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Document management — Electronic document file format for long-term preservation —

Part 4:
Use of ISO 32000-2 (PDF/A-4)

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 171, *Document management applications*, SC 2, *Document file formats, EDMS systems and authenticity of information.*

A list of all parts in the ISO 19005 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

PDF is a digital format for representing page-based documents. PDF files can be created natively in PDF form, converted from other electronic formats or digitized from paper, microform, or other hard copy format. Businesses, governments, libraries, archives and other institutions and individuals around the world use PDF to represent considerable bodies of important information. Much of this information needs to be kept for substantial lengths of time; some needs to be kept permanently. These PDF files need to remain useable and accessible across multiple generations of technology. However, the inclusive, feature-rich nature of the format requires that constraints be placed on its use to make it suitable for the long-term preservation of electronic documents. The future use of, and access to, these objects depends upon maintaining their visual appearance as well as their higher-order properties, such as the logical organization of pages, sections, and paragraphs, machine recoverable text stream in natural reading order, and a variety of administrative, preservation and descriptive metadata.

This document is part of a series of documents, of which this is part 4. This allows future parts to be created without rendering this document or applications based on this document obsolete.

The primary purpose of ISO 19005 is to define a file format based on PDF, known as PDF/A, which provides a mechanism for representing electronic documents in a manner that preserves their visual appearance over time, independent of the tools and systems used for creating, storing or rendering the files. Some parts of ISO 19005 also define a framework for representing the logical structure and other semantic information of electronic documents within conforming files. These goals are accomplished by identifying the set of PDF components that can be used, and restrictions on the form of their use, within conforming PDF/A files.

Parts 3 & 4 in this series enable PDF documents to serve as containers for other file formats, so that a single physical file can contain not only the visual representation but also other representations including the original authored version, richer semantic formats, and others. This standard does not address the long-term suitability of formats, that may be embedded, other than those compliant with any part of this document.

This document is based on PDF version 2.0 (as defined in ISO 32000-2:—[1)]) and as such provides recommendations in how to properly archive content that uses some of the newer features present there including page level output intents, associated files and improvements to tagged PDF.

This document also introduces some new directions in archiving non-static content that can be present in PDF documents, such as form fields and ECMAScript. It seeks to preserve more information in the file (by not requiring its removal during the archival process) and puts a greater burden on conforming viewers to ensure that such information does not alter the visual appearance of the file during consumption.

By itself, PDF/A does not necessarily ensure that the visual appearance of the content accurately reflects any original source material used to create the conforming file; e.g. the process used to create a conforming file might substitute fonts, reflow text, downsample images or use lossy compression. Organizations that need to ensure that a conforming file is an accurate representation of original source material might need to impose additional requirements on the processes that generate the conforming file beyond those imposed by this document. In addition, it is important for those organizations to implement policies and practices regarding the inspection of conforming files for correct visual appearance.

This document is one component of an organization's electronic archival environment for long-term retention of documents. Successful implementation of this document for archival purposes depends upon:

— the retention requirements of an organization's archival environment, records management policies and procedures as specified in ISO 15489-1[2];

1) Under preparation. Stage at the time of publication: ISO/FDIS 32000-2.

— any additional conditions necessary to ensure the persistence of electronic documents and their characteristics over time, including, but not limited to, those defined by ISO 14721[1], and ISO/TR 18492[3];

— quality assurance processes necessary to verify conformance with applicable requirements and conditions; e.g. an inspection regime to verify the quality and integrity of converted source data.

This document is intended to lead to the development of various applications that read, render, write and validate conforming files. Different applications will incorporate various capabilities to prepare, interpret and process conforming files based on needs as perceived by the suppliers of those applications. However, it is important to note that a conforming application needs to be able to read and process appropriately all files complying with a specified conformance level.

This document (in conjunction with its normative references) provides sufficient information to interpret any conforming PDF/A-4 file.

The PDF Association may maintain an ongoing series of application notes for guiding developers and users of this document. These application notes are available at https://www.pdfa.org/. The PDF Association will also retain copies of the specific non-ISO normative references of this document which are publicly available electronic documents.

Document management — Electronic document file format for long-term preservation —

Part 4:
Use of ISO 32000-2 (PDF/A-4)

1 Scope

This document specifies the use of the Portable Document Format (PDF) 2.0, as formalized in ISO 32000-2:—, for preserving the static visual representation of page based electronic documents over time in addition to allowing any type of other content to be included as an embedded file or attachment.

This document does not apply to:

— specific processes for converting paper or electronic documents to the PDF/A format;

— specific technical design, user interface, implementation, or operational details of rendering;

— specific physical methods of storing these documents such as media and storage conditions;

— required computer hardware and/or operating systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14533-3, *Processes, data elements and documents in commerce, industry and administration — Long term signature profiles — Part 3: Long term signature profiles for PDF Advanced Electronic Signatures (PAdES)*

ISO 16684-2, *Graphic technology — Extensible metadata platform (XMP) — Part 2: Description of XMP schemas using RELAX NG*

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

ISO 19005-2, *Document management — Electronic document file format for long-term preservation — Part 2: Use of ISO 32000-1 (PDF/A-2)*

ISO 32000-2:—, *Document management — Portable document format — Part 2: PDF 2.0*

XMP Specification Part 2: Additional Properties – Adobe Systems – https://www.adobe.com/content/dam/acom/en/devnet/xmp/pdfs/XMPSDKReleasecc-2020/XMPSpecificationPart2.pdf

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
end-of-file marker
five-character sequence %%EOF marking the end of a PDF file

3.2
extension schema
conforming XMP schema that is not defined in the XMP Specification nor part 1 or part 2 of this document

3.3
font
identified collection of graphics that may be glyphs or other graphic elements

[SOURCE: ISO 32000-2:—]

3.4
font program
software program written in a special-purpose language, such as the *Type 1*, *TrueType*, or *OpenType* font format, that is understood by a specialized *font* (3.3) interpreter

[SOURCE: ISO 32000-2:—]

3.5
interactive processor
processor (3.8) that requires or allows human interaction with the content and other objects contained in the document during the software's processing phase

Note 1 to entry: A file viewing tool is an example of an interactive processor; a raster image processor is an example of a processor that is not interactive.

3.6
long-term
period of time long enough for there to be concern about the impacts of changing technologies

3.7
PDF
Portable Document Format
file format defined in ISO 32000-2:—

3.8
processor
software application that is able to read and process conforming files

3.9
writer
software application that is able to write conforming files

3.10
XMP packet
structured wrapper for serialized XMP metadata

[SOURCE: ISO 32000-2:—]

4 Notation

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 dictionary keys are written in italic font. Some names can also be used as values, depending on the context, and so the styling of the content will be context specific.

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 ISO 32000-2: —, 7.2.1, may be identified by their ISO/IEC 646 character name written in upper case in bold font followed by a parenthetic two digit hexadecimal character value with the suffix "h".

