INTERNATIONAL STANDARD

ISO 16612-3

First edition
2020-11

Graphic technology — Variable data exchange —

Part 3: Using PDF/X-6 (PDF/VT-3)

Reference number
ISO 16612-3:2020(E)

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Published in Switzerland

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Foreword

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

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

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

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

A list of all parts in the ISO 16612 series can be found on the ISO website.

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

Introduction

This document defines the PDF/VT-3 document format which specifies methods for the use of the Portable Document Format (PDF) for the definition and exchange of all content elements and supporting metadata necessary for printing tasks involving variable or transactional document content. It allows the specification of document structure, document layout, content data, and interaction of graphical elements in a graphics model that supports transparency.

PDF/VT is designed to enable variable document printing (VDP) in a variety of environments from desktop printers to digital production presses, including hybrid workflows involving both conventional and digital printing. These capabilities are used in the creation of one-to-one customer communication print applications including direct marketing documents, transactional documents, and trans-promotional documents, as well as in labels, packaging and industrial print.

The present trend towards the separation of variable document content creation from the details of print production workflow and printing device dependencies is evolving rapidly, but there is an increasing need for predictable connectivity between the two.

The primary focus of PDF/VT is on the exchange of content between businesses or within an integrated environment that produces variable document printing. It is intended to be workflow-architecture-neutral. PDF/VT itself has no provision for encoding workflow or device-specific control information. The aspects of device control, resource, and production management are outside the scope of this document.

PDF/VT does, however, provide a print product metadata framework that may be used to embed workflow control data within the PDF/VT-3 file, as for example, product intent in a format specified in ISO 21812-1, or production requirements at a later stage in the workflow in the Job Definition Format (JDF) or the XML Job Definition Format (XJDF). The job ticket is expected to define the product or production requirements and draw upon PDF/VT for its content and metadata resources.

This document, which defines PDF/VT-3, includes support for the PDF 2.0 imaging model. It builds on the PDF/X-6 standard (defined in ISO 15930-9), which, in turn, references PDF 2.0 (see ISO 32000-2).

Like ISO 16612-2, this document supports the fundamental requirements of portability, device and workflow independence and guaranteed communication of the intended colour reproduction. The native constructs within PDF allow products to provide functionality equivalent to that of PPML workflows as used in ISO 16612-1, but using a single homogeneous format that adds support for a graphics model that supports transparency, as well as up-to-date structure tagging in support of repurposing of data where required.

PDF/VT supports the use of graphics object definitions as a method of specifying graphical content data only once in a PDF/VT-3 file independent of the number of times it is referenced in the file. This approach serves to reduce the file size of a PDF/VT-3 file and allows implementers of conforming processors to employ various processing optimization strategies. Within the context of PDF/X-6, these graphics objects are specified as image, form and transparency group XObjects.

While there is nothing in this document that enforces the creation of PDF/VT-3 files that make efficient use of XObjects, doing so is strongly recommended.

XObjects referenced multiple times from various content streams can be tagged with hint information that aids the conforming processor in its determination of XObject reuse. These hints can include an explicit lifetime scope to indicate the context within which the XObject is known to be referenced multiple times, such as within the current file, or that it is explicitly only referenced once.

An XObject can also be identified as an encapsulated XObject if its definition has a limited and well-defined interaction with the current graphics state when invoked. This explicit hint serves to assist a conforming processor in its optimization strategy.

A PDF/VT-3 file based on PDF/X-6 requires all resources necessary for proper interpretation of the PDF data to be included within the PDF file. This enables an exchange of content where no additional

technical information is required to be communicated between sender and receiver to describe the appearance of page content.

A PDF/VT-3 file based on PDF/X-6p or PDF/X-6n does not necessarily include all ICC profiles required for correct rendering for visualization or print. It isn't necessarily suitable for an exchange without technical discussions between sender and receiver.

Application notes for print-related PDF subsets are available to provide assistance to developers and users and can be found at https://printtechnologies.org/programs/standards-workroom/tools-best-practices/.

