INTERNATIONAL STANDARD

ISO 24517-1

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Document management — Engineering document format using PDF —

Part 1: Use of PDF 1.6 (PDF/E-1)

Gestion de documents — Format de documents d'ingénierie utilisant le PDF —

Partie 1: Utilisation du PDF 1.6 (PDF/E-1)

Reference number
ISO 24517-1:2008(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 24517-1 was prepared by Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Application issues*.

ISO 24517 consists of the following parts, under the general title *Document management — Engineering document format using PDF*:

— *Part 1: Use of PDF 1.6 (PDF/E-1)*

Introduction

The ISO 24517 series defines a file format for the exchange of engineering documents based on the PDF format for various communities working with engineering documentation. It is a multi-part standard with subsequent parts expected to address future workflow and data requirements. The ISO 24517 series improves document exchange, collaboration, and print accuracy within engineering workflows, both inside companies and with extended enterprises of partners, suppliers, customers, government organizations and citizens. It will enable organizations to streamline engineering workflows that incorporate diverse sets of complex documents, resulting in improved productivity and the ability to more quickly deliver better products to market. It defines the features of PDF that are required, recommended, restricted, or prohibited when creating, viewing, marking up, printing, analysing, and distributing engineering documents. It takes into consideration the differing needs of both interactive and non-interactive readers.

The ISO 24517 series specifies the proper use of PDF for on-screen display and printing of engineering documents. Printed engineering documents are assemblies of a page (or pages) created by different organizations which can be inter-departmental or inter-company. It also defines a framework for representing the logical structure and other semantic information of engineering documents within conforming files.

The ISO 24517 series is intended to provide a format for the development of various applications, such as products that read, render, write, print, and validate PDF conforming documents. Different products will incorporate various capabilities to prepare, interpret, and process conforming objects. Adobe Systems Incorporated makes the PDF specification publicly available. However, the inclusive, feature-rich nature of the format requires that additional constraints be placed on its use to make it suitable for engineering workflow documents.

PDF/E allows engineering professionals to reliably create, exchange, and review engineering documentation, including large format documents. PDF/E enables organizations to work more effectively when creating or exchanging engineering documentation.

AIIM, an accredited standards developing organization, maintains an ongoing series of application notes for guiding developers and users of this part of ISO 24517. These application notes are available at http://www.aiim.org/. AIIM will also retain copies of the specific non-ISO normative references of this part of ISO 24517 which are publicly available electronic documents.

Document management — Engineering document format using PDF —

Part 1: Use of PDF 1.6 (PDF/E-1)

1 Scope

This part of ISO 24517 specifies the use of the Portable Document Format (PDF) Version 1.6 for the creation of documents used in engineering workflows.

This part of ISO 24517 does not define the following:

— method of electronic distribution;

— method of creation or conversion from paper or electronic documents to the PDF/E format;

— specific technical design, user interface, or implementation;

— required computer hardware and/operating systems; or

— methods for validating the conformance of PDF/E files or readers.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19005-1:2005, *Document management — Electronic document file format for long-term preservation — Part 1: Use of PDF 1.4 (PDF/A-1)*

ICC.1:2004-10 (Profile version 4.2.0.0), *Image technology colour management — Architecture, profile format, and data structure*, International Color Consortium (available from www.color.org)

Adobe PDF Reference, fifth edition version 1.6, ISBN 0-321-30474-8 (available from <http://www.npes.org/standards/toolspdfx.html>)

Errata for Adobe PDF Reference, fifth edition version 1.6, 31 August 2005 (available from <http://www.npes.org/standards/toolspdfx.html>)

Addendum on Blend Modes. Adobe Systems Incorporated, January 23, 2006 (available from <http://www.npes.org/standards/toolspdfx.html>)

XMP Specification, XMP™: *Adding Intelligence to Media*, Adobe Systems Incorporated, September 2005 (available from http://partners.adobe.com/public/developer/en/xmp/sdk/xmpspecification.pdf)

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
reader
software application that is able to read and process files

3.2
PDF/E-1 conforming reader
software application that is able to read and process PDF/E-1 files in accordance with this part of ISO 24517

3.3
interactive PDF/E-1 conforming reader
PDF/E-1 conforming reader that provides an enhanced level of functionality for some or all of the interactive features of PDF/E-1

3.4
non-interactive PDF/E-1 conforming reader
PDF/E-1 conforming reader that provides no enhanced level of functionality for the interactive features of PDF/E-1

3.5
electronic document
electronic representation of a page-oriented aggregation of text and graphic data, and metadata useful to identify, understand, and render that data, that can be reproduced on paper or optical microform without significant loss of its information content

3.6
EOF marker
end-of-file marker
five character sequence denoted as "**%%EOF**" marking the end of a PDF file

3.7
EOL marker
end-of-line marker
one or two character sequence marking the end of a line of text, consisting of a **CARRIAGE RETURN** character (0Dh) or a **LINE FEED** character (0Ah) or a **CARRIAGE RETURN** followed immediately by a **LINE FEED**

3.8
PDF
Portable Document Format
file format defined in *Portable Document Format Version 1.6* and its *Errata*

3.9
writer
software application that is able to write files

3.10
PDF/E-1 conforming file
PDF/E-1 file
file encompassing all requirements of this part of ISO 24517

4 Notations

For the purposes of this part of ISO 24517, references to "*PDF Reference*" are to the *Adobe PDF Reference, fifth edition version 1.6,* as modified by *Errata for PDF Reference, fifth edition version 1.6,* and by *Addendum on Blend Modes* as identified in Clause 2.

PDF operators, PDF keywords, the names of keys in PDF dictionaries, and other predefined names are written in bold sans serif font; operands of PDF operators or values of PDF dictionary keys are written in italic sans serif font.

EXAMPLE 1 The *Default* value for the **TR2** key.

Token characters used to delimit objects and describe the structure of PDF files, as defined in *PDF Reference*, 3.1, may be identified by their ISO/IEC 10646 character name written in uppercase in bold sans serif font followed by a parenthetic two digit hexadecimal character value with the suffix "h".

EXAMPLE 2 **CARRIAGE RETURN** (0Dh).

Text string characters in content streams, as defined by *PDF Reference*, 3.8.1, may be identified by their ISO/IEC 10646 character name written in uppercase in bold sans serif font followed by a parenthetic four-digit hexadecimal character code value with the prefix "U+".

EXAMPLE 3 **EN SPACE** (U+2002).

5 PDF/E-1 conforming files and readers

This part of ISO 24517 specifies the use of the PDF file format for the exchange of digital data representing a compound entity.

A PDF/E-1 conforming file is a PDF file in which those features necessary for the exchange of a compound entity are in accordance with this part of ISO 24517. A PDF/E-1 conforming file may also include other valid PDF features that do not affect display or function of the compound entity.

PDF/E-1 conformance is identified by use of the **pdfe:ISO_PDFEVersion** property as defined in 13.3. The value of the **ISO_PDFEVersion** key in the document information dictionary shall be *PDF/E-1* for a PDF/E-1 conforming file. Neither the version number in the header of a PDF file, nor the value of the **Version** key in the **Catalog** of a PDF file indicates that a file is in accordance with this part of ISO 24517.

NOTE 1 These values are specified in Table 1 of 13.3.

