Integrating “Smart Documents” into PLM and the Digital Thread

Documents as Models in the Digital Thread
• What is a smart document?

• What’s the problem?
  • Is it really a problem?

• What if a document was actually a model?

• Document models in PLM

• Benefits of documents as models

• What is the potential?
What is a Smart Document?

- Templates
- Document “Review” options
  - Collaboration & Change notifications
- Capable of being programmed (spreadsheets)
- Forms with selection options
- eSignature capabilities
- Connections back to the company Customer Relationship Management (CRM) system
  - Digital rights management (DRM)
  - Tracking Import / Export management

Can documents be more?
What’s the problem?

Let us look at access to specifications
• Large amounts of information
• Stacks and folders of specifications
• Extraneous Information
• Large amounts of cross referencing
• Version Verification

The document quagmire

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Lets Go Electronic!
Electronic solution

Applications:

- Microsoft Word, Excel, PowerPoint
- Adobe FrameMaker, PageMaker
- Arbortext
- Others

- Convert to PDF format
- Include hyperlinks
- Store in PDM system
- DRM management

Electronic is not enough!
“Electronic Documents” enhance search capabilities but most documents don’t talk to each other

Let us look at an example
A Simple Printed Wiring Board Drawing Note

“UNLESS OTHERWISE SPECIFIED PERFORM ELECTRICAL TESTS PER FIND NUMBER 106”

FIND NUMBER 106:
“PRINTED WIRING BOARDS, RIGID, FABRICATION REQUIREMENTS”
“PRINTED WIRING BOARDS, RIGID, FABRICATION REQUIREMENTS”

DOCUMENT PAGE COUNT - 24

4 GOVERNMENT / NATIONALLY RECOGNIZED PUBLICATIONS

12 REFERENCED DOCUMENTS

6 INDUSTRY PUBLICATIONS (ANSI, IPC, SAE)

2 GOVERNMENT PUBLICATIONS

11 INDUSTRY PUBLICATIONS (ASTM, ANSI, IPC)

4 OTHER NGSC DOCUMENTS

2 OTHER NGSC DOCUMENTS (AS APPLICABLE)

2 GOVERNMENT PUBLICATIONS

12 INDUSTRY PUBLICATIONS (ASTM, ANSI, IPC)

4 OTHER NGSC DOCUMENTS

Represents 40+ Unique Documents
Let us get real specific
Let’s narrow further

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- Bow & Twist (Para 3.11.4)
- Shall Meet Para 3.6.1.2
- Requirements of IPC-6012 apply

25 IPC specs
2 joint industry standards
3 ASTM standards
1 UL standard
1 NEMI standard
2 AMS standards
1 ASME standard

37 Unique Documents
How do we see only relevant information?
Leverage transclusion
What if a document was actually a model?

But what if a referenced document changes?
Let’s make it smart!

Two Way Communication!
What does a smart document look like?

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Defines the Authoritative Source!
What does a smart document look like?

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From: J-STD-001D Section 3.3

3.3 Flux Flux shall be in accordance with J-STD-004 or equivalent.

Flux shall conform to flux activity levels L0 and L1 of flux materials rosin (RO), resin (RE), or organic (OR), except organic flux activity level L1 shall not be used for no-clean soldering.

When other activity levels or flux materials are used, data demonstrating compatibility shall be available for review (see 3.1).

Note: Flux or solder paste soldering process combinations previously tested or qualified in accordance with other specifications do not require additional testing.

Type H or M fluxes shall not be used for tinning of stranded wires.

(2)

- Class 1-Defect
- Class 2-Defect
- Class 3-Defect

3.3.1 Flux Application When an external flux is used in conjunction with flux cored solders, the fluxes shall be compatible.
Type H or M fluxes shall not be used for tinning of stranded wires.

(2)

- Class 1-Defect
- Class 2-Defect
- Class 3-Defect

3.3.1 Flux Application: When an external flux is used in conjunction with flux cored solders, the fluxes shall be compatible both from a cleaning process standpoint and a chemical standpoint. Objective evidence of compatibility, e.g., surface insulation resistance testing, ion chromatography testing, shall be available for review, see 1.8.7 and Appendix C. IPC-9202 and IPC-9203 are examples for qualification testing. When an external flux is used in conjunction with flux cored solders, the fluxes shall be compatible.

(4)

- Class 1-Defect
- Class 2-Defect
- Class 3-Defect
What if a document model was part of the Ecosystem?
PLM representation

Engineering BOM
Manufacturing BOM
Bill Of Process
Product Structure
PLM representation

Engineering BOM
Manufacturing BOM
Bill Of Process
Product Structure
PLM expanded view
PLM expanded view

See Status Immediately
See the details
PLM where used
Benefits of documents a models

But wait, there’s more?
Augmented reality
Augmented reality

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OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE WASHINGTON 25, D. C.

13 October 1995

Supply and Logistics

SURFACE ROUGHNESS, WAVINESS AND LAY

MIL-STD-10A

1. This standard has been approved by the Department of Defense for use by the Departments of the Army, the Navy, and the Air Force.
2. In accordance with established procedure, the Standardization Division has designated the Ordnance Corps, Bureau of Ordnance and the Air Force, respectively, as Army-Navy-Air Force custodians of this standard.
3. This standard is mandatory for use effective 15 April 1996 by the Departments of the Army, the Navy, and the Air Force.
4. Recommended corrections, additions, or deletions should be addressed to the Standardization Division, Office of the Assistant Secretary of Defense (Supply and Logistic), Washington 25, D. C.

