
**Graphic technology — Prepress digital
data exchange using PDF —**

Part 4:

**Complete exchange of CMYK and spot
colour printing data using PDF 1.4
(PDF/X-1a)**

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*Technologie graphique — Échange de données numériques de
préimpression utilisant le PDF —*

*Partie 4: Échange complet de données d'impression CMYK et «spot
colour» utilisant le PDF 1.4 (PDF/X-1a)*

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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

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Foreword

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

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

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

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

ISO 15930-4 was prepared by Technical Committee ISO/TC 130, *Graphic technology*, with the support of ANSI Committee for Graphic Arts Technologies Standards (CGATS).

ISO 15930 consists of the following parts under the general title *Graphic technology — Prepress digital data exchange using PDF*:

- Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a);
- Part 3: Complete exchange suitable for colour-managed workflows (PDF/X-3);
- Part 4: Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a);
- Part 5: Partial exchange of printing data using PDF 1.4 (PDF/X-2);
- Part 6: Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3).

Introduction

ISO 15930 (all parts) defines methods for the exchange of digital data within the graphic arts industry and for the exchange of files between graphic arts establishments. It is a multi-part document where each part is intended to respond to different workflow requirements. These workflows differ in the degree of flexibility required. However, increasing flexibility can lead to the possibility of uncertainty or error. The goal throughout the various parts of ISO 15930 has been to maintain the degree of flexibility required while minimizing the uncertainty.

Many printed documents are assemblies of partial pages and/or pages created at different locations and by different organizations. The merging of these individual elements into the final printing forme and the subsequent printing may take place at different locations. Some of these elements may also be routed to multiple sites for incorporation into other documents. Each of these elements is referred to in ISO 15930 as a compound entity.

A variety of data formats and structures are used for the creation of this type of material, but with two prevalent kinds of underlying data structures. These are vector-based data for the encoding of line art and textual information and raster-based data for the encoding of image information, including previously rasterized line art and textual information.

Both kinds of data structures are required along with page description information in an open electronic workflow. The exchange of raster-based data using the TIFF/IT file format is defined in ISO 12639. The subject of ISO 15930 is a format for the exchange of object-based data where individual objects may be in either vector or raster data structures.

PDF/X-1a (Parts 1 and 4 of this International Standard) defines a data format and its usage to permit the predictable dissemination of a compound entity to one or more locations as CMYK (and spot colour) data, in a form ready for final print reproduction, by transfer of a single file. This file contains all the content information necessary to process and render the document, as intended by the sender, coded inside a single PDF file. No other parts, neither external files nor internally embedded files, are required or permitted. This exchange requires no prior knowledge of the sending and receiving environments and is sometimes referred to as "blind" exchange. It is platform- and transport-independent. Part 1 of this International Standard also includes a second conformance level, identified as PDF/X-1, that allows the use of OPI.

These goals are accomplished by defining a specific use of the publicly available *Adobe Portable Document Format*. In order to achieve a level of exchange that avoids any ambiguity in interpretation of the file, a limited set of PDF objects that may be used is identified and restrictions to the use, or form of use, of those objects, and/or keys within those objects are added.

This version of PDF/X-1a (Part 4 of this International Standard) amplifies and refines the information provided in the earlier version (Part 1 of this International Standard), as follows.

- The referenced version of the *Adobe Portable Document Format* has been changed from 1.3 to 1.4.
- The use of OPI has been removed.
- This part of this International Standard contains only one conformance level, identified as PDF/X-1a:2003.
- The following features, introduced in PDF 1.4, have been disallowed in PDF/X-1a:2003: JBIG2, Transparency, and Referenced PDF.

Whereas PDF/X-1a specifies the exchange of complete material, primarily as CMYK data, with all elements present, there are circumstances when this is not appropriate. In certain workflows, some or all of the referenced elements may be more logically present at the receiving site, or may be exchanged at a different

time. These include high-resolution contone-image files, line-art files, etc. These exchanges will generally require prior agreement between sender and receiver. The requirements for such situations are addressed in PDF/X-2 (Part 5 of this International Standard). Further, colour-management capabilities allow elements to be exchanged in colour spaces other than CMYK. The requirements for such situations are addressed in PDF/X-3 (Parts 3 and 6) of this International Standard. In addition, the requirements for intended printing conditions using gray and RGB are included in Parts 3 and 6.

It is anticipated that a variety of products will be developed based on PDF/X, such as readers (including viewers) and writers of PDF/X files, and products that offer combinations of these features. Different products will incorporate various capabilities to prepare, interpret and process conforming files based on the application needs as perceived by the suppliers of the products. However, it is important to note that a conforming reader must be able to read and appropriately process all files conforming to a specified conformance level.

Users are cautioned that there are several different conformance levels that may be associated with PDF/X readers and writers. Two of these are generally referred to as PDF/X-1a. These are defined in Parts 1 and 4 of this International Standard. It is recommended that these be referred to as PDF/X-1a:2001 and PDF/X-1a:2003, respectively.

Although re-purposing of data is not a primary consideration or requirement of this part of ISO 15930, maximum flexibility will be maintained so that future requirements for re-purposing may be accommodated.