Although *PDF Reference* permits compliance with earlier versions of PDF, features described in versions of the PDF specification earlier than 1.6, but not described in *PDF Reference*, shall not be used in a PDF/E-1 conforming file.

A PDF/E-1 conforming writer is a software application that is able to write files in accordance with the requirements of this part of ISO 24517.

A PDF/E-1 conforming reader is a software application that shall be able to read and appropriately process all PDF/E-1 files in a manner conforming to the requirements for PDF/E-1 files as defined in this part of ISO 24517.

A PDF/E-1 conforming reader may parse PDF files that are not PDF/E-1 conforming files. The behaviour of a PDF/E-1 conforming reader on non-conforming files is beyond the scope of this part of ISO 24517.

Rendering of PDF/E-1 conforming files shall be performed as defined in the *PDF Reference* and as restricted by this part of ISO 24517. To the extent that the *PDF Reference* and this part of ISO 24517 permit more than one rendering of a PDF/E-1 conforming file, a PDF/E-1 conforming reader may use embedded job ticket or metadata information to control the rendering of the file more precisely. Furthermore, interactive PDF/E-1

conforming readers may provide user interface elements to control dynamic features of PDF/E-1 such as optional content, three dimensional (3D) and multimedia.

NOTE 2 A PDF/E-1 conforming file is not obligated to use any PDF feature other than those explicitly required by the *PDF Reference* or this part of ISO 24517.

6 Syntax

6.1 File header

The **%** character of the file header shall occur at byte offset 0 of the file.

6.2 File trailer

The file trailer dictionary shall contain the **ID** keyword. The value for the **ID** entry shall be an array of length two, containing two non-empty string objects.

6.3 Document ID

If the document catalog contains an **Encrypt** entry, the value for the **ID** entry in the document trailer and the strings contained in the **ID** array shall be direct.

NOTE This provision ensures that the **ID** entry can always be located and read when the document is encrypted. A circular dependency condition arises when encryption algorithms use the document **ID** strings and those strings are indirect, because the *PDF Reference* states that all indirect objects outside the encryption dictionary itself require encryption. These problems are further compounded when object streams are present in the file, because the **ID** strings could be embedded inside an encrypted object stream.

6.4 Cross-reference tables and cross-reference streams

Any indirect object whose offset is not referenced in a cross-reference table or cross-reference stream shall be exempt from all requirements of this part of ISO 24517. A PDF/E-1 conforming reader shall not use any such objects in any sort of processing or presentation of a PDF/E document.

6.5 Document information dictionary

A document information dictionary may be defined in a PDF/E-1 conforming file. If defined, its elements shall be consistent with analogous XMP metadata properties defined in the *XMP Specification* as specified in Clause 13.

6.6 String objects

Hexadecimal strings shall contain an even number of non-white-space characters, each in the range **0** to **9**, **A** to **F**, or **a** to **f**.

6.7 Stream objects

The value of the **Length** key specified in the stream dictionary shall match the number of bytes in the file following the **LINE FEED** character after the **stream** keyword and preceding the EOL marker before the **endstream** keyword.

NOTE 1 These requirements remove potential ambiguity regarding the ending of stream content.

A stream object dictionary shall not contain the **F**, **FFilter**, or **FDecodeParams** keys.

NOTE 2 These keys are used to point to document content external to the file. The explicit preclusion of these keys has the implicit effect of disallowing external content that can create external dependencies and hinder portability efforts.

6.8 Linearized PDF

Linearization shall be permitted but any linearization information supplied within a file may be ignored by PDF/E-1 conforming readers.

6.9 Implementation limits

PDF/E-1 conforming files shall not violate the following implementation limits for objects outside of stream data or comments (as defined in *PDF Reference*, 3.1.2).

All integer values shall be in the range [-2^{31}, $(2^{31} - 1)$].

All decimal numbers shall be within the range representable by IEEE single-precision floating-point numbers.

The length of a name object shall be at least one byte and at most 127 bytes.

Indirect object numbers shall be at least one and at most 8 388 607.

The number of colourants or tint components in a **DeviceN** colour space shall be at least one and at most 32.

The value of a CID (character identifier) shall be at least zero and at most 65 535.

NOTE 1 By complying with these limits, a PDF/E-1 conforming file is compatible with the widest possible range of readers.

NOTE 2 The restriction on the size of integers imposes a limit on the size of a linearized PDF/E file of $(2^{31} - 1)$ bytes, due to the fact that the **T** entry in the linearization dictionary is an integer equal to the size of the file.

7 Graphics

7.1 General

Restrictions placed on both PDF/E-1 conforming files and reader are described in 7.2 to 7.13. They are intended to address the rendering of graphical page contents, including text and font issues.

7.2 Output intent

A PDF/E-1 conforming file may specify the colour characteristics of the device on which it is intended to be rendered by using a PDF/E-1 **OutputIntent**. A PDF/E-1 **OutputIntent** is an **OutputIntent** dictionary, as defined by *PDF Reference*, 10.10.4, that is included in the file's **OutputIntents** array and has *ISO_PDFE1* as the value of its **S** key and a valid ICC profile stream as the value of its **DestOutputProfile** key.

If a file's **OutputIntents** array contains more than one entry, then all entries that contain a **DestOutputProfile** key shall have as the value of that key the same indirect object, which shall be a valid ICC profile stream.

NOTE This subclause is not in conflict with similar requirements in ISO 19005-1 because multiple **OutputIntent** dictionaries are allowed by both.

7.3 Colour spaces

7.3.1 General

All colours shall be specified in a device-independent manner, either directly by the use of a device independent colour space, or indirectly by the use of an **OutputIntent**. A PDF/E-1 conforming file may use any colour space specified in *PDF Reference*, except as restricted in 7.3.2 to 7.3.4.

NOTE Specifying colour in the device-independent manner described in 7.3 enables predictable colour-rendering based on a colorimetric definition and without reliance on assumptions or information external to the PDF/E-1 conforming file. It also provides a mechanism whereby a colorimetric definition can be associated with device-dependent colour data.

7.3.2 ICCBased colour spaces

All ICCBased colour spaces shall be embedded as ICC profile streams as described in *PDF Reference*, *4.5.4.*

A PDF/E-1 conforming reader shall render **ICCBased** colour spaces as specified by ICC.1:2004-10 and shall not use the **Alternate** colour space specified in an ICC profile stream dictionary.

7.3.3 Uncalibrated colour spaces

A PDF/E-1 conforming file may use either the **DeviceRGB** or **DeviceCMYK** colour space but shall not use both. If an uncalibrated colour space is used in a file then that file shall contain a PDF/E-1 **OutputIntent**, as defined in 7.2. **DeviceRGB** may be used only if the file has a PDF/E-1 **OutputIntent** that uses an **RGB** colour space. **DeviceCMYK** may be used only if the file has a PDF/E-1 **OutputIntent** that uses a **CMYK** colour space.

When rendering a **DeviceGray** colour specification in a file whose **OutputIntent** is an **RGB** profile, a PDF/E-1 conforming reader shall convert the **DeviceGray** colour specification to **RGB** by the method described in *PDF Reference*, 6.2.1.

