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2018-05-14

Text and fonts in PDF

What has PDF 2.0 (not) changed for font encoding?

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- Font checks in PDF/A
- Fonts in PDF
- Changes in ISO 32000-2?
- Issues with glyph selection



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Font Checks in Acrobat DC Preflight for PDF/A-2

- ✗  **Character references** **.notdef** **glyph**
The text contains characters that are mapped to the .notdef glyph. The .notdef glyph should not be directly referenced but is used as a placeholder for missing glyphs instead.
- ✗  **CharSet** in **subset** font is incomplete (font contains glyphs that are not listed)
- ✗  **CID** font does not use **Identity-H** or **-V** **encoding** and Ordering strings are not identical
- ✗  **CID** font does not use Identity-H or -V encoding but Registry strings are not identical
- ✗  **CID** font does not use Identity-H or -V encoding but Supplement entries are incompatible
- ✗  **CID** font uses **CMap** that is not predefined and not embedded
- ✗  **CIDset** in subset font is incomplete (font contains glyphs that are not listed)
- ✗  **CMap** references other CMap that is not predefined
- ✗  **Encoding** entry prohibited for **symbolic** TrueType font
- ✗  Font is not valid
- ✗  Font license flag prohibits embedding
- ✗  Font name is not a valid UTF-8 string
- ✗  Font not embedded (and text rendering mode not 3)
- ✗  Glyphs missing in embedded font
- ✗  Inconsistent WMode entries
- ✗  More than one encoding in symbolic TrueType font's **cmap** and no Microsoft Symbol encoding
- ✗  TrueType font has **Differences array** but does not contain a Microsoft Unicode encoding
- ✗  TrueType font has Differences array with glyph names that are not listed in **Adobe Glyph list**
- ✗  **Type 2 CID** font: **CIDToGIDMap** invalid or missing
- ✗  **Width information** for rendered glyphs is inconsistent
- ✗  Wrong encoding for non-symbolic TrueType font

veraPDF rules:
<https://github.com/veraPDF/veraPDF-validation-profiles/wiki>

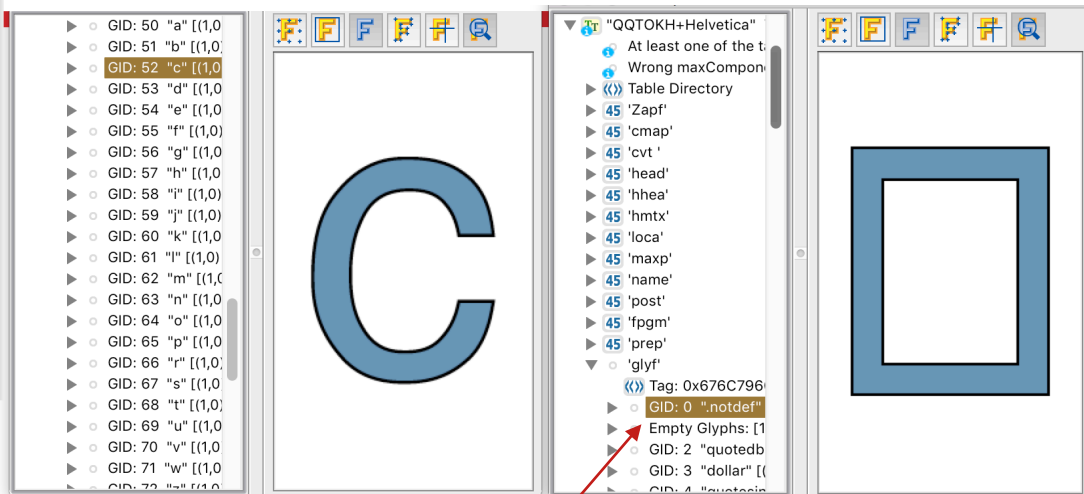
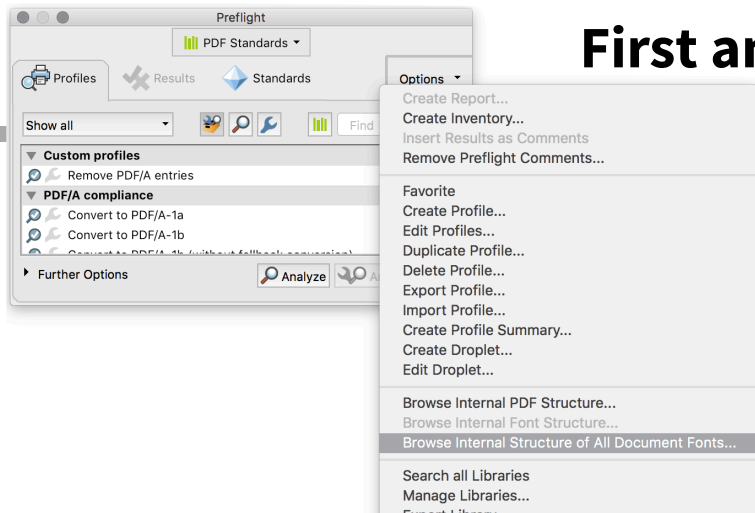