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

Text string characters, as defined by ISO 32000-2:—, 7.9.2, may be identified by their ISO/IEC 10646 character name written in uppercase in bold font followed by a parenthetic four digit hexadecimal character code value with the prefix "U+".

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

The following terms, referring to this specification or parts thereof, are recommended when the full ISO name is not being used:

— "PDF/A" – a synonym for the ISO 19005 family of standards;

— "PDF/A-1" – a synonym for ISO 19005-1;

— "PDF/A-1a" – a synonym for ISO 19005-1 Level A conformance;

— "PDF/A-1b" – a synonym for ISO 19005-1 Level B conformance;

— "PDF/A-2" – a synonym for ISO 19005-2;

— "PDF/A-2a" – a synonym for ISO 19005-2 Level A conformance;

— "PDF/A-2b" – a synonym for ISO 19005-2 Level B conformance;

— "PDF/A-2u" – a synonym for ISO 19005-2 Level U conformance;

— "PDF/A-3a" – a synonym for ISO 19005-3 Level A conformance;

— "PDF/A-3b" – a synonym for ISO 19005-3 Level B conformance;

— "PDF/A-3u" – a synonym for ISO 19005-3 Level U conformance;

— "PDF/A-4" – a synonym for ISO 19005-4;

— "PDF/A-4e" – a synonym for ISO 19005-4 Level E conformance;

— "PDF/A-4f" – a synonym for ISO 19005-4 Level F conformance;

5 Conformance

5.1 Conforming Files

This document defines a file format for representing electronic documents known as "PDF/A-4". Conforming PDF/A-4 files shall adhere to all requirements of ISO 32000-2:— as modified by this document. A conforming file may include any valid ISO 32000-2:— feature that is not explicitly forbidden by this document. Features described in specifications which are not explicitly described in ISO 32000-2:—, should not be used. Features described as deprecated in ISO 32000-2:— shall not be used.

NOTE A conforming file is not obligated to use any PDF feature other than those explicitly required by ISO 32000-2:— or this document.

The proper mechanism by which a file can presumptively identify itself as being a conforming PDF/A-4 file is described in 6.7.3.

5.2 Conforming Processor

A conforming processor shall comply with all requirements regarding processor functional behaviour specified in this document. The requirements of this document with respect to processor behaviour are stated in terms of general functional requirements applicable to all conforming processors. This document does not prescribe any specific technical design, user interface or implementation details of conforming processors.

The rendering and other processing of conforming files shall be performed as defined in ISO 32000-2:— subject to the additional restrictions specified by this document. Features described in specifications that are not explicitly described in ISO 32000-2:— should be ignored by conforming processors.

Conforming PDF/A-4 processors shall read and process appropriately all conforming PDF/A-4 files.

6 Technical requirements

6.1 File structure

6.1.1 General

6.1.2 to 6.1.13 address overall file format issues and the base elements that form the general structure of a conforming file.

Any data contained in a conforming file that is not described in ISO 32000-2:— or this document should be ignored by a conforming processor and shall not be used to render content on a page.

6.1.2 File header

The file header shall begin at byte zero and shall consist of "%PDF-2.n" followed by a single EOL marker, where 'n' is a single digit number between 0 (30h) and 9 (39h).

NOTE 1 This clarifies the requirement in ISO 32000-2:—, 7.5.2

The aforementioned EOL marker shall be immediately followed by a **%** (25h) character followed by at least four bytes, each of whose encoded byte values shall have a decimal value greater than 127.

NOTE 2 The presence of encoded byte values greater than decimal 127 near the beginning of a file is used by various software tools and protocols to classify the file as containing 8-bit binary data that needs to be preserved during processing.

6.1.3 File trailer

No data shall follow the last end-of-file marker as described in ISO 32000-2:—, 7.5.5.

The **Encrypt** key shall not be present in the trailer dictionary.

NOTE 1 The explicit prohibition of the **Encrypt** key has the implicit effect of disallowing encryption and password-protected access permissions.

The **Info** key shall not be present in the trailer dictionary of PDF/A-4 conforming files unless there exists a **PieceInfo** entry in the document catalog dictionary. If a document information dictionary is present, it shall only contain a **ModDate** entry.

NOTE 2 This makes normative the deprecation of this feature in ISO 32000-2:—, 14.3.3, except when needed for a PieceInfo dictionary.

6.1.4 Cross reference table

The **xref** keyword and the cross-reference subsection header shall be separated by a single EOL marker.

Any indirect object whose offset is not referenced in any cross-reference table nor in any cross reference stream shall be exempt from all requirements of this document and may be ignored by a conforming processor. If a conforming processor chooses not to ignore such indirect objects, they shall never influence the way content is rendered.

6.1.5 String objects

The number of hexadecimal digits in a hexadecimal string shall always be even.

NOTE This avoids the provision in ISO 32000-2: — about the absence of the final hexadecimal digit.

6.1.6 Stream objects

6.1.6.1 General

The value of the **Length** key specified in the stream dictionary shall match the number of bytes in the file following the LINE FEED (0Ah) character after the **stream** keyword and preceding the EOL marker before the **endstream** keyword.

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

NOTE 1 These keys are used to point to data external to the file. The explicit prohibition of these keys has the implicit effect of disallowing external content that can create external dependencies and complicate preservation efforts.

NOTE 2 Since an inline image dictionary is not a stream object, this provision allows the presence of the **F** key in an inline image dictionary as the abbreviation for **Filter**.

6.1.6.2 Filters

All standard stream filters listed in ISO 32000-2:—, 7.4, Table 6 may be used, with the exception of *LZWDecode*. Filters that are not listed in ISO 32000-2:—, 7.4, Table 6 shall not be used.

In addition, the *Crypt* filter shall not be used unless the value of the **Name** key in the decode parameters dictionary is *Identity*.

NOTE The *Crypt* filter is used to apply encryption and access control to the file.

6.1.7 Name objects

Font names, names of colourants in Separation and DeviceN colour spaces, and structure type names - after expansion of character sequences escaped with a NUMBER SIGN (23h), if any - shall be valid UTF-8 character sequences.

NOTE These requirements make normative the recommendations set out in ISO 32000-2:—, 7.3.5.

All other name objects should adhere to these same restrictions.

6.1.8 Indirect objects

The object number and generation number shall be separated by a single white-space character. The generation number and **obj** keyword shall be separated by a single white-space character.

The object number and **endobj** keyword shall each be preceded by an EOL marker. The **obj** and **endobj** keywords shall each be followed by an EOL marker.

6.1.9 Inline image dictionaries

The value of the **F** key in the Inline Image dictionary shall not be *LZW, LZWDecode, Crypt* or a value not listed in ISO 32000-2:—, 8.9.7, Table 92 or an array containing any such value.

6.1.10 Linearized PDF

Linearization shall be permitted but any linearization information present within a file should be ignored by conforming processor.

NOTE As defined in ISO 32000-2:—, Annex F, a PDF is not linearized if the value of the **L** key in the linearization dictionary does not match the actual length of the PDF file. This implies that an incremental update to a linearized PDF will render it non-linearized.

