive system and has several duties critical to maintaining the NDT data. The first duty of the manager is to ensure proper storage of NDT data by creating and maintaining metadata mappings, a process detailed in 6.4, and verifying data integrity within the archive. The second duty is overseeing data management, as outlined in 6.2, including defining data ownership assignments, transferring those assignments as necessary, and managing data disposition.

6.3.5 *Quality/Operations Manager*—The quality/operations manager's responsibilities include ensuring that the content inside the DICONDE file is coherent and in line with the business context, user needs, and assurance quality procedures for their external regulation's compliance obligations or their internal quality controls. For instance, it could help characterize the set of DICONDE tags and their purpose for its company, always making sure they are also in conformance with the DICONDE standards. For example, some field might be optional in accordance to the DICONDE standard but defined as mandatory in its field of expertise. In this regard, the quality/operation manager is often a deeply knowledgeable person in their field of expertise. The quality/operations manager should provide guidance and support the various usages of DICONDE inside a company knowing the impact of technical constraints, the possible legal liabilities, and key benefits for the users.

6.4 *Identification of the Data:*

6.4.1 When NDE inspections are undertaken, each method uses a procedure in order to generate a result. It is useful to record the variables used in the procedure both for a frame of reference when an interpretation is conducted and for process improvement.

6.4.2 An information model is a methodology or design for organizing, communicating, and storing the relevant information about the inspection and component under inspection. The model describes the organization of the inspection's metadata in DICONDE-defined data structures, called information object definitions (IODs). The IODs that are intrinsic to NDE are defined in the DICONDE standard pertaining to the particular inspection modality and those that are more general inherit from the DICONDE Practice E2339 and the DICOM NEMA PS3.3. See Fig. 1 as an illustration of how a DICONDE data structure is defined into the IOD. All data, including the metadata and the image data, are stored as attributes in a DICONDE tag. To organize similar attributes, they are abstractly included together in information modules. Several information modules come together to form the IOD. Once defined, a DICONDE object can be generated from the framework of the IOD. Typically, each modality type has an IOD specified. Examples are the X-Ray CT Image (see Practice E2767) and the Ultrasound US Image (see Practice E2663).

6.4.2.1 When creating an information model, it can be useful to list all available information from DICONDE and then select the important or user-required data elements from the list. Fig. 2 shows an example of building a full information model. First, the relevant IOD is selected, for this example, the CT Image definition. For IODs that derive from DICOM IODs, DICONDE information modules that override DICOM modules are found in Practice E2339. In this example, Component Module overrides Patient Module and NDE Equipment Module overrides Equipment Module. Special information modules specific to the DICONDE modality are specified in the respective DICONDE modality standard, in this case, Practice E2767 DICONDE for X-Ray CT. Therefore, the NDE CT Image Module is listed here, which overrides the CT Image Module from DICOM. All information modules from DICOM that are not explicitly overridden in DICONDE are also available for the information model. For example, the Image Pixel Module is listed here, and the others from DICOM should be represented as well. It should be noted that some attributes are repeated in these predefined information models. This is normal for this abstract visualization of the DICONDE object, but the object itself does not contain these duplicates in practice. A filled-in example is included in Appendix X1.

6.4.3 One of the unique concepts used in DICONDE is the concept of the study/series/instance hierarchy. The structure is intended to allow the grouping of test data that is related. The study is analogous to a film jacket such as papers, photographs, radiographs, etc., each representing its own series that is then stored together in one study, bringing all the test data and supportive documentation together in one container. The identifying tags (metadata) also have distinct levels for which they apply, describing the entire collection of the data, a subset of the data, or the data object (for example, a radiographic image) itself. To assist in understanding, Fig. 3 provides a visual representation of the DICONDE hierarchical structure. Note that instance is used generically here and can represent a radiographic image, an ultrasonic waveform screen, or another data file.