When rendering a **DeviceGray** colour specification in a file whose **OutputIntent** is a **CMYK** profile, a PDF/E-1 conforming reader shall convert the **DeviceGray** colour specification to **DeviceCMYK** by the method described in *PDF Reference*, 6.2.2.

When rendering colours specified in a device-dependent colour space a PDF/E-1 conforming reader shall use the file's PDF/E-1 **OutputIntent** dictionary, as defined in 7.2, as the source colour space.

7.3.4 Separation and DeviceN colour spaces

A PDF/E-1 conforming file shall not make use of **DeviceN** colour spaces with an **NChannel** subtype.

A PDF/E-1 conforming reader shall obey the following rules when rendering colour spaces based on **DeviceN** or **Separation** colour spaces.

— If the named colourants in the colour space are all from the list **Cyan**, **Magenta**, **Yellow**, **Black**, the file has an **OutputIntent**, and that **OutputIntent** is a **CMYK** profile, then the colourants shall be treated as components of the colour space specified by the PDF/E-1 **OutputIntent** dictionary, as defined in 7.2, and the alternate colour space shall not be used.

— If the output device does not support the **Separation** colour space or **DeviceN** colorants, the **Alternate** colour space shall be used.

The **Alternate** colour space of a **Separation** or **DeviceN** colour space shall obey all restrictions on colour spaces specified in 7.3.2 and 7.3.3.

7.3.5 3D content

3D content is specified in an unqualified RGB colour space; a PDF/E-1 conforming reader is not required to colour manage 3D content. However, a PDF/E-1 conforming reader that does colour manage 3D content shall follow the rules specified in 7.3.3 for handling **DeviceRGB** colours. The colour management shall be performed after the 3D content is rendered. If the reader cannot render the 3D content and uses the normal appearance of the 3D annotation, the provisions described in 7.3.2 to 7.3.4 shall be applied.

NOTE This means that the PDF/E-1 specification does not ensure consistent colour-rendering of 3D content across devices and reader applications.

7.4 Images

If an image dictionary contains alternate images, the image dictionary and each alternate image dictionary shall contain **OC** keys as defined in Tables 4.39 and 4.41 in the *PDF Reference*.

An image dictionary shall not contain the **OPI** key.

If an image dictionary contains the **Interpolate** key, its value shall be *false.*

The use of the **Intent** key shall conform to the rules given in 7.10.

7.5 Form XObjects

A **form XObject** dictionary shall not contain any of the following:

— the **OPI** key;

— the **Subtype2** key with a value of *PS*; or

— the **PS** key.

NOTE In earlier versions of PDF, the **Subtype2** key with a value of PS and the PS key were used to define arbitrary executable PostScript code streams, which have the potential to interfere with reliable and predictable rendering.

7.6 Reference XObjects

A PDF/E-1 conforming file shall not contain reference **XObjects**.

NOTE Reference **XObjects** refer to arbitrary document content in external PDF files, creating external references that complicate predictable rendering.

7.7 PostScript XObjects

A PDF/E-1 conforming file shall not contain PostScript **XObjects**.

NOTE PostScript **XObjects** contain arbitrary executable PostScript code streams that have the potential to interfere with reliable and predictable rendering.

7.8 Shading operator

The shading dictionary, when referenced by the **sh** operator shall contain a valid **BBox** entry.

7.9 Extended graphics state

An ExtGState dictionary shall not contain the **TR** key. An ExtGState dictionary shall not contain the **TR2** key with a value other than *Default*. A PDF/E-1 conforming reader may ignore any instance of the **HT** key in an ExtGState dictionary.

Use of the **RI** key shall conform to the rules of 7.10.

7.10 Rendering intents

Where a rendering intent is specified, its value shall be one of the four values defined in *PDF Reference*, i.e. *RelativeColorimetric*, *AbsoluteColorimetric*, *Perceptua*l, or *Saturation*.

NOTE The default rendering intent is *RelativeColorimetric*.

7.11 Content streams

A PDF/E-1 conforming file shall not include operators in a **Contents** stream that are not described in the *PDF Reference*, even if they are encapsulated between **BX** and **EX** operators.

A PDF/E-1 conforming reader shall process every page operator according to the *PDF Reference*, even when they are encapsulated between **BX** and **EX** operators.

It is recommended that a PDF/E-1 writer not use the **BX/EX** operators.

NOTE 1 The operators **BX** (begin section where undefined page operators are not reported) and **EX** (end section where undefined page operators are not reported) designate areas in a page description that according to the *PDF Reference* can be ignored and not rendered by a reader that does not understand some or all of the page operators in between **BX** and **EX**.

Use of the **ri** operator shall conform to the rules of 7.10.

NOTE 2 Content streams are used for page descriptions, e.g. the **Contents** stream of a page object or the stream of a form **XObject**, as well as for the appearance stream of annotations, including form fields or **Widget** annotations.

NOTE 3 In earlier versions of the PDF format a PostScript operator PS was defined. As this operator is not defined in *PDF Reference*, its use is implicitly prohibited by 7.10.

NOTE 4 *Set line width* (*LW*) operator is explicitly not restricted to values greater than 0. A line width of 0 is allowed; however the results are device dependent. The resulting one-pixel-wide line might not be visible on high resolution devices.

7.12 Optional content

The **category** array in a usage application dictionary shall not contain a **CreatorInfo** or **User** entry.

NOTE This restriction allows the OCG to carry the **CreatorInfo** or **User** entries in their **Usage** dictionaries, but ensures that those entries will not be used to control the states of the OCGs. In other words, the **CreatorInfo** and **User** entries would be present as descriptive information, not actionable information.

7.13 Print scaling

A PDF/E-1 conforming reader shall obey the contents of the **PrintScaling** key in the viewer preferences dictionary (*PDF Reference*, 8.1). If the **PrintScaling** key is present in the dictionary and set to *None*, the behaviour of readers shall be the following.

— Non interactive printing readers shall only print the document if all the pages can be printed without performing any scaling. If the document cannot be printed, the non interactive printing reader may issue an error.

— Interactive readers shall not allow any scaling factor when performing a print operation.

8 Fonts

8.1 General

The intent of the requirements in 8.2 to 8.6 is to ensure that future rendering of the textual content of a PDF/E-1 conforming file match, on a glyph by glyph basis, the static appearance of the file as originally created and to allow the recovery of semantic properties for each character of the textual content.

It is recommended that text searchability be accommodated in PDF/E files, but it is not required. In situations where full text searchability is required, then the file shall follow the recommendations of PDF/A-1a (Level A conformance).

8.2 Font types

All fonts used in a PDF/E-1 conforming file shall conform to the font specifications defined in *PDF Reference*, 5.5.

For the purposes of this part of ISO 24517, multiple master fonts shall be considered a special case of Type 1 fonts; any requirement explicitly stated with regard to Type 1 fonts shall be implicitly required with regard to multiple master fonts.

NOTE 1 It is the responsibility of the writer to ensure the conformance of all fonts. This part of ISO 24517 does not prescribe the manner in which font conformance is determined.

The value of the **Subtype** key in a font dictionary shall be one of the values listed in Table 5.7 of the *PDF Reference.*

NOTE 2 This requirement resolves an ambiguity in the *PDF Reference* regarding validity of unknown values for Subtype.