6.1.11 Permissions

No keys other than **UR3** and **DocMDP** shall be present in a permissions dictionary (ISO 32000-2:—, 12.8.6, Table 263).

NOTE These restrictions are present to ensure that functionality such as obsolete versions of the "User Rights" dictionary do not appear in a document conforming to this document.

6.1.12 Document catalog dictionary

If the **Version** key is present in the document catalog dictionary, the first character in its value shall be a 2 (32h) and the second character of its value shall be a PERIOD (2Eh) (decimal point). The third character shall be a decimal digit. The number of characters of the value of the **Version** key shall be exactly 3.

NOTE This clarifies the requirement in ISO 32000-2:—, 7.5.2

6.2 Graphics

6.2.1 General

Clauses 6.2.2 to 6.2.10 describe restrictions that shall be placed on both conforming files and processors with respect to the graphical elements described in ISO 32000-2:—, 7.8. A conforming processor shall render these graphical elements onto their respective PDF pages according to the rendering requirements of ISO 32000-2:— as modified by this document.

A conforming interactive processor may choose to put additional user interface elements around, above or below the graphical elements of the page. These user interface elements may be a presentation of other PDF objects (such as bookmarks or page thumbnails) or they may represent non-PDF objects. In all cases, the user interface elements and their contents shall not be required to conform to the requirements of 6.2.2 to 6.2.10.

6.2.2 Content streams

Content streams shall not contain any operators not defined in ISO 32000-2:—, even if such operators are bracketed by the **BX/EX** compatibility operators.

NOTE Content streams, as defined in ISO 32000-2:—, 7.8.2, are used for page descriptions, Form XObjects, Type 1 Patterns, Type 3 glyph descriptions, as well as for the appearances of annotations.

A content stream that references other objects, such as images and fonts that are necessary to fully render or process the stream, shall have an explicitly associated resources dictionary as described in ISO 32000-2:—, 7.8.3. Such resource dictionaries shall define all named resources referenced by this content stream. Any named resource present in the resource dictionary, but whose name is not referenced from the associated content stream, is not used for rendering and therefore shall be exempt from all requirements of this document except those in 6.1.6 - 6.1.9.

6.2.3 Output intent

A conforming file may specify the colour characteristics of the device on which it is intended to be rendered by using a PDF/A OutputIntent. A PDF/A OutputIntent is defined as an output intent dictionary (ISO 32000-2:—, 14.11.5) which shall contain an **S** key whose value shall be *GTS_PDFA1* and a **DestOutputProfile** key whose value shall be a valid ICC profile stream. A PDF/A OutputIntent may be present either in the **OutputIntents** array of the document catalog dictionary or in the **OutputIntents** array of a page dictionary. It is also possible that a document may have a PDF/A OutputIntent in the document catalog dictionary and then an alternative one for certain pages.

NOTE 1 PDF/A requires that an output intent dictionary be present when uncalibrated colour spaces are used (see 6.2.4.3 for more details). It has this requirement in order to ensure reliable rendering of colour through the indirect use of the PDF/A OutputIntent profile provided.

NOTE 2 The value of *GTS_PDFA1* was maintained for this part of ISO 19005 to enable greater compatibility with all parts of ISO 19005.

In addition, the **DestOutputProfileRef** key, as defined in ISO 32000-2:—, 14.11.5, Table 401, shall not be present in any output intent dictionary.

NOTE 3 Disallowing the **DestOutputProfileRef** key maintains the intent of this document of ensuring self-contained documents with no external references. However, it does mean that a single PDF is unable to be compliant with both PDF/A-4 and PDF/X-4p or with both PDF/A-4 and PDF/X-6p.

If the document does not contain a document-level PDF/A OutputIntent (present in the **OutputIntents** array of the document catalog dictionary), then for any page whose contents are not fully specified using device-independent colour (as defined in 6.2.4.1), the page dictionary shall contain an **OutputIntents** key whose value shall be an array containing a PDF/A OutputIntent, representing the page-level PDF/A OutputIntent. When a page-level PDF/A OutputIntent is present, then it shall be considered the current PDF/A OutputIntent when processing that page, otherwise (if present) the document-level PDF/A OutputIntent shall be considered current.

If any **OutputIntents** array contains more than one entry, such as may be the case where a file is compliant with this document and at the same time with PDF/X or PDF/E, 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.

The profile stream that is the value of the **DestOutputProfile** key shall either be an output device profile (Device Class = "prtr") or a monitor profile (Device Class = "mntr"). The profiles shall have a colour space of either "GRAY", "RGB ", or "CMYK". If present in the **DestOutputProfile** stream object, the **Alternate** key shall be ignored by a PDF/A-4 conforming processor.

6.2.4 Colour spaces

6.2.4.1 General

All colours shall be specified in a device-independent manner, either directly by the use of device-independent colour spaces, or indirectly by the means of the **DestOutputProfile** in the PDF/A OutputIntent. A conforming file may use any colour space specified in ISO 32000-2:—, except as restricted in 6.2.4.2 to 6.2.4.5.

NOTE Specifying colour in a device-independent manner as described within 6.2.4 enables predictable colour rendering based on a colorimetric definition and without reliance on heuristic assumptions or on information external to the conforming file. It also provides a mechanism whereby a colorimetric definition can be associated with device-dependent colour data.

6.2.4.2 ICCBased colour spaces

The profile that forms the stream of an **ICCBased** colour space shall conform to ISO 32000-2:—, 8.6.5.5.

A conforming processor shall render **ICCBased** colour spaces as specified by ISO 32000-2:—, and shall not use the **Alternate** colour space specified in an ICC profile stream dictionary.

Overprint mode (as set by the **OPM** value in an **ExtGState** dictionary) shall not be one (*1*) when an **ICCBased** CMYK colour space is used and when overprinting for stroke or fill or both is set to *true*.

NOTE 1 This prohibition avoids unpredictable overprinting behaviour when overprint mode is 1 if implicit colour conversion is applied as described in ISO 32000-2:—, 8.6.7.

An **ICCBased** colour space shall not be used where the profile is a CMYK destination profile and is identical to that in the current PDF/A OutputIntent or the current transparency blending colorspace. Profiles shall be treated as identical if:

— the **ICCBased** colour space and the output intent use indirect references to the same embedded profile stream; or

— MD5 hash values for the two profiles are the same. MD5 values are read from the value of the *Profile ID* field within each profile, if present and if not set as zero. If no MD5 value is included in each profile, then a value shall be calculated following the methodology set out in of ISO 15076-1:2010, 7.2.18.

NOTE 2 This avoids the possibility of output differing depending on whether a renderer applies the implicit colour conversion described on ISO 32000-2:—, 8.6.5.7.

6.2.4.3 Uncalibrated/Device colour spaces

DeviceRGB shall only be used if a device independent **DefaultRGB** colour space has been set when the **DeviceRGB** colour space is used or if the current transparency blending space, when the **DeviceRGB** colour space is used, is a device independent RGB-based colour space or the current PDF/A OutputIntent, when the **DeviceRGB** colour space is used, contains an 'RGB' destination profile.

