# INTERNATIONAL STANDARD

# ISO 15930-1

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# Graphic technology — Prepress digital data exchange — Use of PDF —

## Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)

*Technologie graphique — Échange de données numériques de préimpression — Emploi de PDF —*

*Partie 1: Échange complet employant les données CMYK (PDF/X-1 et PDF/X-1a)*

Reference number
ISO 15930-1:2001(E)

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# Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

ISO 15930-1 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 — Use of PDF*:

— *Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)*

— *Part 2: Guidelines for partial exchange of printing data (PDF/X-2)*

— *Part 3: Complete exchange suitable for colour managed workflows (PDF/X-3)*

Annexes A to D of this part of ISO 15930 are for information only.

# Introduction

ISO 15930 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 minimising 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 form 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.

Part 1 of ISO 15930 defines a data format and its usage to permit the predictable dissemination of a compound entity to one or more locations as CMYK data, in a form ready for final print reproduction, by transfer of a single file. This file must contain all the content information necessary to process and render the document, as intended by the sender. 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.

These goals are accomplished by defining a specific use of the publicly available *Adobe Portable Document Format* as specified in Version 1.3 In order to achieve a level of exchange that avoids any ambiguity in interpretation of the file, it identifies a limited set of PDF objects which may be used and adds restrictions to the use, or form of use, of those objects, and/or keys within those objects. It includes two compliance levels, PDF/X-1 and PDF/X-1a, that differ only in their allowed use of OPI references, and encryption which are allowed in PDF/X-1 but not in PDF/X-1a.

Whereas PDF/X-1 and PDF/X-1a specify the exchange of complete material, primarily as CMYK data, with all elements present, there are occasions where 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 fonts, high resolution contone image files, or line art files. These exchanges will generally require prior agreement between sender and receiver. Further, evolving colour management capabilities may allow elements to be exchanged more expeditiously in colour spaces other than CMYK. The requirements for such situations are addressed in later parts of ISO 15930.

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.

It is anticipated that a variety of products will be developed around PDF/X-1, 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.

The PDF/X-1 conformance level of this part of ISO 15930 is generally similar to ANSI CGATS.12/1-1999, *Graphic technology — Prepress digital data exchange — Use of PDF for composite data — Part 1: Complete exchange (PDF/X-1)*. ANSI CGATS.12/1 is based on *Portable Document Format Reference Manual* Version 1.2 as extended by Adobe Technical Note #5188. This part of ISO 15930 is based on the *Adobe Portable Document Format* Version 1.3.

Users are cautioned that there are currently three different conformance levels that may be associated with PDF/X readers and writers. Two of these are generally referred to as PDF/X-1 and are those compatible with ANSI CGATS.12/1-1999 and the PDF/X-1 compatibility level of this part of ISO 15930. It is recommended that these be referred to as PDF/X-1:1999 and PDF/X-1:2001 respectively. Further this part of ISO 15930 makes provision for a 2nd conformance level which does not allow OPI references or encryption. This should be referred to as PDF/X-1a:2001. While a PDF/X-1:2001 reader should accept and properly read files conforming to both PDF/X-1:2001 and PDF/X-1a:2001 conformance levels, readers meeting the other two conformance levels should not be expected to properly read files outside of their own conformance level.

An ongoing series of Application Notes [1] is maintained for the guidance of developers and users of the ISO PDF/X family of International Standards. They are available from NPES The Association for Suppliers of Printing, Publishing and Converting Technologies in the standards section at http://www.npes.org/standards/workroom.html.

Attention is drawn to the fact that it is claimed that compliance with this part of ISO 15930 may involve the use of a patent concerning data encryption (clause 6.17). ISO takes no position concerning the evidence, validity and scope of this patent right. The holder of this patent right has assured ISO that they are willing to negotiate licenses under reasonable and non-discriminatory terms and conditions with applicants throughout the world. Information may be obtained from: RSA Data Security, Inc., 100 Marine Parkway, Redwood City, CA 94065-1031, USA. Attention is also drawn to the possibility that some of the elements of this part of ISO 15930 may be the subject of patent rights other than those identified above. ISO shall not be held responsible for identifying any or all such patent rights.

# Graphic technology — Prepress digital data exchange — Use of PDF —

## Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)

## 1 Scope

This part of ISO 15930 specifies the methods for the use of the Portable Document Format (PDF) for the dissemination of compound CMYK digital data, in a single exchange, that is complete and ready for final print reproduction.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15930. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15930 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 12639, *Graphic technology — Prepress digital data exchange — Tag image file format for image technology (TIFF/IT)*

ANSI CGATS.12/1-1999, *Graphic technology — Prepress digital data exchange — Use of PDF for composite data — Part 1: Complete exchange (PDF/X-1)*

ICC.1:1998-09, *File Format for Color Profiles*, International Color Consortium

*Adobe Portable Document Format,* version 1.3, 2nd Ed., Adobe Systems Incorporated, Dated July 2000, ISBN 0-201-61588-6

Adobe Technical Note #5002 — *Encapsulated PostScript File Format Specification* — Version 3.0, 1 May 1992, Adobe Systems Incorporated

Adobe Technical Note #5044 — *Color Separation Conventions for PostScript Language Programs*, 12 February 1996, Adobe Systems Incorporated

Adobe Technical Note #5413 — *Recording Output Intentions for Color Critical Workflows*, 22 January 2001, Adobe Systems Incorporated

*Desktop Color Separation Specification 2.0*, June 1993, revised May 1995, Quark Inc.