A PDF/E-1 conforming reader may ignore hinting information present in Type 1 fonts.

NOTE 3 The Type 1 font specification is incomplete with regard to the use of hinting information. It is nevertheless possible to produce acceptable rasterizations of font outlines without the use of this data.

8.3 Composite fonts

8.3.1 General

For any given composite (Type 0) font referenced within a PDF/E-1 conforming file, the **CIDSystemInfo** entries of its **CIDFont** and CMap dictionaries shall be compatible, as described in *PDF Reference*, 5.6.2; in other words, the **Registry** and **Ordering** strings of the CIDSystemInfo dictionaries for that font shall be identical, unless the value of the CMap dictionary **UserCMap** key is *Identity-H* or *Identity-V*.

8.3.2 CIDFonts

For all Type 2 **CIDFonts**, the **CIDFont** dictionary shall contain a **CIDToGIDMap** entry that shall be a stream mapping from CIDs to glyph indices or the name *Identity*, as described in *PDF Reference*, Table 5.14.

8.3.3 CMaps

All CMaps used within a PDF/E-1 conforming file, except *Identity-H* and *Identity-V*, shall be embedded in that file as described in *PDF Reference*, 6.5.4. For those CMaps that are embedded, the integer value of the **WMode** entry in the CMap dictionary shall be identical to the **WMode** value in the embedded CMap stream.

8.4 Embedded font programs

The font programs for all fonts used within a PDF/E-1 conforming file shall be embedded within that file, as defined in *PDF Reference*, 5.8, except when the fonts are used exclusively with text-rendering mode 3. A font is considered to be used if any of its glyphs are referenced in any of the following contexts:

— the Contents stream of a page object;

— the stream of a Form **XObject**;

— the appearance stream of an annotation, including form fields;

— the content stream of a Type 3 font glyph; or

— the stream of a tiling pattern.

Only fonts that are legally embeddable in a file for unlimited, universal rendering shall be used.

All PDF/E-1 conforming readers shall use the embedded fonts, rather than other locally resident, substituted, or simulated fonts for rendering.

NOTE 1 As discussed in *PDF Reference*, text-rendering mode 3 specifies that glyphs are not stroked, filled, or used as a clipping boundary. A font referenced for use solely in this mode is therefore not rendered and is thus exempt from the embedding requirement.

NOTE 2 There is no exemption from the requirements of 8.4 for the 14 standard Type 1 fonts. Type 3 fonts are exempt from the requirements of 8.4 because the manner in which Type 3 fonts are defined ensures that they are always embedded within PDF files, although through use, a mechanism that differs from that of *PDF Reference*.

NOTE 3 As stated in 8.5, font subsets are acceptable as long as the embedded font programs provide glyph definitions for all characters referenced within the file. Embedding the font programs allows any PDF/E-1 conforming reader to reproduce correctly all glyphs in the manner in which they were originally published without reference to possibly ephemeral external resources.

NOTE 4 This part of ISO 24517 precludes the embedding of fonts whose legality depends upon special agreement with the font copyright holder. Such an allowance places unacceptable burdens on an archive to verify the existence, validity and longevity of such claims.

8.5 Font subsets

As stated in 8.4, embedded font programs shall define all font glyphs referenced for rendering with a PDF/E-1 conforming file. Type 0 **CIDFont** and Type 1 and TrueType font subsets, as described in *PDF Reference*, 5.5.3, may be used as long as the embedded font programs define all appropriate glyphs.

For all Type 1 font subsets referenced within a PDF/E-1 conforming file, the font descriptor dictionary shall include a **CharSet** string listing the character names defined in the font subset, as described in *PDF Reference*, Table 5.19.

For all **CIDFont** subsets referenced within a PDF/E-1 conforming file, the font descriptor dictionary shall include a **CIDSet** stream identifying which CIDs are present in the embedded **CIDFont** file, as described in *PDF Reference*, Table 5.21.

NOTE The use of font subsets allows a potentially substantial reduction in the size of PDF/E-1 conforming files.

8.6 Character encodings

All non-symbolic TrueType fonts shall specify *MacRomanEncoding* or *WinAnsiEncoding* as the value of the **Encoding** entry in the font dictionary. All symbolic TrueType fonts shall not specify an **Encoding** entry in the font dictionary, and their font programs' cmap tables shall contain exactly one encoding.

NOTE This requirement makes normative the suggested guidelines described in *PDF Reference*, 5.5.5.

9 Annotations

9.1 General

In addition to the rendering behaviour defined by *PDF Reference*, as modified by this part of ISO 24517, PDF/E-1 conforming interactive readers shall provide a mechanism to display the values of the **Contents** key of annotation dictionaries.

NOTE This part of ISO 24517 does not prescribe the specific behaviour or technical implementation details that interactive readers can use to implement this functional requirement.

9.2 Annotation types

Annotation types not defined in *PDF Reference* shall not be permitted.

9.3 Annotation dictionaries

An annotation dictionary shall contain the **F** key. The **F** key's **Print** flag bit shall be set to *1* and its **Hidden**, **Invisible** and **NoView** flag bits shall be set to *0*.

The **NoZoom** and **NoRotate** flag bits of the **F** key in a **Text** annotation shall be *1*.

NOTE 1 The restrictions on annotation flags prevent the use of annotations that are hidden or that are viewable but not printable. The **NoZoom** and **NoRotate** flags are permitted, which allows the use of annotation types that have the same behaviour as the commonly-used text annotation type. By definition, text annotations exhibit the **NoZoom** and **NoRotate** behaviour even if the flags are not set, as described in *PDF Reference*, 8.4.5; explicitly setting these flags removes any potential ambiguity between the annotation dictionary settings and reader behaviour.

An annotation dictionary shall not contain the **C** array or the **IC** array unless the colour space of the **DestOutputProfile** in the PDF/E-1 **OutputIntent** dictionary, defined in 7.2, is *RGB*.

NOTE 2 These provisions ensure that the device colour spaces used in annotations by mechanisms other than an appearance stream are indirectly defined by means of the PDF/E-1 **OutputIntent**.

If an annotation dictionary contains the **AP** key, the appearance dictionary that it defines as its value shall contain only the **N** key, whose value shall be a stream defining the appearance of the annotation. With the exception of 3D and multimedia annotation types, PDF/E-1 conforming readers shall render only this appearance as defined in *PDF Reference*.

This subclause only restricts the presentation of annotations on the rendered page. Readers can provide alternate user interface elements pertaining to the annotations. This International Standard imposes no restrictions or requirements upon such presentations.

10 Interactive forms

The document's interactive form dictionary that forms the value of the **AcroForm** key in the catalog object of a PDF/E-1 file, if present, shall not contain the **XFA** key.

NOTE The use of XML-based XFA forms is prohibited by this requirement because of their dynamic layout.

The **NeedAppearances** entry in an interactive form dictionary, if present, shall have a value of *False*.

11 Actions

11.1 General

JavaScript and **ImportForm** actions shall not be permitted. Additionally, the deprecated **set-state** and **no-op** actions shall not be permitted.

NOTE 1 **JavaScript** actions permit arbitrary executable code that has the potential to interfere with reliable and predictable rendering.

NOTE 2 **ImportForm** actions introduce data from sources outside the PDF file, violating the requirement that the document be self-contained.