DeviceCMYK shall only be used if a device independent **DefaultCMYK** colour space has been set when the **DeviceCMYK** colour space is used or if the current transparency blending space, when the **DeviceCMYK** colour space is used, is a device independent CMYK-based colour space or the current PDF/A OutputIntent, when the **DeviceCMYK** colour space is used, contains a 'CMYK' destination profile.

DeviceGray shall only be used if a device independent **DefaultGray** colour space has been set when the **DeviceGray** colour space is used, or if a PDF/A OutputIntent is in effect.

NOTE As described in ISO 32000-2:—, 8.6.5.6, colours that are specified in a device colour space (**DeviceGray**, **DeviceRGB**, or **DeviceCMYK**) are device dependent. By setting default colour spaces, a conforming writer can request that such colours be systematically transformed *(*remapped*)* into device-independent CIE-based colour spaces.

When rendering colours specified in **DeviceRGB** or **DeviceCMYK,** and no matching device independent default colour space has been set, a conforming processor shall use the profile in the current PDF/A OutputIntent dictionary as the source colour space.

When rendering colours specified in **DeviceGray** and no device independent **DefaultGray** colour space has been set, a conforming processor shall render the **DeviceGray** colour as follows:

— If the current PDF/A OutputIntent contains a "GRAY" destination profile, that profile shall be used as the source colour space when rendering the colour.

— If the current PDF/A OutputIntent contains an "RGB" destination profile, then the conforming processor shall convert the **DeviceGray** colour to RGB by the method described in ISO 32000-2:—, 10.4.2.1, and shall use the RGB destination profile as the source colour space when rendering the colour.

— If the current PDF/A OutputIntent contains a "CMYK" destination profile, then the conforming processor shall convert the **DeviceGray** colour to CMYK by the method described in ISO 32000-2:—, 10.4.2.2, and shall use the CMYK destination profile as the source colour space when rendering the colour.

6.2.4.4 Separation and DeviceN colour spaces

If the named colourants in the colour space are all from the list **Cyan**, **Magenta**, **Yellow**, **Black**, and **None** and if the file has a current PDF/A OutputIntent at the time this colour space is set, and if that PDF/A OutputIntent contains a "CMYK" destination profile, then a conforming processor shall treat the colourants **Cyan**, **Magenta**, **Yellow**, **Black** as components of the colour space specified by the destination profile in the current PDF/A OutputIntent dictionary, as defined in 6.2.3.

NOTE 1 All other aspects of rendering **Separation** colour spaces are described in ISO 32000-2:—, 8.6.6.4.

NOTE 2 All other aspects of rendering **DeviceN** and **NChannel** colour spaces are described in ISO 32000-2:—, 8.6.6.5.

The alternate space of a **Separation** or **DeviceN** colour space shall obey all restrictions on colour spaces specified in 6.2.4.2 and 6.2.4.3.

For any spot colour used in a **DeviceN** or **NChannel** colour space, an entry in the **Colorants** dictionary shall be present. Any **Separation** colorspace which appears in a **Colorants** dictionary shall obey the same restrictions as any other **Separation** colorspace.

All **Separation** arrays within a single conforming PDF/A-4 file (including those in **Colorants** dictionaries) that have the same *name* shall have the same *tintTransform* and *alternateSpace.* In evaluating equivalence, the PDF objects shall be compared, rather than the computational result of the use of those PDF objects. Compression and whether or not an object is direct or indirect shall be ignored.

NOTE 3 A PDF/A-4 writer might need to synchronize multiple *alternateSpace* and *tintTransform* entries when creating a PDF/A-4 file.

The **Separation** arrays in the **Colorants** dictionary of **DeviceN** and **NChannel** colour spaces should be consistent with the *tintTransform* and *alternateSpace* of the **DeviceN** or **NChannel** colour space itself.

6.2.4.5 Indexed and Pattern colour spaces

Indexed and **Pattern** colour spaces are indirect methods of specifying colour. All the requirements of 6.2.4 apply to the underlying colour spaces of **Indexed** and **Pattern** colour spaces.

6.2.5 Extended graphics state

A graphics state parameter dictionary (ISO 32000-2:—, 8.4.5) shall not contain the **TR** or the **HTO** keys. A graphics state parameter dictionary shall not contain the **TR2** key with a value other than *Default*. A conforming processor may ignore any instance of the **HT** key in any graphics state parameter dictionary.

The **TransferFunction** key in a halftone dictionary shall be used only as required by ISO 32000-2:—.

NOTE 1 The TransferFunction key in a halftone dictionary can only be present if it is a component in a Type 5 halftone dictionary representing a colorant other than Cyan, Magenta, Yellow or Black.

All halftones in a conforming PDF/A-4 file shall have the value **1** or **5** for the **HalftoneType** key.

NOTE 2 This prohibits the use of threshold screens that will produce different appearances at different resolutions.

Halftones in a conforming PDF/A-4 file shall not contain a **HalftoneName** key.

The use of the **FL** key shall conform to the requirements of 6.2.6.

Conforming processors shall ignore the **BG, BG2**, **UCR** and **UCR2** functions that may be present in a graphics state parameter dictionary when rendering the PDF.

Conforming processors shall respect the **OP**, **op** and **OPM** entries in graphics state parameter dictionaries as described in 8.6.7 of ISO 32000-2:— and 6.2.4.2 of this document when rendering the PDF. When rendering to a device that does not natively support all colourants to be rendered, a conforming processor shall simulate the overprinting of the colourants as if they had been rendered to a device that did natively support them.

NOTE 3 Having a conforming processor respect these entries, both when viewing on screen and printing, ensures a consistent rendering between these two types of output.

6.2.6 Flatness

Conforming processors shall ignore the actual value of the **FL** entry of the extended graphics state or the operand value for the **i** operator. Instead, when a conforming processor renders content, it shall choose a value suitable to enable efficient rendering without introducing visible artefacts.

6.2.7 Images

6.2.7.1 General

An **Image** dictionary shall not contain the **Alternates** key or the **OPI** key.

If an **Image** dictionary contains the **Interpolate** key, its value shall be *false*. For an inline image, the **I** key, if present, shall have a value of *false*.

6.2.7.2 Thumbnail images

A conforming processor shall never substitute the rendering of a page by making use of thumbnail images, regardless whether such thumbnail images are retrieved from an **xmp:Thumbnails** entry in the document or a page level metadata streams (ISO 32000-2:—, 14.3.2) or from any other data in the file.

6.2.7.3 JPEG2000

When used, JPEG2000 compression shall be used as specified in ISO 32000-2:—. Only the JPX baseline set of features, as restricted or extended by ISO 32000-2:—, and this subclause, shall be used.

NOTE 1 The JPX baseline set of features is defined in ISO/IEC 15444-2 M 9.2.

The number of colour channels in the JPEG2000 data shall be 1, 3 or 4.