An ongoing series of *Application Notes*^[5] is maintained for the guidance of developers and users of the PDF/X family of International Standards. These *Application Notes*, and other documents relevant to PDF/X, are available from NPES The Association for Suppliers of Printing, Publishing and Converting Technologies in the NPES Standards Workroom at <<http://www.npes.org/standards/tools.html>>.

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Graphic technology — Prepress digital data exchange using PDF —

Part 4: Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a)

1 Scope

This part of ISO 15930 specifies the use of the Portable Document Format (PDF) Version 1.4 for the dissemination of complete digital data, in a single exchange, that contains all elements ready for final print reproduction. CMYK and spot-colour data are supported in any combination.

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 15930-1:2001, *Graphic technology — Prepress digital data exchange — Use of PDF — Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)*

ISO 15930-3:2002, *Graphic technology — Prepress digital data exchange — Use of PDF — Part 3: Complete exchange suitable for colour-managed workflows (PDF/X-3)*

ISO 15930-5:2003, *Graphic technology — Prepress digital data exchange using PDF — Part 5: Partial exchange of printing data using PDF 1.4 (PDF/X-2)*

ISO 15930-6:2003, *Graphic technology — Prepress digital data exchange using PDF — Part 6: Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3)*

PDF Reference: Adobe Portable Document Format, Version 1.4, Adobe Systems Incorporated — 3rd ed. (ISBN 0-201-75839-3)

PDF Reference: Adobe Portable Document Format, Version 1.4 errata dated 2003/6/18. Available from Internet <<http://partners.adobe.com/asn/acrobat/docs/PDF14errata.txt>>

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

3 Terms, abbreviated terms and definitions

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

3.1

bleed

additional printing area outside the nominal printing area necessary for the allowance of mechanical tolerance in the trimming process

3.2

blind exchange

exchange of compound entities that requires no exchange of technical information between sender and receiver in order for the receiver to render the printed page as intended by the sender

3.3

characterized printing condition

printing condition (offset, gravure, flexographic, direct, etc.) for which process control aims are defined and for which the relationship between input data (printing tone values, usually CMYK) and the colorimetry of the printed image is documented

NOTE 1 The relationship between input data (printing tone values) and the colorimetry of the printed image is commonly referred to as characterization.

NOTE 2 It is generally preferred that the process control aims of the printing condition and the associated characterization data be made publicly available via the accredited standards process or industry trade associations.

3.4

CMYK

subtractive process colour model where the channels are called Cyan, Magenta, Yellow and Black

3.5

complete exchange

exchange of compound entities in which all elements and element resources are present as part of a single exchange and all of the information needed to process the compound entity is either in the compound entity or is specified within the applicable standard and its normative references

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3.6

compound entity

unit of work with all text, graphics and image elements prepared for final print reproduction and that may represent a single page for printing, a portion of a page or a combination of pages

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3.7

conformance level

identified set of restrictions and requirements with which files, readers and writers must comply

3.8

element

substructure of a compound entity relative to the current processing environment, such as a block of text, a contone picture or an outline graphic that, by itself, comprises the smallest logical composed unit of a compound entity

3.9

font

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

3.10

glyph

recognizable abstract graphic symbol that is independent of any specific design

[ISO/IEC 9541-1]^[1]

3.11

glyph metrics

set of information in a glyph representation used for defining the dimensions and positioning of the glyph shape

3.12**ICC****International Color Consortium**

industry association formed to develop standardized mechanisms for colour management

3.13**ICC profile**

set of colorimetric transforms prepared in accordance with ICC.1:1998

3.14**job ticket**

electronic specification of process control for print production in either a published or proprietary format

NOTE Job tickets as defined here include only data intended to affect the rendered appearance of the file. See References [3] and [4].

3.15**non-print element**

element not intended for final print reproduction, including previews, preview images and all annotations of types other than **TrapNet** and **PrinterMark**

3.16**PDF****Portable Document Format**

file format defined in the *PDF Reference*

3.17**PDF dictionary**

associative table containing key-value pairs, specifying the name and value of an attribute for objects, which is generally used to collect and tie together the attributes of a complex object

3.18**PDF/X-1a:2001**

PDF/X-1a conformance level defined in ISO 15930-1:2001

3.19**PDF/X-1a:2003**

PDF/X-1a conformance level defined in this part of ISO 15930

3.20**PDF/X-2:2003**

PDF/X-2 conformance level defined in ISO 15930-5:2003

3.21**PDF/X-3:2002**

PDF/X-3 conformance level defined in ISO 15930-3:2002

3.22**PDF/X-3:2003**

PDF/X-3 conformance level defined in ISO 15930-6:2003

3.23**print element**

element intended for final print reproduction including **TrapNet** and **PrinterMark** annotations

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**3.24
printing tone-value**

number, recorded as data in the computer, corresponding to that percentage area on a printing forme that is intended to accept ink for transfer to the final sheet in offset lithography, or the equivalent in other printing systems

NOTE See **characterized printing condition** (3.3).

