

Implementing Quality and Reliability on the Assembly Line

Dave Bergman, VP International Relations
IPC – Association Connecting Electronics Industries
Bannockburn, IL.

Many will look to IPC standards for advice or workmanship requirements for electronic assemblies. Some will find a copy of IPC-A-610 *Acceptability of Electronic Assemblies* and stop there. But IPC has many other tools that can help improve quality and reliability for companies involved in manufacturing electronics. This presentation will tour the factory floor and point out some of the best and often overlooked resources from IPC.

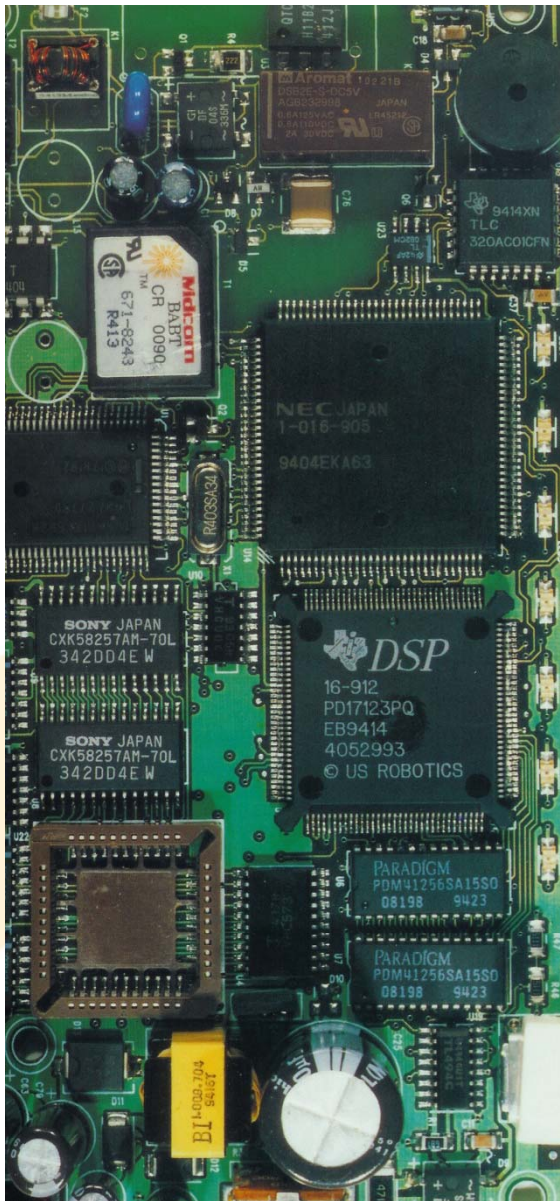
Implementing Quality and Reliability on the Assembly Line

David Bergman, IPC

A special note of thanks

Lars-Olof Wallin
IPC European
Representative





IPC-A-610

Revision D
February 2005
Supersedes Revision C
January 2000

Acceptability of Electronic Assemblies

Developed by



ASSOCIATION CONNECTING
ELECTRONICS INDUSTRIES®

Will this book
solve the problems?

NO!!

