Designation: E 1475 – 9702

An American National Standard

Standard Guide for Data Fields for Computerized Transfer of Digital Radiological Test Examination Data[1]

This standard is issued under the fixed designation E 1475; 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 guide provides a listing and description of the fields that are recommended for inclusion in a digital radiological test examination data base to facilitate the transfer of such data. This guide sets guidelines for the format of data fields for computerized transfer of digital images files obtained from radiographic, radioscopic, computed radiographic, or other radiological examination systems. The field listing includes those fields regarded as necessary for inclusion in the data base: (*1*) regardless of the radiological examination method (as indicated by Footnote C in Table 1), (*2*) for radioscopic examination (as indicated by Footnote E in Table 1), and (*3*) for radiographic examination (as indicated by Footnote D in Table 1). In addition, other optional fields are listed as a reminder of the types of information that may be useful for additional understanding of the data or applicable to a limited number of applications.

1.2 It is recognized that organizations may have in place an internal format for the storage and retrieval of radiological test examination data. This guide should not impede the use of such formats since it is probable that the necessary fields are already included in such internal data bases, or that the few additions can easily be made. The numerical listing and its order indicated in this guide is only for convenience; the specific numbers and their order carry no inherent significance and are not part of the data file.

1.3 The types of radiological test examination systems that appear useful in relation to this guide include radioscopic systems as described in Guide E 1000, Practices E 1255, E 1411 and E 1411, E 2033, and radiographic systems as described in Guide E 94 and Practices E 748 and E 1742. Many of the terms used are defined in Terminologies E 1013 and Terminology E 1316.

1.4 *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:*

[1] This guide is under the jurisdiction of ASTM Committee E-7 E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.011 on Radiology (X Digital Imaging and Gamma) Method. Communication in Nondestructive Evaluation (DICONDE).

Current edition approved May July 10, 1997. 2002. Published February 1998. September 2002. Originally published as E 1475 – 92. Last previous edition E 1475 – 9207.

E 94 Guide for Radiographic ~~Testing~~ Examination[2]
E 748 Practices for Thermal Neutron Radiography of Materials[2]
E 1000 Guide for Radioscopy[2]

[2] *Annual Book of ASTM Standards*, Vol 03.03.

E ~~1013 Terminology Relating to Computerized Systems~~[3]
~~E 1255 Practice~~ 1255 Practice for Radioscopy[2]
E 1316 Terminology for Nondestructive Examinations[2]
E 1411 Practice for Qualification of Radioscopic Systems[2]
E 1416 Test Method for Radioscopic Examination of Weldments[2]
E 1742 Practice for Radiographic Examination[2]
E 2033 Practice for Computed Radiology (Photostimulable Luminescence Method)[2]

3. Significance and Use

3.1 The primary use of this guide is to provide a standardized approach for the data file to be used for the transfer of digital radiological data from one user to another where the two users are working with dissimilar systems. This guide describes the contents, both required and optional for an intermediate data file that can be created from the native format of the radiological system on which the data was collected and that can be converted into the native format of the receiving radiological data analysis system. The development of translator software to accomplish these data format conversions is being addressed under a separate effort; this will include specific items needed for the data transfer, for example, language used, memory requirements, and intermediate specification. This guide will also be useful in the archival storage and retrieval of radiological data as either a data format specifier or as a guide to the data elements which should be included in the archival file.

