IEEE-ISTO
Printer Working Group
Portable Document Format: Image-Streamable
(PDF/is)

Working Draft
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Maturity Level: Stable

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Abstract: This document specifies an application of PDF (Portable Document Format) that has two important properties: First, it is an "image"-based format, and proper rendering of the document is represented by (binary or color) images. Second, the format is suitable for incremental generation and thus it is a "streaming" format. The subset is called "PDF/is", for "PDF Image-Streamable".

PDF/is is formally a subset of PDF 1.4, and is intended to be fully compatible with software that reads PDF 1.4. There are "profiles" of PDF/is, which are distinguished primarily by the methods if image compression and/or techniques employed. The representations of image data employed are specified in the PDF 1.4 language reference [pdf], which in turn describes the PDF representation of image data specified by ITU-T recommendations for black-and-white facsimile ([t.4], [t.6]), ISO/IEG specifications for digital compression and coding of continuous-tone still images [jpeg], and lossy/lossless coding of bi-level images [jbig2].

PDF/is is intended to be useful within the IPPFAX protocol [reference], which is used to provide a synchronous, reliable exchange of image documents between senders and receivers. For this reason, PDF/is also includes an optional security features for digital signaturing.

59 This document is available electronically at:
60   ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20040116.pdf,
61   ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20040116.doc

62
63 A version showing the changes from the previous version is available at:
64   ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20040116-rev.pdf

65 The latest version of this specification is available at:
66   ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-latest.pdf,
67   ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-latest.doc

68 For a definition of "Maturity Level" used on the title page, along with any other questions about
69 the Printer Working Group's processes, please see the PWG process document [process].

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About the IEEE-ISTO PWG

The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and Technology Organization (ISTO) with member organizations including printer manufacturers, print server developers, operating system providers, network operating systems providers, network connectivity vendors, and print management application developers. The group is chartered to make printers and the applications and operating systems supporting them work together better. All references to the PWG in this document implicitly mean "The Printer Working Group, a Program of the IEEE ISTO." In order to meet this objective, the PWG will document the results of their work as open standards that define print related protocols, interfaces, procedures and conventions. Printer manufacturers and vendors of printer related software will benefit from the interoperability provided by voluntary conformance to these standards.

In general, a PWG standard is a specification that is stable, well understood, and is technically competent, has multiple, independent and interoperable implementations with substantial operational experience, and enjoys significant public support.

For additional information regarding the Printer Working Group visit: http://www.pwg.org

Contact information:

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           subscribe ifx
           end

Implementers of this specification are encouraged to join the IFX Mailing List in order to participate in any discussions of clarifications or review of registration proposals for additional names. Requests for additional media names, for inclusion in this specification, should be sent to the IFX Mailing list for consideration.

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216

217 # 1   Introduction

218
219   This document specifies an application of PDF (Portable Document Format) that has two
220   important properties: First, it is an "image"-based format, and proper rendering of the document is
221   represented by (binary or color) images. Second, the format is suitable for incremental generation
222   and thus it is a "streaming" format. The subset is called "PDF/is", for "PDF Image-Streamable".

223   PDF/is is formally a subset of PDF 1.4, and is intended to be fully compatible with software that
224   reads PDF 1.4. There are "profiles" of PDF/is, which are distinguished primarily by the methods if
225   image compression and/or techniques employed. The representations of image data employed
226   are specified in the PDF 1.4 language reference [pdf], which in turn describes the PDF
227   representation of image data specified by ITU-T recommendations for black-and-white facsimile
228   ([t.4], [t.6]), ISO/IEG specifications for digital compression and coding of continuous-tone still
229   images [jpeg], and lossy/lossless coding of bi-level images [jbig2].

230   PDF/is is intended to be useful within the IPPFAX protocol [ifx], which is used to provide a
231   synchronous, reliable exchange of image documents between senders and receivers. For this
232   reason, PDF/is also includes an optional security features for digital signaturing.

233 # 2   Terminology

234   This section defines terminology used throughout this document.

235 ## 2.1   Conformance Terminology

236   Capitalized terms, such as **MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY,**
237   **NEED NOT, OPTIONAL,** and **PROHIBITED**, have special meaning relating to conformance as
238   defined in RFC 2119 [rfc2119] and [rfc2911] section 12.1. If an implementation supports the
239   extension defined in this document, then these terms apply; otherwise, they do not. These terms
240   define conformance to *this document (and [rfc2911]) only*; they do not affect conformance to
241   other documents, unless explicitly stated otherwise. To be more specific:

242   **REQUIRED (REQ)** - an adjective used to indicate that a conforming PDF/is Producer or
243   Consumer's implementation MUST support the indicated operation, object, attribute, or attribute
244   value. See [rfc2911] "Appendix A - Terminology for a definition of "support".

245   **RECOMMENDED (REC)** - an adjective used to indicate that a conforming PDF/is Producer or
246   Consumer's implementation SHOULD support the indicated operation, object, attribute, or
247   attribute value.

248   **OPTIONAL (OPT)** - an adjective used to indicate that a conforming PDF/is Producer or
249   Consumer's implementation MAY support the indicated operation, object, attribute, or attribute
250   value.

251   **PROHIBITED (PROH)** - an adjective used to indicate that a conforming PDF/is Producer or
252   Consumer's implementation MUST NOT support the indicated operation, object, attribute, or
253   attribute value.

254   **AS SPECIFIED** – is used to indicate that a conforming PDF/is Producer or Render
255   implementation MUST, MAY, or MUST NOT support the indicated operation, object, attribute, or
256   attribute value as is defined in the indicated specification.

257   **OR** – a conjunction that specifies a logical 'or', implying that a choice of one or more of the
258   choices specified.

259   ## 2.2   Other Terminology

260   The following terms are introduced and capitalized in order to indicate their specific meaning:
261
262   **Implement** – The specified feature is present in the Document.
263
264   **Support** – A Producer has the capability of Implementing the feature specified, or the Consumer
265   has the capability of understanding and acting on the Implementation.
266
267   **Document** – The PDF/is-formatted electronic representation of a set of one or more pages that
268   the Sender sends to the Receiver.
269
270   **Consumer** – This is the agent (software, hardware or some combination) that converts the
271   Document into a displayed or printed form.

272   **Producer** -- This is the agent (software, hardware or some combination) that creates the
273   Document.

274   **Forward-Reference** – In indirect object reference (See [pdf] Section 3.2.9) or a Resource Name
275   (See Section 4.10) that refers to an object that appears later in the Document.

276   **Cache** – Consumer's storage, either memory, disk, or the like, to hold Document data as it's
277   received from the Producer.

278   **Page-Relative Objects** – Objects that are indirectly referenced (See [pdf] Section 3.2.9) by either
279   a 'Page' Dictionary or through a chain of object references that start with a reference from a
280   'Page' Dictionary.

281   **Discarded** – An adjective that describes a PDF object. An object is 'Discarded' when the
282   Consumer no longer has access to the data within the object in question.

283   **Object Size** – The number of bytes required to represent an object in the Document. The size is
284   calculated by subtracting the offset of the first byte of the line following the "endobj" of the object
285   in question, from the offset of the first byte of the *object number* (See [pdf] Section 3.2.9).

286   **Imaging Area** – For the Producer, the Imaging Area of a page is the area specified by the Page
287   Dictionary's 'MediaBox'. The Producer should use the actual area images from the source media
288   for the 'MediaBox'. This would be the size of the input media for an edge-to-edge scan, for
289   example. For the Consumer, the Imaging Area is an area on the output media that will contain all
290   of the page's image content (the "inking" area). The Consumer usually uses the output media's
291   printable area as the Imaging Area but may constrain it further to match the Producer's Imaging
292   Area.

293   **Scaled Page** – When the Consumer's Imaging Area does not match the Producer's Imaging Area
294   within 1/72 of an inch in either height OR width, the page is considered to be a Scaled Page.

295 **Horizontal Scaling Factor** – The Horizontal Scaling Factor is equal to the Consumer's Imaging
296 Area width divided by the Producer's Imaging Area width, but MUST be 1.0 for a non-Scaled
297 Page.

298 **Vertical Scaling Factor** – The Vertical Scaling Factor is equal to the Consumer's Imaging Area
299 height divided by the Producer's Imaging Area height, but MUST be 1.0 for a non-Scaled Page.

300 **Originator Identifier** – An Image XObject that indicates information about the originator of the
301 Document. See the protocol spec referencing this specification for details on what the 'Originator
302 Identifier' MUST contain.