11.2 Hypertext links

Interactive PDF/E-1 conforming readers may choose to make hyperlinks non-actionable, but in addition to the rendering behaviour defined by the *PDF Reference*, as modified by this part of ISO 24517, they shall provide a mechanism to present to the user the **F** and **D** keys of a **GoToR** action dictionary, the **URI** key of a **URI** action dictionary, and the **F** key of a **SubmitForm** action dictionary.

NOTE Since hyperlinks transfer the thread of execution outside the control of an interactive reader, this subclause allows an interactive reader to choose to make them not actionable. For purposes of archival disclosure of the complete information content of PDF/E documents, it is important for interactive readers to provide some mechanism to expose the destination of all hyperlinks. However, this part of ISO 24517 does not prescribe any specific behaviour or the technical implementation details that interactive readers might use to meet the functional requirement of this subclause.

12 Presentations

Non-interactive PDF/E-1 conforming readers shall ignore all parameters pertaining to presentations, as described in *PDF Reference*, 8.3.3.

Non-interactive PDF/E-1 conforming readers shall ignore the **PresSteps** entry in a page dictionary.

Interactive PDF/E-1 conforming readers may obey the parameters in a page object pertaining to presentations, as described in *PDF Reference*, 8.3.3. Furthermore, an interactive reader may obey **PresSteps** entry in a page dictionary. However, if these features are supported by an interactive reader, the reader shall provide a distinct “Presentation Mode”, as described in *PDF Reference*, 8.3.3. Furthermore, these navigation controls shall only be honoured when the reader is in presentation mode.

NOTE This subclause makes the recommended behaviour described in *PDF Reference*, p. 566, a requirement.

13 Metadata

13.1 General

PDF/E-1 files shall conform to all of the requirements of ISO 19005-1:2005, 6.7 and its Corrigenda, except those overridden by this part of ISO 24517.

13.2 Version Identification

The XMP metadata of PDF/E-1 conforming files may contain conformance properties defined in other PDF-based ISO Standards. In particular, properties belonging to the **pdfxid:** (ISO 15930 series) and **pdfaid:** (ISO 19005 series) namespaces are allowed but not required.

The document information dictionary of PDF/E-1 conforming files may contain conformance entries defined in other PDF-based ISO Standards. In particular, the **GTS_PDFXVersion** (ISO 15930 series) is allowed but not required.

NOTE This subclause explicitly makes the presence of required conformance properties and entries as defined in other PDF-based ISO Standards optional for PDF/E-1 conforming files.

13.3 Document information dictionary

In addition to the entries in ISO 19005-1, Table 1, the following entry applies to PDF/E-1 files.

Table 1 — Crosswalk between document information dictionary and XMP properties

Document information dictionary		XMP	
Entry	**PDF type**	**Property**	**XMP type**
ISO_PDFEVersion	*text string*	**pdfe:ISO_PDFEVersion**	*Text*
NOTE The XML namespace URI for the **dc** prefix is <http://purl.org/dc/elements/1.1/>; the namespace URI for the **pdf** prefix is <http://www.adobe.com/pdf/1.3/>; and the namespace URI for the **xmp** prefix is <http://www.adobe.com/xap/1.0/>. The XML namespace URI for the pdfe prefix is <http://www.aim.org/pdfe/ns/id/>.			

The value of **GTS_PDFXVersion** in the information dictionary, if present, shall be encoded in **PDFDocEncoding**; Unicode encoding shall not be used.

The value of the document information dictionary entries and their analogous XMP properties shall be equivalent. For properties that map from the PDF *text string* type to the XMP *Text* type, value equivalence shall be on a character-by-character basis, independent of encoding, comparing the numeric ISO/IEC 10646 code points for the characters.

NOTE 1 The explicit requirement for equivalence between the values of document information dictionary entries and their analogous XMP properties has the implicit effect of providing unambiguous interpretation of that property's value.

If the **dc:creator** property is present in XMP metadata, then it shall be represented by an ordered *Text* array of length one whose single entry shall consist of one or more names. Equivalence between **Author** and **dc:creator**, shall be on a character-by-character basis, independent of encoding, comparing the numeric ISO/IEC 10646 code points for the characters.

NOTE 2 For the purpose of converting from **Author** to the **dc:creator** property in XMP metadata, then **dc:creator** is represented by a *seq ProperName* structure consisting of one or more names per entry, with each entry of the ordered list being equivalent to the separation of a comma delimited list.

EXAMPLE 1 The document information dictionary entry:

```
/Author (Peter, Paul and Mary)
```

is equivalent to the XMP property:

```
<dc:creator>
    <rdf:Seq>
        <rdf.:li>Peter</rdf:li>
        <rdf.:li>Paul </rdf:li>
        <rdf.:li>Mary</rdf:li>
    </rdf:Seq>
</dc:creator>
```

Date properties are formatted as a variable-length sequence of temporal components ranging in granularity: year, month, day, hour, minute, second. For properties that map between the PDF *date* type, defined by *PDF Reference*, 3.8.3, and the XMP *Date* type, defined by *Date and Time Format*s, value equivalence shall be on a component-by-*component* basis, relative to coordinated universal time (UTC), i.e. correcting for local time zone offset.

EXAMPLE 2 The document information dictionary entries:

```
/CreationDate (D:20040402)
/ModDate (D:20040408091132-05'00')
```

are equivalent to the XMP properties:

```
<xmp:CreateDate>2004-04-02</xmp:CreateDate>
<xmp:ModifyDate>2004-04-08T14:11:32Z</xmp:ModifyDate>
```

13.4 XMP header

The **bytes** and the **encoding** attributes shall not be used in the header of an XMP packet.

NOTE Both the **bytes** and **encoding** attributes are deprecated in *XMP Specification*.

13.5 File identifiers

A PDF/E-1 conforming file shall include metadata properties to identify the file. File identifiers shall be included through use of the **xmpMM:DocumentID**, **xmpMM:VersionID**, and **xmpMM:RenditionClass** properties in the document metadata stream. In most instances, the value of the **xmpMM:RenditionClass** will be *default*.

This part of ISO 24517 recommends the use of a 128-bit number in the form of a uuid-schemed UI (e.g. *uuid: 36fc6010-1f6c-4191-8696-7e92478da16c*) for the value of the **xmpMM:DocumentID** property. It should be generated in such a way that there is a high probability that it is unique. There are various common schemes for generating a unique identifier. While this part of ISO 24517 does not specify a particular scheme, the algorithms set out in ISO/IEC 11578:1996 and DCE 1.1[7] are recommended.

All PDF/E-1 files shall contain the following properties in the document metadata stream and their values shall contain appropriate data prior to exchange: **xmp:CreateDate, xmp:ModifyDate, xmp:MetadataDate**, and **dc:title**. A zero-length string shall not be used for any of these four keys.

The **xmp:CreatorTool** and **pdf:Producer** properties should be present in the document metadata stream.

The **ID** key in the file trailer shall be present. Document creators should ensure that the **ID** in the trailer is likely to be unique; for example, by following the recommendations in the *PDF Reference.*

13.6 File provenance information

If the document's contents are modified, the value of the Document Info Dictionary's **ModDate** key (if present), the **Metadata xmp:ModifyDate,** and **xmp:MetadataDate** shall be updated. However, if only the document information dictionary and/or **Metadata** values are updated, then only the value of **xmp:MetadataDate** should be changed.