Font Checks in Preflight for PDF/A-2 - Questions to answer

- What is
 - a glyph?
 - a .notdef glyph?
 - a CharSet or a CIDSet?
 - Identity-H or Identity-V
 - font encoding?
 - CMap? Is it the same as a cmap?
 - Differences array
 - a Type 2 CID font?
 - a CIDToGIDMap
 - Width information
- Why is it important whether a font is “symbolic”?
- How are fonts embedded into PDF?

✗	tt	Character references .notdef glyph
		The text contains characters that are mapped to glyphs that cannot be directly referenced but is used as a placeholder.
✗	44	CharSet in subset font is incomplete (font contains glyphs not in CharSet)
✗	44	CID font does not use Identity-H or -V encoding
✗	44	CID font does not use Identity-H or -V encoding
✗	44	CID font does not use Identity-H or -V encoding
✗	44	CID font uses CMap that is not predefined and not a subset of the font's CharSet
✗	44	CIDset in subset font is incomplete (font contains glyphs not in CIDset)
✗	44	CMap references other CMap that is not predefined
✗	44	Encoding entry prohibited for symbolic TrueType fonts
✗	44	Font does not follow veraPDF rules:
✗	44	Font does not follow https://github.com/veraPDF/veraPDF-validation-profiles/wiki
✗	44	Font not embedded (and text rendering mode not set to /S) or not embedded as a subset
✗	44	Glyphs missing in embedded font
✗	44	Inconsistent WMode entries
✗	44	More than one encoding in symbolic TrueType fonts
✗	44	TrueType font has Differences array but does not contain glyph IDs
✗	44	TrueType font has Differences array with glyph IDs not in the font's CharSet
✗	44	Type 2 CID font: CIDToGIDMap invalid or missing
✗	44	Width information for rendered glyphs is inconsistent
✗	44	Wrong encoding for non-symbolic TrueType fonts

First answers



What is

- a 'glyph' is the shape of a character in a font
- a '.notdef' glyph is a particular character that is used when glyph selection fails
 - in TrueType at GID 0
 - in Type 1 / CFF by name ".notdef"



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How a page description in PDF makes use of fonts

- Page description (content stream) selects font through an internal name:
/F25 12 Tf
- Internal name points to font resource object (for current page):
/Resources << /Font << /F25 12 0 R >> >>
- Font resource object contains:
 - Information about the font, for example
 - Base name (example: /Courier)
 - Font type (example: /TrueType)
 - Max. glyph bounding box (example: [-57 -212 961 1000])
 - Character widths (example: [593 615 572 ...])
 - Optionally: the actual font itself (= “font is embedded”)
 - Data stream (for example in /FontFile2 ...)
 - Other widths entries inside of the font stream
 - Optionally: /ToUnicode table for mapping to Unicode