303 **Nearest-Neighbor Interpolation** – A two-dimensional interpolation of pixel values in which the
304 amplitude of the interpolated sample is the amplitude of its nearest neighbor.

305 **Bilinear Interpolation** – A two-dimensional linear interpolation of pixel values based on the four
306 pixels in a 2 x 2 pixel neighborhood.

307 **Bicubic Interpolation** – A two-dimensional cubic interpolation of pixel values based on the 16
308 pixels in a 4 x 4 pixel neighborhood.

309 # 3   PDF Document Requirements

310 The following table specifies the required (REQ), prohibited (PROH), and optionally (OPT)
311 Supported PDF objects/filters for a Producer and Consumer to be considered compliant with
312 this specification. Requirements for a specific object/filter to be considered Supported can be
313 found in the 'PDF Object Requirements' section of this specification.
314

315 **Table 3-1: PDF Object Requirements**

PDF Object/Filter	Producer	Consumer	Reference
'ASCIIHexDecode' Filter	PROH	PROH	[pdf] Section (3.3.1)
'ASCII85Decode' Filter	PROH	PROH	[pdf] Section (3.3.2)
'LZWDecode' Filter	PROH	PROH	[pdf] Section (3.3.3)
'RunLengthDecode' Filter	PROH	PROH	[pdf] Section (3.3.4)
Incremental Updates	PROH	PROH	[pdf] Section (3.4.5)
Functions	PROH	PROH	[pdf] Section (3.9)
File specification	PROH	PROH	[pdf] Section (3.10)
Graphics State Parameter Dictionaries	PROH	PROH	[pdf] Section (4.3.4)
Path objects	PROH	PROH	[pdf] Section (4.4)
'DeviceGray' Color Space	PROH	PROH	[pdf] Section (4.5.3)
'DeviceRGB' Color Space	PROH	PROH	[pdf] Section (4.5.3)
'DeviceCMYK' Color Space	PROH	PROH	[pdf] Section (4.5.3)
Pattern Color Space	PROH	PROH	[pdf] Section (4.5.5)
Separation Color Space	PROH	PROH	[pdf] Section (4.5.5)
DeviceN Color Space	PROH	PROH	[pdf] Section (4.5.5)
Pattern Objects	PROH	PROH	[pdf] Section (4.6)
Inline Image Objects	PROH	PROH	[pdf] Section (4.8.6)
Form Xobjects	PROH	PROH	[pdf] Section (4.9)
Postscript Xobjects	PROH	PROH	[pdf] Section (4.10)
Font Objects	OPT	OPT	[pdf] Section (5)
Transparency	PROH	PROH	[pdf] Section (7)

Name Tree	PROH	PROH	[pdf] Section (3.8.4)
Number Tree	PROH	PROH	[pdf] Section (3.8.5)
'FlateDecode' Filter	OPT	REQ	[pdf] Section (3.3.3)
'CCITTFaxDecode' Filter	REQ	REQ	[pdf] Section (3.3.5)
File Header	REQ	REQ	[pdf] Section (3.4.1)
Cross-Reference Table	REQ	REQ	[pdf] Section (3.4.3)
File Trailer	REQ	REQ	[pdf] Section (3.4.4)
Document Catalog	REQ	REQ	[pdf] Section (3.6.1)
Page Tree Nodes	REQ	REQ	[pdf] Section (3.6.2)
Page Dictionary	REQ	REQ	[pdf] Section (3.6.2)
Content Streams	REQ	REQ	[pdf] Section (3.7.1)
Resource Dictionaries	REQ	REQ	[pdf] Section (3.7.2)
Image XObjects	REQ	REQ	[pdf] Section (4.7)
'JBIG2Decode' Filter	OPT	REQ	[pdf] Section (3.3.6)
'DCTDecode' Filter	OPT	REQ	[pdf] Section (3.3.7)
Encryption Dictionary	PROH	PROH	[pdf] Section (3.5)
'DeviceGray' Color Space	PROH	PROH	[pdf] pg. 182, See "ICCBased Color Space" section of this specification.
'DeviceRGB' Color Space	PROH	PROH	[pdf] pg. 184, See "ICCBased Color Space" section of this specification.
'Lab' Color Space	PROH	PROH	[pdf] pg. 187
'ICCBased' Color Space	REQ	OPT, See 'ICCBased Color Space' Section.	[pdf] pg. 189
'Indexed' Color Space	OPT	REQ	[pdf] pg. 199
Masked Images	OPT	REQ	[pdf] Section (4.8.5)
Interactive Form Dictionary and Annotation Field Dictionary and Signature Dictionary (Security Profile <DIG-SIG>)	OPT	OPT	[pdf] Section (8.6.1-3) [pdf-ppk] Section (2)
Cached Objects	REQ	REQ	Section 3.4
Banding	OPT	REQ	Section 3.3.11.3
Document Information Dictionary	OPT	OPT	[pdf] Section 9.2.1

316

317   3.1   File Layout (Informative)

318   Given that a Document is fully compliant with this specification, the Document will, nominally,
319   have the following layout:

320   **Table 3-2: File Layout**

	Object
	Object
A	'PDF/is' Dictionary.
B	Page Dictionary for page 'n'
C	Content Stream 'a' for page 'n'
D	Image XObject 'x' for page 'n', stream 'a'
E	Color Space for image 'x' (cached), if not already loaded
F	Image Mask for image 'x', stream 'a', page 'n', if image is masked
G	[Repeat D-F for next Image 'x+1', stream 'a', page 'n', if present]
H	[Repeat C-G for next stream 'a+1' on page 'n', if present]

I	Content Stream Array for page 'n' (See Page Dictionary)
J	Resource Dictionary for page 'n'.
K	[Repeat B-J for next page 'n+1', if present]
L	Document Catalog
M	Page Tree Node(s)
N	Interactive Form Dictionary (If digitally signed)
O	Annotation Field Dictionary (If digitally signed)
P	Signature Dictionary (If digitally signed)
Q	Cross-Reference Table (See [pdf] Section 3.4.3)
R	File Trailer

321

322   4   PDF Object Requirements

323   The following sub-sections describe the object field values of the REQUIRED and OPTIONAL
324   PDF objects in PDF/is. The numbers in '( )'s refer to section numbers in the PDF Specifications
325   [pdf], unless otherwise noted. 'AS SPECIFIED' refers to the PDF Specification [pdf] unless
326   otherwise noted.

327   All 'Required' and 'Optional' fields of a Document object (either specified here or referred to as
328   'Required' or 'Optional' in [pdf] or [pdf-ppk]) MUST be Supported if the object in question is to be
329   considered 'Supported by the Consumer'. This rule does not apply if the definition of an object
330   specifically states the requirements for the Consumer.

331   Support for all 'Required' fields of a Document object (either specified here or referred to as
332   'Required' in [pdf] or [pdf-ppk]) is REQUIRED if the object in question is to be considered
333   'Supported by the Producer'. Support for all 'Optional' fields of a Document object is OPTIONAL
334   for the Producer. This rule does not apply if the definition of an object specifically states the
335   requirements for the Producer.

336   4.1   'PDF/is' Dictionary

337   The 'PDF/is' Dictionary is a new Dictionary object that is REQUIRED for a PDF/is document.

338   The existence of this dictionary object is the one and only way to determine if the PDF in question
339   is a PDF/is Document. The references in this object to items referred to in the Document Trailer
340   are necessary to satisfy 'Producer Requirement' #6, see Section 4.1.

341   **Table 4-1: PDF/is Dictionary**

Field	Type	Specification
'Type'	Name	MUST have a value of '/Fis_PDFis'.
'Fis_Version'	Number	REQUIRED: A Real number of the format **MAJ_VER.MIN_VER**. (See below)
'Info'	Dictionary	MUST have same value as 'Info' field in the 'Document Trailer'. See [pdf] Table 3.12 for specification.
'ID'	Array	MUST have same value as 'ID' field in the 'Document Trailer'. See [pdf] Table 3.12 for specification.
'Fis_NextPage'	Dictionary	REQUIRED: MUST be an Indirect Object Reference to the first 'Page Dictionary'.
'Fis_DSig'	Dictionary	OPTIONAL: MUST be an Indirect Object Reference to the

		'Signature Dictionary', if present.
'Fis_OrigID'	Dictionary	OPTIONAL: MUST be an Indirect Object Reference to the 'Originator Identifier' Image XObject, if present.
'Fis_Duplex'	Boolean	REQUIRED: MUST be 'false' unless the Document is known to be duplex and all odd numbered pages precede all even numbered pages (1, 3, 5,…, n*2 - 1, 2, 4, 6, …, n*2) – note that the last page (n*2) is optional since the Document may have an odd number of pages. See 'Page Ordering'.