1. GENERAL

1.1 Purpose. This standard establishes a uniform system for the identification and specification of the geometric irregularities of the surfaces of solid materials. It provides, through the use of symbols and numerical classifications, a means for accurately expressing surface roughness, waviness and lay requirements on drawings, in specifications, or verbally.

1.2 Scope. This standard covers surface irregularities with respect to their height, width, and direction. It shall replace all former practices for specifying finishes or surface conditions and shall apply to any surface of sufficient hardness to be evaluated in terms of microinches (millimeters of an inch) under the provisions herein specified.

1.3 Materials and Processes. This standard is not concerned with materials analysis, microstructure, corrosion resistance, appearance, lustre, color or like characteristics except when...
What about drawings?

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Table V

<table>
<thead>
<tr>
<th>Roughness Height Rating</th>
<th>General Application of Roughness Height Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Very rough, low grade surface resulting from sand casting, torch or saw cutting, chipping or rough forging. Machine operations are not required as appearance is not objectionable. This finish, rarely specified, is suitable for unmachined clearance areas on machinery, jigs, and other rough construction items.</td>
</tr>
<tr>
<td>500</td>
<td>Very rough, low grade surfaces, where smoothness is of no object, resulting from heavy cuts and coarse feeds in milling, turning, shaping, boring, and from very rough filing, rough disc grinding and snagging. This surface is suitable for clearance areas on machinery, jigs, and fixtures. This surface roughness may be obtained by natural processes of sand casting or rough forging.</td>
</tr>
<tr>
<td>250</td>
<td>Coarse production surfaces, for unimportant clearance and cleanup operations, resulting from very coarse surface grind, rough file, disc grind, and from rapid feeds in turning, milling, shaping, drilling, boring, grinding, etc., where definite tool marks are not objectionable. The roughness may also be produced on the natural surfaces of forgings, permanent mold castings, extrusions and rolled surfaces. Surfaces with this roughness value can be produced very economically and is used to a great extent on parts where stress requirements, appearance, and conditions of operations and design permit.</td>
</tr>
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</table>
| 125                      | This is the roughest surface recommended for parts subject to leads, vibration, and high stress. This surface roughness is also permitted for bearing surfaces when the motion is slow and the loads are light or intermittent, but not to be specified for best rotating shafts, axles, and parts subject to severe vibration or extreme tension. This surface is a medium, commercial machine finish in which relatively high speeds and fine feeds are used in taking light cuts with well-sharpened tools, and may be economically produced on lathes, milling machines, shapes, grinders, etc. The surface finish may also be obtained on permanent mold castings, die castings, extrusions, and rolled

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What about drawings?

1. ALL DIMENSIONS IN INCHES
2. ROUGHNESS PER FIND NUMBER 8

3.00"
3.75"
2.00"
250
### MIL-STD-10A - MILITARY STANDARD SURFACE ROUGHNESS WAVINESS AND LAY

5.2.4 Effect on drawings, specifications, etc. In normal design applications, the performance difference between the values obtained from the roughness height averaging method and the RMS method is not large enough to warrant the conversion of drawings, specifications, etc. However, on critical surfaces, where slight differences in surface roughness is significant, the 11 percent conversion factor may be used.

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<tr>
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<td>Coarse production surfaces, for unimportant clearance and cleanup operations, resulting from very coarse surface grinds, roughing, final grinding, etc. This surface smoothness is objectionable. The surface may also be produced on the natural surfaces of forgings, permanent mold castings, extrusions and rolled surfaces. Surfaces with this roughness value can be produced very economically and is used to a great extent on parts where stress requirements, appearance, and conditions of operation and design permit.</td>
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<td>125</td>
<td>This is the roughest surface recommended for parts subject to feeds, vibration, and high stress. This surface roughness is also permitted for bearing surfaces when the motion is slow and the loads are light or insufficient, but not to be specified for fast rotating shafts, axles, and parts subject to severe vibration or extreme tension. This surface is a medium, commercial machine finish in which relatively high speeds and fine feeds are used in taking light cuts with well-sharpened tools, and may be economically produced on lathes, milling machines, shapers, grinders, etc. The surface finish may also be obtained on permanent mold castings, die castings, extrusions, and rolled surfaces.</td>
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What is the Potential?

• Interconnectivity to the authoritative source change
  • What if a critical value changed in a table?

• Proactively recognize change impact

• Demonstrable digital thread of documents

• Ensure compliance

• Maximize continuous improvement
  • Is there a best practice update?
  • Is there a change due to lessons learned?

• Documents as models today is akin to moving from paper to CAD
  • Potential is limited by ingenuity and imagination

Work Smarter NOT Harder!
Maximize the Model Based Ecosystem

• Purposeful specifications
• Version cognizance
• Managed in PLM/PDM/ERP
• Linked to CAD data
• Get the most out of your documents
• What about AI - ask questions “How do I .....”
• Think outside the box

SMART CONNECTED DOCUMENTS!
Thank You

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