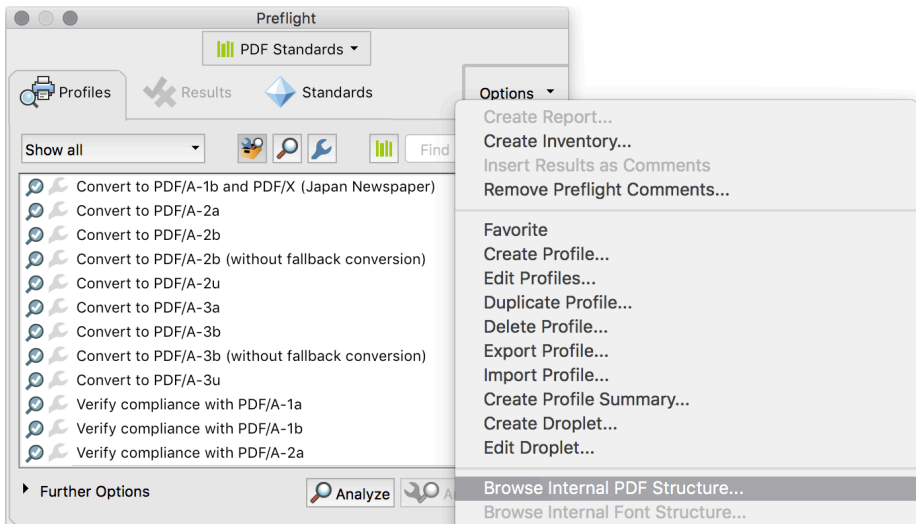
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Analyzing fonts in PDF using Acrobat DC Preflight



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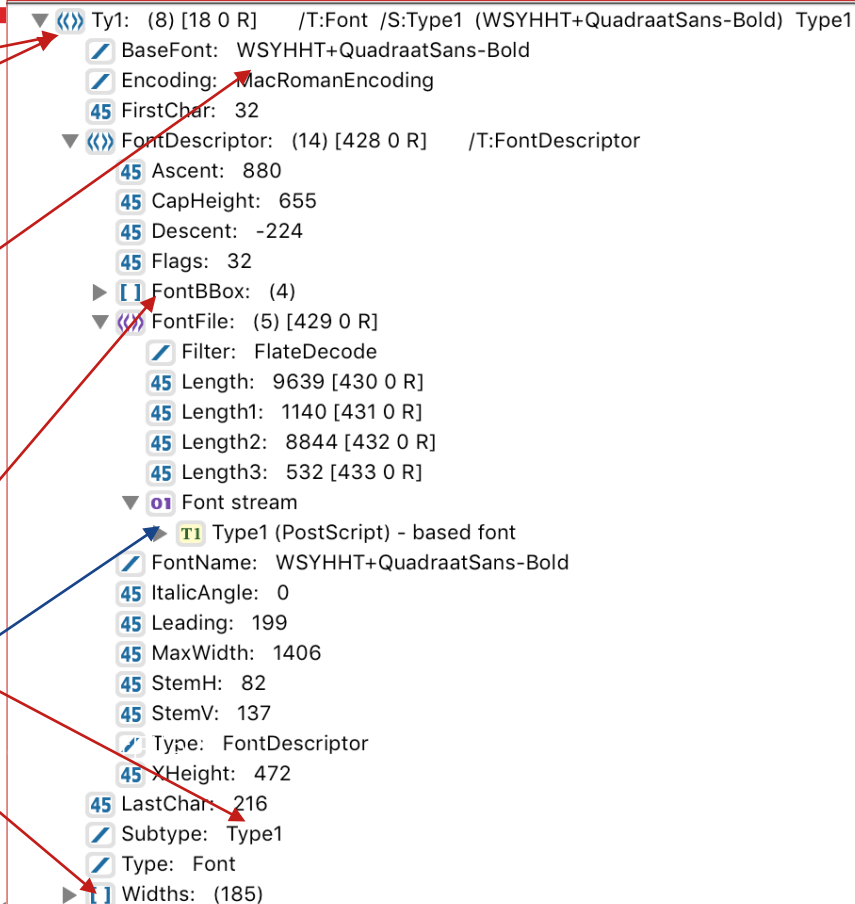
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```