If a PDF/E-1 conforming file is changed in any way, even if only by the addition or modification of metadata or digital signatures, then the PDF/E-1 writer shall modify the changing identifier part of the file trailer dictionary **ID** key as described in *PDF Reference*, 10.3.

13.7 Validation

All content of all XMP packets shall be well-formed as defined by *Extensible Markup Language (XML) 1.0*[9], 2.1, and *RDF/XML Syntax Specification (Revised)*[12], Clause 7. If possible, at the time a writer creates or resaves a PDF/E-1 conforming file all of the content of that file's XMP packets should be validated.

14 Embedded files

A non-interactive PDF/E-1 conforming reader may ignore all embedded files.

An interactive PDF/E-1 conforming reader shall provide user-interface elements suitable for communicating the presence of embedded files to a user.

15 Multimedia

15.1 General

The handling of multimedia for the different conformance levels of reader as well as the restrictions on the use of must-have parameters in order to increase the viability of embedded media are defined in 15.2 to 15.5.

15.2 Self-contained

All multimedia clips shall be entirely self-contained and embedded within the PDF/E-1 file each as a single stream. Media types that are by definition distributed amongst multiple streams or reliant on external data sources are prohibited.

15.3 Handling of multimedia

A non-interactive PDF/E-1 conforming reader shall display the normal appearance of a screen annotation.

An interactive PDF/E-1 conforming reader shall either display the normal appearance of a multimedia screen annotation or process the multimedia in accordance with the *PDF Reference*.

It is not required that a PDF/E-1 conforming reader further process multimedia clips.

15.4 Must-have parameters

No dictionary listed in *PDF Reference*, 9.1.1 (p. 714), may have an MH entry.

NOTE This provision maximizes the likelihood of a media clip being viable. It is beyond the scope of this part of ISO 24517 to prescribe policy pertaining to the presence of multimedia players in a system in which a PDF/E conforming reader resides.

15.5 Alternate presentations

The Names dictionary in a PDF/E-1 conforming file shall not have an **AlternatePresentations** entry.

16 3D

16.1 General

The conformance levels regarding handling of 3D artwork are defined in 16.2 to 16.4, which facilitates predictable rendering of 3D models without the need for 3D **JavaScript**.

16.2 Display of 3D annotations

A non-interactive PDF/E-1 conforming reader shall display the Normal appearance of a 3D annotation.

An interactive PDF/E-1 conforming reader shall either display the Normal appearance of a 3D annotation, or process and display the associated 3D artwork in accordance with the *PDF Reference*, the *U3D* specification, and other restrictions as specified in this part of ISO 24517.

16.3 Supported 3D formats

The Subtype entry in a 3D stream dictionary shall have a value of U3D.

NOTE 1 *PDF Reference* states that there might be other values of the 3D Subtype in future versions of the reference. Future parts of ISO 24517 based on later versions of the *PDF Reference* might allow other 3D subtypes.

If a Subtype other than U3D is encountered, a PDF/E-1 conforming reader shall leave the annotation in its inactive state and display its normal appearance.

NOTE 2 This provision makes the behaviour recommended in *PDF Reference* a requirement for a PDF/E-1 consumer.

16.4 3D JavaScript

16.4.1 OnInstantiate script

A PDF/E-1 conforming reader may ignore the **OnInstantiate** entry in a 3D stream.

NOTE This provision allows a reader to be conformant without supporting 3D **JavaScript**.

16.4.2 Resources dictionary

A 3D stream dictionary shall not contain a **Resources** entry.

NOTE The **Resources** entry is a repository for image data and 3D models intended for use by the **OnInstantiate** script for assembling complex models from component sub-parts. This provision guarantees that the information needed to instantiate and correctly render the 3D model is contained within the U3D stream; no assembly by means of **JavaScript** is required.

17 Unrecognized data

17.1 Extensions to the PDF format

The rendering of PDF/E-1 conforming files shall be performed as defined in *PDF Reference* subject to the further requirements specified by this part of ISO 24517. Features described in PDF specifications prior to version 1.6 that are not explicitly described in *PDF Reference* are not allowed in a PDF/E file.

NOTE This subclause allows future or third party extensions to be present in a PDF/E-1 conforming file. However, it prohibits the presence of such extensions from affecting the manner in which a PDF/E-1 conforming reader renders the file.

18 Encryption

18.1 General

The security features allowed in a PDF/E-1 conforming file and the restrictions and requirements placed on conformant consumers regarding their processing of PDF/E-1 files are defined in 18.2 to 18.4.

This part of ISO 24517 allows PDF/E-1 conforming documents to be encrypted.

NOTE It is beyond the scope of this part of ISO 24517 to define the mechanism by which a reader (interactive or non-interactive) obtains a password to open an encrypted document. While interactive readers by nature have the means to request such information from a user, non-interactive readers will have to obtain the password via implementation-specific mechanisms, such as a separate communications channel or an associated job-ticket.

18.2 Encryption version

If a PDF/E-1 file contains an encryption dictionary, it shall contain a **V** entry. The value of the **V** entry shall be *1*, *2*, or *4*.

18.3 Direct objects in the encryption dictionary

The values of all entries of Tables 3.18, 3.19, 3.21, 3.22, and 3.24 in *PDF Reference* whose types are string, array, or dictionary shall be direct.

This removes any ambiguity regarding whether strings in subdictionaries or subarrays of the encryption dictionary require being direct. All strings, dictionaries, and arrays in the encryption dictionary that are defined within *PDF Reference*, no matter how deeply nested, shall be direct. This part of ISO 24517 cannot impose such restrictions on the entries defined by security handlers other than those defined in *PDF Reference*, but it is important to note that any such strings used for decryption are required to be direct to avoid circular dependencies in reading the encryption dictionary when the document is opened.

18.4 User access permissions

A PDF/E-1 conforming reader shall restrict user access to an encrypted PDF file according to the permissions contained in the file.

19 Digital signatures

19.1 General

PDF Reference defines a variety of signature features. However, some of them rely on algorithms for computing digest values that are not fully documented. PDF/E restricts the use of signature features to those that are completely and unambiguously specified. Restrictions on the digital signature features that may appear in a PDF/E-1 file are given 19.2 to 19.5. The behaviour of PDF/E-1 conforming readers with respect to digital signatures are defined in 19.6 to 19.10.

19.2 Declaring the presence of signatures

A PDF/E-1 conforming file that contains signature fields shall have a **SigFlags** entry in the interactive form dictionary (*PDF Reference*, section 8.6.1). The low-order bit of this entry shall be 1. If the document contains no signature fields, the **SigFlags** entry shall either be absent or the low order bit shall be 0.

NOTE This subclause guarantees that the **SigFlags** entry accurately reflect the status of the document with respect to the presence of signature fields.

19.3 Signature dictionaries

A signature dictionary shall appear as the value of the **V** entry in at least one signature field in the document.

A signature dictionary shall contain a **ByteRange** entry that spans the entire document at the time of signing, excluding the signature's **Contents** entry.

A signature dictionary may have a **References** array.

