INTERNATIONAL STANDARD

ISO 19005-3

First edition
2012-10-15

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

Part 3: Use of ISO 32000-1 with support for embedded files (PDF/A-3)

Gestion de documents — Format de fichier des documents électroniques pour une conservation à long terme —

Partie 3: Utilisation de l'ISO 32000-1 avec support de fichiers incorporés (PDF/A-3)

Reference number
ISO 19005-3:2012(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 19005-3 was prepared by Technical Committee ISO/TC 171, *Document management applications*, Subcommittee SC 2, *Application issues*, in cooperation with ISO/TC 130, *Graphic technology*, ISO/TC 42, *Photography*, and ISO/TC 46, *Information and documentation*, Subcommittee SC11, *Archives/records management*.

ISO 19005 consists of the following parts, under the general title *Document management — Electronic document file format for long-term preservation*:

— *Part 1: Use of PDF 1.4 (PDF/A-1)*

— *Part 2: Use of ISO 32000-1 (PDF/A-2)*

— *Part 3: Use of ISO 32000-1 with support for embedded files (PDF/A-3)*

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 International Standard is created as a multi-part document, of which this is part 3. 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 static visual appearance over time, independent of the tools and systems used for creating, storing or rendering the files.

A secondary purpose of ISO 19005 is to define a framework for representing the logical structure and other semantic information of electronic documents within conforming files.

Another purpose of ISO 19005 is to provide a framework for recording the context and history of electronic documents in metadata within conforming files.

This part of ISO 19005 adds a new goal (beyond that of ISO 19005-2) which is to 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 part of ISO 19005 does not address the long-term suitability of formats, that may be embedded, other than those compliant with any part of this International Standard.

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.

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 part of ISO 19005, such as those best practices in Annex C. In addition, it is important for those organizations to implement policies and practices regarding the inspection of conforming files for correct visual appearance.

PDF/A does not directly address the topic of authenticity either for the underlying content to be visually represented or the PDF/A file itself. Such authenticity is generally considered to be important for legal, regulatory and governance purposes and is beyond the scope of this part of ISO 19005.

This part of ISO 19005 is one component of an organization's electronic archival environment for long-term retention of documents. Successful implementation of this part of ISO 19005 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[6];

— 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[5], ISO/TR 15801[7], and ISO/TR 18492[8];

— 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 part of ISO 19005 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 part of ISO 19005 extends the capabilities of ISO 19005-2. Just as with ISO 19005-2, it is based on PDF version 1.7 (as defined in ISO 32000-1).

This part of ISO 19005 (in conjunction with its normative references) provides sufficient information to interpret any conforming PDF/A-3 file.

NPES and AIIM (accredited standards developing organizations) maintain an ongoing series of application notes for guiding developers and users of this part of ISO 19005. These application notes are available at <http://www.npes.org/standards/toolspdfa.html> and <http://www.aiim.org/Research-and-Publications/Standards/Articles/PDFA-Application-Notes>. Both NPES and AIIM will also retain copies of the specific non-ISO normative references of this part of ISO 19005 which are publicly available electronic documents.

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

Part 3: Use of ISO 32000-1 with support for embedded files (PDF/A-3)

1 Scope

This part of ISO 19005 specifies the use of the Portable Document Format (PDF) 1.7, as formalized in ISO 32000-1, 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 part of ISO 19005 is not applicable 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 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/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*[1)]

ISO/IEC 10646, *Information technology — Universal Coded Character Set (UCS)*[2)]

ISO 15076-1, *Image technology colour management — Architecture, profile format and data structure — Part 1: Based on ICC.1:2010*

ISO 15930-7:2010, *Graphic technology — Prepress digital data exchange using PDF — Part 7: Complete exchange of printing data (PDF/X-4) and partial exchange of printing data with external profile reference (PDF/X-4p) using PDF 1.6*

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 32000-1, *Document management — Portable document format — Part 1: PDF 1.7*

Extensible Markup Language (XML) 1.0 (Third Edition), W3C Recommendation, 4 February 2004. Available at <http://www.w3.org/TR/2004/REC-xml-20040204>

1) The character encoding defined in ISO/IEC 646 is equivalent to ANSI X3.4 (ASCII) and ECMA-6.

2) The character code values defined in ISO/IEC 10646 are equivalent to those of Unicode.