▼ Ty1: (8) [18 0 R] /T:Font /S:Type1 (WSYHHT+QuadraatSans-Bold) Type1
  BaseFont: WSYHHT+QuadraatSans-Bold
  Encoding: MacRomanEncoding
  45 FirstChar: 32
  ▼ FontDescriptor: (14) [428 0 R] /T:FontDescriptor
    45 Ascent: 880
    45 CapHeight: 655
    45 Descent: -224
    45 Flags: 32
    ▶ [1] FontBBox: (4)
    ▼ FontFile: (5) [429 0 R]
      Filter: FlateDecode
      45 Length: 9639 [430 0 R]
      45 Length1: 1140 [431 0 R]
      45 Length2: 8844 [432 0 R]
      45 Length3: 532 [433 0 R]
      ▼ Font stream
        ▶ [1] Type1 (PostScript) - based font
          FontName: WSYHHT+QuadraatSans-Bold
          45 ItalicAngle: 0
          45 Leading: 199
          45 MaxWidth: 1406
          45 StemH: 82
          45 StemV: 137
          Type: FontDescriptor
          45 XHeight: 472
          45 LastChar: 216
          Subtype: Type1
          Type: Font
          ▶ [1] Widths: (185)
  
```

A font in a PDF

- Internal name
- Font resource object
- Font resource object contains:
 - Information about the font
 - Base name
 - Font type
 - Max. glyph bounding box
 - Character widths
 - Optionally: the actual font itself
 - Optionally: ToUnicode table



```

Ty1: (8) [18 0 R] /T:Font /S:Type1 (WSYHHT+QuadraatSans-Bold) Type1
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```

How a page description in PDF refers to glyphs (encoding, glyph selection, glyph mapping)

1. Character code in the page description (a number, one or several bytes)
2. Explicit or implicit mapping, possibly in multiple steps
 - If present via “Encoding” or “CMap” entry in PDF font object
 - Or via encoding defined in the embedded font (built-in encoding)
3. Glyph in actual font by its glyph name or glyph ID
(the outline that actually gets painted)



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- | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|----|
| | 9 | 1 | 5 | 7 | 6 | 8 | 4 | 3 | 2 | 10 |
|--|---|---|---|---|---|---|---|---|---|----|

glyph name to glyph in Type 1 font

91

= CID type 2 character code $\rightarrow$ CMap.Identity-1 $\rightarrow$ CIDToGIDMap.Identity $\rightarrow$ glyph ID



Font types

- Simple fonts
 - 1 byte character codes can address max. 256 glyphs
 - Type 1
 - Type 1 (classic)
 - CFF Type 1 (compact font format)
 - ‘byte code’ instead of ‘clear text’ PostScript operators and operands
 - TrueType (developed by Adobe and Microsoft in the 80th as a competitor to Type 1)
 - Type 3 (not a real font – uses PDF code for each glyph)
 - OpenType (internally either Type 1/CFF flavor or TrueType flavor)
- Composite fonts
 - 1 or 2 byte character codes can address max. 65535 glyphs
 - Type 0 (Type 1 or OpenType/Type 1/CFF based)
 - Type 2 (TrueType or OpenType/TrueType based)



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True Type

- All font types are either Type 1 (PostScript) like or TrueType like
- True Type has advanced features (which sometimes cause font issues)
 - In a font more than one encoding possible via “cmaps” (different from “CMaps” in CID fonts)
 - An optional embedding flag can specify whether the font may be legally embedded
 - The .notdef is by convention on GID 0 (there are no names)
- In PDF a *symbolic flag* specifies whether or not it merely contains symbolic characters (Zapf Dingbats, Windings etc.)
 - If non-symbolic the font should specify a standard encoding (MacRoman or WinAnsi) in the PDF
 - If symbolic all encoding information in the PDF part is ignored