Electronic Design

Product spec

Component data

Electronic schematic

Net list
BOM

CAD

CAM

IPC standard

- 1
- 2
- 3
- 4

IPC standard

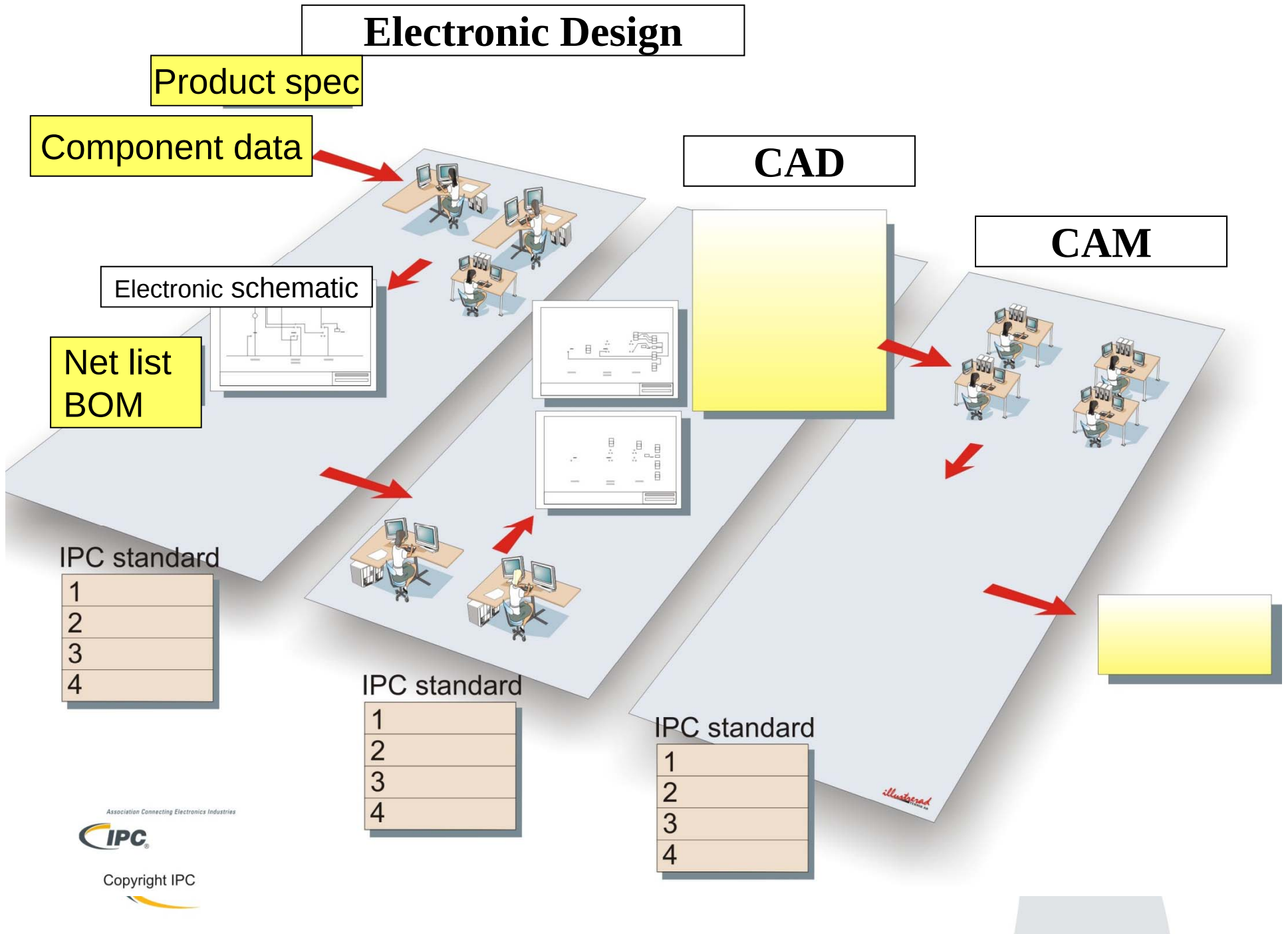
- 1
- 2
- 3
- 4

IPC standard

- 1
- 2
- 3
- 4



Copyright IPC



CAM

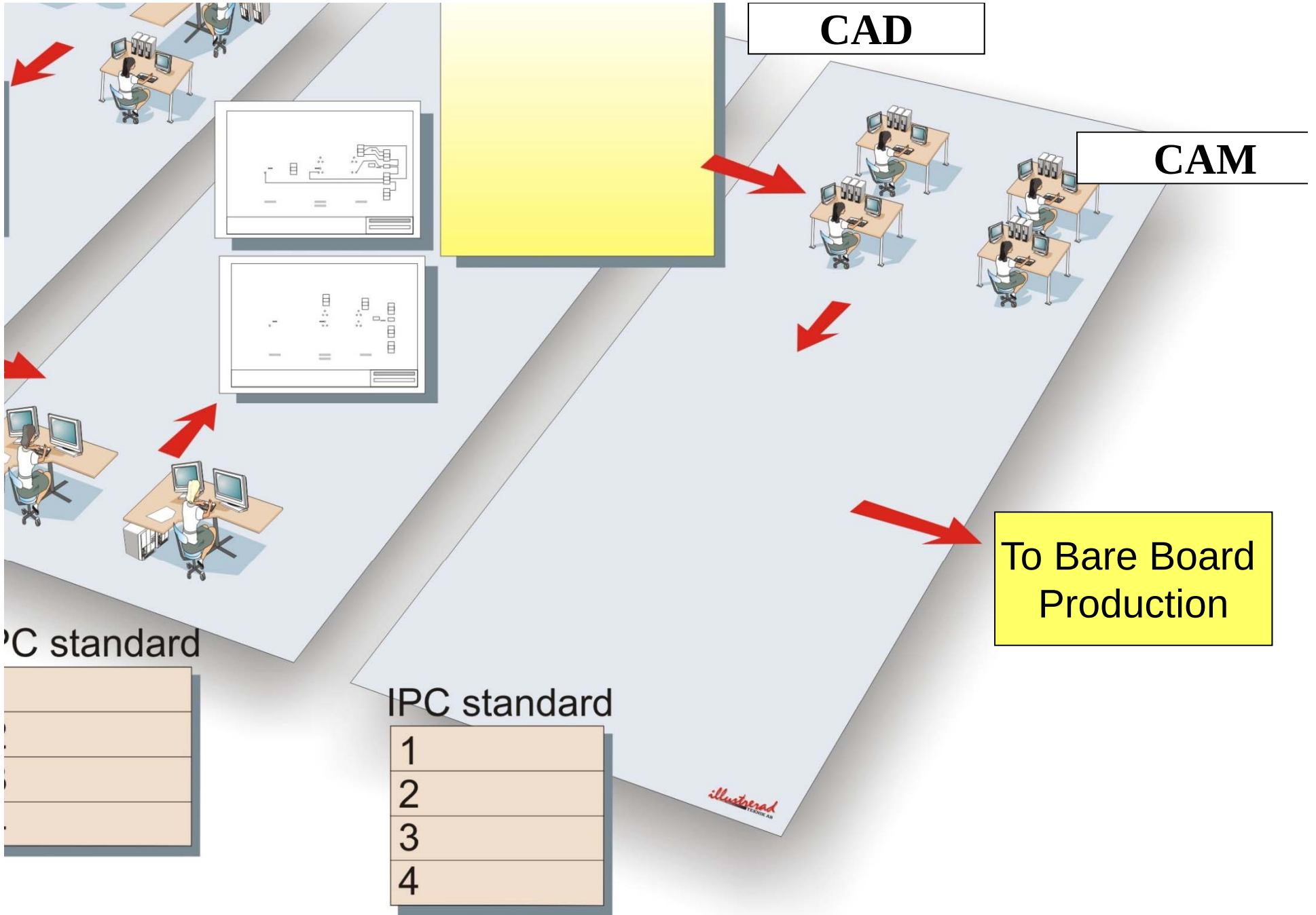
Gerber files on all copper layer
Gerber files on solder mask
Gerber files on legend print.
Drill file & Drill information
Bare Board Specification
Mechanical drawing.
Coordinates for SMD assembly
Gerber file for solder paste stencil

IPC standard

1
2
3
4

IPC standard

1
2
3
4



IPC-9691A

IPC-4562A

IPC-4121

IPC-4563

IPC-4101C

?