*Draft TIFF Technical Note #2*, 17 March 95, Tom Lane, the Independent JPEG Group

*PostScript Language Reference Manual*, third edition, 1999, Adobe Systems Incorporated, ISBN 0-201-37922-8

*TIFF, Revision 6.0*, June 3, 1992, Adobe Systems Incorporated

## 3 Terms and definitions

For the purposes of this part of ISO 15930, 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

NOTE The bleed area includes area that may be printed but does not include printers' marks of any kind.

**3.2**
**blind exchange**
exchange of compound entities which 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**
cyan-magenta-yellow-black used as a modifier of printing tone values, colours, process colorants, etc.

**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

**3.6**
**compound entity**
unit of work with all text, graphics and image elements prepared for final print reproduction and may represent a single page for printing, a portion of a page or a combination of pages

**3.7**
**DCS**
desktop colour separation file formats as defined by *Desktop Color Separation Specification 2.0*

**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**
**EPS**
Encapsulated PostScript as defined by Adobe Technical Note #5002

**3.10**
**font**
identified collection of graphics that may be glyphs or other graphic elements

**3.11**
**glyph**
recognizable abstract graphic symbol that is independent of any specific design (ISO/IEC 9541-1 [2])

**3.12**
**glyph metrics**
set of information in a glyph representation used for defining the dimensions and positioning of the glyph shape (ISO/IEC 9541-1 [2])

**3.13**
**ICC**
International Color Consortium, an industry association formed to develop standardized mechanisms for colour management

**3.14**
**non-print element**
an element not intended for final print reproduction such as previews, preview images or non-printing annotations

**3.15**
**OPI reference**
PDF dictionary of *OPI* type that has an *F* key the value of which is a file specification for an external file which is also referred to as an OPI dictionary in the PDF documentation

**3.16**
**partial exchange**
exchange of compound entities in which some elements or element resources are intentionally excluded from the exchange, and are separately available

NOTE Examples of excluded elements or element resources are fonts and high resolution images.

**3.17**
**PDF (Portable Document Format)**
file format defined in the *Adobe Portable Document Format*

**3.18**
**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

**3.19**
**preview**
visible placeholder representing at least the size and shape of the area to be replaced by the referenced object

NOTE A visible placeholder may be something as basic as a rectangle of the appropriate size containing no image content, or may be a partial or complete representation of the intended content. See 3.20

**3.20**
**preview image**
preview consisting of a raster image representing a compound entity at a resolution suitable for viewing on a computer display

**3.21**
**print element**
element intended for final print reproduction

**3.22**
**printing tone value**
data value corresponding to the relative area of a printing surface that is intended to transfer ink to the substrate being printed. See 3.3 *characterized printing condition*

**3.23**
**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 co-ordinate system

NOTE The most common of these are the cyan, magenta and yellow dyes or pigments used to create images, often with the addition of black as a fourth process colorant.

**3.24**
**reader**
software application that is able to read and appropriately process files

**3.25**
**spot colour**
single colorant, identified by name, whose printing tone values are specified independently from colour values specified in a colour co-ordinate system

**3.26**
**TIFF**
tagged image file format as defined by revision 6.0 of TIFF

**3.27**
**TIFF/IT**
format for exchanging raster-based data as defined in ISO 12639

**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 Sometimes colloquially 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 Symbols and 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.

File type designations beginning with the string "TIFF/IT" refer to file data structures defined in ISO 12639.

For the purpose of this part of ISO 15930 references to the "PDF Reference Manual" are to the *Adobe Portable Document Format*, as identified in clause 2.

## 5 Conformance

This part of ISO 15930 defines the use of the PDF file format for the exchange of digital data representing a compound entity.

A conforming PDF/X-1 file is a PDF file in which those features necessary for the exchange of a compound entity adhere to this part of ISO 15930. A conforming file may also include other valid PDF features that do not affect final print reproduction of the compound entity. A conforming PDF/X-1a file is a conforming PDF/X-1 file that adheres to the further restrictions set out in 6.5, 6.13, and 6.17.

A conforming writer is a software application that shall be able to write files conforming to the requirements of this part of ISO 15930.

A conforming PDF/X-1 reader is a software application that shall be able to read and appropriately process all conforming PDF/X-1 files as defined in this part of ISO 15930. A conforming PDF/X-1 reader may also be able to read and process all files conforming to ANSI CGATS.12/1-1999 having a value of (CGATS.12/1-1999) for the **GTS_PDFXVersion** key in the **Info** dictionary.