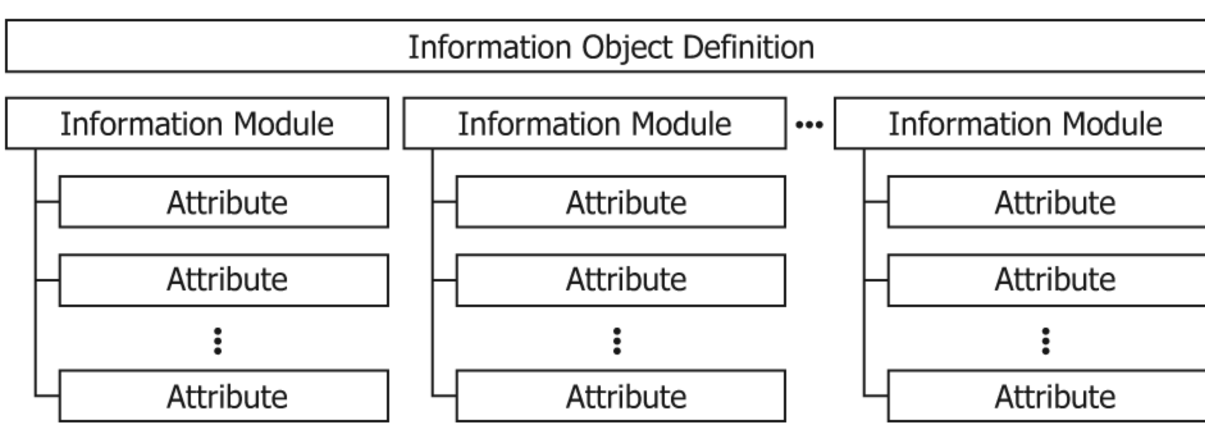

FIG. 1 Structure of a DICONDE Information Object Definition, Where all Data are Stored into Attribute Tags, Which are Abstractly Organized into Information Modules, Which Together Make Up the DICONDE IOD

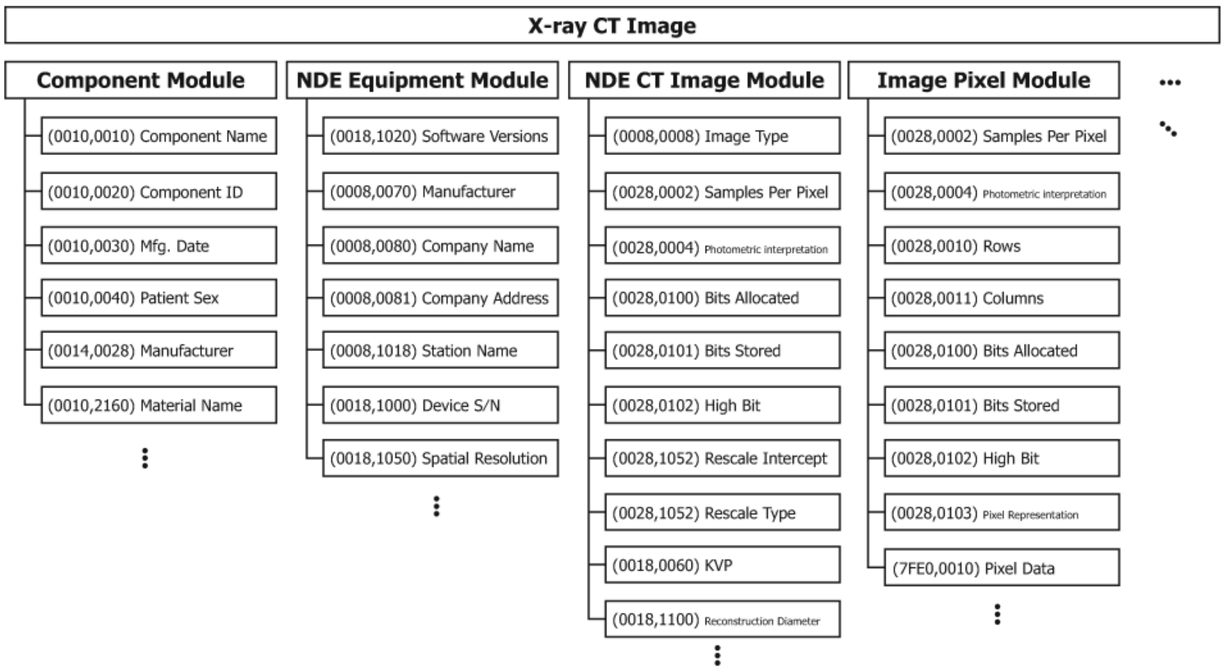

FIG. 2 Example of a Full Information Model From the Three Sources: Practice E2339, DICONDE Modality-Specific Practice E2767, and DICOM NEMA PS3