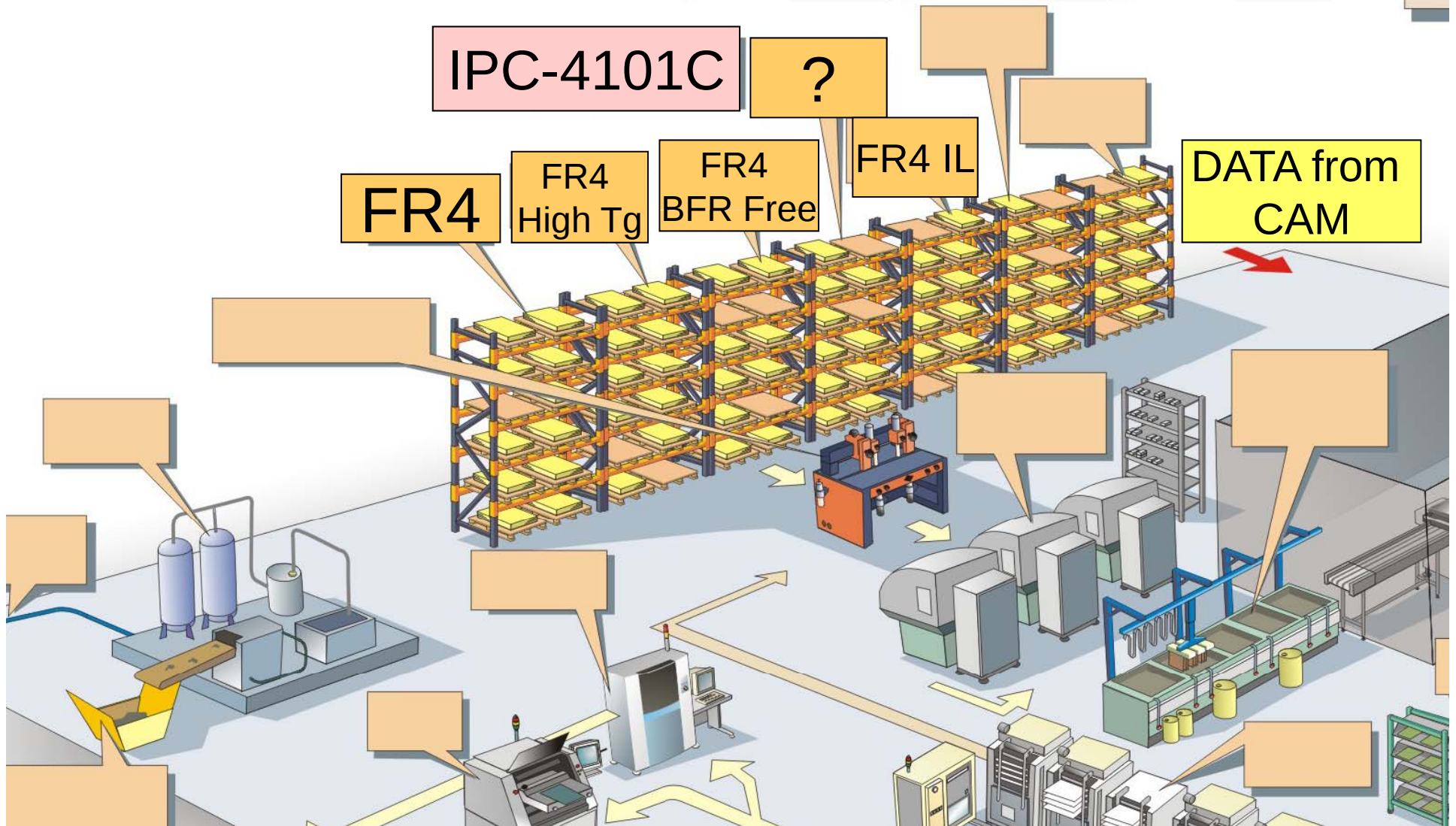
FR4

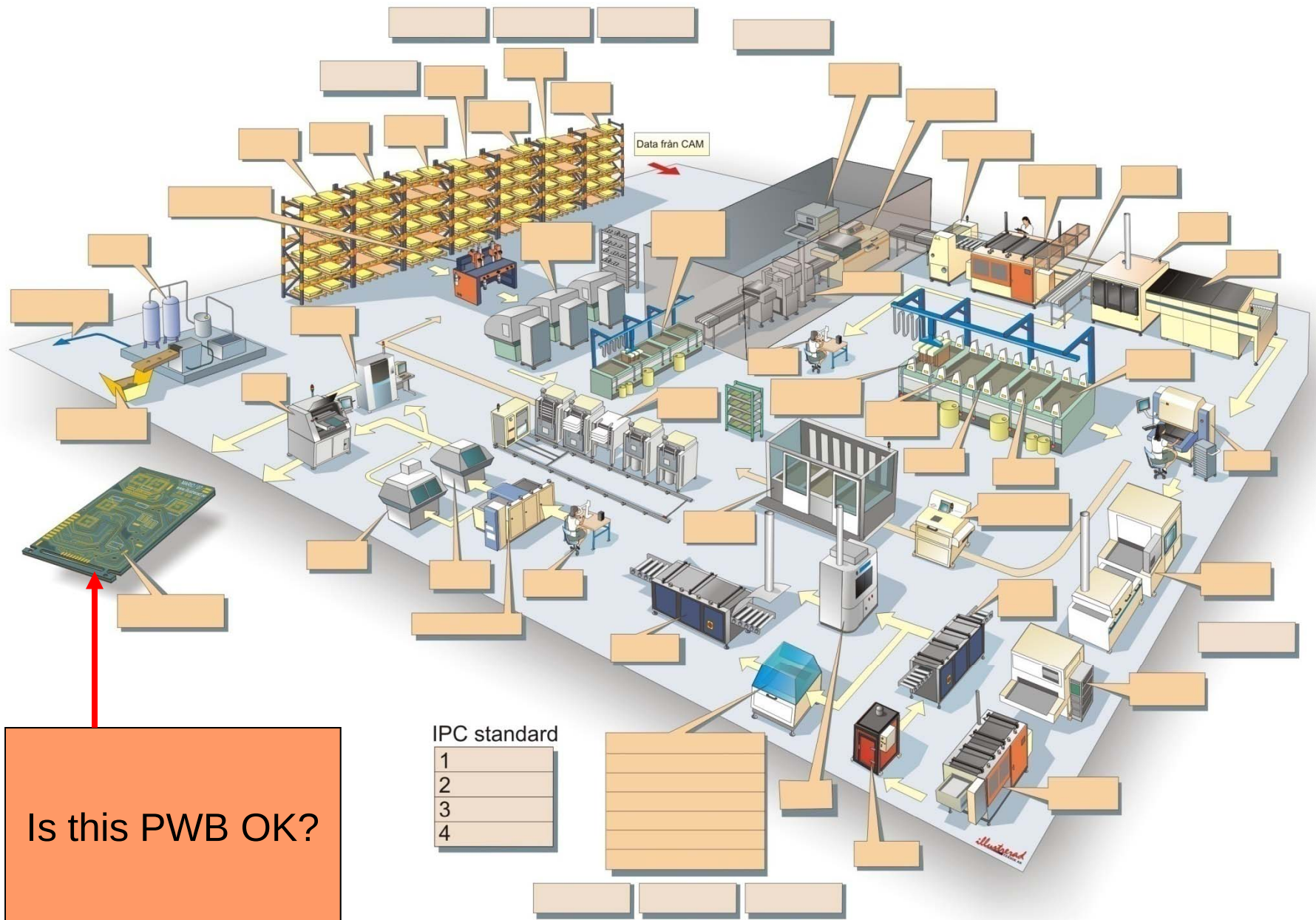