TABLE 1 Field Listing

Field Number[A]	Field Name and Description	Category Sets, Values and Units[B]
Header Information:		
1[C,D]	Intermediate file name	Alphanumeric string
2[C,D]	Format revision code	Alphanumeric string
3[C,D]	Format revision date	yy/mm/dd
4[C,D]	Source file name	Alphanumeric string
5	Examination file description notes	Alphanumeric string
6[C,D]	Examining company/location	Alphanumeric string
7[C,D]	Examination date	yy/mm/dd
8	Examination time	hh/mm/ss
9[C,D]	Type of examination	Alphanumeric string
10	Other examinations performed	Alphanumeric string
11[C,D]	Operator name	Alphanumeric string
12[C,D]	Operator identification code	Alphanumeric string
~~13[C,D]~~	~~ASTM, ISO or other applicable standard inspection specification~~	~~Alphanumeric string~~
13[C,D]	ASTM, ISO or other applicable standard specification	Alphanumeric string
14	Date of applicable standard	yy/mm/dd
15[C,D]	Acceptance criteria	Alphanumeric string
16	Notes	Alphanumeric string
Examination System Description:		
17	Examination system manufacturer(s)	Alphanumeric string
18	Examination system model	Alphanumeric string
19	Examination system serial number	Alphanumeric string
Source Section:		
20[C,D]	Radiologic source manufacturer	Alphanumeric string
21[C,D]	Radiological source model	Alphanumeric string
22	General source description	Alphanumeric string
23	Last calibration date	Alphanumeric string
24	Notes on source section	Alphanumeric string
Image Receptor Section:		
25[C,D]	Receptor type	Alphanumeric string
26[C,D]	Convertor type	Alphanumeric string
27	Receptor manufacturer	Alphanumeric string
28	Receptor model number	Alphanumeric string
29[C,D]	Notes on receptor section	Alphanumeric string
Exposure Section:		
30[C,D]	Peak radiation energy used, or	kV
31[C,D]	Isotope source (use either 30 or 31)	Alphanumeric string
32	Tube current	mA
33	Radiation dosage rate	mR/min
34	Radiation exposure time	min
35[C]	Source-detector distance (SDD)	m
36[C]	Source-object distance (SOD)	m
~~37[C]~~	~~Image magnification of source side of inspection object~~	~~%~~
37[C]	Image magnification of source side of examination object	%
38[D]	Notes on exposure section	Alphanumeric string
Processing Section (Film/Paper):		
39[E]	Process description	Automated or manual
40[E]	Process method	Wet or dry
41	Processor type	Alphanumeric string
42	Processor model number	Alphanumeric string
43	Notes on processor section	Alphanumeric string
Image Processing Description:		
44[C,D]	Image processing used for image data	Alphanumeric string
45	Image processor hardware manufacturer	Alphanumeric string
46	Image processor hardware model	Alphanumeric string
47	Image processor software source	Alphanumeric string
48	Image processor software version	Alphanumeric string
49[D]	Pixel resolution	Pixels per cm
50	Notes on image processor	Alphanumeric string
Examination Sample or Part Description:		
51[C]	Sample or part name	Alphanumeric string
52	Sample or part name description	Alphanumeric string
53[C]	Sample or part identification code	Alphanumeric string
54[C]	Sample or part material	Alphanumeric string
55	Notes on sample or part	Alphanumeric string
56[C]	Number of image segments for sample	Integer number
57[C]	Reference standard identification	Alphanumeric string
58	Reference standard description	Alphanumeric string
59[C]	Reference standard file name	Alphanumeric string
60	Reference standard file location	Alphanumeric string
Coordinate System and Scan Description:		
61[F]	Machine coordinate system scan axis	Alphanumeric string
62[F]	Machine coordinate system index axis	Alphanumeric string
63[F]	Machine coordinate system *z*-axis	Alphanumeric string