ICC.1:1998-09, *File Format for Color Profiles, International Color Consortium. Available at* <http://www.color.org/ICC-1_1998-09.PDF>

ICC.1:2001-12, *File Format for Color Profiles (Version 4.0.0), International Color Consortium. Available at* <http://www.color.org/>

ICC.1:2003-09, *File Format for Color Profiles, International Color Consortium. Available at* <http://www.color.org/

ICC.1:2004-10, *File Format for Color Profiles, International Color Consortium. Available at* <http://www.color.org/ICC-1_2004-10.PDF>

RDF/XML Syntax Specification (Revised), W3C Recommendation, 10 February 2004. Available at <http://www.w3.org/TR/2004/REC-rdf-syntax-grammar-20040210/>

XMP: Extensible Metadata Platform, (September 2005), Adobe Systems Incorporated. Available at <http://www.aiim.org/documents/standards/xmpspecification.pdf>

Adobe Glyph List, 20 September 2002, Adobe Systems Incorporated. Available at <http://partners.adobe.com/public/developer/en/opentype/glyphlist.txt>

Adobe Supplement to ISO 32000-1, BaseVersion 1.7, ExtensionLevel 5, Adobe Systems Incorporated. Available at <http://www.adobe.com/devnet/acrobat/pdfs/adobe_supplement_iso32000_1.pdf>

RFC 2315, PKCS #7: Cryptographic Message Syntax Version 1.5

RFC 3280, Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile

3 Terms and definitions

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

3.1
conformance level
identified set of restrictions and requirements to which files and readers are required to comply

3.2
electronic document
electronic representation of a page-oriented aggregation of text, images and graphic data and metadata useful to identify and understand that data, that can be reproduced on paper or other substrates, as well as rendered electronically on display devices, without significant loss of its information content

3.3
end-of-file marker
five character sequence **%%EOF** marking the end of a PDF file

3.4
EOL marker
end-of-line marker
one or two character sequence marking the end of a line, consisting of a **CARRIAGE RETURN** character (0Dh) or a **LINE FEED** character (0Ah) or a **CARRIAGE RETURN** followed immediately by a **LINE FEED**

3.5
extension schema
conforming XMP schema that is not defined in the XMP Specification nor ISO 19005-1 or ISO 19005-2

3.6
font
identified collection of graphics that may be glyphs or other graphic elements

[ISO 32000-1]

3.7
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 interpreter

NOTE See ISO 32000-1:2008, 9.2.1.

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

NOTE A file viewing tool is an example of an interactive reader; a raster image processor is an example of a reader that is not interactive.

3.9
Level A conformance
conformance level encompassing all requirements of this part of ISO 19005

3.10
Level B conformance
conformance level encompassing the requirements of this part of ISO 19005 regarding the visual appearance of electronic documents, but neither their structural or semantic properties nor the requirement that all text have Unicode equivalents

3.11
Level U conformance

conformance level encompassing the requirements of this part of ISO 19005 regarding the visual appearance of electronic documents, with the requirement that all text in the document have Unicode equivalents

3.12
long-term
period of time long enough for there to be concern about the impacts of changing technologies, including support for new media and data formats, and of a changing user community, on the information being held in a repository, which may extend into the indefinite future

3.13
PDF
Portable Document Format
file format defined in ISO 32000-1

3.14
reader
software application that is able to read and process PDF/A files

3.15
writer
software application that is able to write PDF/A files

3.16
XMP packet
structured wrapper for serialized XMP metadata that can be embedded in PDF as well as other file formats

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 sans serif 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 32000-1:2008, 7.2.1, may be identified by their ISO/IEC 646 character name written in upper case 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, as defined by ISO 32000-1:2008, 7.9.2, 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).

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-3” – a synonym for ISO 19005-3;

— “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*.

5 Conformance levels

5.1 General

This part of ISO 19005 defines a file format for representing electronic documents known as “PDF/A-3”. Conforming PDF/A-3 files shall adhere to all requirements of ISO 32000-1 as modified by this part of ISO 19005. A conforming file may include any valid ISO 32000-1 feature that is not explicitly forbidden by this part of ISO 19005. Features described in PDF specifications prior to Version 1.7, which are not explicitly described in ISO 32000-1, should not be used.

NOTE 1 A conforming file is not obligated to use any PDF feature other than those explicitly required by ISO 32000-1 or this part of ISO 19005.

As described in 6.1.2, the version number of a file may be any value from 1.0 to 1.7, and the value shall not be used in determining whether a file is in conformance with this part of ISO 19005.

NOTE 2 The proper mechanism by which a file can presumptively identify itself as being a PDF/A-3 file of a given conformance level is described in 6.6.4.

5.2 Level A conformance

Level A conforming files shall adhere to all of the requirements of this part of ISO 19005. A file meeting this conformance level is said to be a “conforming PDF/A-3a file.”