NOTE The ability to read files prepared in accordance with ANSI CGATS.12/1-1999, the predecessor to this part of ISO 15930, is important to preserve upward compatibility.

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. The processing of other PDF/X-1 files by a PDF/X-1a reader shall be at the discretion of the application software.

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 conforming files shall be performed as defined in the PDF Reference Manual.

# 6 Technical requirements

## 6.1 General

The requirements contained in all parts of clause 6, except as noted in 6.5, 6.13, and 6.17, apply equally to PDF/X-1 and PDF/X1a.

## 6.2 Data structure

A PDF/X-1 file consists of four sections: header, body, cross-reference table, and trailer. The body of a PDF/X-1 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 specific PDF features required by this part of ISO 15930 are summarized in annex A and are defined in 6.3 to 6.21, inclusive. These features shall be used as prescribed in the PDF Reference Manual and as further specified by this part of ISO 15930.

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 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.

A PDF/X-1 file may contain two classes of elements: those intended for final print reproduction (print elements), and those not intended for final print reproduction (non-print elements). Non-print elements include such incidental elements as previews, preview images or non-printing annotations. All components of a compound entity shall be contained in the body of a single PDF/X-1 file.

"Complete" means the exchanged files shall include:

- all PDF resources (listed in the PDF Reference Manual) used in the file including all fonts, font metrics, font encodings, and colour space resources;
- any OPI externally referenced files embedded in the PDF/X-1 file as streams; and
- all print elements, properly prepared for a single intended printing condition.

NOTE For exchange of partial compound entities refer to ISO 15930-2 [3].

## 6.3 Colour

### 6.3.1 General

All print elements shall be exchanged as CMYK data, gray scale data, or separation colour data. The CMYK and gray scale printing tone values in print elements, including those in OPI referenced files, shall be colour corrected and adjusted for a single characterized printing condition prior to exchange.

PDF print elements in a PDF/X-1 file may be defined in **DeviceCMYK**, **DeviceGray**, **Separation**, **DeviceN**, **Indexed** and **Pattern** colour spaces as specified and restricted in the following sections. Spot colours are represented using **Separation** or **DeviceN** colour spaces.

Non-print elements may make use of any PDF colour space.

### 6.3.2 Identification of characterized printing condition

The characterized printing condition for which data has been prepared is identified by use of an **OutputIntents** array in the **Catalog** object as described in Adobe Technical Note #5413. The **OutputIntents** array shall contain exactly one **OutputIntent** dictionary in which the value of the **S** key is the name /GTS_PDFX, henceforth referred to as the PDF/X OutputIntent object. Additional **OutputIntent** dictionaries may be present; if so they shall use different values for the **S** key and shall be ignored by a PDF/X-1 conforming reader.

The PDF/X OutputIntent object shall include the **OutputConditionIdentifier** key. Where the intended printing condition is a printing condition included in the registry of characterizations maintained by the ICC, as described in ICC.1, the value of the **OutputConditionIdentifier** key should be exactly the same as the name used in the ICC registry. See annex C.

If the value of the **OutputConditionIdentifier** key does not match a characterization name in the ICC registry the **DestOutputProfile** key shall be present in the PDF/X OutputIntent object, and the **OutputCondition** key should be present.

If the value of the **OutputConditionIdentifier** key does match a characterization name in the ICC registry the **DestOutputProfile** and **OutputCondition** keys may be present but are not required.

If the value of the **OutputConditionIdentifier** key matches a characterization name in the ICC registry the **RegistryName** key shall be present with the value (*http://www. color. org*). If it matches a characterization name in any other registry it is strongly recommended that the **RegistryName** key be present, preferably with a value that provides a URL at which more information regarding the registry may be obtained.

The profile that is the value of the **DestOutputProfile** key, if present, shall include an AtoB1Tag (Device to PCS: Colorimetric rendering intent). If present in the **DestOutputProfile** stream object, the **Alternate** key shall be ignored by a PDF/X-1 conforming reader.

The values of the **profileDescriptionTag** and **charTargetTag**, if present in the ICC profile, shall be ignored

NOTE ANSI CGATS.12/1 requires that the characterized printing condition shall be identified in all ICCBased color spaces as an entry in the ICC **profileDescriptionTag** of the associated ICC compliant profile in the following form: "<GTS_:cpc>"characterized printing condition name"</GTS_:cpc>". Leading and trailing white space characters in the characterized printing condition name will be ignored.

If the **OutputCondition** key is present its value should be a string describing the intended printing condition in a form that will be meaningful to a human operator at the site receiving the exchanged file.

All PDF print elements and objects in externally referenced files that are encoded in **DeviceCMYK** or **DeviceGray** colour spaces, either directly or as the *base* colour space of an **Indexed** colour space, shall be interpreted as having been prepared for the printing condition identified by the PDF/X OutputIntent object.