342

343   See [pdf] Section 3.2.5 for definition of an 'Array Object'. See [pdf] Section 3.2.2 for definition
344   of a 'Numeric Object'.

345   **4.1.1   Fis_PDFis Key**

346   **4.1.1.1   MAJ_VER:**

347   The 'major' version number of this PDF/is specification to which the Producer conforms to
348   at the time the Document was created. The 'major' version of this specification is
349   currently '1'.

350   **4.1.1.2   MIN_VER:**

351   The 'minor' version number of this PDF/is specification to which the Producer conforms to
352   at the time the Document was created. The 'minor' version of this specification is
353   currently '0'.

354   **4.1.1.3   Example**

355   An example of the PDF/is Dictionary for an encrypted, digitally signed, Document that
356   needs a 4 Megabyte cache might look like this:

```
357            1 0 obj
358            <<
359                    /Type /Fis_PDFis
360                    /Fis_Version 1.0
361                    /Encrypt 2 0 R
362                    /Root 3 0 R
363                    /Info 4 0 R
364                    /ID [<8c41995c6e014675e850d36e6c2f6114><8c41995c6e014675e850d36e6c2f6114>]
365                    /Fis_NextPage 5 0 R
366                    /Fis_DSig 6 0 R
367            >>
368            endobj
```

369   **4.2   PDF/is Format Identification**

370   To refer to this version of the PDF/is specification from another specification, the string
371   "PDF/is-1.0" should be used.

372

373   **4.3   'CCITTFaxDecode' Filter**

374   See [pdf] Section 3.3.5, [t.4], and [t.6]. Note that only 'Group 4' images are Supported by PDF/is,
375   see 'K', below.

376   **Table 4-2: CCITTFaxDecode Filter**

Field	Specification
'K'	MUST have a value of -1.
'EndOfLine'	AS SPECIFIED
'EncodedByteAlign'	AS SPECIFIED
'Columns'	AS SPECIFIED
'Rows'	AS SPECIFIED
'EndOfBlock'	AS SPECIFIED
'BlackIs1'	AS SPECIFIED
'DamagedRowsBeforeError'	AS SPECIFIED

377

378   **4.4   'JBIG2Decode' Filter**

379   See [pdf] Section 3.3.6, [jbig2], and [t.89].

380   **Table 4-3: JBIG2Decode Filter**

Field	Specification
<All Details>	AS SPECIFIED, except as noted below.

381

382   • Consumers MUST support **Profile 1** (0x00000101 BASE), **Profile 2** (0x00000102 Upper
383   Huffman), **Profile 3** (0x00000103 Lower Arithmetic) and **Profile 4** (0x00000104 Medium
384   lossy/lossless arithmetic) as defined in [t.89]. Support for JBIG2 is OPTIONAL for the
385   Producer. The Producer MUST NOT Implement any profile other than one of the four
386   specified, above.

387   • All Consumers MUST support at least "Level 2" Memory (See [t.89], Table 1, Item 18).

388   • The Producer MUST adhere to the Function and Memory constraints as specified in
389   [t.89].

390

391   **4.5   'DCTDecode' Filter**

392   See [pdf] Section 3.3.7, [ps-jpeg], [ps], and [jpeg].

393   PDF/is supports both the JPEG Baseline DCT and Extended sequential DCT compressed image
394   formats.

395   **Table 4-4: DCTDecode Filter**

Field	Specification
<All Details>	AS SPECIFIED, except as noted below.

396

397   • Images MUST NOT be encoded using 'Progressive JPEG'.

398   • Images MUST have either 1 or 3 color components.

399   • All 3 component images (RGB, or YUV) MUST have their component data 'interleaved'.
400   See [jpeg] Section 4.8.1.

401 • YUV encoding (See [pdf] pg. 60) is the RECOMMENDED encoding for image data.
402   Rationale: Separation of luminance and chrominance information can facilitate greater
403   image compression and simplifies the process of converting color image data to
404   grayscale for Consumers that do not support color.

405 • The Consumer MUST adhere to the Memory requirements specified in Section 11 "RAM
406   Requirements" of [ps-jpeg] for the Consumers Supported image resolution(s).

407 4.6 'FlateDecode' Filter

408 See [pdf] Section 3.3.3.

409 'Flate' encoding MUST NOT be used to compress image data. 'Flate' MAY only be used to
410 compress non-image stream data, such as 'ICCBased Color Space' data, 'Indexed Color Space'
411 data, and 'Content Stream' data.

412 See [pdf] Table 3.7:

413 **Table 4-5: FlateDecode Filter**

Field	Specification
<All Fields>	PROHIBITED.

414

415 4.7 File Trailer

416 See [pdf] Table 3.12.

417 **Table 4-6: File Trailer**

Field	Specification
'Size'	AS SPECIFIED
'Prev'	PROHIBITED
'Root'	AS SPECIFIED
'Encrypt'	PROHIBITED
'Info'	OPTIONAL.
'ID'	REQUIRED. MUST use a pseudo-random number in place of 'File Size' when generating this value. See [pdf] Section 9.3 for guidelines on how to generate this value. Rationale: Using a random number in place of file size is due to the requirements of using this field in generating the encryption key for the 'standard encryption' algorithm ([pdf] Step 5 of Algorithm 3.2, pg. 78): file size will not be known at the time this field is needed. Support for 'standard encryption' may be added to a future version of this specification.

418

419 4.8 Document Catalog

420 See [pdf] Table 3.16.
421

422 It should be noted that Page Attributes MUST NOT be Inherited (See [pdf] pg. 91) due to the
423 nature of the ordering of the objects in this format. Rationale: Since the parent object (a Page
424 Tree Node) of a Page Dictionary will not appear in the Document until after the page, streaming
425 of the data for a page that has an inherited attribute would not be possible.
426

427 **Table 4-7: Document Catalog**

Field	Specification
'Type'	AS SPECIFIED
'Version'	AS SPECIFIED
'Pages'	AS SPECIFIED
'PageLabels'	PROHIBITED
'Names'	PROHIBITED.
'Dests'	PROHIBITED.
'ViewerPreferences'	OPTIONAL for both Producer and Consumer.
'PageLayout'	OPTIONAL for both Producer and Consumer.
'PageMode'	OPTIONAL for both Producer and Consumer.
'Outlines'	PROHIBITED.
'Threads'	PROHIBITED.
'OpenAction'	PROHIBITED.
'AA'	PROHIBITED.
'URI'	PROHIBITED.
'AcroForm'	REQ if <DIG-SIG>, PROH otherwise. MUST point to a 'Interactive Form Dictionary'
'Metadata'	AS SPECIFIED.
'StructTreeRoot'	PROHIBITED.
'MarkInfo'	AS SPECIFIED., See below.
'Lang'	PROHIBITED.
'SpiderInfo'	PROHIBITED.
'OutputIntents'	PROHIBITED.
'Fis_header	MUST be an indirect object reference to the 'PDF/is Dictionary'.

428
429

430 **4.9   Page Tree Nodes**

431 See [pdf] Table 3.17.

432 **Table 4-8: Page Tree Nodes**

Field	Specification
'Type'	AS SPECIFIED
'Parent'	AS SPECIFIED
'Kids'	AS SPECIFIED
'Count'	AS SPECIFIED
<All 'Page Dictionary' Fields, see [pdf] Table 3.18>	PROHIBITED

433

434 If the Producer of a Document knows that the Document is being generated in some non
435 sequential order, this fact SHOULD be conveyed by reordering the 'Kids' objects from the order in
436 which they appear in the Document. Rationale: If the Producing device were scanning the pages
437 of a duplexed document by scanning the fronts of all pages first (as an example), reordering the

438   'Kids' objects in this way would allow a Consumer that has random access to the Document (i.e.
439   does not need to stream the data) the ability to display the pages in the proper order. If
440   reordering is to be accomplished, the Page Dictionary of the front and back of the same page
441   must have the same 'Parent' (Page Tree Node) entry in order to facilitate reorder, since all 'Kids'
442   of a particular Page Tree Node have sequential page numbers.