**3.25
process colorant**

one of a set of colorants that, when printed together, produce a range of colours able to reproduce the values specified by a colour coordinate system and which, in the context of this part of this International Standard, always refers to C, M, Y, or K

NOTE See **CMYK** (3.4).

**3.26
reader**

software application that is able to read and appropriately process files

**3.27
spot colour**

single colorant, identified by name, whose printing tone-values are specified independently from the colour values specified in a colour coordinate system

**3.28
trapping**

modification of boundaries of colour areas to account for dimensional variations in the printing process by overprinting in selected colours at the boundaries between colours that might inadvertently be left uncoloured due to normal variations of printing press registration

NOTE Trapping is sometimes referred to as chokes and spreads or grips. This is not the same as ink trapping.

**3.29
writer**

software application that is able to write files

4 Notations

PDF operators, PDF keywords, the names of keys in PDF dictionaries, and other predefined names are written in a bold sans serif type font; for example, the key **Trapped**.

Operands of PDF operators or values of dictionary keys are written in an italic sans serif font; for example the *False* value for the **Trapped** key.

For the purposes of this part of this International Standard, references to the “*PDF Reference*” are to the *PDF Reference: Adobe Portable Document Format* corrected by the errata dated 2003/6/18 (see Clause 2).

5 Conforming files and equipment

This part of this International Standard defines the use of the PDF file format for the exchange of digital data representing a compound entity.

A conforming PDF/X-1a file is a PDF file in which those features necessary for the exchange of a compound entity are in accordance with this part of this International Standard. A conforming file may also include other valid PDF features that do not affect final print reproduction of the compound entity.

Neither the version number in the header of a PDF file, nor the value of the **Version** key in the **Catalog** of a PDF file shall be used in determining whether a file is in accordance with this part of this International Standard.

A conforming PDF/X-1a writer is a software application that shall be able to write files in accordance with the requirements of this part of this International Standard. A conforming PDF/X-1a reader is a software application that shall be able to read and appropriately process all conforming PDF/X-1a files as defined in this part of this International Standard. A conforming PDF/X-1a reader shall also be able to read and process all files in accordance with the PDF/X-1a conformance level specified in ISO 15930-1:2001 having a value of (*PDF/X-1:2001*) for the **GTS_PDFXVersion** key, and (*PDF/X-1a:2001*) for the **GTS_PDFXConformance** key in the **Info** dictionary and that also conform to 6.16 of this part of this International Standard. The processing of files conforming to the PDF/X-1 conformance level as specified in ISO 15930-1:2001 by a PDF/X-1a reader shall be at the discretion of the application software.

NOTE The ability to read files prepared in accordance with the PDF/X-1a:2001 conformance level as specified in ISO 15930-1:2001, the predecessor to this part of ISO 15930, is important to preserve compatibility. Users are cautioned that there are several different conformance levels that may be associated with PDF/X readers and writers. Two of these are generally referred to as PDF/X-1a. These are defined in Parts 1 and 4 of this International Standard. These are referred to as PDF/X-1a:2001 and PDF/X-1a:2003, respectively.

Although *PDF Reference* permits compliance with earlier versions of PDF, features described in versions of the PDF specification earlier than 1.4, but not described in *PDF Reference*, should not be used in a conforming PDF/X-1a file. Such features may be ignored by a PDF/X-1a reader.

All conforming readers shall parse all PDF files but may ignore those features not required by this part of ISO 15930. A reader may ignore an annotation's **Print** flag except for those in a **TrapNet** annotation.

Rendering of conforming files shall be performed as defined in the *PDF Reference* and as restricted by this part of ISO 15930. To the extent that the *PDF Reference* and this part of this International Standard permit more than one rendering of a conforming file, a conforming reader may use embedded job-ticket or metadata information to control the rendering of the file more precisely.

EXAMPLE 1 (Trapping) If a conforming PDF/X-1a file specifies **Trapped=False**, a conforming reader might use job-ticket information to determine details of how the file is to be trapped. If the file specifies **Trapped=True**, a conforming reader is required to ignore any trapping information in an embedded job ticket.

EXAMPLE 2 (Screening) A conforming reader may use embedded job-ticket information to determine the screening to be used to render the file. Note that a conforming PDF/X-1a reader is permitted to ignore screening information in the PDF/X-1a file (see 6.9). A conforming reader might use screening data from the PDF/X-1a file, from the job ticket, or from local system defaults.

6 Technical requirements

6.1 Data structure

A PDF/X-1a file consists of four sections: header, body, cross-reference table, and trailer. The body of a PDF/X-1a file contains a sequence of numbered objects (such as numbers, names, strings, dictionaries and streams) representing the text characters, graphics, images and their associated resources describing the compound entity being exchanged. The PDF features which shall be required are specified in 6.2 to 6.17, inclusively and are summarized in Annex A. These features shall be used as prescribed in the *PDF Reference* and as further restricted by this part of this International Standard.

In order to achieve the requirements of a blind exchange, the use of a pre-separated PDF file (where the separations for each page are described as separate page objects, each painting only a single colorant) shall not be permitted.

NOTE 1 This does not prohibit the use of pre-separated workflows in which the separations of a page are combined into a single PDF page object.