### 6.3.3 Separation and DeviceN colour spaces

**Separation** and/or **DeviceN** colour spaces may be used for CMYK colours, for spot colours, and for information that is not colour related (e.g. , varnishes, die cutting and other overlays).

NOTE It is the responsibility of the originator of the PDF/X-1 compliant file to assure consistent use of spot colour names across all objects in the file. Industry recognized names should be used wherever possible. It is recommended that colour names "Red", "Green", or "Blue" not be used as names for spot colours.

All **Separation** and **DeviceN** colour space resources in a PDF/X-1 file shall use **DeviceGray** or **DeviceCMYK** for their *alternateSpace*.

A PDF/X-1 conforming reader shall treat process separations specified using a **Separation** colour space, or as values within the

*names* array of a **DeviceN** colour space as having been prepared for the characterized printing condition identified in the PDF/X OutputIntent object.

In situations where spot colour separations specified in **Separation** or **DeviceN** colour spaces are to be printed using process colorants the *alternateSpace* and *tintTransform* supplied in the **Separation** or **DeviceN** colour space shall be used to perform that transformation. If the *alternateSpace* is **DeviceCMYK** a PDF/X-1 conforming reader shall treat that as being the same CMYK as identified by the PDF/X OutputIntent object. If the *alternateSpace* is **DeviceGray** a PDF/X-1 conforming reader shall treat that as meaning the black separation of the CMYK identified by the PDF/X OutputIntent object.

A conforming reader is not required to reassemble data expressed in **Separation** colour spaces into a process colour image.

#### 6.3.4 Indexed and Pattern colour spaces

The *base* colour space of **Indexed** and **Pattern** colour spaces shall be one of **DeviceCMYK**, **DeviceGray**, **DeviceN**, or **Separation** as restricted by 6.3.2 and 6.3.3.

#### 6.3.5 Single tonal range files and spot colours

Printing tone values of spot colours shall be specified using **Separation** or **DeviceN** colour spaces. "Black" may be printed using the **DeviceGray** colour space or by using the Black **Separation** colour space. However, if **Separation** or **DeviceN** colour spaces are used, all the restrictions of 6.3.7 shall apply.

NOTE The use of the Black **Separation** colour space may cause a different overprinting behaviour than does that of the **DeviceGray** colour space unless the **OPM** key in the extended graphics state has a value of 1.

#### 6.3.6 Images tinted using OPI 2

The **Inks** value in an OPI 2.0 dictionary, if present, shall be *full_color*, *registration*, or an array containing *monochrome* as its first value. If the *monochrome* type is used, all ink names used shall be CMYK colorants.

Where externally referenced files contain graphic objects employing grayscale or bilevel data where the referencing OPI dictionary has a value of *Spot* for the **ColorType** key that data shall be regarded as having been defined in a **Separation** colour space and the provisions set out in 6.3.3 shall apply.

### 6.4 Fonts

Fonts that contain glyphs, related metrics, and font encodings for at least all the characters used shall be embedded within the file. The receiver shall use the embedded fonts (rather than other locally resident, substituted, or simulated fonts) for rendering and display. Unless special agreements are in place with the font copyright holder, only fonts that are publicly identified as legally embeddable in a file for display and rendering shall be used.

### 6.5 OPI references to embedded files

All OPI referenced files shall be included as **EmbeddedFiles** in the PDF/X-1 file prior to the exchange. See annex B. A conforming PDF/X-1a file shall not include any OPI references.

NOTE An OPI reference provides a location for externally referenced data and a set of values that describe and apply to the referenced data. Although the values expressible were derived from the *Open Prepress Interface Specification 1.3* [4] and the *Open Prepress Interface (OPI) Specification – Version 2.0* , this does not preclude the use of other image replacement schemes that can be mapped to the OPI dictionary.

The only allowable file types are as shown in table 1. The registered names for use in the **Subtype** key of an **EmbeddedFile** object are shown in table 1. The use of the **Subtype** key is required in an **EmbeddedFile** object.

NOTE TIFF/IT-CT/P1 is an application of TIFF 6.0 specifically for graphic arts use. Therefore, the use of TIFF/IT-CT/P1 is recommended for CMYK data.

**Table 1 — File types and registered names**

| File type | Registered name |
|---|---|
| TIFF/IT-FP/P1 [a] | *GTS_TIFFIT-FPP1* |
| TIFF/IT-CT/P1 [a] | GTS_TIFFIT-CTPa1 |
| TIFF/IT-LW/P1 [a] | *GTS_TIFFIT-LWP1* |
| TIFF/IT-HC/P1 [a] | *GTS_TIFFIT-HCP1* |
| TIFF/IT-BP/P1 [a] | *GTS_TIFFIT-BPP1* |
| TIFF/IT-BL/P1 [a] | *GTS_TIFFIT-BLP1* |
| TIFF/IT-MP/P1 [a] | *GTS_TIFFIT-MPP1* |
| TIFF 6.0 [b] | *GTS_TIFF-X1* |
| EPS [c] | *GTS_EPS_X1* |
| Desktop Color Separation (DCS) Version 2.0 and Version 1.0 [c] | *GTS_DCS_X1* |

[a] Limited as described in 6.12.
[b] Limited as described in 6.11.
[c] Limited as described in 6.10.