443

444   **4.10 Page Dictionary**

445   See [pdf] Table 3.18.

446   **Table 4-9: Page Dictionary**

Field	Specification
'Type'	AS SPECIFIED
'Parent'	AS SPECIFIED
'LastModified'	AS SPECIFIED
'Resources'	MUST NOT be inherited, otherwise AS SPECIFIED.
'MediaBox'	MUST NOT be inherited, otherwise AS SPECIFIED.
'CropBox'	PROHIBITED: Same as 'MediaBox'.
'BleedBox'	PROHIBITED.
'TrimBox'	PROHIBITED.
'ArtBox'	PROHIBITED.
'BoxColorInfo'	PROHIBITED.
'Contents'	REQUIRED: MUST be an Indirect Object Reference to an Array Object that contains Indirect Object References to all Content Streams on the page. The Array Object MUST be placed immediately before the Resource Dictionary for the page.
'Rotate'	MUST NOT be inherited
'Group'	PROHIBITED.
'Thumb'	PROHIBITED.
'B'	PROHIBITED.
'Dur'	PROHIBITED.
'Trans'	PROHIBITED.
'Annots'	PROHIBITED.
'AA'	PROHIBITED.
'Metadata'	AS SPECIFIED.
'PieceInfo'	AS SPECIFIED.
'StructParents'	PROHIBITED.
'ID'	PROHIBITED.
'PZ'	OPTIONAL for both Producer and Consumer.
'SeparationInfo'	PROHIBITED.
'Fis_NextPage'	REQUIRED: An Indirect Object Reference to either: the next 'Page Dictionary'; or, if this is the last page in the Document, to the 'Document Catalog'.
'Fis_Duplex'	OPTIONAL: A 'boolean' object that defaults to 'false' and MUST be 'false' unless 'Fis_Duplex' in the 'PDF/is Dictionary' is 'true' and this is the first even numbered page in the Document.
'Fis_NextCS'	REQUIRED: MUST be an Indirect Object Reference to the first 'Content Stream' on the page.

447

448   **4.10.1 Page Ordering**

449   The Producer SHOULD order the pages in the Document sequentially from 1 to 'n'. For example,
450   if the original document is duplex, the Producer SHOULD attempt to place the content from the
451   back of page 1 (page 2) immediately after the content from page 1. This is preferable to placing
452   content from all page fronts (odd number pages) followed by the content from all page backs
453   (even numbered pages).
454
455   If the Producer chooses not to follow this page ordering guideline, the Producer MUST place all of
456   the page fronts in the Document before all of the page backs – all odd numbered pages MUST
457   precede all even numbered pages. In addition, the Producer MUST indicate this fact by
458   specifying '/Fis_Duplex true' boolean object in the PDF/is Dictionary. The point at which the
459   pages are flipped MUST be indicated by placing the '/Fis_Duplex true' boolean object in the Page
460   Dictionary of the first even numbered page.

461   **4.11 Content Streams**

462   See [pdf] Table 3.4.

463   **Table 4-10: Content Streams**

Field	Specification
'Length'	REQUIRED: MUST not be an Indirect Object Reference.
'Filter'	PROHIBITED.
'DecodeParms'	PROHIBITED.
'F'	PROHIBITED.
'FFilter'	PROHIBITED.
'FDecodeParms'	PROHIBITED.
'Fis_NextCS'	REQUIRED: MUST be an Indirect Object Reference to the next Content Stream for the current page or the 'Resource Dictionary' if this is the last Content Stream on the page.

464

465   The dictionary mapping of Resource Names to indirect object numbers used in the Content
466   Streams and Resource Dictionary MUST follow the following rule:

467   All Resource Names (See [pdf] Section 3.7.2) MUST have their indirect object ID's as the trailing
468   part of the Resource Name. Resource Names MUST NOT have any digits (0-9) anywhere else in
469   their name. Names MUST start with a letter. Consumers SHOULD use this convention to avoid
470   having to cache the entire page in order to gain access to the Resource Dictionary at the end of
471   the page data. For example, a page with two images that are overlapping and masked, might
472   look like this:

```
473        3 0 obj %Page dictionary for page 1
474        <<
475             /Type /Page
476             /Resources 4 0 R
477             /Contents 5 0 R
478             …
479        >>
480        endobj
481
482        6 0 obj     %Content for page 1
483        <</Length 45>>
484        stream
```

```
485              …
486              /Im7 Do     % Image object at object number 7
487              /Im8 Do     % Image object at object number 8
488              /Fis_NextCS 4 0 R %Points to Res. Dict. – only one CS.
489       endstream
490       endobj
491
492       7 0 R
493       <<
494              /Type /XObject
495              /Colorspace /Cs9  % Color space at object number 9.
496              …
497       >>
498       stream
499       …
500       endstream
501       endobj
502
503       10 0 R
504       <<
505              /Type /XObject
506              /Mask 8 0 R
507              /Colorspace /Cs7
508              …
509       >>
510       stream
511       …
512       endstream
513       endobj
514
515       7 0 obj     %Color Space
516       <</Length 3450>>
517       stream
518       …
519       endstream
520       endobj
521
522       8 0 obj     %Mask for image object 10.
523       …
524       endobj
525
526       5 0 obj
527       [6 0 R]      %Array of Content Streams.
528       endobj
529
530       4 0 obj     %Resources for page 1
531       <<
532              /XObject << /Im9 9 0 R
533                         /Im10 10 0 R >>
534              /ColorSpace << /Cs7 7 0 R >>
535       >>
536       endobj
537       //Page 2 would begin here…
```

Rationale: Since Indirect Object References from within Resource Dictionaries are prohibited (See [pdf] Section 3.7.2) we need a way to refer to these objects without requiring full buffering of a page. By requiring the objects to be written this way, the Consumer can process the Content Stream(s) and their associated Images and Color Spaces without requiring the Resource Dictionary. The Resource Dictionary must be written at the end of the page since it must refer to all objects that were used on the page.

See [pdf] Table 4.1:

546   **Table 4-11: Content Stream Operators**

Operators	Specification	Reference
q	AS SPECIFIED	[pdf] Table 4.7
Q	AS SPECIFIED	[pdf] Table 4.7
cm	MUST be [Sx 0 0 Sy Tx Ty], See Below	[pdf] Table 4.7
Do	AS SPECIFIED	[pdf] Table 4.34
DP	PROHIBITED except for 'Banding operator' and 'Cache operator', see below	[pdf] Table 9.8
BX	AS SPECIFIED	[pdf] Table 3.20
EX	AS SPECIFIED	[pdf] Table 3.20
BT	AS SPECIFIED	[pdf] Table 5.4
ET	AS SPECIFIED	[pdf] Table 5.4
'	AS SPECIFIED	[pdf] Table 5.6
"	AS SPECIFIED	[pdf] Table 5.4
T*	AS SPECIFIED	[pdf] Table 5.5
Tc	AS SPECIFIED	[pdf] Table 5.2
Td	AS SPECIFIED	[pdf] Table 5.5
TD	AS SPECIFIED	[pdf] Table 5.5
Tf	AS SPECIFIED, also see Font Objects	[pdf] Table 5.2
Tj	AS SPECIFIED	[pdf] Table 5.6
TL	AS SPECIFIED	[pdf] Table 5.2
Tm	AS SPECIFIED	[pdf] Table 5.5
Tr	REQUIRED, and MUST be '3'	[pdf] Table 5.2
Ts	AS SPECIFIED	[pdf] Table 5.2
Tw	AS SPECIFIED	[pdf] Table 5.2
Tz	AS SPECIFIED	[pdf] Table 5.2
<All other Operators>	PROHIBITED	[pdf] Table A.1

547

548   Support for text operators (all operators beginning with the letter 'T', as well as the BT, ET, ',
549   and " operators) are OPTIONAL for both the Producer and the Consumer. If text operators
550   are found in a Document, the Consumer MAY ignore them as they do not affect the rendering
551   of the page content since all text MUST be 'invisible' (Text Mode (Tr) == 3).

552   **4.11.1 'cm' Operator:**

553   See [pdf] Table 4.7 for definition of 'cm' operator. Note that all coordinates in PDF/is are
554   in the 'default user space' (See [pdf] pg. 138).

555   Given:

556   Wi = Width (X-direction) of the Image in inches.

557   Hi = Height (Y-direction) of the Image in inches.

558   Xi = Horizontal translation, in inches, from the left edge of the page to the left edge of the
559   image.

560   Yi = Vertical translation, in inches, from the bottom edge of the page to the bottom of the
561   image.

562

563   The Producer MUST ensure that the following is true:

564   **Sx** = Wi * 72

565   **Sy** = Hi * 72

566   **Tx** = Xi * 72

567   **Ty** = Yi * 72

568

569   **4.11.2 'Do' Operator:**

570   See [pdf] Table 4.34 for definition of 'Do' operator.

571

572   **Image Resolution Calculations**

573   Given:

574   Img = The 'Image XObject' associated with the 'Do' operator.

575   Cm = The current 'cm' operation in effect for 'Img'.

576   Wp = 'Width' field of 'Img'.

577   Hp = 'Height' field of 'Img'.

578   Sx = 'Sx' value of 'Cm'.

579   Sy = 'Sy' value of 'Cm'.

580

581   The following must be assumed by the Producer and the Consumer:

582   (Wp * 72 / Sx) = The resolution, in the X-direction, of 'Img', in dots per inch.