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Mapping to Unicode (encoding for semantics)

- Text search, copying of text
- Optional in PDF – *not* required for painting glyphs (required in PDF/A conformance levels U and A)

From Acrobat DC Preflight's "Inventory" report:

Glyphs used in PDF:

.	1	2	3	•	—
U+002E CiD 46 period	U+0031 CiD 49 one	U+0032 CiD 50 two	U+0033 CiD 51 three	U+2022 CiD 165 bullet	U+2013 CiD 208 endash



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Options of mapping to Unicode

- Implicitly by standard encodings for glyph selection in PDF (example: MacRomanEncoding)
- Encoding information in the actual font (“ToUnicode” cmap in TrueType fonts)
- By glyph names in Type 1 fonts via the Adobe Glyph List (maps glyph names to Unicode)
- Explicitly by a ToUnicode table in the PDF data structure



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Unicode mappings are not necessarily correct
(as everything when it comes to fonts)

		
U+0023 CID 35 NUMBER SIGN	U+0024 CID 36 DOLLAR SIGN	U+0025 CID 37 PERCENT SIGN



Questions answered?

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Overview

- Font tools in pdfToolbox
- Fonts in PDF
- Changes in ISO 32000-2?
- Issues with glyph selection



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CIDSet and CharSet

Lists of glyphs present in an embedded font *subset* (Type1: CharSet / All others: CIDSet)
PDF/A-1: Has to be complete for all *used* glyphs
PDF/A-2: Has to be complete for all glyphs in the font object - *if present*



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Width entries

ISO 32000-1:

The two sets of widths shall be identical.

ISO 32000-2:

These widths shall be consistent with the actual widths given in the font program.

Much clearer but no differences in meaning.



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Standard 14 fonts

Standard 14 fonts are fonts that are expected to be present on an output device

(Times-Roman, Helvetica, Courier, Symbol, Times-Bold, Helvetica-Bold, Courier-Bold, ZapfDingbats, Times-Italic, Helvetica-Oblique, Courier-Oblique, Times-BoldItalic, Helvetica-BoldOblique, Courier-BoldOblique)



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PDF 1.7:

Certain entries did not have to be present for these fonts.

ISO 32000-1 and ISO 32000-2:

No such exceptions, recommendation for PDF processors to be prepared for their absence.



More changes

Clarifications for glyph painting (no changes)

Glyph selection for Type 3 fonts improved

Requirement to use CID 0 if CIDtoGIDMap fails to provide a GID (clarification)

Clearer identification of referenced specifications

Several (informative) notes

Summary: Better to understand and much clearer
- but not much news



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Missing glyph

- Page description references a non-existing glyph in a font
- Possible reasons:
 - old vs. new font version (example: only new version has the Euro sign)
 - incorrect subset font: subsetting algorithm stripped too much, or stripped the wrong glyphs



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We have something against expensive fonts...