## 6.6 Related files

When the OPI referenced file is a set of files, all the files of the set shall be embedded using the **EF** key for the directly referenced file and the **RF** key for the indirectly referenced files as described in the PDF Reference Manual.

## 6.7 Previews

For externally referenced files, previews as defined in 3.19 shall be included. If the OPI referenced file has a preview image as defined in 3.20, this preview image shall be included in the PDF/X-1 file as an **Image XObject** object that references the OPI dictionary.

NOTE Some industry practices may require a preview image for all OPI referenced files. Appropriate trade practices should be followed.

## 6.8 Data compression

Data compression is not required. If data compression for PDF objects that are not **Image XObjects** is desired, only PDF-supported Flate and RunLength lossless data compression methods shall be used. PDF objects that are **Image XObjects** may be compressed using PDF-supported JPEG, Flate or RunLength compression or, for monochrome (one bit per sample) images, PDF-supported CCITT Fax compression.

## 6.9 Trapping

The **Trapped** key contained in the **Info** dictionary shall be used when exchanging files. The **Trapped** key indicates the state of trapping within the file. If the entire file has not been trapped then the value of the trap key shall be set to *False*. Otherwise, the entire file shall have been trapped as necessary, and the value of the trap key shall be set to *True*. Partially trapped files are not permitted. A value of *Unknown* for the trap key is prohibited in PDF/X-1 files.

If a file contains a TrapNet annotation, the value of the **Trapped** key in the **Info** dictionary shall be *True*.

NOTE If the page contents are edited after the creation of a TrapNet annotation the TrapNet annotation will no longer be valid.

The **FontFauxing** key in a TrapNet annotation shall either not be present, or shall be an empty array. In a PDF/X-1 conforming file the value of the **PCM** key in the appearance dictionary of a TrapNet annotation shall be *DeviceCMYK*.

### 6.10 Limitations to use of EPS and DCS externally referenced files

All EPS (as defined in Adobe Technical Note #5002) and DCS (as defined in *Desktop Color Separation Specification 2.0*) files shall contain PostScript as defined in the *PostScript Language Reference Manual*, and pseudo operators as defined in Adobe Technical Note #5044. The only painting operators and pseudo operators permitted in externally referenced EPS and DCS files are: **image**, **colorimage**, **imagemask**, **customcolorimage**, and **separationimage**. However, clipping paths that are vector elements are allowed in externally referenced EPS and DCS files only in order to facilitate common cropping and silhouette functions. EPS and DCS files shall not contain transfer functions.

NOTE This restricts the imageable content of externally referenced EPS and DCS files to raster data.

EPS and DCS files may include screening parameters. Any specification of screening parameters shall be compatible with the characterized printing conditions and shall use the **TransferFunction** key in a halftone dictionary only where required by the *PostScript Language Reference Manual*. Conforming readers may ignore the screening parameters, if present. See annex D. All halftone dictionaries included in embedded EPS and DCS files must be of types 1, 2 or 5.

NOTE This prohibits threshold screens that will produce different appearances at different resolutions, and halftone dictionaries containing proprietary data.

EPS and DCS files shall not be compressed using LZW.

Externally referenced EPS files shall not contain an embedded ICC profile. All **Separation** or **DeviceN** colour spaces in externally referenced EPS files shall use **DeviceCMYK**, or **DeviceGray** for their *alternateSpace* and the provisions set out in 6.3.3 shall apply.

The *base* colour space of **Indexed** colour spaces in externally referenced EPS files shall be one of **DeviceCMYK**, or **DeviceGray**, or **DeviceN** and the provisions set out in 6.3.4 shall apply.

The underlying colour space of **Pattern** colour spaces in externally referenced EPS files shall be one of **DeviceCMYK**, **DeviceGray, DeviceN**, or **Separation**.

If the externally referenced EPS or DCS file comprises a single monochrome plane and the referencing OPI object includes the definition of a colour to be applied, that colour shall be used for that file.

### 6.11 Limitations to the use of TIFF 6.0 externally referenced files

The use of TIFF 6.0 for CMYK files is restricted to files conforming to TIFF/IT-CT/P1 with the exception that the CMYK data may be represented using TIFF **Compression**=7 as defined in *DRAFT TIFF Technical Note #2*.

The use of TIFF 6.0 for grayscale files is limited to baseline grayscale with the exception that the data may be represented using TIFF **Compression**=7 as defined in *DRAFT TIFF Technical Note #2*.

For JPEG, only Baseline DCT or Extended sequential DCT compressed images are permitted in an externally referenced TIFF 6.0 file. The image so compressed shall consist of one scan and one frame. Zero-size images are invalid. Colour transformations prior to compression shall not change the number of colour components.