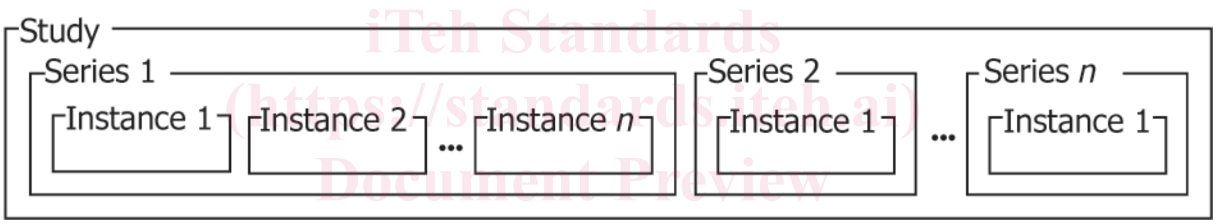

FIG. 3 DICONDE Hierarchical Identifier Structure

6.4.4 Before digital test data is captured, the criteria necessary to organize the test data must be defined. As with any filing or organization system, certain pieces of information are more important in locating and sorting. Organization methods are not universal as they are situationally unique. The Practice E2339 DICONDE standard, along with its modality-specific extensions, provide an information framework through the concept of "tags" for the storage of many different kinds of discrete information (metadata), with each tag having a designated purpose. Each DICONDE object (which may be realized as a DICONDE file) is a mini-database that requires a certain set of tags to be defined, but can contain as much or as little additional data as desired. The required tags are a subset specified by DICONDE as type 1 (required identifiers), meaning that those tags must be defined in every DICONDE object for the absolute minimal identification of the test data contained. These include: Modality, Study Date, Study Time, Component Name, and Component ID. Note that while the standard requires that Component Name and Component ID are present, it does not require that these tags contain any value. There are additional less obvious tags stored which are unique identifiers (UID) for every object generated. These unique identifier tags include Study Instance UID (0020, 000D), Series Instance UID (0020,000E), and SOP Instance UID (0008,0018). While end-users do not typically interact with these tags, it is important to understand their purpose. The DICOM standard defines UID tags as needing to be globally unique and non-overlapping for their level in the hierarchy, as no two studies, series, or instances should ever have the same value. Hence only instances belonging to the same series should share a Series Instance UID and only series belonging to the same study should share a Study Instance UID. To this end, the UID is made of two parts with one being a manufacturer's prefix, which is an ISO registered assignment (under ISO 8824 as defined by ISO 9834-1[7]), followed by a manufacturer generated random suffix. Manufacturers are required to implement a method for guaranteeing a globally unique suffix within the range of their assignment. This suffix is typically generated using a combination of a computer identifier, system serial number, timestamp, datestamp, and some incremented counter, but the pattern and method is vendor-defined. It is important to note that because time is a common factor in many UID uniqueness algorithms, the time

[7] ISO 9834-1 provides complete specifications on how to register for an organizational identifier. Common ISO member bodies provide registration services (for example, IBN in Belgium, ANSI in the United States, AFNOR in France, BSI in Great Britain, DIN in Germany, and COSIRA in Canada).

and date on any DICONDE object generating equipment should be set properly to prevent duplicate identifiers being generated.

6.4.5 Metadata tags defined during capture and processing do not need to be limited to the absolute minimal required identifiers, and it is generally recommended to not rely only on the minimum identifiers. Other tags, not specifically for the purpose of identifying the test data, are available to store additional attributes, which describe the test data and may be useful to record for future reference. Examples of such data from the radiographic modalities, can include, but are not limited to: kV, mA, source isotope, distance from source to detector, etc.

6.4.6 *Creating an Information Model for Test Data:*

6.4.6.1 Collect the internal operational identifiers used to associate components under inspection and their reports. Make certain to document the maximum length such an identifier could be by number of characters.

(1) Consider the information recorded on the technique sheets and inspection reports. Look for letter/number combinations that indicate the component under inspection. These may contain part numbers, customer numbers, drawing numbers, line numbers, work order numbers, section numbers, or facility codes.

(2) Locate any existing film, paper, video, photographic, or digital file organization methods currently utilized. Letter/number combinations used in cataloging and sorting of existing test data can be brought forward as-is or can provide a basis for creation of a new identifier.