Field Number[A]	Field Name and Description	Category Sets, Values and Units[B]
64[F]	Part coordinate system *x*-axis	Alphanumeric string
65[F]	Part coordinate system *y*-axis	Alphanumeric string
66[F]	Part coordinate system *z*-axis	Alphanumeric string
67	Number of object target points	Integer number
68	Object target point number	Integer number
69	Object target point description	Alphanumeric string
70	Object target point *x*-axis	Alphanumeric string
71	Object target point *y*-axis	Alphanumeric string
72	Object target point *z*-axis	Alphanumeric string
73	Description of data plane projection	Alphanumeric string
74	Notes on coordinate system	Alphanumeric string
Measurement Parameters:		
75[C]	Minimum value of data	Integer
76[C]	Maximum value of data	Integer
77[C]	Dynamic range resolution	Number of bits
78[C,D]	Data scale	Linear, logarithmic, define scale
79[E]	Relationship between film optical density and digital value	Mathematical relationship between film density and digital value; range of density covered (0–4, 0.5–4.5, etc.)
80[C,D]	Dynamic range implemented	Detected exposure range covered by gray scale of each pixel in image data file. Expressed as decades of exposure latitude (1.6, 2, 4, etc.) Industrial film/screen/chemistry systems are typically 2
81[C]	Physical spacing of the digitization interval at the image receptor	Scans/mm (100 µm, 80 µm, 50 µm, 25 µm, etc.)
82[C]	Data recording format	Alphanumeric string
Examination Results:		
83	Discontinuity location	Alphanumeric string
84	Discontinuity description	Alphanumeric string
85	Disposition	Accept, reject or repair
86	Notes on examination results	Alphanumeric string
87	Image segment number	Integer number
88	Image segment description	Alphanumeric string
89	Image segment location	Alphanumeric string
90	Image segment orientation	Alphanumeric string
91	Annotation	Alphanumeric string
92	Notes on the data (including notes on compression)	Alphanumeric string
93	Total number of data points	Integer number
~~94~~	~~Actual stream of radiologic~~	~~Real number~~
94	Actual stream of radiologic data	Real number

[A] Field numbers are for reference only. They do not imply a necessity to include all these fields in any specific database nor imply a requirement that fields used be in this particular order.

[B] Units listed first are SI; those in parentheses are inch-pound (English).

[C] Denotes essential field for computerization of ~~test~~ examination results, regardless of examination method.

[D] Denotes essential field for radiographic examination.

[E] Denotes essential field for radiographic examination.

[F] Denotes essential field for radioscopic examination.

3.2 Although the recommended field listing includes more than 90 field numbers, only about half of those are regarded as essential and are marked Footnote C in Table 1. Fields so marked must be included in the data base. The other fields recommended provide additional information that a user will find helpful in understanding the radiological image and examination result. These header field items will, in most cases, make up only a very small part of a radiological examination file. The actual stream of radiological data that make up the image will take up the largest part of the data base. Since a radiological image file will normally be large, the concept of data compression will be considered in many cases. Compressed data should be noted, along with a description of the compression method, as indicated in Field No. ~~91~~ 92 (see Table 1).

3.3 This guide provides a data file for a single image. It is recognized that a complete examination record may contain several files for the same examination method in different areas, with or without image processing, for different examination methods, and for variations within a single method (for example, different x-ray energies). This file will permit the examination of a single image and will include information about the existence of other images and records for the examined object. This single image may be one created by overlaying or processing results from multiple examination approaches, for example, data fusion. For such images, the notes sections must clearly state how the image for this file was created.

4. Description of the Field Listings

4.1 Table 1 is a recommended field format for the computerized storage, retrieval and transfer of radiological image ~~test~~ examination data. There are three columns of information, as indicated in 4.1.1-4.1.3:

4.1.1 *Field Number*—A reference number for ease of dealing with the individual fields within this guide. It has no permanent value and does not become part of the data base itself.

4.1.2 *Field Name and Description*—The complete name of the field, descriptive of the element of information that would be included in this field of the data base.

4.1.3 *Category Sets, Values or Units*— A listing of the types of information which would be included in the field or the units in which the numbers are expressed. Category sets are closed (that is, complete) sets containing all possible (or acceptable) inputs to the field. Values are representative sets, listing sample (but not necessarily all acceptable) inputs to the field.

4.2 The information for reporting radiological examination results is divided into eleven segments, as follows:

4.2.1 Header information,

4.2.2 Examination system description,

4.2.3 Source description,

4.2.4 Image receptor,

4.2.5 Exposure,

4.2.6 Processing,

4.2.7 Image processing description,

4.2.8 Examination sample or part description,

4.2.9 Coordinate system and scan description,

4.2.10 Measurement parameters, and

4.2.11 Examination results.

4.3 Additional explanations for selected fields are given in Section 5.

5. Explanation of Fields

5.1 *Field Number, Name, and Description* :

5.1.1 *Field No. 1: Intermediate File Name*—Name of the data base file containing all of the information to follow. This is the archive or transfer file itself.