The use of TIFF 6.0 for bilevel files is limited to baseline bilevel with the exception that the data may be represented using TIFF **Compression**=3 (CCITT T.4) or TIFF **Compression**=4 (CCITT T.6).

An externally referenced TIFF file shall not contain an embedded ICC profile. If the externally referenced TIFF 6.0 file comprises a single monochrome plane and the referencing OPI object includes the definition of a colour to be applied, that colour shall be used for that file.

### 6.12 Limitations to the use of TIFF/IT-P1 externally referenced files

If the externally referenced TIFF/IT-P1 file comprises a single monochrome plane and the referencing OPI object includes the definition of a colour to be applied, that colour shall be used for that file.

### 6.13 PDF file identification

A PDF/X-1 file shall be so identified using the **GTS_PDFXVersion** key in the **Info** dictionary. The type of the value of the **GTS_PDFXVersion** key is string.

The value of the **GTS_PDFXVersion** key for files prepared in accordance with this part of ISO 15930 is (PDF/X-1:2001).

A PDF/X-1a conforming file shall be further identified using the **GTS_PDFXConformance** key in the **Info** dictionary. The type of the value of the **GTS_PDFXConformance** key is string. The value of the **GTS_PDFXConformance** key in a PDF/X-1a conforming file shall be (PDF/X-1a:2001).

The **GTS_PDFXConformance** key may be present in a PDF/X-1 conforming file which is not also a PDF/X-1a conforming file. In such cases the value shall be (PDF/X-1:2001).

All PDF/X-1 files shall contain the following key value pairs in the **Info** dictionary and their keywords shall be filled in prior to exchange: **CreationDate**, **ModDate**, and **Title**.

The **Creator** and **Producer** keywords in the **Info** dictionary should be filled in prior to exchange.

The **ID** key in the **trailer** shall be used.

### 6.14 Bounding boxes

Each **Page** object of a PDF/X-1 file shall include a **MediaBox.** Each **Page** object shall include one, but not both, of **TrimBox** or **ArtBox**. The **MediaBox** may be included by inheritance.

If the **BleedBox** is present, the **ArtBox** or the **TrimBox** shall not extend beyond the boundaries of the **BleedBox**. If the **CropBox** is present, the **ArtBox** or the **TrimBox** shall not extend beyond the boundaries of the **CropBox**.

NOTE 1 Some industry practices may require the use of the **BleedBox**. Appropriate trade practices should be followed.

NOTE 2 The use of **TrimBox** is recommended over the use of **ArtBox**.

### 6.15 Extended Graphics state

A conforming PDF/X-1 file shall not contain the transfer function key (**TR** or **TR2**) or halftone phase (**HTP**) keys within an **ExtGState** resource.

A conforming reader may ignore the halftone key (**HT**). See annex D.

Use of the halftone key (**HT**) shall be consistent with the characterized printing conditions and shall make use of the **TransferFunction** key in a halftone dictionary only as required by the PDF Reference Manual.

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

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

Halftones in a conforming PDF/X-1 file shall not contain a **HalftoneName** key.

### 6.16 PostScript XObject and the PS operator

A PDF/X-1 file shall not contain instances of the **PostScript XObject** and/or the **PS** operator.

### 6.17 Use of the Encrypt dictionary

The **Encrypt** dictionary may be used to set access rights to a PDF/X-1 compliant file, if desired. No encryption other than **Standard** encryption shall be used. If the **Encrypt** dictionary is used, the value of the **U** key in the **Encrypt** dictionary shall be such that the password is an empty string, and bit 3 of the value of the **P** key in the **Encrypt** dictionary shall be set to 1 to enable printing.

NOTE Because printing is always enabled, this use of encryption does not prevent viewing the contents of the file. However, other access rights controlled by the **P** key, such as those controlling changes to the document and copying the content of the document, may be selectively enabled or disabled. If these features are disabled, the user may only be able to print the document.

A PDF/X-1a compliant file shall not contain an **Encrypt** dictionary.

### 6.18 Alternate Images

An **Image XObject** in a PDF/X-1 conforming file that includes alternate images shall have no alternate where **DefaultForPrinting** is set to true.

NOTE This means that the image that is viewed by default will also be printed by default.

All images included in the **Alternate** array of an **Image XObject,** and the base image, shall represent the same area of the same master image, and may differ only in colour space, bit depth, resolution, compression, and encoding.

### 6.19 Annotations

All Annotations other than PDF Trapping annotations shall have extensions lying completely outside the **BleedBox** (or the **TrimBox** or **ArtBox** if no **BleedBox** is present). A PDF/X-3 reader may completely ignore annotations except for PDF trapping annotations.

NOTE 1 A list of annotation types can be found in the section "Annotations" of the PDF Reference Manual.