A processor conforming to this document is not required to be capable of processing documents conforming to ISO 16612-1, which is based on the use of PPML. Neither is it required to be capable of processing documents conforming to ISO 16612-2, although it is anticipated that many creators of processors may choose to do so.

Graphic technology — Variable data exchange —

Part 3:
Using PDF/X-6 (PDF/VT-3)

1 Scope

This document defines the PDF/VT-3 document format and methods to enable reliable document exchange for variable data and transactional (VT) printing. It uses the Portable Document Format (PDF) Version 2.0, as restricted by PDF/X-6, for the representation of such documents. It allows the specification of document structure and layout, content data, and interaction of graphics objects in a graphics model that supports transparency and both device-dependent and device-independent colour spaces. All elements are either included or provision is made for unique identification of externally supplied ICC profiles.

PDF/VT-3 is designed to enable variable data and transactional printing in a variety of environments from desktop printers to digital production presses. This includes hybrid workflows involving both conventional and digital printing.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15930-9, *Graphic technology — Prepress digital data exchange using PDF — Part 9: Complete exchange of printing data (PDF/X-6) and partial exchange of printing data with external profile reference (PDF/X-6p and PDF/X-6n) using PDF 2.0*

ISO 32000-2:—[1)], *Document management — Portable document format — Part 2: PDF 2.0*

3 Terms and definitions

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

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

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

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

3.1
encapsulated XObject
XObject having a well-defined limited interaction with the current graphics state at the point of invocation

3.2
PDF/VT-3
document format and methods which enable reliable document exchange for variable data and transactional printing

1) Under revision. Stage at the date of publication: ISO/FDIS 32000-2:2020.

3.3
PDF/VT-3 file
PDF 2.0 file conforming to the requirements of this document

3.4
record
collection of information relevant to pages that are to be processed together

Note 1 to entry: A common example of a record is the information about a single recipient for which a collection of pages was generated.

4 Notations

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

Operands of PDF operators or values of dictionary keys are written in an italic font; for example, the *true* value for the key **I**.

5 Conforming files and equipment

This document specifies the use of the PDF file format for the exchange of digital data representing a compound entity.

This document is based on ISO 15930-9, and defines one conformance level as follows.

— *PDF/VT-3* requires all compound entities, metadata and resources used in representing graphical content to adhere to the requirements of any of the conformance levels specified in ISO 15930-9.

PDF/VT conformance is identified in a PDF/VT-3 file by use of the **pdfvtid:GTS_PDFVTVersion** property as specified in 6.3. Neither the version number in the header of a PDF file nor the value of the **Version** key in the **Catalog** of a PDF file shall be used in determining whether a file is in accordance with this document.

A PDF/VT-3 file shall conform to all requirements set out in Clause 6.

A PDF/VT-3 conforming writer is an application that is able to write PDF/VT-3 files in accordance with the conformance requirements specified in Clause 6.

A PDF/VT-3 conforming processor is an application or system that is able to read and appropriately process all PDF/VT-3 files in accordance with the conformance requirements specified in Clause 6.

NOTE There is no requirement in this document that a PDF/VT-3 conforming processor be able to read and process files conforming to ISO 16612-2, although it is anticipated that many developers of PDF/VT-3 processors will choose to make them do so.

All conforming processors shall read and appropriately process the **DPartRoot** dictionary and its **DPart** sub-dictionaries defined in 6.4 and 6.5.

All conforming PDF/VT-3 processors that update a PDF/VT-3 file, shall write a new value for both the **pdfvtid:GTS_PDFVTModDate** and the **xmp:ModifyDate** properties when they do so.

To the extent that ISO 15930-9 and this document permit more than one rendering of a PDF/VT-3 file, a conforming processor may use a job ticket or metadata information to further restrict the rendering of the file.

6 Technical requirements

6.1 General

The PDF features that shall be required, prohibited or restricted are specified in 6.2 to 6.6. These features shall be used as prescribed in ISO 32000-2 and as further restricted by ISO 15930-9 and this document.

6.2 PDF/VT-3 file requirements

A PDF/VT-3 file shall conform to any of the conformance levels specified in ISO 15930-9.