(3) Consider any lead markers, screen captures, or other identifying letter/number combinations visually added in the test data.

6.4.6.2 Once collected, split the identifiers into two categories: inspection identifying and technique detail. While all tags are stored within a DICONDE object, Inspection identifying identifiers are those useful for identifying the specific part or inspection and will be the subset of tags used by an indexed archive for locating the inspection (searching). Be aware that not all vendors support indexing all tags. Technique detail identifiers are those useful for describing the inspection protocols, such as kV and mA for X-Ray sources, which may be useful later for interpretation, post-processing, etc.

6.4.6.3 Sort the different inspection identifier letter/number combinations found and rank them in order of specificity to the test data, how useful they are within the context of business operations, the likelihood of requesting test data or inspection reports, and how descriptive of the test data they are.

6.4.6.4 *Mapping the Identifiers to DICONDE Tags:*

(1) Component Name and Component ID user specified tags should always be used for maximum compatibility. As for any user-specified or user-entered values, it is the responsibility of the vendor's software to guarantee the data entered is DICONDE conformant, such as validation of allowable characters, length of input, and unit.

(2) For a system that provides a DICONDE Study Root query (C-FIND) capability, some user-specified tags are required to be searchable. These tags are the Component Name, Component ID, Study ID, and Accession Number.

(3) Some vendors offer the ability to permit the search of other tags in addition to those defined by the standard. This can be confirmed through a review of the product's DICONDE conformance statement, which every vendor is required to publish per Practice E3147.

(4) When defining the tags to use for search capabilities, consider all the available tags that can be used with each system of the solution that is being evaluated and sort the list. Start the list with Component Name and Component ID and follow with all the searchable tags available. If systems are being evaluated from multiple vendors, it is important to recognize that the tags to be used must be chosen from those common on all systems being evaluated, which may limit the number of searchable tags.

(5) Next to each of the tags on the list, place the identifier code (the (xxxx,xxxx) group/element pairing), field type (see VR), and maximum number of characters supported by that field. Reference Practice E2339 and the respective modality method DICONDE standard to determine the identifier code, unit (if any), and value representation (VR). Cross-reference the VR value with the DICONDE value representations table in Appendix X2 to determine the allowable characters and maximum length of input. All tags not explicitly defined in DICONDE inherit from DICOM; therefore, it is possible to use tags outlined in the DICOM standard and the respective modality method defined there. Value representation (VR) is represented in the standard as a two-letter code. See a complete list of all the VR types in Part 5, subsection 6.2 of the DICOM standard.

(a) With the list of tags on one side and the list of identifying letter/number combinations on the other, draw connections between the two lists, linking one identifying letter/number combination with one tag. Ensure that the chosen identifier will not violate the type or maximum number of characters allowed for that tag. Component Name and Component ID should be used first for the most important identifiers since they are universally searchable. An example mapping information model table is shown in Fig. 4. Note that Fig. 4 is an example of a mapping that ensures maximum compatibility with DICONDE standards, but is simplistic for illustrative purposes and is not an ideal mapping to be used as a template.

(6) All of the identifiers matched with DICONDE tags serve as the mapping table to indicate what identifiers will be entered into which DICONDE fields making up the information model.

(7) Some manufacturers allow their software labels to be changed to use the identifier's name instead of the DICONDE field name to simplify usability. This reduces user error during the capture and handling of DICONDE data. It is nevertheless important to keep the mapping table for future reference, as changes to DICONDE products may require reconfiguration, or when exchanging data with a third-party, references to the mapping table will be necessary.

6.4.6.5 For all other modality-detailed metadata that is desired to be stored, but not necessarily directly searched for in an archive, the information model can be extended using the DICONDE Practice E2339, the respective modality method DICONDE standard, and the respective modality method in the