FR4
High Tg

FR4
BFR Free

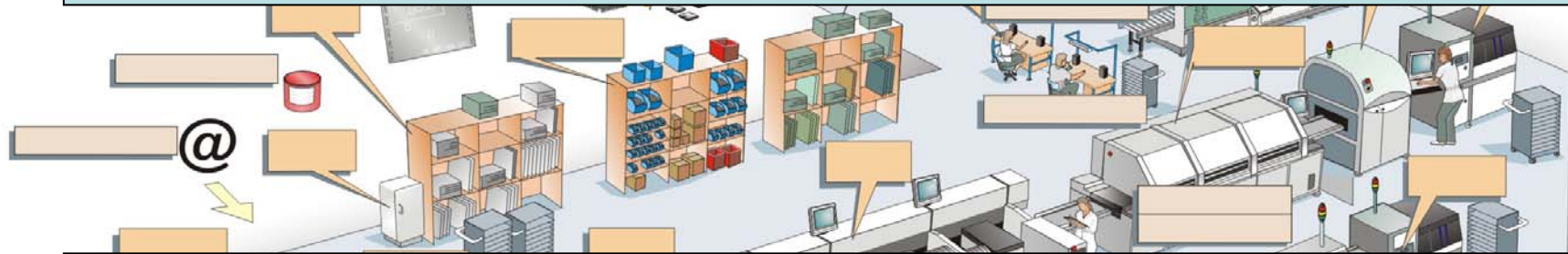