583   (Hp * 72 / Sy) = The resolution, in the Y-direction, of 'Img', in dots per inch.

584   **4.11.3 'DP' Operators:**

585   See [pdf] Table 9.8 for a definition of the 'DP' Operator.

586   Only the 'Marked Content' flags 'Banding Operator' and the 'Cache operator' are
587   permitted in PDF/is, all other flags are PROHIBTED.

588   **4.11.3.1 'Banding' Operator:**

589   Banding facilitates the creation of a complex series of images on a PDF/is page to a
590   Consumer that may be memory constrained and unable to otherwise display the page. If
591   the Producer of the Document is able to determine that the current page's image layering
592   (or "masking") will violate the cache memory constraints of the Consumer; the Consumer
593   MUST break up the current page into non-overlapping regions to be displayed ('Banding')
594   or free up resources using the 'Cache Operator' (see below). Banding is specified in one
595   of the content streams of the page.
596
597   All images or masks in the content stream in a particular 'Band' do not overlay, and are
598   not overlaid by, any images or masks in any other 'Band'.
599
600   To indicate that a new 'Band' is beginning, the content stream MUST contain the
601   following operator syntax, exactly as shown:
602   **/Fis_band<</Fis_band [Y]>> DP**
603
604   Where:
605   **Y**: A 'Real Numeric Object' (See [pdf] Section 3.2.2) of the minimum Y-coordinate value
606   that this band will contain.

607   And:
608   All coordinate values are in the 'default user space' (See [pdf] pg. 138) coordinate system
609   (0,0 is lower left), at 72 units per inch, relative to the Page Dictionary's 'MediaBox'.
610
611   • Bands may only progress from top to bottom (highest to lowest Y coordinate).
612   • The last Band on the page MUST not have a Banding operator since the close of
613   the Content Stream will indicate that the last band is to be rendered.
614   • The extent of an image within a particular Band MUST meet the following
615   requirements:
616   o Its top edge MUST have a y-coordinate value less than the **Y** value of
617   the previous Band.
618   o Its bottom edge MUST have a y-coordinate greater than, or equal to the
619   **Y** value of the current Band, or '0' if this is the last band.
620
621   See the following examples to help illustrate this feature.
622
623   For the examples, below:
624   N: [Y]
625   Where 'N' is the order in which the band appears in the Content Stream.
626   'Y' is the 'Y' value of the Band operator.
627
628   Example #1: an 8.5" X 11" page (612x792 units), divided into 3 equal sized Bands:
629

1: [528]
2: [264]
3: (No operator)

630
631   Example #2: and 11" X 17" page (792x1224 units), divided into 4 "bands":
632

1: [918]
2: [612]
3: [306]
4: (No operator)

633
634
635   A 'Band Operator' MAY occur in any Content Stream for that page. If the page has more
636   than one Content Stream it MUST be considered as described in [pdf] page 89, under
637   'Contents'.
638
639   To illustrate what a 'Banded' content stream might look like; here is the content stream
640   for Example #2, above:

```
641        stream
642        q
643        792 0 0 306 0 1224 cm   % region of first 'band'.  792 units
644        wide, 306 units high,
645        /Im1 Do                % Display image in first band.
646        /Fis_band <</Fis_band [918]>> DP    % 'Band Operator'
```

```
647              Q
648              q
649              792 0 0 306 0 918 cm
650              /Im2 Do                    % Display image in second band.
651              /Fis_band <</Fis_band [612]>> DP
652              Q
653              q
654              792 0 0 306 0 612 cm
655              /Im3 Do                    % Display image in third band.
656              /Fis_band <</Fis_band [306]>> DP
657              Q
658              q
659              792 0 0 306 0 306 cm
660              /Im4 Do                    % Display image in last band.
661              endstream
662
```

4.11.3.2 'Cache' Operator:

The 'Cache Operator' allows the Producer of the Document to specify that certain 'cached' objects (See 'Cached Objects' section in this specification) may be released from the cache at a certain point in the content stream. See 'Cache Release' section in this document for use of this operation. This operation would allow a Consumer to Discard specified objects to free resources for image operations. This operator has the following syntax:

```
        /Fis_cache <</Fis_cache [OBJECTS]>> DP
```

Where 'OBJECTS' is an array of object ID references. For example:

```
        /Fis_cache <</Fis_cache [23 0 R 34 0 R]>> DP
```

…will release objects 23 and 34 from the cache.

4.12 Resource Dictionaries

See [pdf] Table 3.21.

The Resource Dictionary MUST reference all Image XObjects and ColorSpaces that are used on the current page. The position of the image objects, their masks, and color spaces with respect to each other is defined in the Image XObject section of this specification.

The 'Resource Dictionary' MUST be the last object for any given page. This is an indicator to the Consumer that the current page is complete.

Table 4-12: Resource Dictionaries

Field	Specification
'ExtGState'	PROHIBITED.
'ColorSpace'	PROHIBITED.
'Pattern'	PROHIBITED.
'Shading'	PROHIBITED.
'XObject'	AS SPECIFIED.
'Font'	AS SPECIFIED.
'ProcSet'	PROHIBITED.
'Properties'	PROHIBITED.

685

4.13 ICCBased Color Space

687   See [pdf] Table 4.16 & Table 3.4.

688   **Table 4-13: ICCBased Color Space**

Field	Specification
'N'	MUST have a value of '3'.
'Alternate'	PROHIBITED, Implies '/DeviceRGB' (See [pdf]).
'Range'	AS SPECIFIED.
'Metadata'	AS SPECIFIED.
'Length'	REQUIRED. MUST NOT be an indirect object reference.
'Filter'	PROHIBITED.
'DecodeParms'	PROHIBITED.
'F'	PROHIBITED.
'FFilter'	PROHIBITED.
'FDecodeParms'	PROHIBITED.

689

690   The following rules MUST be adhered to:
691   • All color image data MUST be 'sRGB' color data (See [srgb]). Color images MUST use
692   the 'sRGB' standard ICC profile [srgb-icc].
693   • The [srgb-icc] profile MUST be Implemented in the Document, unmodified.
694   • The profile MUST be Implemented after its first reference (See Producer Conformance
695   Requirement #6) and SHOULD be cached (See 'Cached Objects') for further references.
696
697   Since the color image data meets the 'sRGB' specification, the Consumer has the following two
698   options:

699   **1**   Tune the output device to use 'sRGB' image data. This would allow the
700   Consumer to avoid having to implement a full ICC profile engine. The image data would
701   be used directly which could greatly simplify the image data processing.
702   **2**   Support ICC profiles. In this case, the Consumer does not need to know that the
703   image data conforms to 'sRGB'; instead, the Consumer can process the data using an
704   entirely ICC based color management approach (See [icc]). This method would be the
705   choice for the Consumer that supports the full PDF specification [pdf].
706

4.14 Indexed Color Space

708   See [pdf] Page 199.
709
710   An Indexed color space MAY be used for grayscale or color images, as necessary.
711
712   An Indexed Color Space object MUST take the following form:
713
714   [/Indexed *base hival lookup*]
715
716   Where:
717
718   'base' MUST be an array of the form:
719   [/ICCBased *X*]

720   Where 'X' is an indirect object reference to an ICCBased 'sRGB' color space (See
721   ICCBased Color Space).
722 'hival' MUST be as defined on page 200 in [pdf].
723 'lookup' MUST be as defined on page 200 in [pdf] but MUST be a stream.
724
725 Example:
726
727   10 0 obj
728   [/Indexed [/ICCBased 12 0 R] 255 11 0 R]]
729   endobj
730
731   11 0 obj
732   <</Length 768>>
733   stream
734   ….%256 color lookup table values in R-G-B order…
735   endstream
736   endobj
737
738   12 0 obj
739   %ICCBased 'sRGB' color space
740   …
741

742 **4.15 Image XObjects**

743
744 See [pdf] Table 4.35 & Table 3.4 for description of the following table.