If the number of colour space specifications in the JPEG2000 data is greater than 1, there shall be exactly one colour space specification that has the value *0x01* in the **APPROX** field. If the specified colour space specification uses an ICC profile, then that profile shall conform to the requirements of ISO 32000-2:—, 8.6.5.5.

NOTE 2 The value *0x01* in the **APPROX** field identifies the colour space with the best colour fidelity available.

The value of the **METH** entry in its 'colr' box shall be *0x01, 0x02* or *0x03*. A conforming processor shall use only that colour space and shall ignore all other colour space specifications.

JPEG2000 enumerated colour space 19 (*CIEJab*) shall not be used.

JPEG2000 enumerated colour space 12 (*CMYK*) which is part of JPX but not JPX baseline, may be used.

Where the JPEG2000 image effectively uses *DeviceGray, DeviceRGB* or *DeviceCMYK* – whether through the **ColorSpace** entry in the Image XObject or in the absence thereof through the colour space definition in the JPEG2000 data, the provisions of 6.2.4.3 shall apply.

NOTE 3 s-YCC and es-YCC - the two YCC flavors allowed in baseline JPX - are just alternative representations of sRGB and esRGB. Details can be found in ISO/IEC 15444-2.

NOTE 4 ISO 32000-2:— states that a **ColorSpace** entry in an Image XObject containing JPEG2000-compressed data overrides any colour space defined within the JPEG2000 data stream itself. It further requires that the number of colour channels in the JPEG2000 data has to match the number of components in the colour space defined in the **ColorSpace** entry of the Image XObject; the PDF producer has to ensure that the samples are consistent with the colour space used.

The bit-depth of the JPEG2000 data shall have a value in the range 1 to 38. All colour channels in the JPEG2000 data shall have the same bit-depth.

Images compressed using the JPEG2000 compression method shall be created and read as described in ISO/IEC 15444-2:2004.

NOTE 5 This section provides for a subset of JPEG2000 that is also aligned with various parts of ISO 15930 (PDF/X).

6.2.8 XObjects

6.2.8.1 Form XObjects

A form XObject dictionary shall not contain an **OPI** key.

6.2.8.2 Reference XObjects

A conforming file shall not contain any reference XObjects.

NOTE Reference XObjects refer to arbitrary document content in external PDF files, creating external dependencies that complicate preservation efforts.

6.2.9 Transparency

PDF transparency (as described in ISO 32000-2:—, Clause 11) may be used in a conforming PDF/A-4 file.

A conforming processor shall use the current PDF/A output intent as the default blending colour space (ISO 32000-2:—, 11.3.4). If the document does not contain a PDF/A output intent, then all pages that contain transparency shall either have a page-level PDF/A output intent or the page dictionary shall include the **Group** key, and the attribute dictionary that forms the value of that **Group** key shall include a **CS** entry whose value shall be used as the default blending colour space.

NOTE This requirement ensures that there is always an explicitly defined transparency blending space specified for any content which has associated transparency.

The value for any **CS** key in any transparency group's attribute dictionary shall conform to the restrictions on colour spaces set out in 6.2.4.

Only blend modes that are specified in ISO 32000-2:— shall be used for the value of the **BM** key in a graphics state dictionary (ISO 32000-2:—, 8.4.5) or an annotation dictionary (ISO 32000-2:—, 12.5.2). A PDF/A-4 compliant processor shall process these blend modes as described in ISO 32000-2:—, 11.3.5.

6.2.10 Fonts

6.2.10.1 General

The intent of the requirements in 6.2.10.2 to 6.2.10.9 is to ensure that the future rendering of the textual content of a conforming file matches, on a glyph by glyph basis, the static appearance of the file as originally created and, when possible, to allow the recovery of semantic properties for each character of the textual content. Unless a requirement specifically states that it shall only apply to text that would

be rendered by a conforming processor, they shall apply to any font including those used exclusively with text rendering mode 3.

NOTE A font referenced solely in text rendering mode 3 (ISO 32000-2:—, 9.3.6) is not rendered and is thus exempt from the requirements that impact the visual representation of the glyphs of a font.

6.2.10.2 Font types

All fonts and font programs used in a conforming file, regardless of rendering mode usage, shall conform to the provisions in ISO 32000-2:—, 9.6 and 9.7 as well as to the font specifications referenced by these provisions.

NOTE It is the responsibility of the writer to ensure this conformance. This document does not prescribe the manner in which font conformance is determined.

Multiple master fonts shall be considered a special case of Type 1 fonts; any requirement stated with regard to Type 1 fonts shall also be required with regard to multiple master fonts.

6.2.10.3 Composite fonts

6.2.10.3.1 General

For any given composite (Type 0) font within a conforming file, the **CIDSystemInfo** entry in its CIDFont dictionary and its Encoding dictionary shall have the following relationship:

— If the **Encoding** key in the Type 0 font dictionary has a value of *Identity-H* or *Identity-V*, then any values for the **Registry**, **Ordering**, and **Supplement** keys may be used in the CIDSystemInfo dictionary of the CIDFont.

— Otherwise the corresponding values of the **Registry** and **Ordering** keys in both CIDSystemInfo dictionaries shall be identical, and the value of the **Supplement** key in the CIDSystemInfo dictionary of the CIDFont shall be greater than or equal to the value of the **Supplement** key in the CIDSystemInfo dictionary of the CMap.

NOTE The requirement for the **Supplement** key ensures that the font includes glyphs for all CIDs which can be referenced by the CMap.

6.2.10.3.2 CIDFonts

ISO 32000-2:—, 9.7.4 Table 115 requires that all embedded 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 ISO 32000-2:—, 9.7.4 Table 115.

6.2.10.3.3 CMaps

All CMaps used within a conforming PDF/A-4 file, except those listed in ISO 32000-2:—, 9.7.5.2 Table 116, shall be embedded in that file as described in ISO 32000-2:—, 9.7.5. 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.

A CMap shall not reference any other CMap except those listed in ISO 32000-2:—, 9.7.5.2 Table 116.

6.2.10.4 Embedding

6.2.10.4.1 General

The font programs for all fonts used for rendering within a conforming file shall be embedded within that file, as defined in ISO 32000-2:—, 9.9. A font is considered to be used if at least one of its glyphs is referenced from a content stream (6.2.2).

NOTE 1 Embedding the font programs allows any conforming processor to reproduce correctly all glyphs in the manner in which they were originally published without reference to external resources.

NOTE 2 As discussed in ISO 32000-2:—, 9.3.6, 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.

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

NOTE 3 This document precludes the embedding of font programs whose legality depends upon special agreement with the copyright holder. Such an allowance places unacceptable burdens on an archive to verify the existence, validity and longevity of such claims.

Embedded fonts shall define all glyphs referenced for rendering within the conforming file.

NOTE 4 As stated in 6.2.10.4.2, subsets of a font are acceptable as long as the embedded font provides glyph definitions for all characters referenced within the file.

All conforming processors shall use the embedded fonts, rather than other locally resident, substituted or simulated fonts, for rendering.

NOTE 5 There is no exemption from the requirements of 6.2.10.4 for the 14 standard Type 1 fonts.