5.3 Level B conformance

In recognition of the varying preservation needs of the diverse user communities making use of PDF files, this part of ISO 19005 defines a Level B conformance level. Level B conforming files shall adhere to all of the requirements of this part of ISO 19005 except those of 6.2.11.7 and 6.7. A file meeting this conformance level is said to be a “conforming PDF/A-3b file.”

NOTE 1 The Level B conformance requirements are intended to be those minimally necessary to ensure that the rendered visual appearance of a conforming file is preservable over the long term. However, Level B conforming files might not have sufficiently rich internal information to allow for the preservation of the document’s logical structure and content text stream in natural reading order, which is provided by Level A conformance. The requirements for Level A conformance place greater responsibilities on writers of conforming files and those preparing such files, but these requirements allow for a higher level of document preservation service and confidence over time. Additionally, Level A conformance facilitates the accessibility of conforming files for physically impaired users.

NOTE 2 A Level B conforming file can include features from Clauses 6.2.11.7 and 6.7, but still choose to identify itself as Level B.

5.4 Level U conformance

In recognition of the varying preservation needs of the diverse user communities making use of PDF files, this part of ISO 19005 defines a Level U conformance level. Level U conforming files shall adhere to all of the requirements of this part of ISO 19005 except those of 6.7. A file meeting this conformance level is said to be a “conforming PDF/A-3u file.”

NOTE 1 The Level U conformance requirements are intended to be those necessary to ensure that not only is the rendered visual appearance of a conforming file preservable over the long term, but that any text contained in the document can be reliably extracted as a series of Unicode codepoints. However, Level U conforming files might not have sufficiently rich internal information to allow for the preservation of the document’s logical structure and content text stream in natural reading order, which is provided by Level A conformance. The requirements for Level A conformance place greater responsibilities on writers of conforming files and those preparing such files, but these requirements allow for a higher level of document preservation service and confidence over time. Additionally, Level A conformance facilitates the accessibility of conforming files for physically impaired users.

NOTE 2 A Level U conforming file can include features from Clause 6.7, but still choose to identify itself as Level U.

NOTE 3 Level U was introduced in ISO 19005-2 and therefore does not have an equivalent in ISO 19005-1.

5.5 Conforming readers

A conforming reader shall comply with all requirements regarding reader functional behaviour specified in this part of ISO 19005. The requirements of this part of ISO 19005 with respect to reader behaviour are stated in terms of general functional requirements applicable to all conforming readers. This part of ISO 19005 does not prescribe any specific technical design, user interface or implementation details of conforming readers.

The rendering and other processing of conforming files shall be performed as defined in ISO 32000-1 subject to the additional restrictions specified by this part of ISO 19005. Features described in PDF specifications that are not explicitly described in ISO 32000-1 shall be ignored by conforming readers.

Conforming PDF/A-3 readers shall read and process appropriately all PDF/A-3 files. In addition, conforming PDF/A-3 readers shall read and process appropriately all PDF/A-1 files as defined by ISO 19005-1 and PDF/A-2 files as defined by ISO 19005-2.

6 Technical requirements

6.1 File structure

6.1.1 General

Subclauses 6.1.2 to 6.1.12 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 32000-1 or this part of ISO 19005 should be ignored by a conforming reader 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-1.n" followed by a single EOL marker, where 'n' is a single digit number between 0 (30h) and 7 (37h).

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 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

The file trailer dictionary shall contain the **ID** keyword whose value shall be File Identifiers as defined in ISO 32000-1:2008, 14.4.

NOTE 1 No data can follow the last end-of-file marker except a single optional end-of-line marker as described in ISO 32000-1:2008, 7.5.5.

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

NOTE 2 The explicit prohibition of the **Encrypt** keyword has the implicit effect of disallowing encryption and password-protected access permissions.

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 part of ISO 19005 and may be ignored by a conforming reader. If a conforming reader chooses not to ignore such indirect objects, they shall never influence the way content is rendered.

6.1.5 Document information dictionary

A document information dictionary may be present in a conforming file and a PDF/A-3 compliant reader shall ignore it.

NOTE Metadata can be included in a document through the use of XMP metadata streams as specified in 6.6.3.

6.1.6 String objects

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

NOTE This avoids the provision in ISO 32000-1 about the absence of the final hexadecimal digit.

6.1.7 Stream objects

6.1.7.1 General

The **stream** keyword shall be followed either by a **CARRIAGE RETURN** (0Dh) and **LINE FEED** (0Ah) character sequence or by a single **LINE FEED** (0Ah) character. The **endstream** keyword shall be preceded by an EOL marker.

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**.