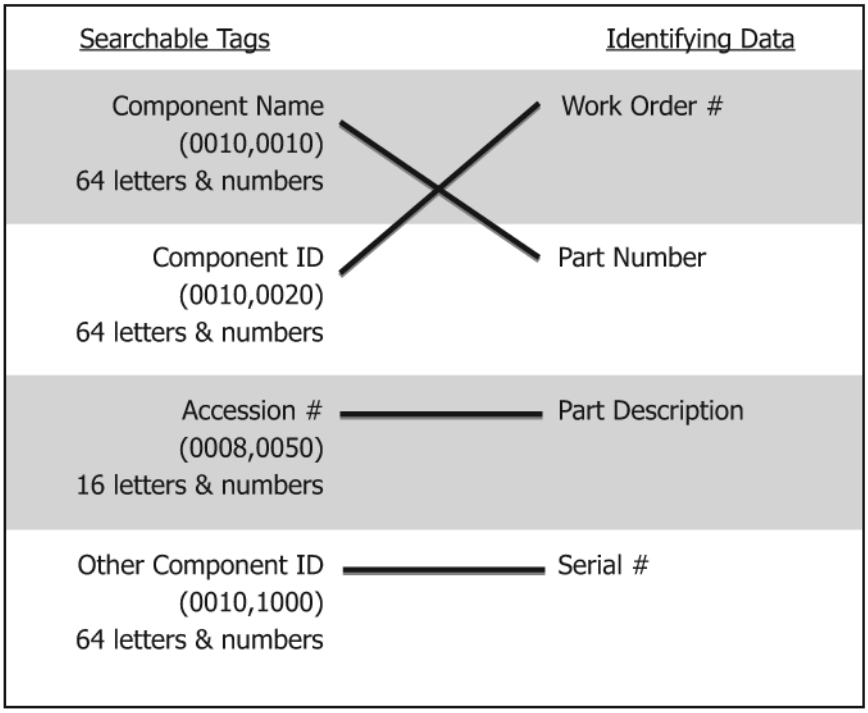

FIG. 4 Example DICONDE Tag to Identifying Information Mapping

DICOM standard. Data in DICONDE is organized in IODs. The base IODs are defined in Practice E2339, and the modality-specific IODs are defined in the modality method DICONDE standards. The DICONDE standards define only the IODs from DICOM that are specific to NDE. For all other allowed IODs, the user is referred to the DICOM standard. For data that is desired to be saved but cannot be mapped to a modality-specific IOD, DICONDE allows the use of private tags, which can be user-defined. See the DICONDE Guide E3169 for more information on using private tags.

6.4.6.6 As a recommendation and as best practice, the creation of blank IOD tables from the three locations (Practice E2339, the DICONDE modality-specific specification, and the DICOM standard) can be documented in spreadsheets for the relevant IOD by the user designing the information model. This facilitates the generation of the information model design by displaying in one location all the metadata that can be saved in a DICONDE-compliant fashion.

6.4.6.7 Several examples of information models and mapping scenarios are outlined in Appendix X1.

6.5 *Storage Selection:*

6.5.1 A data archive is a system or method for the long-term preservation of digital information. Archives come in many varieties providing different features and storage methods, each with their own pros and cons. Before beginning any purchasing process, the purchaser should consider several key factors:

(1) How long does the data need to be maintained?

(2) What resources are available now and for the duration of the longevity required?

(a) What are the physical and financial resources?

(3) What manner of access is needed to the data (turn-around time, locations, access restrictions)?

(4) Is there necessity or consequences for prior data (inspection intervals, revisions, etc.)?

(5) What are the repercussions of not having or losing the data?

6.5.2 At the highest level, there are three important differentiators across all archive systems:

(1) DICONDE *or* non-DICONDE

(2) Indexed *or* non-indexed

(3) Vendor proprietary *or* vendor agnostic

6.5.2.1 Archives that are DICONDE compliant or DICONDE aware have the ability to process DICONDE files and hence understand how to parse the tag structure. These systems generally have some or all of the following characteristics:

(1) Storage of DICONDE data objects (for example, metadata, imagery, test results, presentation states, structured reports).

(2) Incorporation of specialized SOP class objects that represent strictly nondestructive testing modalities such as eddy current methods.

(3) DICONDE network standard interface for storage, query, and retrieval.

Non-aware systems treat a DICONDE file as an unknown file type and while they can store the file as-is, it will not be able to parse or display any of the tags or image data. These non-indexed systems are repositories that rely on manual techniques such as folder and file names to organize the data. A standard computer file system is an example of this. Non-aware systems also do not support any DICONDE network interfaces.

6.5.2.2 An indexed system means that the archival system utilizes some form of database, which records a subset of the identification tags (metadata) for each inspection, allowing for