6.2.10.4.2 Subset embedding

ISO 32000-2:—, 9.6 and 9.7 permit the embedding of subsets of font programs.

NOTE The use of subsets of a font and its associated font program allows a potentially substantial reduction in the size of conforming files.

6.2.10.5 Font metrics

For every font embedded in a conforming file, the glyph width information in the font dictionary and in the embedded font program shall be consistent for every glyph referenced for rendering. Glyphs that are referenced only with rendering mode 3 are exempt from this requirement.

If a Type 3 font is used for rendering, then as described in ISO 32000-2:—, Table 111, the operands of the **d0** and **d1** operators of each **CharProc** shall be consistent with the glyph's width.

If a composite (Type0) font is used for rendering in vertical writing mode (ISO 32000-2:—, 9.7.4.3) and if the associated embedded font program contains information about vertical metrics of the glyphs, this information shall also be consistent with values of the **DW2** and **W2** keys in the font descriptor dictionary.

For this document, consistent is defined to be a difference of no more than 1/1000 unit in text space (ISO 32000-2:—, 9.2.4).

NOTE This requirement is necessary to ensure predictable font rendering, regardless of whether a given processor uses the metrics in the font dictionary or those in the font program.

6.2.10.6 Character encodings

For all non-symbolic TrueType fonts used for rendering, the embedded TrueType font program shall contain at least Microsoft Unicode (3,1 – Platform ID=3, Encoding ID=1), or Macintosh Roman (1,0 – Platform ID=1, Encoding ID=0) "cmap" subtable that all necessary glyph lookups are able to be carried out.

All non-symbolic TrueType fonts shall have either *MacRomanEncoding* or *WinAnsiEncoding* as the value for the **Encoding** key in the Font dictionary or as the value for the **BaseEncoding** key in the dictionary that is the value of the **Encoding** key in the Font dictionary.

In addition, all non-symbolic TrueType fonts shall not define a **Differences** array unless all of the glyph names in the **Differences** array are listed in the Adobe Glyph List and the embedded font program contains at least the Microsoft Unicode (3,1 – Platform ID=3, Encoding ID=1) encoding in the "cmap" subtable.

Symbolic TrueType fonts shall not contain an **Encoding** entry in the font dictionary, and the "cmap" subtable in the embedded font program shall either contain the Microsoft Symbol (3,0 – Platform ID=3, Encoding ID=0) or the Mac Roman (1,0 – Platform ID=1, Encoding ID=0) encoding.

In all cases for TrueType fonts that are to be rendered, character codes shall be able to be mapped to glyphs according to ISO 32000-2:—, 9.6.5 without the use of a non-standard mapping chosen by the conforming processor.

6.2.10.7 Unicode character maps

The font dictionary of all fonts, regardless of their rendering mode usage, should include a **ToUnicode** entry whose value is a CMap stream object that maps character codes for at least all referenced glyphs to Unicode values, as described in ISO 32000-2:—, 9.10.3, unless the font meets at least one of the following four conditions:

— fonts that use the predefined encodings *MacRomanEncoding*, *MacExpertEncoding* or *WinAnsiEncoding*, as defined in ISO 32000-2:—, Annex D;

— Type 1 and Type 3 fonts where the glyph names of the glyphs referenced are all contained in the Adobe Glyph List or the set of named characters in the Symbol font, as defined in ISO 32000-2:—, Annex D;

— Type 0 fonts whose descendant CIDFont uses the Adobe-GB1, Adobe-CNS1, Adobe-Japan1 or Adobe-KR-9 character collections.

— Non-symbolic TrueType fonts.

NOTE Unicode mapping allows the retrieval of semantic properties about every character referenced in the file.

If a **ToUnicode** CMap is present, the Unicode values specified there shall all be greater than zero (0), but not equal to either U+FEFF or U+FFFE.

6.2.10.8 Use of ActualText

For any character, regardless of its rendering mode, that is mapped to a code or codes in the Unicode Private Use Area (PUA), an **ActualText** entry (ISO 32000-2:—,14.9.4) should be present for this character or a sequence of characters of which such character is a part.

NOTE While this recommendation and the one previous will ensure that all glyphs can be mapped to Unicode, it does not guarantee that the text is in proper reading order.

The **ActualText** entry shall not contain any PUA values.

6.2.10.9 Use of .notdef glyph

A PDF/A-4 compliant document shall not contain a reference to the **.notdef** glyph from any of the text showing operators, regardless of text rendering mode, in any content stream.

NOTE Since the **.notdef** glyph does not have any semantic value, this requirement is present to avoid any ambiguity which might result from its use.

6.3 Annotations

6.3.1 Annotation types

Annotation types not defined in ISO 32000-2:—, 12.5.6.1, Table 171 shall not be permitted. Additionally, the **Sound, Screen** and **Movie** types shall not be permitted.

NOTE 1 Support for multimedia content is outside the scope of this document.

3D and **RichMedia** types shall only be permitted in a PDF/A-4e compliant file as described in Annex B.

NOTE 2 PDF/A-4e provides a profile of PDF/A that supports 3D but is otherwise compatible with this document.

The **FileAttachment** type shall only be permitted in a PDF/A-4f compliant file as described in Annex A.

NOTE 3 PDF/A-4f provides a profile of PDF/A that supports embedded files but is otherwise compatible with this document.

6.3.2 Annotation dictionaries

Except for annotation dictionaries whose **Subtype** value is *Popup*, all annotation dictionaries shall contain the **F** key. If present, the **F** key's **Print** flag bit shall be set to *1* and its **Hidden**, **Invisible, ToggleNoView,** and **NoView** flag bits shall be set to *0*.

Text annotations should set the **NoZoom** and **NoRotate** flag bits of the **F** key to *1*.

NOTE 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 ISO 32000-2:—, 12.5.6.4; explicitly setting these flags removes any potential ambiguity between the annotation dictionary settings and processor behaviour.

6.3.3 Annotation appearances

For all annotation dictionaries containing an **AP** key, the appearance dictionary that it defines as its value shall contain only the **N** key. If an annotation dictionary's **Subtype** key has a value of *Widget* and its **FT** key has a value of *Btn*, the value of the **N** key shall be an appearance sub-dictionary otherwise the value of the **N** key shall be an appearance stream.

NOTE 1 Appearance dictionaries are required to be present in a file and rendered appropriately according to ISO 32000-2:—, 12.5.2, Table 166 and the following paragraph. This ensures the reliable rendering of the annotations.

NOTE 2 In accordance with the requirements of 12.7.5.2.3 and 12.7.5.2.4 of ISO 32000-2:—, a button field will have multiple appearance states, each one associated with the specific values that the button can take.

All graphics content in any appearance dictionary shall conform to all applicable provisions in 6.2.

6.3.4 Display of annotation contents

In addition to the rendering behaviour defined by ISO 32000-2:— as modified by this document, conforming interactive processors shall provide a mechanism to display the values of the **Contents** key (if present) of all annotation dictionaries, including those whose **Subtype** value is *Widget*, except for Widgets of type **Sig** (Digital Signature).