6.1.7.2 Filters

All standard stream filters listed in ISO 32000-1:2008, 7.4, Table 6 may be used, with the exception of *LZWDecode*. In addition, the *Crypt* filter shall not be used unless the value of the **Name** key in the decode parameters dictionary is *Identity*. Filters that are not listed in ISO 32000-1:2008, 7.4, Table 6 shall not be used.

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

6.1.8 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 32000-1:2008, 7.3.5.

All other name objects should adhere to these same restrictions.

6.1.9 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.

6.1.10 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 32000-1:2008, Table 6 or an array containing any such value.

6.1.11 Linearized PDF

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

NOTE As defined in ISO 32000-1:2008, 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.

6.1.12 Permissions

No keys other than **UR3** and **DocMDP** shall be present in a permissions dictionary (ISO 32000-1:2008, 12.8.4, Table 258). If **DocMDP** is present, then the Signature References dictionary (ISO 32000-1:2008, 12.8.1, Table 253) shall not contain the keys **DigestLocation**, **DigestMethod**, and **DigestValue**.

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 part of ISO 19005.

6.1.13 Implementation limits

A conforming file shall not contain any integer greater than 2147483647.

A conforming file shall not contain any integer less than –2147483648.

A conforming file shall not contain any real number outside the range of $\pm 3.403 \times 10^{38}$.

A conforming file shall not contain any real number closer to zero than $\pm 1.175 \times 10^{-38}$.

A conforming file shall not contain any string longer than 32767 bytes.

A conforming file shall not contain any name longer than 127 bytes.

A conforming file shall not contain more than 8388607 indirect objects.

A conforming file shall not nest q/Q pairs by more than 28 nesting levels.

A conforming file shall not contain a DeviceN colour space with more than 32 colourants.

A conforming file shall not contain a CID value greater than 65535.

NOTE 1 These values are derived from ISO 32000-1:2008, Table C.1. They are in US locale using a **FULL STOP** (2Eh) as decimal separator.

The size of any of the page boundaries described in ISO 32000-1:2008, 14.11.2 shall not be less than 3 units in either direction, nor shall it be greater than 14400 units in either direction.

NOTE 2 This requirement makes normative a recommendation from ISO 32000-1:2008, C.2

NOTE 3 By complying with these limits, a conforming file is compatible with the widest possible range of readers.

6.2 Graphics

6.2.1 General

Subclauses 6.2.2 to 6.2.11 describe restrictions that shall be placed on both conforming files and readers with respect to the graphical elements described in ISO 32000-1:2008, 7.8. A conforming reader shall render these graphical elements onto their respective PDF pages according to the rendering requirements of ISO 32000-1 as modified by this part of ISO 19005.

A conforming interactive reader 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 6.2.11.

6.2.2 Content streams

Content streams shall not contain any operators not defined in ISO 32000-1 even if such operators are bracketed by the **BX**/**EX** compatibility operators.

NOTE 1 In earlier versions of PDF, a PostScript operator **PS** was defined. As this operator is not defined in ISO 32000-1, its use is implicitly prohibited by this clause.

NOTE 2 Contents streams, as defined in ISO 32000-1:2008, 7.8.2, can be used for page descriptions, Form XObjects, Type 1 Patterns, Type 3 fonts, as well as for the appearances of annotations.

The use of the rendering intent operator ('**ri**') shall conform to the requirements of 6.2.6.

The use of the flatness operator ('**i**') shall conform to the requirements of 6.2.7.

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 32000-1:2008, 7.8.3. Any named resource present in the resources 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 part of ISO 19005.

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 shall be identified as an **OutputIntent** dictionary, as defined by ISO 32000-1:2008, 14.11.5, that is included in the file's **OutputIntents** array. It shall have *GTS_PDFA1* as the value of its **S** key and a valid ICC profile stream as the value of its **DestOutputProfile** key.

NOTE 1 PDF/A requires that an OutputIntent 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 OutputIntent profile provided.

NOTE 2 The value for GTS_PDFA1 was maintained for this part of ISO 19005 to enable greater compatibility with ISO 19005-1.

In addition, the **DestOutputProfileRef** key, as defined in ISO 15930-7:2010, Annex A, shall not be present in any PDF/X OutputIntent.

NOTE 3 Disallowing the **DestOutputProfileRef** key maintains the intent of this part of ISO 19005 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-3 and PDF/X-4p.

If a file's **OutputIntents** array contains more than one entry, such as may be the case where a file is compliant with this part of ISO 19005 and at the same time with PDF/X-4 or PDF/E-1, 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 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-3 conforming reader.

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