745   **Table 4-14: Image XObjects**

Field	Specification
'Type'	MUST be 'XObject'
'Subtype'	MUST be 'Image'
'Width'	AS SPECIFIED
'Height'	AS SPECIFIED
'ColorSpace'	AS SPECIFIED. Only 'ICCBased' or 'Indexed' color spaces are permitted.
'BitsPerComponent'	AS SPECIFIED
'Intent'	REQUIRED. 'Perceptual' is RECOMMENDED.
'ImageMask'	AS SPECIFIED
'Mask'	AS SPECIFIED, see below.
'SMask'	PROHIBITED.
'Decode'	AS SPECIFIED.
'Interpolate'	AS SPECIFIED. 'False' implies "Nearest-Neighbor Interpolation". 'True' implies 'Bilinear Interpolation' or 'Bicubic Interpolation' at the discretion of the Consumer. The actual method by which these are implemented is not specified.
'Alternates'	PROHIBITED.
'Name'	PROHIBITED.
'StructParent'	PROHIBITED.
'ID'	PROHIBITED.
'OPI'	PROHIBITED.
'Metadata'	AS SPECIFIED.
'Length'	REQUIRED: MAY be an indirect object reference to a numeric object that

	MUST be the next object in the Document, See below.
'Filter'	REQUIRED: MUST be one of: 'DCTDecode', 'CCITTFaxDecode', or 'JBIG2Decode'. No other filters are allowed.
'DecodeParms'	AS SPECIFIED.
'F'	PROHIBITED.
'FFilter'	PROHIBITED.
'FDecodeParms'	PROHIBITED.

746

- An 'ImageMask', if indicated in an Image XObject, MUST appear in the Document before the Image XObject that references it.

- All image data, regardless of compress method (Filter), MUST be ordered as specified in Section 4.8.3 and in Figure 4.26 of [pdf], contrary to the 'Note' at the bottom of page 265 of [pdf].

- Grayscale images MUST use an Indexed Color Space.

- If the 'Length' specifier for a stream is an indirect object reference to a numeric object, the Producer MUST place the following comment on the line after the 'endstream' keyword:

  o   %ID['ID' field value from 'PDF/is Dictionary']

Using Section 4.1.1.3 as an example, we would have:

```
endstream
%ID[<8c41995c6e014675e850d36e6c2f6114><8c41995c6e014675e850d36e6c2f6114>]
```

Rationale: By placing this 'ID' at the end of the stream object a Consumer does not have to understand the format of the stream in order to find its end. The Consumer can simply search for the 'ID' string to determine where the stream ends. This is mainly useful when the Consumer is reading a newer version of the PDF/is document format that it does not understand.

4.16 Masked Images

See [pdf] Section 4.8.5.

Table 4-15: Masked Images

Field	Specification
<All Fields>	AS SPECIFIED

4.17 Interactive Form Dictionary

See [pdf] Table 8.47.

Table 4-16: Interactive Form Dictionary

Field	Specification
'Fields'	MUST be an Array of indirect object reference(s) to 'Annotation Field Dictionary'(s).
'NeedAppearances'	PROHIBITED
'SigFlags'	MUST be '3'

'CO'	PROHIBITED
'DR'	PROHIBITED
'DA'	PROHIBITED
'Q'	PROHIBITED

773

4.18 Font Objects

775 'Font Objects' (See [pdf] Section 5.4) include both 'Font Dictionaries' ([pdf] Table 5.8) and 'Font
776 Descriptors' ([pdf] Table 5.18).

777 Fonts can be used in PDF/is Documents only for text searching and extraction capabilities. All
778 text MUST be invisible (See 'Tr' in Content Streams). As such, support for Font Objects is
779 OPTIONAL for both the Producer and the Consumer. Since text is invisible, the Consumer need
780 not Support Text Operators (in Content Streams) or Font Objects as they do not affect the
781 rendered output.

782 Font Objects, if present, MUST follow the following rules:

783 • Embedded font programs ([pdf] Section 5.8) are PROHIBITED.

784 • All font 'SubTypes' ([pdf] Table 5.7) except 'TrueType' ([pdf] Section 5.5.2) and 'Type1'
785 ([pdf] Section 5.5.1) are PROHIBITED.

786 • 'Font Dictionaries' MUST be implemented AS SPECIFIED in [pdf].

787 • 'Font Descriptors' MUST be Implemented AS SPECIFIED in [pdf].

788

4.19 Annotation Field Dictionary

790 See [pdf] Tables 8.10 & 8.49. This dictionary consists of entries from both a 'Annotation
791 Dictionary (Table 8.10) and a 'Field Dictionary' (Table 8.49).

792 Only Digital Signature Annotations are allowed in PDF/is.

793   **Table 4-17: Annotation Field Dictionary**

Field	Specification
'Type'	MUST be 'Annot'
'Subtype'	MUST be 'Widget'
'Contents'	PROHIBITED.
'P'	PROHIBITED.
'Rect'	MUST be '[0 0 0 0]'
'NM'	PROHIBITED.
'F'	PROHIBITED.
'BS'	PROHIBITED.
'Border'	PROHIBITED.
'AP'	PROHIBITED.
'AS'	PROHIBITED.
'C'	PROHIBITED.
'CA'	PROHIBITED.
'T'	PROHIBITED.
'Popup'	PROHIBITED.
'A'	PROHIBITED.

'AA'	PROHIBITED.
'StructParent'	PROHIBITED.
'FT'	MUST be 'Sig'
'Parent'	PROHIBITED.
'Kids'	PROHIBTED.
'T'	AS SPECIFIED.
'TU'	AS SPECIFIED.
'TM'	PROHIBITED.
'Ff'	MUST be '1'.
'V'	MUST be an indirect object reference to a 'Signature Dictionary'.
'DV'	PROHIBITED.
'AA'	PROHIBITED.

794
795

4.20 Signature Dictionary

797 See [pdf] Table 8.60 and [pdf-ppk] Table 2.

798 The Digital Signature format MUST only be in the 'Raw Format', see [pdf-ppk] Section 2.2.

799 **Table 4-18: Signature Dictionary**

Field	Specification
'Type'	MUST be 'Sig'
'Filter'	AS SPECIFIED.
'SubFilter'	MUST be 'adbe.x509.rsa_sha1'
'Name'	AS SPECIFIED.
'Reason'	AS SPECIFIED.
'Location'	AS SPECIFIED.
'M'	AS SPECIFIED.
'ByteRange'	PROHIBITED (Implies all bytes in the Document with the exclusion of the bytes represented by the value of the 'Cert' field. See [pdf] for this field)
'Contents'	AS SPECIFIED.
'Cert'	AS SPECIFIED.
'R'	AS SPECIFIED.
'V'	AS SPECIFIED.
'ADBE_Build'	AS SPECIFIED.
'ADBE_AuthType'	AS SPECIFIED.
'ADBE_PwdTime'	AS SPECIFIED.

800

801 5 Object Lifetime

802 Some Consumer's may be limited in the amount of storage they may have to cache the
803 Document as it's received from the Producer. This storage limitation may prohibit the Consumer
804 from holding the entire Document before beginning to render the first page. To facilitate this
805 storage constraint, PDF/is has a mechanism of "object lifetime". This mechanism defines how
806 long an object must be held in storage before it is no longer needed.
807
808 If a Document can be fully maintained in the Consumer's storage, i.e. the Consumer is a PC or
809 some other device with large quantities of storage; the Document's Cross-Reference table should

810 be used to access objects as they are needed. In this case, the Consumer should follow the
811 parsing model as spelled out in the PDF Reference [pdf].

813 If a Document cannot be fully maintained within the Consumers storage or if it is uncertain if it will
814 be able to do so, the Document MUST be linearly parsed and the following parsing rules MUST
815 be adhered to:

817 • Documents MUST be parsed in order, from beginning to end.
818 • All Consumer's MUST have the ability to cache at least 4 Megabytes (4,194,304 bytes) of
819 PDF/is Document data. This memory is in addition to any memory required for JBIG2
820 image processing (2 Megabytes, See 'JBIG2Decode' Section) and for raster image
821 buffers on the Consuming device.

823 At the end of generation of each Dictionary Object (See [pdf] Section 3.2.6), the Producer MUST
824 ensure that 4 Megabyte cache memory limit will not been exceeded when the Consumer reads
825 the Document. If the Producer exceeds the limit as calculated using the formula shown below,
826 the Document is Invalid. If the limit will be exceeded, the Producer MUST either reorganize the
827 current page by using either "Banding", freeing up some "cached" objects, reducing the use of
828 masked images (or lowering their resolution), or by using some other process in order to avoid
829 breaking the cache buffer limit.