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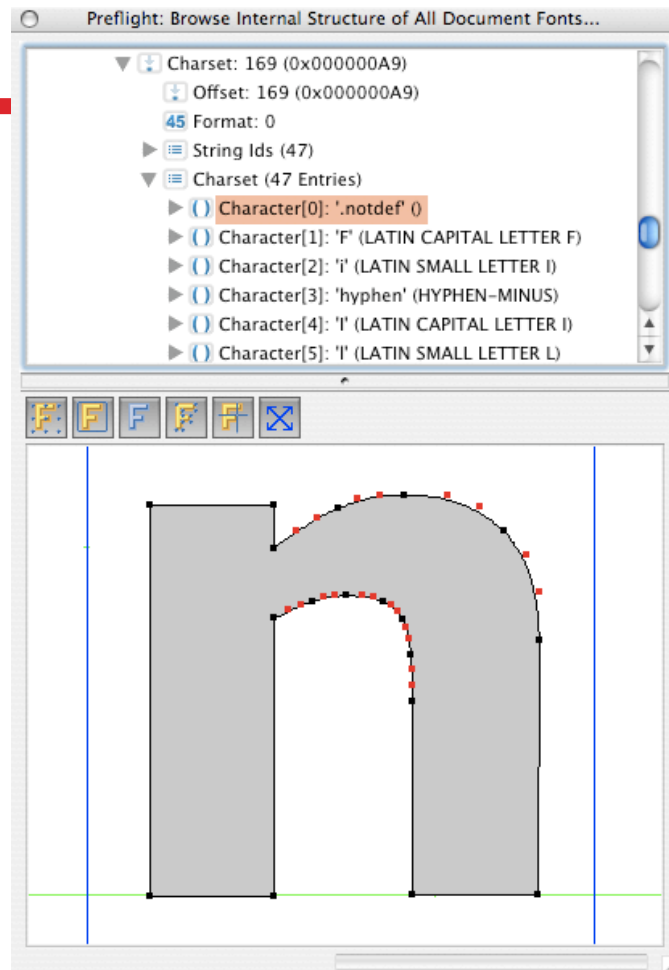
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.notdef is not a notdef

- TrueType font should use GID 0 for the notdef (fallback glyph)
- In this case it is used for a regular character glyph “n”
- Not necessarily a problem



Glyph substitution

- Character code and encoding do not match each other properly
- Example: a PDF creation software “thinks” in WinAnsiEncoding, but a font is embedded using MacRomanEncoding
 - Umlauts and diacritical characters are not properly displayed
 - Glyphs ‘swap places’



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- Geburtsdatum Tag Monat Jahr
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- (a) Anschrift in den USA (Name des Hotels/Zielort)
(b) Ort (c) Bundesstaat
- Ausstellung des Reisepasses durch (Land)
- Reisepassnummer
- Land des Wohnsitzes
- Folgende Länder wurden auf dieser Reise vor der Ankunft in den USA besucht
- Fluggesellschaft/Flugnummer oder Name des Schiffes
- Der Hauptzweck dieser Reise ist geschäftlicher Natur: Ja ☐ Nein ☐
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(a) Früchte, Pflanzen, Lebensmittel, Insekten:	Ja ☐	Nein ☐
(b) Fleisch, Tiere, Tier- oder Wildprodukte:	Ja ☐	Nein ☐
(c) Krankheitserreger, Zellkulturen, Schnecken:	Ja ☐	Nein ☐
(d) Erde oder ich war (wir waren) auf einem landwirtschaftlichen Betrieb/einer Weide:	Ja ☐	Nein ☐
- Ich habe mich (wir haben uns) in unmittelbarer Nähe eines Viehbestands aufgehalten (darunter fällt z.B. das Berühren von und der Umgang mit Tieren): Ja ☐ Nein ☐
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(Eine Definition von Zahlungsmittel ist auf der Rückseite des Formulars zu finden)
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- Einwohner – Der Gesamtwert aller Güter, einschließlich Handelswaren, die ich (wir) im Ausland gekauft oder erworben habe (haben) (darunter fallen auch Geschenke für jemand anders, jedoch nicht in die USA versandte Gegenstände) und in die USA einführe (einführen), beläuft sich auf: \$
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Lesen Sie bitte die Anleitungen auf der Rückseite dieses Formulars. Dort ist auch Platz zur Auflistung aller von Ihnen anzumeldenden Gegenstände vorgesehen.