NOTE This document does not prescribe the specific behaviour or technical implementation details that interactive processors can use to implement this functional requirement.

6.4 Interactive forms

6.4.1 General

The intent of the requirements of 6.4 is to ensure that there is no ambiguity about the rendering of form fields.

The value of a form field shall not be used by a conforming processor when rendering the field. Instead, the conforming processor shall follow the requirements of 6.3.3 and render the appearance dictionary.

NOTE 1 The value of a field, except that of a button field, is the value of the **V** key in the field dictionary. A pushbutton field has no value.

A widget annotation's annotation dictionary or field dictionary shall not contain the **A** key but may contain **AA** keys. The **NeedAppearances** flag of the interactive form dictionary shall either not be present or shall be *false*.

NOTE 2 Annotations of type *Widget* are also subject to all provisions of 6.3.2 and 6.3.3.

A conforming processor that removes **JavaScript** actions but still needs to store information about an interactive form's values or logic (such as **JavaScript** actions) while maintaining PDF/A-4 conformance shall store that information as an embedded file stream (ISO 32000-2:—, 7.11.4) in the **EmbeddedFile** name tree (ISO 32000-2:—, 7.7.4) in XFDF format (ISO 19444-1). Its file specification dictionary shall contain an **AFRelationship** key with a value of *FormData*.

6.4.2 XFA forms

The document's interactive form dictionary that forms the value of the **AcroForm** key in the document catalog dictionary of a conforming PDF/A-4 file, if present, shall not contain the **XFA** key. In addition, the document catalog dictionary shall not contain the **NeedsRendering** key.

NOTE This prohibits the use of XML-based XFA forms which are deprecated in ISO 32000-2:—.

6.5 Digital signatures

6.5.1 General

As permitted by ISO 32000-2:—, 12.8, a PDF/A-4 conforming file may contain one user rights signature, one certifying signature or one or more approval signatures. Such signatures shall be specified in the PDF through the use of *signature fields* in accordance with ISO 32000-2:—, 12.7.5.5. All annotations associated with signature fields shall meet the requirements of 6.3.2 and 6.3.3 of this document.

When generating signature appearances and any other PDF objects as part of the signing process, a conforming processor shall ensure that they do not invalidate conformance with this document, specifically concerning any content added to the annotation's appearance.

6.5.2 Signature profiles

A simple digital signature for PDF/A-4 represents that at a given (but insecure) time, the holder of the certificate certified or approved the document as it existed. Such a signature shall conform to one of the PAdES profiles from either ISO 32000-2 or ISO 14533-3.

If only a basic signature is required, then follow the PAdES-BES or PAdES-EPES profiles as denoted in ISO 32000-2:—, 12.8.3.4 and conforming with ISO 14533-3:2017, 6.4.2.

NOTE 1 Digital signatures conforming to both ISO 32000-2:—, 12.8.3.4 and ISO 14533-3:2017, 6.4.2 are equivalent to B-B level of EN 319 142-1.

If there is a requirement to increase the security of the signature and enable validation after expiration or revocation of the certificate, add a timestamp to the signature following ISO 32000-2:—, 12.8.3.4.4. Any such signatures and timestamps shall be compliant with one of the two PAdES-T profiles denoted in ISO 14533-3:2017, 6.4.3 – either a) PAdES-T profile by Document timestamp or b) PAdES-T profile by Signature Timestamp Attribute.

NOTE 2 Digital signatures conforming to one of these two PAdES-T profiles of ISO 14533-3:2017, 6.4.3 are equivalent to B-T level of EN 319 142-1.

Should there be a need to preserve the validity status of the signatures in a conforming PDF/A-4 file, for the long term, such signatures need to use a form that contains all the validation material that is necessary for subsequent validations. These signatures shall follow 12.8.3.4.4, 12.8.4 and 12.8.5 of ISO 32000-2:—. In addition, all validation data and application of timestamps applied to such signatures shall be compliant with the PAdES-A profile denoted in ISO 14533-3:2017, 6.5.1 to 6.5.6.

NOTE 3 Digital signatures conforming to PAdES-A profile of ISO 14533-3:2017, 6.5.1 to 6.5.6 are equivalent to B-LT level of EN 319 142-1.

NOTE 4 This form is necessary in order to protect digital signatures, timestamps and validation data from weakened digest algorithms and cryptographic algorithms used in these components.

6.5.3 Proof of existence

Document timestamp (DTS) dictionaries, as defined in ISO 32000-2:—, 12.8.5, may be independently used for a proof of existence of a conforming PDF/A-4 file. In such a case, it does not matter whether the PDF document contains a signature as described in 6.5.2.

NOTE 1 The maintenance of the validity of a DTS dictionary can also be done using proofs of existence external to the conforming PDF/A-4 file. Such proofs of existence can then be maintained independently without the need to reopen and augment every PDF document. Such techniques are outside of the scope of this document and are not described any further.

A timestamped conforming PDF/A-4 file shall follow ISO 32000-2:2020, 12.8.5, and may also be compliant with the PAdES-DT profile in ISO 14533-3:2017, Annex B.

NOTE 2 Annex B of ISO 14533-3 does not permit the timestamping of a file that contains a digital signature.

In order to have a PDF/A-4 conforming file that has the ability to be deterministically valid, on the long term, it shall be signed and timestamped using a form described in ISO 32000-2:—, 12.8.4 and 12.8.5 that ensures all the validation material that is necessary for subsequent validations is present.

6.5.4 Validation

Digital signatures and timestamps should be validated as necessary. When validating digital signatures and timestamps, the process should follow 12.8.3, 12.8.4 and 12.8.5 of ISO 32000-2:—. Where possible, validation data denoted in ISO 14533-3:2017, 6.5.7, Table 10 should be used.

6.6 Action

6.6.1 General

The **Launch**, **Sound**, **Movie**, **ResetForm**, **ImportData, Hide, Rendition** and **Trans** actions shall not be permitted. Additionally, the obsoleted **set-state** and **no-op** actions, that were defined in earlier PDF specifications, shall not be permitted.

NOTE 1 Support for multimedia content is outside the scope of this document. The **ResetForm** action changes the rendered appearance of a form. The **ImportData** action imports form data from an external file. **Hide** actions set an annotation's Hidden flag.

The **SetOCGState** and **GoTo3DView** actions shall only be permitted in a PDF/A-4e compliant file as described in Annex B.

NOTE 2 PDF/A-4e provides a profile of PDF/A that supports 3D but is otherwise compatible with this document.

Named actions other than **NextPage**, **PrevPage**, **FirstPage**, and **LastPage** shall not be permitted. In response to each of the four allowed named actions, conforming interactive processors shall perform the appropriate action described in ISO 32000-2:—, 12.6.4.12, Table 215.

NOTE 3 Additional requirements for interactive form fields are specified in 6.4.