NOTE 2 This provision guarantees that when a page from a PDF/X-1 file is rendered on a screen by a PDF viewing application, the visual impression of the actual page is not obscured by such annotations. Also, this provision avoids unexpected behaviour of PDF files viewed on screen by using invisible interactive elements inside the page area.

NOTE 3 As Acrobat Forms elements are a special case of annotations, the same rules apply as for other annotation types.

### 6.20 Actions and JavaScripts

A conforming PDF/X-1 file shall not include Actions or JavaScripts.

### 6.21 Use of the BX/EX operators

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

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

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

NOTE 2 It is recommended that a PDF/X-1 writer not use of the **BX**/**EX** operators.

# Annex A
(informative)

# PDF feature summary

Table A.1 lists those PDF objects, and keys within those objects, where the requirements of PDF/X-1 vary from those of the PDF Reference Manual. Each record in the table notes the status of the object, or key, and the section of this specification where the status is defined. Statuses used are:

| | |
|---|---|
| Required | A conforming file shall contain this object or key. |
| Prohibited | A conforming file shall not contain this object or key. |
| Restricted | Certain values or combinations of values with contents are required or prohibited. See the section(s) referenced for full details. |
| Recommended | It is recommended that all conforming files include this key. |

A conforming PDF/X-1 file also conforms to the PDF Reference Manual; that is, it includes all objects, keys and values noted as required in that manual, and may not contain objects, keys or values which are prohibited by the manual singly or in combination. A conforming reader may support all other objects, keys and values as defined in the normative references specifying PDF file structure as desired.

If a reference to a PDF dictionary object is included in the table, but keys within that object are not explicitly listed, then all keys within that object and its descendants (if any) inherit their status from the item which is shown in the table. If any keys within a dictionary object are explicitly listed in the table then a conforming reader is not required to support any other keys (or their descendants) within that object type unless they are required by the PDF Reference Manual, nor are other keys prohibited.

An object is descendant from another object (called the ancestor) if 1) it is the value of a key in the ancestor object, 2) the ancestor object is an array and the descendant object is an element of that array, or 3) the descendant object is a descendant of a descendant of the ancestor object.

If a key or object is noted as required, all ancestor objects required to access it from the document's **Trailer** are also required; e.g., the **Trapped** key in the **Info** object is required, therefore the **Info** object itself is required.

All operators defined in the normative references for use in PDF **Contents** streams may be included in a conforming PDF/X-1 files, except for those listed below:

Operators which are prohibited for use in PDF/X-1 files:

| Operator | Effect | Reference |
|---|---|---|
| **PS** | execute in-line PostScript | 6.16 |
| **rg** | set fill colour in RGB | 6.3 |
| **RG** | set stroke colour in RGB | 6.3 |
| **ri** | set colour rendering intent | 6.3 |

Operators which a conforming reader is expected to parse in a **Contents** stream, but is not required to act on beyond removing appropriate numbers of objects from the operand stack:

| Operator | Effect |
|---|---|
| **BX** | Begin section where undefined page operators are not reported |
| **EX** | End section where undefined page operators are not reported |
| **BMC** | Begin marked content |
| **BDC** | Begin marked content with property list |
| **EMC** | End marked content |
| **MP** | Mark point |
| **DP** | Mark point with property list |

**Table A.1 — PDF objects for which the PDF/X-1 requirements varies from the PDF Reference Manual**

| Objects | Keys | Status | References |
|---|---|---|---|
| **Trailer** | **ID** | Required | 6.13 |
| | **Encrypt** | Restricted in PDF/x-1<br>Prohibited in PDF/X-1a | 6.17 |
| **Info** | **CreationDate** | Required | 6.13 |
| | **Creator** | Recommended | 6.13 |
| | **GTS_PDFXConformance** | Required in PDF/X-1a | 6.13 |
| | **GTS_PDFXVersion** | Required | 6.13 |
| | **ModDate** | Required | 6.13 |
| | **Producer** | Recommended | 6.13 |
| | **Title** | Required | 6.13 |
| | **Trapped** | Required | 6.9 |
| **Page** | **ArtBox** | Restricted | 6.14 |
| | **TrimBox** | Restricted | 6.13 |
| **Resources** | **ColorSpace** | Restricted | 6.3 |
| | **Fonts** | Required if text is used | 6.4 |
| | **PS XObject** | Prohibited | 6.16 |
| **Alternate** | **Image XObject** | Restricted | 6.18 |
| **ExtGState** | **HTP** (Halftone Phase) | Prohibited | 6.15 |
| | **HT** (Halftone) | Restricted | 6.15 |
| | **TR** (Transfer Function) | Prohibited | 6.15 |
| | **RI** (Rendering Intent) | Prohibited | 6.2 |
| **Font** | **FontDescriptor** | Required if text in fonts other than Type 3 is used | 6.4 |
| **FontDescriptor** | **FontFile** or **FontFile2** or **FontFile3** | Required if text in Type 1, Truetype, or Type 1 Compact fonts is used, depending on font type [a] | 6.4 |
| **TrapNet annotation** | **FontFauxing** | Restricted | 6.9 |
| | **PCM** | Restricted | 6.9 |
| Action Dictionaries | All | Prohibited | 6.19 |
| **File specification** | **EF** | Required if OPI references are used [b] | 6.6 |
| | **RF** | Required if OPI references are used which require more than a single file [b] | 6.6 |
| **EmbeddedFiles** | **Subtype** | Required if OPI references are used [b] | 6.5 |
| | Stream contents | Restricted | 6.5, 6.10, 6.11, 6.12 |
| **Streams** | **Filter** | Restricted | 6.8 |