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4. (a) Anschrift in den USA (Name des Hotels/Zielort)
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(c) Krankheitserreger, Zellkulturen, Schnecken: Ja ☐ Nein ☐

(d) Erde oder ich war (wir waren) auf einem landwirtschaftlichen Betrieb/einer Weide: Ja ☐ Nein ☐

12. Ich habe mich (wir haben uns) in unmittelbarer Nähe eines Viehbestands aufgehalten (darunter fällt z.B. das Berühren von und der Umgang mit Tieren): Ja ☐ Nein ☐

13. Ich führe (wir führen) Geld, Zahlungsmittel oder ausländische Geldmittel im Wert von mehr als US\$ 10.000 mit mir (uns): (Eine Definition von Zahlungsmittel ist auf der Rückseite des Formulars zu finden) Ja ☐ Nein ☐

14. Ich führe (wir führen) Handelswaren mit mir (uns): (Zum Verkauf bestimmte Waren, Warenmuster zur Kundenanwerbung oder andere Güter, die nicht als persönliche Gebrauchsgegenstände gelten.) Ja ☐ Nein ☐

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Unterbringung mit 2 Erwachsenen im DZ mit Zustellbett)



Dietrich von Seggern

Managing Director,
callas software GmbH

Vice Chair,
PDF Association



Reasons for glyph substitution

1. The PDF is the problem

- Encodings used incorrectly when producing PDF (typical for some “cheap” PDF printer drivers or PDF creation tools)
- Encodings used incorrectly when rewriting PDF (optimization, editing, merging fonts, ...)
- .notdef is used and directly referenced (in a TrueType font)



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Reasons for glyph substitution

2. The PDF is not the problem

- Broken caching of fonts in PDF viewers, output systems (RIPs) or when transparency flattening
- Multiple instances of same original font on various pages
 - using the same name (ABCDEF+BaseFontName)
 - but with non-identical subsets
- Can easily happen when two or more PDFs are merged
- Processor establishes one instance, when ‘seeing’ the next instance it assumes it is identical to the first instance and uses first instance
- Preflight’s “Fix potential font problems” includes a Fixup “Make font name unique for all fonts” that adds a unique prefix to each font



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Recap

- **Font checks in PDF/A**

- **Fonts in PDF**

- What is
 - a glyph?
 - a .notdef glyph?
 - a CharSet or a CIDSet?
 - Identity-H or Identity-V
 - font encoding?
 - CMap? Is it the same as a cmap?
 - Differences array
 - a Type 2 CID font?
 - a CIDToGIDMap
 - Width information

- Why is it important whether a font is “symbolic”?
- How are fonts embedded into PDF?

- **Changes in ISO 32000-2?**

- **Issues with glyph selection**

- ✗ **t** Character references .notdef glyph
The text contains characters that are mapped to the .notdef glyph, which is not be directly referenced but is used as a placeholder.
- ✗ **44** CharSet in subset font is incomplete (font contains characters not in the subset)
- ✗ **44** CID font does not use Identity-H or -V encoding and does not use a CMap
- ✗ **44** CID font does not use Identity-H or -V encoding but uses a CMap
- ✗ **44** CID font does not use Identity-H or -V encoding but uses a CMap
- ✗ **44** CID font uses CMap that is not predefined and not a subset of the font's CMap
- ✗ **44** CIDset in subset font is incomplete (font contains characters not in the subset)
- ✗ **44** CMap references other CMap that is not predefined
- ✗ **44** Encoding entry prohibited for symbolic TrueType fonts
- ✗ **44** Font is not valid
- ✗ **44** Font license flag prohibits embedding
- ✗ **44** Font name is not a valid UTF-8 string
- ✗ **44** Font not embedded (and text rendering mode not 3)
- ✗ **44** Glyphs missing in embedded font
- ✗ **44** Inconsistent WMode entries
- ✗ **44** More than one encoding in symbolic TrueType font
- ✗ **44** TrueType font has Differences array but does not contain glyph names
- ✗ **44** TrueType font has Differences array with glyph names
- ✗ **44** Type 2 CID font: CIDToGIDMap invalid or missing
- ✗ **44** Width information for rendered glyphs is inconsistent
- ✗ **44** Wrong encoding for non-symbolic TrueType font



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Thank you!

Any questions?

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