6.6.2 Handling of JavaScript actions

While permitted to be present in a conforming file, a conforming interactive processor shall provide special treatment for actions of type *JavaScript*. These actions may only be executed when they are invoked explicitly by a user (such as via outlines or buttons). A conforming processor, that is non-interactive, shall not execute them at all.

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

NOTE 2 JavaScript is formally known as ECMAScript and is referred to as ECMAScript in this document. For backwards compatibility reasons the term JavaScript is retained in keywords.

6.6.3 Trigger events

A Widget annotation's annotation dictionary or field dictionary may include an **AA** entry for an additional-actions dictionary. If they do, they may include any of the keys listed in ISO 32000-2:—, 12.6.3, Tables 197 to 200.

The document catalog dictionary should not include an **AA** entry for an additional-actions dictionary. Page dictionaries should not include an **AA** entry for an additional-actions dictionary. Annotation dictionaries other than Widget annotation dictionaries should not include an **AA** entry for an additional-actions dictionary.

If a document catalog dictionary or page dictionary or an annotation dictionary (other than a Widget annotation dictionary) include an **AA** entry, its value (which is an additional-actions dictionary) shall only contain keys from the following list: **E**, **X**, **D**, **U**, **Fo**, and **Bl**.

In all cases, additional-actions shall comply with 6.6.1.

A conforming interactive processor should implement any additional-action as described in ISO 32000-2:—, 12.6 as modified by this document in clause 6.6.2.

NOTE These additional-actions dictionaries define arbitrary actions such as **JavaScript** that do not always require a user's intervention, which is why they are not recommended to be present in a PDF/A-4 file.

6.6.4 Handling of GoToR, GoToE, URI and SubmitForm actions

While permitted to be present in a conforming file, there are four types of actions for which a conforming interactive processor shall provide special treatment – the **GoToR**, **GoToE**, **URI** and **SubmitForm** actions. The conforming interactive processor shall provide a mechanism to display the **F** and **D** keys of a **GoToR** or **GoToE** action dictionary, the **URI** key of a **URI** action dictionary, and the **F** key of a **SubmitForm** action dictionary.

In addition, since the actual invocation of these four actions by a conforming interactive processor involves the locating of and interacting with other files that may or may not be conforming, the processor may choose to not allow the actual invocation of these actions.

NOTE For purposes of archival disclosure of the complete information content of conforming files, it is important for interactive processors to provide some mechanism to expose the destination of such actions. However, this document does not prescribe any specific behaviour or the technical implementation details that interactive processors might use to meet these functional requirements.

6.7 Metadata

6.7.1 General

Clauses 6.7.2 to 6.7.5 specify requirements for metadata within conforming files. Metadata is essential for effective management of a file throughout its life cycle. A file depends on metadata for identification and description, as well as for describing appropriate technical and administrative matters. As a result, writers of conforming files possibly have to comply with various domain-specific metadata requirements defined external to this document. This document outlines a structured, consistent framework that supports a broad variety of metadata requirements.

6.7.2 Metadata streams

6.7.2.1 General

The document catalog dictionary of a conforming file shall contain the **Metadata** key whose value is a metadata stream as defined in ISO 32000-2:—, 14.3.2.

All content of all XMP packets located in any metadata stream present in the PDF shall be well-formed as defined by XMP (ISO 16684-1). At the time a conforming writer creates or resaves a conforming file, every XMP packet present in any metadata stream should be validated.

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

NOTE Both the **bytes** and **encoding** attributes are deprecated in ISO 16684-1.

6.7.2.2 Namespaces and prefixes

According to the W3C XML Namespace recommendation (https://www.w3.org/TR/2006/REC-xml-names11-20060816/), namespace prefixes are shortcuts to namespace URIs. No significance is given to the prefix itself, except where a specific prefix is identified as required, any prefix may be used. The prefixes in Table 1 should be used for all properties using the namespaces identified by the URIs listed in that Table.

In addition, namespace URIs are for identification purposes only and are not required to be actionable links. None of the namespace URI's defined in this document is guaranteed to be an actionable link. Attempting to dereference or follow any of these links may not result in a valid web page.

Table 1 — Mappings between namespace URIs and their prefixes

URI	Prefix
http://purl.org/dc/elements/1.1/	dc

Table 1 *(continued)*

URI	Prefix
http://ns.adobe.com/pdf/1.3/	pdf
http://ns.adobe.com/xap/1.0/	xmp
http://ns.adobe.com/xap/1.0/mm/	xmpMM

6.7.2.3 Schemas

Each metadata stream should have an associated file (as the value of the **AF** key, ISO 32000-2:—, 14.3.2, Table 347) that is an embedded file specification containing an **AFRelationship** key whose value is *Schema*. The data contained in that file specification's stream shall conform with ISO 16684-2.

6.7.3 Version identification

The PDF/A version of a file shall be specified using the PDF/A identification schema defined in this subclause.

The PDF/A identification schema defined in Table 2 uses the namespace URI https://www.aiim.org/pdfa/ns/id/. The required schema namespace prefix is **pdfaid**.

Table 2 — PDF/A identification schema

Property	Value type	Category	Explanation
pdfaid:part	Open choice of Integer	Internal	(Required) PDF/A version identifier
pdfaid:rev	Open choice of Integer	Internal	(Required) Four digit year of the date of publication or revision
pdfa:conformance	Closed choice of Text	Internal	(Optional) PDF/A conformance level: E or F

The value of **pdfaid:part** shall be the part number of ISO 19005 to which the file conforms. Files prepared in conformance with this document shall use a value of *4*.

If the file conforms to a version of ISO 19005 that is defined by a dated revision to a part, then the value of **pdfaid:rev** shall be the four digit year of that revision.

A PDF/A-4e conforming file (as described in Annex B) shall specify the value of **pdfa:conformance** as *E*. A PDF/A-4f conforming file (as described in Annex A) shall specify the value of **pdfa:conformance** as *F*. A file that does not conform to either PDF/A-4e or PDF/A-4f shall not provide any **pdfa:conformance**.

The values of the **pdfaid:part** and **pdfaid:rev** properties do not by themselves determine conformance with a part of ISO 19005. The actual determination of conformance shall be performed as specified in Clause 5.

6.7.4 File identifiers

A conforming file should have one or more metadata properties to characterize, categorize and otherwise identify the file. This document does not mandate any specific identification scheme. Identifiers may be externally based, such as an International Standard Book Number (ISBN) or a Digital Object Identifier (DOI), or internally based, such as a Globally Unique Identifier/Universally Unique Identifier (GUID/UUID) or another designation assigned during workflow operations. Identifiers may be included through the use of properties such as the **xmp:Identifier** property, the **xmpMM:InstanceID**, **xmpMM:DocumentID**, **xmpMM:VersionID** properties, or use of properties from an extension schema. Since any identification system may be used so long as the properties comply with XMP requirements and this document, the previous list shall not be considered as exhaustive.

If an **xmpMM:History** entry, as described in 6.7.5, is added to a conforming file, then the changing identifier part of the file trailer dictionary **ID** key shall be modified according to 6.1.3 of this document.