FR4 IL

DATA from
CAM

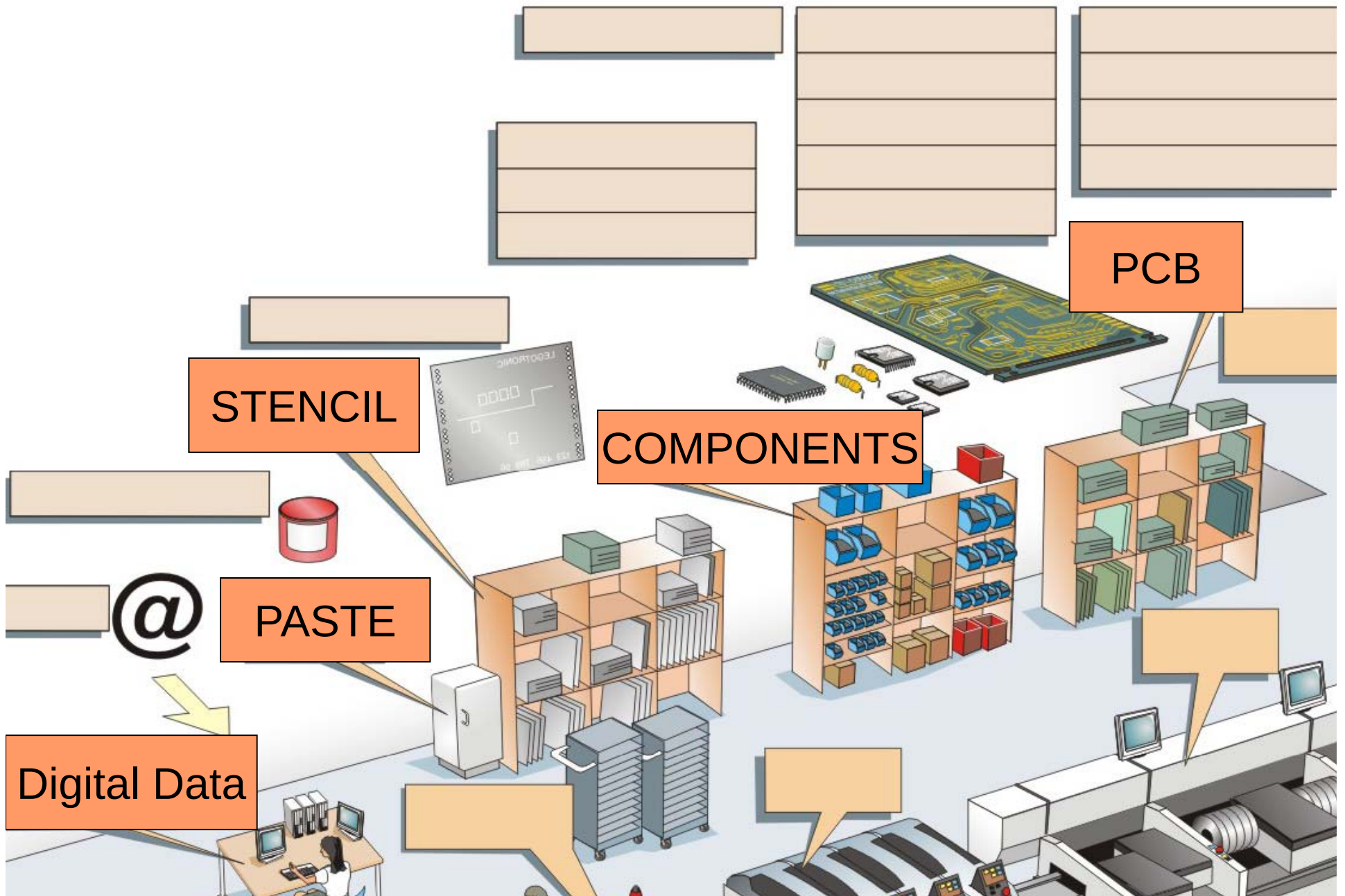