6.3 PDF/VT-3 file identification

A PDF file shall be identified as PDF/VT-3 by the **pdfvtid:GTS_PDFVTVersion** property in the document metadata. The **pdfvtid** prefix denotes the use of the PDF/VT identification extension schema defined in this subclause.

The identification schema defined in Table 1 uses the namespace URI http://www.npes.org/pdfvt/ns/id/. The required schema namespace prefix is **pdfvtid**.

Table 1 — PDF/VT identification property

Property	Value type	Description
pdfvtid:GTS_PDFVTVersion	Text	(Required) PDF/VT conformance level identifier
pdfvtid:GTS_PDFVTModDate	Date	(Required) The date and time at which the PDF/VT-3 file was last written
pdfvtid:rev	Open choice of Integer	(Required) Four-digit year of the date of publication or revision

The values of the **pdfvtid:GTS_PDFVTVersion** property for PDF/VT-3 files prepared in accordance with this document shall be as shown in Table 2.

Table 2 — Required pdfvtid:GTS_PDFVTVersion values

Conformance level	pdfvtid:GTS_PDFVTVersion
PDF/VT-3	*PDF/VT-3*

The value of the **pdfvtid:GTS_PDFVTVersion** property does not in itself determine conformance with this document. The actual determination of conformance shall be performed as specified in Clause 5.

All conforming PDF/VT-3 files shall contain both the **pdfvtid:GTS_PDFVTModDate** and the **xmp:ModifyDate** properties in their document metadata and they shall both have the same value.

NOTE 1 The above requirements assist a conforming processor in recognizing whether or not a PDF/VT-3 file has been modified by a tool that does not conform to PDF/VT-3 or PDF/X-6.

NOTE 2 Provisions for PDF/X-6 with regard to the **pdfxid:GTS_PDFXVersion** entry still apply, independent of, and in addition to, the provisions in this clause with regard to the **pdfvtid:GTS_PDFVTVersion** entry.

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

The document metadata of a PDF/VT-3 file shall not contain any other properties in the **pdfvtid** namespace.

6.4 Document part hierarchy

The **Catalog** dictionary of a conforming PDF/VT-3 file shall have a **DPartRoot** key whose value is an indirect object reference to a **DPartRoot** dictionary, as specified in ISO 32000-2:—, 14.12.

At least one **DPart** dictionary shall be present in the document part hierarchy.

Each **Page** object defined in the PDF/VT-3 file shall be included in the page range defined by one and only one **DPart** dictionary.

NOTE 1 ISO 32000-2 requires that the **DPart** leaf nodes of the document part hierarchy reference pages in the same order as PDF pages referenced from the page tree. PDF viewers that ignore the document part hierarchy will therefore present the pages in the same order as those that follow the document part hierarchy.

Each **Page** object shall have a **DPart** key that has a value that is an indirect reference to the leaf node **DPart** dictionary whose range of pages includes this **Page** object.

NOTE 2 As stated in ISO 32000-2, the **DPart** key in a **Page** object enables a conforming processor to directly retrieve the section of the document part hierarchy that applies to this **Page** object. For example, this enables efficient retrieval of document part metadata (DPM) based on page indices for certain implementation approaches for cut-and-stack imposition. It also enables ready access of DPM data in conforming processors.

In the context of a PDF/VT-3 file the **RecordLevel** key in the **DPartRoot** dictionary shall identify the zero-based level of the document part hierarchy where each DPart node of that level corresponds to the set of pages generated from a record.

A value of *0* for the **RecordLevel** key in the **DPartRoot** dictionary corresponds to the DPart node identified by the value of the **DPartRootNode** key in the **DPartRoot** dictionary.

NOTE 3 If the **RecordLevel** entry is not present in the **DPartRoot** dictionary then records are not explicitly identified in this file.

The **DPartRoot** dictionary shall contain a **NodeNameList** entry.

All **DPart** dictionaries that do not contain a **DParts** entry shall contain a **Start** entry.

6.5 Document part metadata (DPM)

DPM should be populated in conformance with standards such as ISO 21812-1. Custom metadata should only be included if no standardized method of conveying the same information exists.