830 Calculation of the current cache buffer size MUST follow the following formula:

831 1) The current total Document size (in bytes) that has been created up to the point at which
832 this calculation is being made.

833 2) Minus the 'Object Size' of all released 'Cached' objects (See "Cached Objects" Section of
834 this specification), up to that point.

835 3) Minus the 'Object Size' of all non-cached 'Page-Relative Objects' for previous pages, not
836 already accounted for by #2.

837 4) Minus the 'Object Size' of all non-cached 'Image XObjects' data for any previous 'Bands'
838 on the current page; if the page is "Banded".

839 5) Minus the 'Object Size' of the last 'Image XObject' in the current 'Band', if the page is
840 "Banded".

841 6) Minus the 'Object Size' of the 'Image XObject' for the current page, if the page is not
842 "Banded".

843 Rationale: The last two items assume that the Consumer will process image data as it is
844 received and will not need to cache these objects before rendering.

845

6   Cached Objects

847 If a 'Page-Relative' object MAY be used on more than one page or in more than one 'Band', it will
848 be necessary to specify the object as 'Cached'. This will allow an object to be used throughout
849 the Document that otherwise would be discarded. This caching mechanism only applies to
850 'Page-Relative' 'Dictionary Objects'; see [pdf] Section 3.2.6.

851 An object that is held in the Consumers cache by the 'Cache Hold' mechanism MUST be
852 maintained in the cache until one of the following conditions is met:

853 • The 'Cache Operator' is invoked on this object in a page's Content Stream.

854 • The 'Document Catalog' is reached.

855 To specify that a particular object should be 'cached', add the following Name Object (See [pdf]
856 Section 3.2.4) to the Dictionary Object (See [pdf] Section 3.2.6) to be cached:

857   /Fis_Cache

858   7   Conformance Requirements

859 This section specifies the conformance requirements for Consumers and Producers.

860   7.1   Producer conformance requirements

861 In order to conform to this specification, a Document Producer:

862   1.   MUST specify the version of PDF (See [pdf] Section 3.4.1) as being 'PDF 1.4'.

863   2.   MUST place the 'PDF/is Dictionary' as the first object in the PDF.

864   3.   MUST NOT include any private 'PDF Name Registry' values/objects (See [pdf] –
865   Appendix E) that affect printed output.

866   4.   MUST place the objects: 'Interactive Form Dictionary', 'Annotation Field Dictionary' and
867   'Digital Signature' objects as the last three objects (in that order) in the Document, if the
868   Document is Digitally Signed. Note that in a situation where the Consumer cannot cache
869   the entire document before rendering, the detection of a valid or invalid Digital Signature
870   will only occur after rendering of the entire Document.

871   5.   MUST ensure that there is at least one Forward-Reference to each object. The only
872   object that does not have to follow this rule is the 'PDF/is Dictionary'. Rationale: This will
873   aid the Consumer with identifying objects as they are encountered in the data stream.

874   6.   MUST ensure that all objects appear in the PDF AFTER the object in which they are first
875   referenced (Satisfied by Requirement 6) and BEFORE the next 'Page Dictionary' unless
876   the object is a Cached Object (See Section 3.4).

877   7.   MUST ensure that all object identifiers ([pdf] Section 3.2.9) start at the beginning of a line.

878   8.   MUST ensure that all 'endobj' keywords ([pdf] Section 3.2.9) start at the beginning of a
879   line.

880   9.   MUST NOT Linearize the Document. See [pdf] Appendix F.

881   10. MUST NOT Incrementally Update the Document. See [pdf] Section 3.4.5.

882   11. MUST only encoded images with resolutions of at least 300 but not more than 1200 dots
883   per inch (dpi). It is RECOMMENDED that the Producer place images in the Document in
884   the images original resolution, i.e. not scaled.

885   12. MAY include an 'Originator Identifier' image that MUST, if present, be displayed on, at
886   least, the first page. The image MUST be referenced by the 'Fis_OrigID' field in the
887   'PDF/is Dictionary' and MUST be 'cached' if displayed on more than the first page.

888   13. MUST end all text lines with a PDF Reference specified 'EOL Marker' (See [pdf] pg. 26).

889   14. MUST not use multiple, sequential 'EOL Markers' (See [pdf] pg. 26), i.e. there should be
890   no blank lines in the Document.

891   15. MUST only use either a space or a horizontal tab character as white space ([pdf] Table
892   3.1).

893   16. MUST keep white-spaces to a single instance. Runs of multiple white-space characters
894   are PROHIBITED.

895   17. MUST place the following five characters as the second line in the Document: %âãÏÓ
896   (Hex values 0x25, 0xE2, 0xE3, 0xCF, 0xD3)

897   18. MUST separate the 'xfer' keyword from the cross reference subsection header by a
898   single EOL Marker (See [pdf] Section 3.4.3).

899   19. MUST NOT place any data following the '%%EOF' at the end of the Document.

900   20. MUST NOT place any data between the end of one Dictionary object and the beginning
901   of the next Dictionary object.

902   21. MUST place an 'EOL Marker' after all 'stream' keywords.

903   22. MUST place an 'EOL Marker' before all 'endstream' keywords.

904   23. MUST place an 'EOL Marker' after all 'obj' keywords.

905   24. MUST place an 'EOL Marker' after all 'endobj' keywords.

906   25. MUST place all *object numbers*, *generation numbers*, and 'obj' keywords (See [pdf]
907   Section 3.2.9) together on a single line and the individual items are each to be separated
908   by a single white space character.

7.2   Consumer conformance requirements

910   In order to conform to this specification, a Document Consumer:

911   1. MUST Support all of the REQUIRED objects.

912   2. MUST Interpolate images up or down in resolution, as required, to properly match the
913   Document's image resolution(s) to the Consumer's device capabilities.

914   3. MUST abide by the "Object Lifetime" rules in Section 3.4 if unable to Cache the entire
915   Document.

916   4. MUST terminate processing of the Document if it is detected that the Document has been
917   incrementally updated (See [pdf] Section 3.4.5) as these Documents are PROHIBITED.

918   5. MUST have a Horizontal Scaling Factor that is within 0.3% of the Vertical Scaling Factor
919   for any particular page.

920   6. MUST have all Vertical and Horizontal Scaling Factors within the range of 0.9 and 1.1,
921   inclusive for all pages.

922   7. MAY display the Originator Identifier where specified in a page's Content Stream.

923   8. MUST attempt to recover from an invalid Document. Any Document that does not
924   conform to this specification is considered to be 'Invalid'. If a formatting error is
925   encountered in a Document, the Consumer MUST attempt to recover from the error by
926   following the rules shown below.

927   a. If the error was encountered in a stream, the Consumer MUST skip to the end of
928   the stream ignoring all remaining data in the stream.

929   b. If the error was encountered in an object outside of a stream, the Consumer
930   SHOULD skip to the end of the current object, if possible. If not possible, the
931   Consumer MUST skip to the next Page Object.

932   It should be noted that skipping objects in this way will cause the current page to be
933   invalid. The details of handling invalid pages are outside the scope of this
934   specification. In addition, if some of the skipped objects were 'Cached' additional
935   pages may also be invalid.

936 8   Issues

937   • None currently.

938 9   Sample PDF/is Document

939 The 'source' of the sample document in this section can be viewed with most text editors
940 ('Wordpad' is a good choice) but should only be modified with a binary editor, as the stream data
941 contained therein is not compatible with text editors. Comments on the format of the documents
942 are contained within the documents themselves.
943
944 This sample is a one page document. The page contains a 'CCITTFaxDecode' masked,
945 'DCTDecode' color foreground image with a 'DCTDecode' gray scale background image.
946   ftp://pwg.org/pub/pwg/QUALDOCS/SamplePDFax/sample2.pdf
947

948 10 Normative References

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950   Adobe Systems, "PDF Reference, third edition, Adobe Portable Document Format
951   Version 1.4", Addison-Wesley, December 2001,
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953   df Also see errata: http://partners.adobe.com/asn/acrobat/docs/PDF14errata.txt.

954 [pdf-ppk]
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956   Adobe Systems, September 2001,
957   http://partners.adobe.com/asn/developer/pdfs/tn/ppk_pdfspec.pdf

958 [ps-jpeg]
959   Adobe Systems Incorporated, "Supporting the DCT Filters in PostScript Level 2",
960   November 1992, http://partners.adobe.com/asn/developer/pdfs/tn/5116.DCT_Filter.pdf

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963   Wesley, 1999, http://partners.adobe.com/asn/developer/pdfs/tn/PLRM.pdf. Also see
964   errata: http://partners.adobe.com/asn/developer/pdfs/tn/PSerrata.txt.