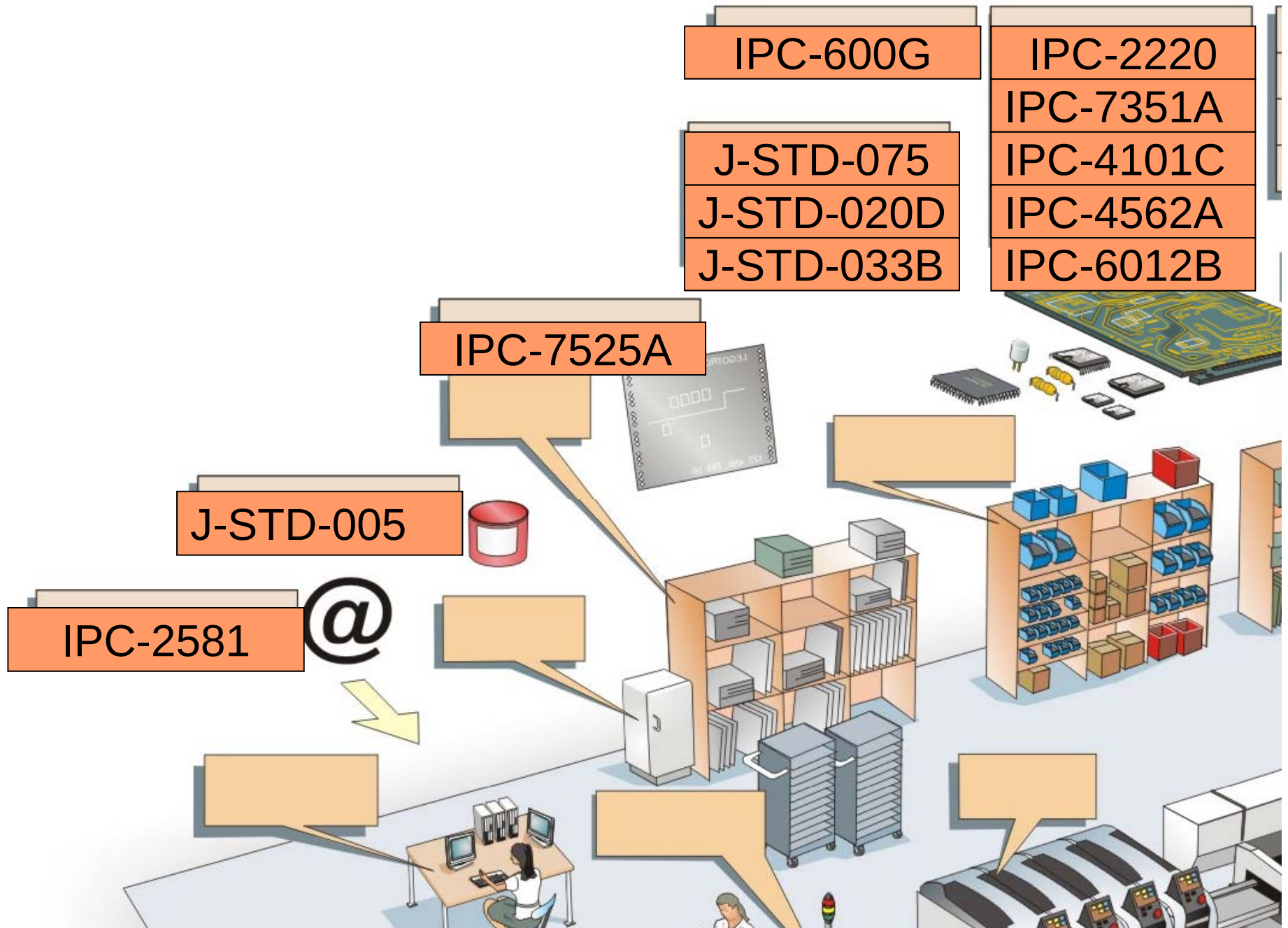


In Sweden it will cost
around 1200 \$/hour.