NOTE PDF/E-1 requires that all signatures be associated with a signature field. Invisible signatures can be simulated by specifying an empty appearance stream and a Rect entry with a value of [0 0 0 0] for the signature field's widget annotation. PDF/E-1 also requires that the entire file be used in calculating the signature digest.

19.4 Signature reference dictionaries

A signature reference dictionary shall have a **TransformMethod** entry with a value of **DocMDP**.

The **P** entry in a signature reference dictionary's **TransformParams** dictionary shall have a value of *1*.

NOTE The use of **FieldMDP**, **Identity**, and **UR** transform methods is prohibited by this requirement.

19.5 Document permissions dictionary

The document permissions dictionary shall not contain **UR** entries.

The document permissions dictionary may contain a **DocMDP** entry. The value of this entry, a signature reference dictionary, shall conform to the restrictions detailed in 19.2.

19.6 Detection and notification

A PDF/E-1 conforming interactive reader shall provide features to inform the user of the presence of signatures and to view the signature information.

19.7 Display of signature fields

A PDF/E-1 conforming reader shall display the normal appearance of a signature field's associated Widget annotation.

19.8 Detection of changes

An interactive PDF/E-1 conforming reader shall provide features for determining whether the document has been changed since it was signed. It shall determine and represent the validity of the signature in accordance with all appropriate restrictions carried in the signature.

19.9 Prevention of changes

An interactive PDF/E-1 conforming reader shall honour any and all restrictions on modifying the document imposed through the use of digital signatures. In particular, if there is a **DocMDP** entry in the document's permissions dictionary, the reader shall prohibit changes to the document.

19.10 Verification of the identity of signer

An interactive PDF/E-1 conforming reader may provide tools for verifying the identity of the signer.

If a signer's identity is not verified, an interactive PDF/E-1 conforming reader shall provide a means to inform the user of that fact. In addition, the reader shall provide information stating whether it was due to lack of access to the necessary resources, lack of support for verification in the reader, or the identification of the signer being invalid.

NOTE Verification of signer identity might require access to resources (e.g., servers, data) external to the system on which the reader is executing. Because access to these resources cannot be guaranteed, it is not a requirement that an interactive PDF/E-1 conforming verify the signature.

Annex A
(informative)

PDF/E use cases

A.1 General

This annex presents a series of use cases that attempt to capture some of the most common applications (both existing and potential) of PDF/E for the exchange of engineering information.

This collection of use-cases was developed by the joint members of ISO/TC 171/SC 2 and AIIM utilizing both their direct knowledge, and their industry expertise.

In its current form, this document is not intended to provide a complete enumeration of uses of PDF/E for the exchange of engineering information. It does, however, give an idea of the possible areas of exchange that could benefit from the use of the PDF/E structure as follows:

— modular and engineered housing;

— submission to regulatory agencies;

— design presentations;

— assembly instructions;

— printing;

— archiving and general uses.

A.2 Modular and engineered housing

A.2.1 Rationale

Manufactured or modular construction includes all buildings that are built in a factory and then transported to their final destination, instead of being built on site. These buildings need to be built according to the building codes and regulations of the destination and are required to go through an approval process to ensure proper construction. The plan review approval process is seldom if ever performed by the manufacturer itself. This review is commonly done by a third party review agency, and the approved plans are then sent to the final regulatory agency.

A.2.2 Users

Users of modular and engineered housing include:

— manufacturers;

— third party reviewers;

— regulatory agencies.

A.2.3 Workflow

The workflow includes the following.

a) The manufacturer creates the design drawings and converts them into PDF files. These files are then sent to the third party review agency to be reviewed for compliance with the appropriate building codes.

b) If the plans pass the approval, the third party review agency stamps and digitally signs the plans, and submits them to the final regulatory agency.

c) If the plans need revisions for code violations, the review agency uses the comment and markup tools within Acrobat to note any violations or needed changes. The plans are then sent back to the manufacturer for revision.

d) Plans are then re-submitted to the review agency until they can be approved, digitally signed, and sent on to the final regulatory agency.

e) The final regulatory agency will follow their own review process, affix their approval stamps to the drawings, seal the drawings with their digital signature, and return the approved drawings to the manufacturer for construction.

A.2.4 Benefits

The benefits are the following:

— fast secure document exchange between manufacturer and reviewer;

— a significant cost advantage over paper and postal review methods;

— document storage is far more efficient;

— changes or markup can be easily identified to speed re-review times;

— PDF/E drawing exchange is platform and program independent, which allows diversity in both manufacturing and review environments.

A.2.5 Requirements or best practices

The requirements or best practices are the following.

— Final engineering documents need to comply with regulatory agencies' specific requirements.

— Digital signatures used to "seal" and certify engineering documents in lieu of the traditional "wet stamp".

— Third party review stamp annotations should be flattened prior to transmission to 'lock' the stamp to the page.

A.3 Submission to regulatory agencies

A.3.1 Rationale

Many engineering documents need to be submitted to a regulatory agency, either for approval, or to be filed for official notification and use. While this may seem to be an archival function, PDF/E allows a more robust format for the regulatory use of these documents.

A.3.2 Users

Users include:

— engineering professionals;

— regulatory agencies.

A.3.3 Workflow

The workflow includes the following.

a) The engineering professional submits the final documents to the regulatory agency.

b) The regulatory agency follows internal procedures for document handling.

c) Often engineering documents need to be professionally “sealed”. Two possible formats have been identified for electronically sealing these documents.

   1) In the case of engineering documents that need a single seal, or are sealed by a single professional, the use of a digital signature on the entire PDF file is recommended.

   2) Often engineering documents come from several different sources before the “package” is submitted to a regulatory agency. PDF and PDF/E can be utilized by taking separate digitally signed documents as attachments to a master sealed cover letter or digital envelope. This method allows a final, or chief, professional to digitally sign and seal the entire collection of documents that have been individually signed and sealed by multiple subcontractors.

A.3.4 Benefits

The benefits are the following:

— fast secure document exchange;

— a significant cost advantage over paper and postal methods;

— document storage is far more efficient;

— PDF/E drawing exchange is platform and program independent, which allows diversity in both the engineering professional and regulatory environments.

A.3.5 Requirements or best practices

The requirements or best practices are the following.

— Final engineering documents need to comply with regulatory agencies’ specific requirements.

— Digital signatures used to “seal” and certify engineering documents in lieu of the traditional “wet stamp” on paper.

A.4 Design presentations

A.4.1 Rationale

A municipal planner can better judge proposals by seeing the impact of structures on skylines or landscapes.

An architect can bring a project to life on the desktops of clients, contractors, and colleagues with interactive, photorealistic models and fly-through animations.

Plant owner-operators will be able to reduce total cost of ownership by providing maintenance crews with composite PDF documents, including hierarchical animations of access and dismantling procedures to help them repair or refit equipment. Along with the interactive 3D models, work instructions, specifications, and schedules can all be included in a single PDF file.

Members of the public will better understand proposed changes to infrastructure and cast more informed votes for approval or rejection.

PDF/E is useful as the primary deliverable for manufacturing to produce prototypes from 2D Drawings that are rendered in the PDF/E file. Embedding 3D data is useful to illustrate design intent in a way that is not obvious in a 2D drawing.