965 [ifx]
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967   ftp://pwg.org/pub/pwg/QUALDOCS/wd-ifx10-20031210.pdf

968 [ifx-req]
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970   ftp://ftp.pwg.org/pub/pwg/QUALDOCS/requirements/wd-ifxreq10-20031112.pdf

971 [t.4]
972   ITU-T Recommendation T.4, "Standardization of group 3 facsimile apparatus for
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975   ITU-T Recommendation T.6, "Facsimile coding schemes and coding control functions for
976   group 4 facsimile apparatus", November 1988

977 [t.89]
978   ITU-T Recommendation T.89, "Application profiles for Recommendation T.88 –
979   Lossy/lossless coding of bi-level images (JBIG2) for facsimile", September 2001

980 [rfc2119]
981   Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC
982   2119, September 2000, ftp://ftp.rfc-editor.org/in-notes/pdfrfc/rfc2911.txt.pdf.

983 [rfc2911]
984   Hastings, Herriot, deBry, Isaacson, Powell, "Internet Printing Protocol/1.1: Model and
985   Semantics", September 2000, ftp://ftp.rfc-editor.org/in-notes/pdfrfc/rfc2911.txt.pdf.

986 [jpeg]
987   JTC 1/SC 29, "Information technology – Digital compression and coding of continuous-
988   tone images: Requirements and guidelines", ISO/IEC 10918-1:1994, 1994.

989 [jbig2]
990   JTC 1/SC 29, "Information technology – Lossy/lossless coding of bi-level images",
991   ISO/IEC 14492:2001, December 2001.

992 [icc]
993   International Color Consortium (ICC), ICC.1:1998-09, "File Format for Color Profiles",
994   1998. http://www.color.org/ICC-1_1998-09.PDF

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996   International Color Consortium (ICC), ICC.1A:1999-04, "Addendum 2 to Spec.
997   ICC.1:1998-09", 1999. http://www.color.org/ICC-1A_1999-04.PDF

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999   International Electrotechnical Commission (IEC), IEC/3WD 61966-2.1, "Colour
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1005   ## 11 Informative References

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1015   [process]
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1017   http://www.pwg.org/chair/pwg-process20-20030217.pdf

1018   ## 12 Revision History (to be removed when standard is approved)

Date	Author	Notes
10/9/02	Rick Seeler, Adobe Systems	Version 0.01 (never released)
10/23/02	Rick Seeler, Adobe Systems	Version 0.02 ftp://pwg.org/pub/pwg/QUALDOCS/pwg-ifx-pdfax-P02-021023-rev.pdf
11/19/02	Rick Seeler, Adobe Systems	Version 0.03 ftp://pwg.org/pub/pwg/QUALDOCS/pwg-ifx-pdfis-P03-021110-rev.pdf
11/22/02	Rick Seeler, Adobe Systems	Version 0.04 ftp://pwg.org/pub/pwg/QUALDOCS/pwg-ifx-pdfis-P04-021122-rev.pdf
12/19/02	Rick Seeler, Adobe Systems	Version 0.05 ftp://pwg.org/pub/pwg/QUALDOCS/pwg-ifx-pdfis-P05-021219-rev.pdf
2/19/03	Rick Seeler, Adobe Systems	Version 0.06 ftp://pwg.org/pub/pwg/QUALDOCS/pwg-ifx-pdfis-P06-030219-rev.pdf
3/14/03	Rick Seeler, Adobe Systems	Version 0.50 ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20030314-rev.pdf
3/24/03	Rick Seeler, Adobe Systems	Version 0.60 ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20030324-rev.pdf
5/6/03	Rick Seeler, Adobe Systems	Maturity: Prototype ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20030506-rev.pdf
6/30/03	Rick Seeler, Adobe Systems	Maturity: Prototype

		ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20030630-rev.pdf
8/5/03	Rick Seeler, Adobe Systems	Maturity: Prototype ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20030805-rev.pdf
11/12/03	Rick Seeler, Adobe Systems	Maturity: Prototype ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20031112-rev.pdf
1/16/04	Rick Seeler, Adobe Systems	Maturity: Stable ftp://pwg.org/pub/pwg/QUALDOCS/wd-pdfis10-20040116-rev.pdf

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16 Appendix A – Intellectual Property

In addition to this section, see the 'Intellectual Property' or 'Patent' sections in the specifications referred to by the Normative References in this specification for additional Intellectual Property related issues.

16.1 Patents – Unknown Status

The following patents have been brought forward as possibly relevant intellectual property pertaining to implementations of PDF/is. No formal statement has been made by the patent holder(s) as to the relevance of these patents with respect to implementations of PDF/is.

1049   Patents listed here meet all of the following three criteria:

1050   1) The patent has been identified by someone who is familiar with the technical fields
1051   relevant to this Specification, and who believes use of the invention covered by the patent
1052   may be infringed upon by a particular implementation of this Specification.

1053   2) The patent has not been identified as being essential to PDF/is: the patent will not
1054   necessarily be infringed upon by an implementation of PDF/is but some implementations
1055   may do so.

1056   3) The patent holder has not explicitly made the intellectual property freely available as
1057   defined in Item 1 under section 9.3 of the PWG Process Document [process].

1058   Patents:

1059   1) US Patent, RE35657, Xerox, Buckley et. al.: Means for combining data of different
1060   frequencies for a raster output device., Nov. 11, 1997.

1061   2) US Patent 5778092, Scansoft, MacLeod et. al.: Method and apparatus for
1062   compressing color or gray scale documents., Dec. 20, 1996.

1063   **16.2 Patents – Relevant and Essential**

1064   Currently, the only relevant and essential patents that pertain to implementations of PDF/is have
1065   been made Royalty Free by the following Intellectual Property statement.
1066

1067   **Adobe Systems Incorporated**

1068   **Patent Clarification Notice Specific to Use of "Portable Document Format: Image-Streamable"**
1069
1070   Adobe has a number of patents covering technology that is disclosed in the Portable Document Format
1071   (PDF) Specification, version 1.4 and later, as documented in PDF Reference and associated Technical
1072   Notes (the "PDF Specification"). Adobe desires to promote the use of PDF as the basis for a file format
1073   called "Portable Document Format: Image-Streamable" ("PDF/is") that is currently under development by
1074   the Printer Working Group ("PWG"), a program of the IEEE-ISTO.
1075
1076   This Patent Clarification Notice is in addition to the permissions statement set forth in Section 1.4 of the
1077   PDF Reference which shall also apply to Adobe's contribution to PDF/is.
1078
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1088
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1090   A "Royalty Free License" shall mean a license that:
1091

1092   i)   shall be available to all implementers of PDF/is worldwide, whether or not members of the
1093   PWG;
1094   ii) shall extend to all Essential Claims owned or controlled by Adobe and its Affiliates;
1095   iii) shall not be conditioned on payment of royalties, fees or other consideration except as
1096   described in (iv) and (v) below;
1097   iv) may be conditioned on a grant of a reciprocal license on identical terms to all Essential
1098   Claims owned or controlled by the licensee and its Affiliates; and
1099   v) may include reasonable, customary terms relating to operation or maintenance of the license
1100   relationship including but not limited to the following: choice of law, dispute resolution, and
1101   patent notices.
1102

1103   "Essential Claims" shall mean all claims in any patent or patent application, in any jurisdiction in the
1104   world, that (A) Adobe and/or its Affiliates own and (B) that would be necessarily infringed by
1105   implementation of PDF/is. A claim is necessarily infringed hereunder only when a licensee can prove that it
1106   is not possible to avoid infringing it because there is no non-infringing alternative for implementing the
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1108   the art at the time a licensee implements PDF/is.
1109

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1111

1112   1) any claims other than as set forth above even if contained in the same patent as Essential Claims;
1113   and
1114   2) claims that would be infringed only by
1115   a) portions of an implementation that are not required by PDF/is
1116   b) enabling technologies that may be necessary to make or use any product or portion thereof
1117   that complies with PDF/is but are not themselves expressly set forth in PDF/is; or
1118   c) the implementation of technology developed elsewhere and merely incorporated by reference
1119   into PDF/is.
1120

1121   For purposes of the Essential Claims definition, PDF/is shall be deemed to include only architectural and
1122   interoperability requirements and shall not include any implementation examples or any other material that
1123   merely illustrates the requirements of PDF/is.
1124

1125   An "Affiliate" of a first entity is a second entity that is controlled (greater than 50%) by, in control of, or
1126   under common control with the first entity.
1127
1128