No two keys present in a single DPM dictionary shall have the same name after expanding hash escape sequences.

6.6 Recurring graphics object definitions

6.6.1 General

XObjects should be used for encoding graphics objects that are referenced more than once from page content streams present in a PDF/VT-3 file. A PDF/VT-3 conforming writer should optimize the PDF/VT-3 file by identifying all graphics objects that are referenced more than once and writing them only once in each PDF/VT-3 file as an appropriate type of XObject.

NOTE 1 This method of factoring out redundant graphical content definitions within a PDF/VT-3 file is a means by which a conforming writer can reduce the size of a conforming file and concisely convey graphics object semantics in a way that allows a PDF/VT-3 conforming processor to consume it efficiently.

NOTE 2 A common performance optimization strategy for a conforming processor implementation, such as a PDF/VT-3 conforming RIP, is to minimize the need to re-process an XObject known to be referenced multiple times with the same intended appearance.

NOTE 3 A graphics object can be encoded as an XObject regardless of whether it is referenced a single time or multiple times from one or more page object content streams in the PDF/VT-3 file.

This document defines additional entries that may be included in an XObject dictionary, as shown in Table 3.

Table 3 — PDF/VT-3 XObject entries

Key	Value type	Description
GTS_Encapsulated	Boolean	(Optional) Indicates whether the XObject has a well-defined and limited interaction with the current graphics state at the point of invocation. Default value: *false*.
GTS_Scope	Name	(Optional) The scope within which the graphical content defined by an XObject is referenced. Default value: *Unknown*.

NOTE 4 ISO 16612-2 defined two additional entries: **GTS_Env** and **GTS_XID**, which are not described in this document and have no specified meaning in a PDF/VT-3 file.

6.6.2 XObject usage scope hints

The **GTS_Scope** key identifies the scope within which the graphical content defined by an XObject is referenced in a PDF/ VT-3 file. A conforming writer should specify a **GTS_Scope** key in an XObject if the lifetime scope of the XObject is known.

If present, the **GTS_Scope** key shall have a value that is one of *SingleUse*, *Record*, *File* or *Unknown*. If the **DPartRoot** dictionary does not contain the **RecordLevel** key, or contains the **RecordLevel** key with a value of *0*, the **GTS_Scope** key shall not have the value of *Record*.

ISO 16612-2 included values of *Stream* and *Global* for **GTS_Scope**; neither of these values are permitted in a PDF/VT-3 file.

NOTE 1 Knowledge of the scope of references to XObjects provides hint information useful for optimized processing by a conforming processor.

The **GTS_Scope** key may have a value of *Unknown* if the scope of the XObject is not known to the conforming writer.

The number of references to an XObject within a PDF/VT-3 file is defined as the number of occurrences of the **Do** operator that refer to that XObject present in all of the content streams in the PDF/VT-3 file.

NOTE 2 An XObject can be referenced multiple times with different active graphics states. This can influence a conforming processor's performance optimization strategy.

NOTE 3 It is possible to have an XObject referenced from another XObject that itself is referenced multiple times. Therefore, the number of occurrences of the **Do** operator is not a measure of the times an XObject will be rendered. Even though an XObject could be referenced only once, this single reference can occur in a content stream that is referenced multiple times, causing that XObject to be rendered multiple times.

The value for the **GTS_Scope** key should be *SingleUse* if the XObject is referenced no more than once from a **Do** operator present in the PDF/ VT-3 file. The value of *SingleUse* for **GTS_Scope** shall not be used if the XObject is referenced more than once in the PDF/VT-3 file.

The value of the **GTS_Scope** key should be *Record* if the XObject is referenced more than once from **Do** operators present in the PDF/VT-3 file from the pages belonging to a single record. The value of *Record* for **GTS_Scope** shall not be used if the XObject is referenced from pages in multiple records.

The value of the *GTS_Scope* key should be *File* if:

— the XObject is referenced more than once from **Do** operators present in the PDF/VT-3 file; and

— those references are in more than the pages belonging to a single record, or the **DPartRoot** dictionary does not contain the **RecordLevel** key.