[a] Type 1 Compact fonts are sometimes described as CFF fonts.
[b] PDF/X-1a compliance level does not permit OPI.

# Annex B
(informative)

# OPI, external references, external files and streams

PDF/X-1 allows the use of externally referenced files using the OPI mechanisms described in the normative references (PDF Reference Manual). However, this part of ISO 15930 requires that all such externally referenced files be included in the PDF file as stream objects. Therefore, although OPI high resolution image data are not expressed as a PDF Image Object, and are thus external to PDF, they are still embedded in the single PDF/X-1 exchange.

PDF supports streams to contain data that are not expressed using the PDF syntax or structure. Such streams require the use of well-defined filters so that receiving applications can process them appropriately. There is a distinction between externally referenced files included as streams, however, and those that are actually external to the file. PDF 1.3 can support either mechanism, though PDF/X-1 supports only the former.

# Annex C
(informative)

# Minimal requirements for PDF/X OutputIntent objects

The International Color Consortium (ICC) has established a registry for characterization data of standard printing processes. Recognized standards organizations may provide data for inclusion in the registry. This registry is maintained by the ICC Secretariat.

The ICC does not endorse any data referenced by the registry.

Each printing process is identified by a short name (the Reference name in the ICC characterization data registry). The registry provides full details of the printing system and indicates where and how measurement data may be obtained. The format of the measurement data is not specified by the ICC, but it is anticipated that a simple format such as IT8 or ISO format for measurement data will be used. Such data formats are fully identified in the registry.

It is recommended that the short name of a characterization printing condition be used as the value of the **OutputConditionIdentifier** key in a PDF/X OutputIntent object wherever possible.

# Annex D
(informative)

# Clarifications

## D.1 General

This annex identifies several issues that warrant additional clarification. A more complete discussion is included in *Application Notes for ISO PDF/X* standards available from NPES The Association for Suppliers of Printing, Publishing and Converting Technologies in the standards section at http://www.npes.org/standards/workroom.html.

## D.2 Copydot information included as bilevel data

Copydot scans of pre-screened data (high resolution scans of halftone films) or equivalent electronically generated bit-mapped files are included as bilevel data, either as **Image XObjects** or external files. Unless the resolution of the copydot data has an integer relationship with the imaging device resolution, undesirable imaging artefacts may occur.

The resolution of a bilevel image, whether an **Image XObject** or an external file, can be obtained from the object or file either from keys or tags in the object or file or, for EPS or DCS files, by interpreting the PostScript therein. Such information may therefore be extracted, if desired, for pre-flight or other verification applications.

To ensure consistent reproduction copydot information needs to be prepared to conform to the reference printing condition of the PDF/X-1 file.

## D.3 Specification of screening parameters

The general approach envisioned for PDF/X-1 data exchanges is that the receiving system is responsible for the screening of the data consistent with the characterized printing condition specified for the file. However, in some workflows there is a need to specify specific screening parameters for certain images. All mechanisms for including contone images within a PDF/X-1 file, either as externally referenced files or as **Image XObjects**, except for TIFF/IT or TIFF files, include the ability to specify screening parameters. As noted in this part of ISO 15930, it may be appropriate for some applications to ignore these parameters if present. Where an originator of a PDF/X-1 file feels that screening parameters are important to achieve a particular imaging requirement, and should not be ignored, that requirement needs to be communicated to the receiver of the file as part of the business data relating to the particular advertisement or printing job.

## D.4 Fonts

This part of ISO 15930 requires the embedding of fonts needed for output. The license agreements for some fonts do not permit their embedding. This prohibits the use of these fonts in PDF/X-1 files. The creator of the file is expected to ensure that all fonts are used in compliance with their licensing agreements.

# Bibliography

[1] *Application Notes for ISO PDF/X standards*, http://www.npes.org/standards/workroom.html

[2] ISO/IEC 9541-1:1991, *Information technology — Font information interchange — Part 1: Architecture*

[3] ISO 15930-2: —[1], *Graphic technology — Prepress digital data exchange — Use of PDF — Part 2: Guidelines for partial exchange of printing data (PDF/X-2)*

[4] *Open Prepress Interface Specification 1.3*, 22 September 1993, Aldus Corporation, partners.adobe.com/asn/developer/pdfs/tn/OPI_13.pdf

[1] To be published.

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