5.1.2 *Field No. 6: Examining Company/Location*—The legal name/location of the company which performed the radiologic examination.

5.1.3 *Field No. 9: Type of Examination*— Radiographic, radioscopic, other; x-ray, gamma ray, neutron, other.

5.1.4 *Field No. 10: Other Examinations Performed*—Other NDT examinations, ultrasonic, liquid penetrant, etc.

5.1.5 *Field No. 17: System Manufacturer* .

5.1.6 *Field No. 18: System Model*—Repeat for each system.

5.1.7 *Field No. 19: Serial Number*—Repeat for each system.

5.1.8 *Field No. 25: Receptor Type*—Film/screens, image intensifier, etc.

5.1.9 *Field No. 26: Convertor Type*—Lead screen, gadolinium oxysulfide screen cesium iodide scintillator, etc.

5.1.10 *Field No. 29: Notes on Receptor Section*—Specific film type or other receptor.

5.1.11 *Field No. 38: Notes on Exposure*— Additional useful information (for example, filtration, double-wall technique, 128 frame integration, etc.).

5.1.12 *Field No. 43: Notes on Processor*— Additional useful information (for example, cycle, time/temperature data, etc.).

5.1.13 *Field No. 44: Imaging Processing Used*—Frame integration (No.), edge enhancement, histogram equalization, subtraction, etc.

5.1.14 *Field No. 50: Notes on Image Processor*—Additional useful information (for example, algorithms/transforms, luminance range, etc.).

5.1.15 *Field No. 55: Notes on Sample and Part*—Any service data available for the article including flight hours, aircraft assignments, and special incidents, such as impacts, collisions, hail storms, fires, etc.

5.1.16 *Field No. 56: Number of Image Segments*—If the image of the part is accomplished in multiple physical segments.

5.1.17 *Field Nos. 61 through 63: Machine Coordinate System*—Describe the coordinate system used by the original examinspeeation equipments referenced to the radiation source. For example, scan axis = *X* axis, positive down; *Z* axis, positive away.

5.1.18 *Field Nos. 64 through 66: Part Coordinate System* —Describe the coordinate system of the part in the scan frame. Give the origin and unit vectors as referenced to the machine coordinate system.

5.1.19 *Field No. 74: Coordinate System Notes*—Additional information which clarifies the coordinate system or part orientation, or both. Describe coordinates of image, for example *x* (plus to right), *y* (plus upward), *z* (plus into image plane).

5.1.20 *Field No. 75: Minimum Value of Data*—Lower bound of pixel intensity value for this image file, raw or processed as the case may be, for example, 00.

5.1.21 *Field No. 76: Maximum Value of Data*—Upper limit of pixel intensity value for this image file, raw or processed as the case may be, for example, 127 or 255.

5.1.22 *Field No. 77: Data Sample Resolution*—The number of bits to which the original data were digitized.

5.1.23 *Field No. 81: Data Recording Format*—ASCII, numeric values or characters, Binary 16 bit in two 8-bit words, etc.

5.1.24 *Field No. 85: Notes on Examination Results*—Additional useful information (for example, custom representative accepted examined part on waiver, etc.).

5.1.25 *Field No. 86: Image Segment Number*— Sequence number for this segment of the image data. If the entire part is imaged

in one ~~test~~ examination and all of this data is saved in a single file, there will be only one image segment for the part (and perhaps one for the reference standard).

5.1.26 *Field Nos. 88 through 89: Image Segment Location and Orientation*—The location and orientation of the segment on the part. Include the bounds on the image area described by bounding points, lines or planes, or both.

6. Keywords

6.1 data base; data fields; data transfer; dynamic range; dynamic range resolution; nondestructive testing; radiological examination; radioscopic examination