After an engineer has produced a PDF file for manufacturing, the people on the shop floor may want further clarification on design intent for certain subtleties; the depth of a hole for example. Each of these subtleties may initiate a conversation between engineering and manufacturing, which can lead to a significant increase in lead-time for the prototype. If the person on the shop floor can view the 3D representation as supplemental information to the 2D drawing that they are building against, the design intent is often much clearer and the clarification from engineering can become unnecessary.

A.4.2 Users

Users vary from municipal planners to engineering clients.

A.4.3 Workflow

The workflow varies with application.

A.4.4 Benefits

The benefits are the following:

— fast secure document exchange;

— a significant cost advantage over paper and postal methods;

— document storage is far more efficient;

— PDF/E drawing exchange is platform and program independent, which allows diversity in both the engineering professional and regulatory environments.

A.5 Assembly instructions

A.5.1 Rationale

Assembly instructions show how parts fit together and utilize part numbers, or animations showing parts. Assembly instructions include parts catalogues and maintenance and repair manuals.

A.5.2 Users

Users include:

— manufacturers;

— maintenance and repair personnel.

A.5.3 Workflow

The workflow includes the manufacturer creating a catalogue of details and repair drawings to be distributed to their maintenance facilities to aid with repair of assemblies.

A.5.4 Benefits

The benefits are the following:

— fast secure document exchange;

— a significant cost advantage over paper and postal methods;

— document storage is far more efficient;

— PDF/E drawing exchange is platform and program independent, which allows diversity in both the engineering professional and regulatory environments.

A.6 Printing

A.6.1 Rationale

The engineering workflow includes steps where it is necessary to generate printed documents with various levels of quality and quantity, for example

— review with subcontractors,

— project presentation,

— request for quotation,

— assembly manual,

— training manual.

Depending on users' needs, the quality requested can be anything from draft to very high, with additional requirements for a few copies to thousands. Printing can be done in a single location (print then distribute) or several locations across the world (distribute then print).

The documents to print are generally composed of standard multi-sheet documents and specific engineering documents with larger sizes and with graphical content. The original documents may have been generated by multiple applications (e.g. CAD system, GIS applications, MS Office).

At printing time, it may be necessary to add additional signage like a stamp, print date, scaling factor.

Depending on infrastructure, the printing work can be done in-house or by outside engineering department or commercial reprographers.

Printing should be possible without the use of original CAD applications and any assumption about the printer environment. There should also be an assurance that print outcome can be defined without ambiguity and in a predictable way.

The content of the file to be printed should be tamper-proof, thereby addressing security issues and enabling some legal assurance.

PDF/E-1 can include 3D models to support engineering workflows. On screen, it is possible to display views of the model from different viewpoints and with different lighting conditions. When using interactive consumers, it

is possible to produce a printed snapshot of this model at operator's request. These snapshots are derived from the view currently displayed on the screen.

When a non-interactive consumer processes a PDF/E-1 file which includes a 3D model, it will print the default view which is attached with the 3D model. This default view provides a consistent print of a document including a 3D model.

A.6.2 Users

Users include:

— designers;

— architects;

— engineers;

— clients/customers;

— consultants;

— marketing personnel.

A.6.3 Workflow

The workflow could include an architectural firm distributing electronic files for highs or low-end printing to the various parties involved in a project (project owner, contractors, etc.).

A.6.4 Benefits

The benefits are the following:

— ability to print to devices regardless of software availability;

— ability to securely exchange and print;

— ability to print offline.

A.7 Archiving

A.7.1 Rationale

As a strict subset of the PDF 1.4 reference, PDF/A-1 (see ISO 19005-1) restricts the inclusion of certain elements of a PDF/E, including layers, interactive data, and its ability to archive 3D information. It is anticipated that the next version of the PDF/A standard (PDF/A-2) will accommodate some of these elements. Until a version of PDF/A is available which handles complex data, such as 3D, PDF/E-1, in conjunction with Universal 3D (U3D), another open standard, can be used to retain PDF-based documents. However, PDF/E-1 was developed as an exchange format, and not as a format for long-term retention.

A.7.2 Users

Users include anyone requiring archiving of the full PDF/E engineering content and they should consider PDF/E-1 to be simply a piece of a larger retention policy and archiving system.

A.8 General use examples

A.8.1 Ensuring traceability of engineering data

Traceability is of the utmost concern in the creation and communication of engineering documents. Often it is not sufficient to simply state the result of a calculation. Rather the requirement is to demonstrate how the result was obtained by including referenced sources and intermediate steps. Metadata is useful in associating this type of information with the document and with individual components contained therein.

PDF/E-1 extends the metadata capabilities of *PDF Reference* to provide for the association of trace information with engineering documents. This information is useful for a variety of use cases including but not limited to impact analysis, search and compliance assurance.

A.8.2 Enhanced unit recognition and conversion

PDF Reference provides fundamental support for measurement to be performed on model data such as a CAD drawing that is embedded within a document. The existing support for units used within these measurements is primitive in that it puts the onus on the document writer to define all aspects of a particular unit including the symbol to use and conversion capabilities. Well-known unit systems such as SI (http://physics.nist.gov/cuu/Units/index.html) exist that define this information in a normative fashion.

PDF/E-1 enhances the units support present in *PDF Reference* by allowing document writers to make use of a well known unit system such as SI without the need to define the appropriate symbols and conversion factors in use. This capability provides for many use cases including locale specific conversion of measurement readings (e.g. metric to U.S. units) without requiring the document creator to predict all possible unit requirements of the reader.

Bibliography

[1] ISO/IEC 10646:2003, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

[2] ISO/IEC 11578:1996, *Information technology — Open Systems Interconnection — Remote Procedure Call (RPC)*

[3] ISO 15930-4:2003, *Graphic technology — Prepress digital data exchange using PDF — Part 4: Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a)*

[4] ISO 15930-6, *Graphic technology — Prepress digital data exchange using PDF — Part 6: Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3)*

[5] ISO/IEC 16262:2002, *Information technology — ECMAScript language specification*

[6] Adobe Acrobat 7.0.7, 3D *JavaScript Reference*, Adobe Systems Incorporated, January 17, 2006 (available from http://partners.adobe.com/public/developer/en/acrobat/sdk/pdf/javascript/Acro3DJS.pdf)

[7] DCE 1.1, *Remote Procedure Call*, The Open Group, August 1977 (available from http://www.opengroup.org/public/pubs/catalog/c706.htm)

[8] ECMA-363, *Universal 3D File Format*, 2nd ed., August 2005 (available from http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-363.pdf)

[9] *Extensible Markup Language (XML) 1.0 (3rd ed.)*, W3C Recommendation 04 February 2004 (available from http://www.w3.org/TR/2004/REC-xml-20040204/)

[10] IEEE 754-1985, *Standard for Binary Floating-Point Arithmetic*, Institute of Electrical and Electronics Engineers, Inc.

[11] *Namespaces in XML 1.1*, W3C Recommendation, February 4, 2004 (available from http://www.w3.org/TR/2004/REC-xml-names11-20040204)

[12] *RDF/XML Syntax Specification (Revised)*, W3C Recommendation, February 10, 2004 (available from http://www.w3.org/TR/rdf-syntax-grammar/)

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