Total: 19,100 \$ per Day.





IPC-600G

IPC-2220

J-STD-003B

IPC-7351A

IPC-SM-840

J-STD-075

IPC-4101B

IPC-4552

J-STD-020D

IPC-4562A

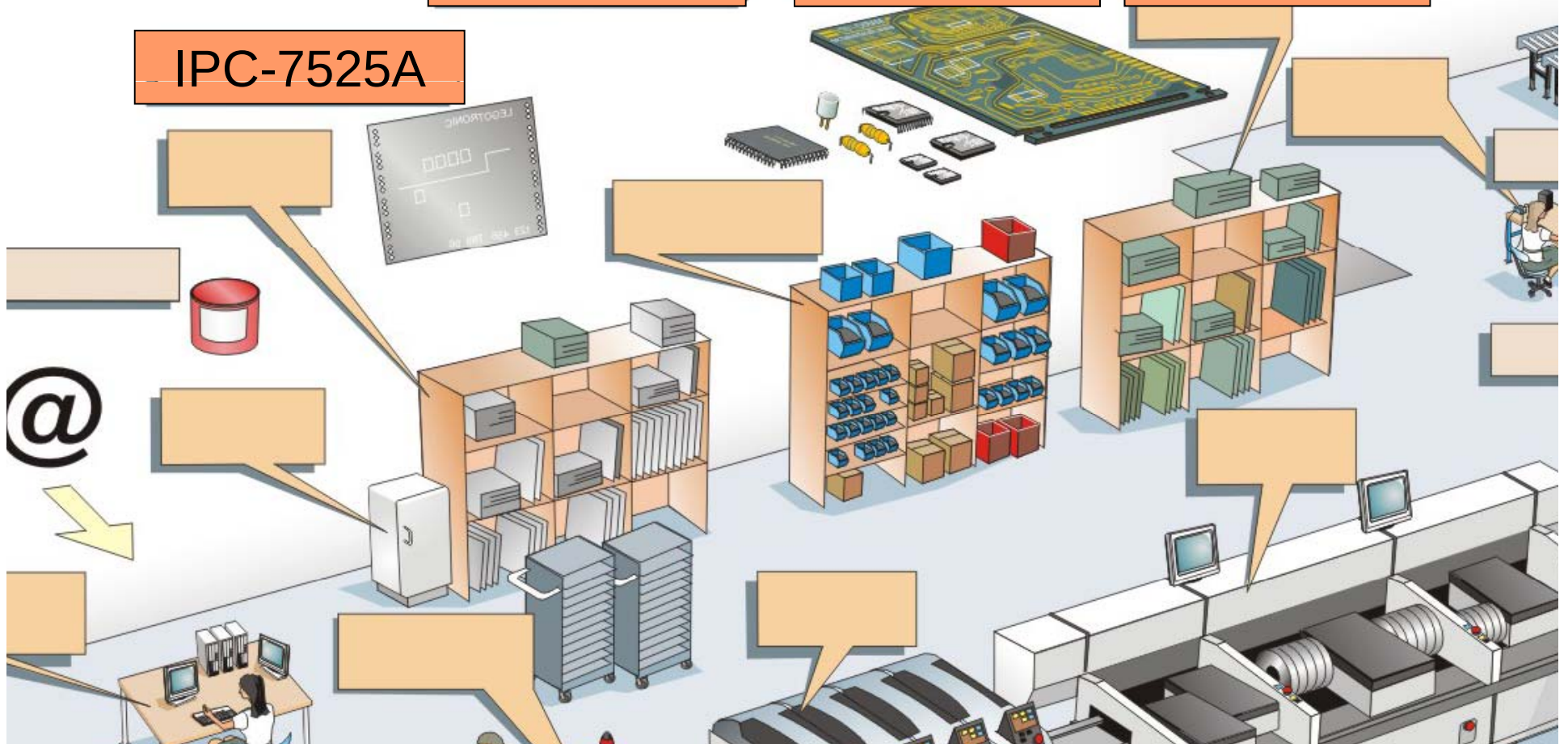
IPC-4553

J-STD-033B

IPC-6012B

IPC-4554

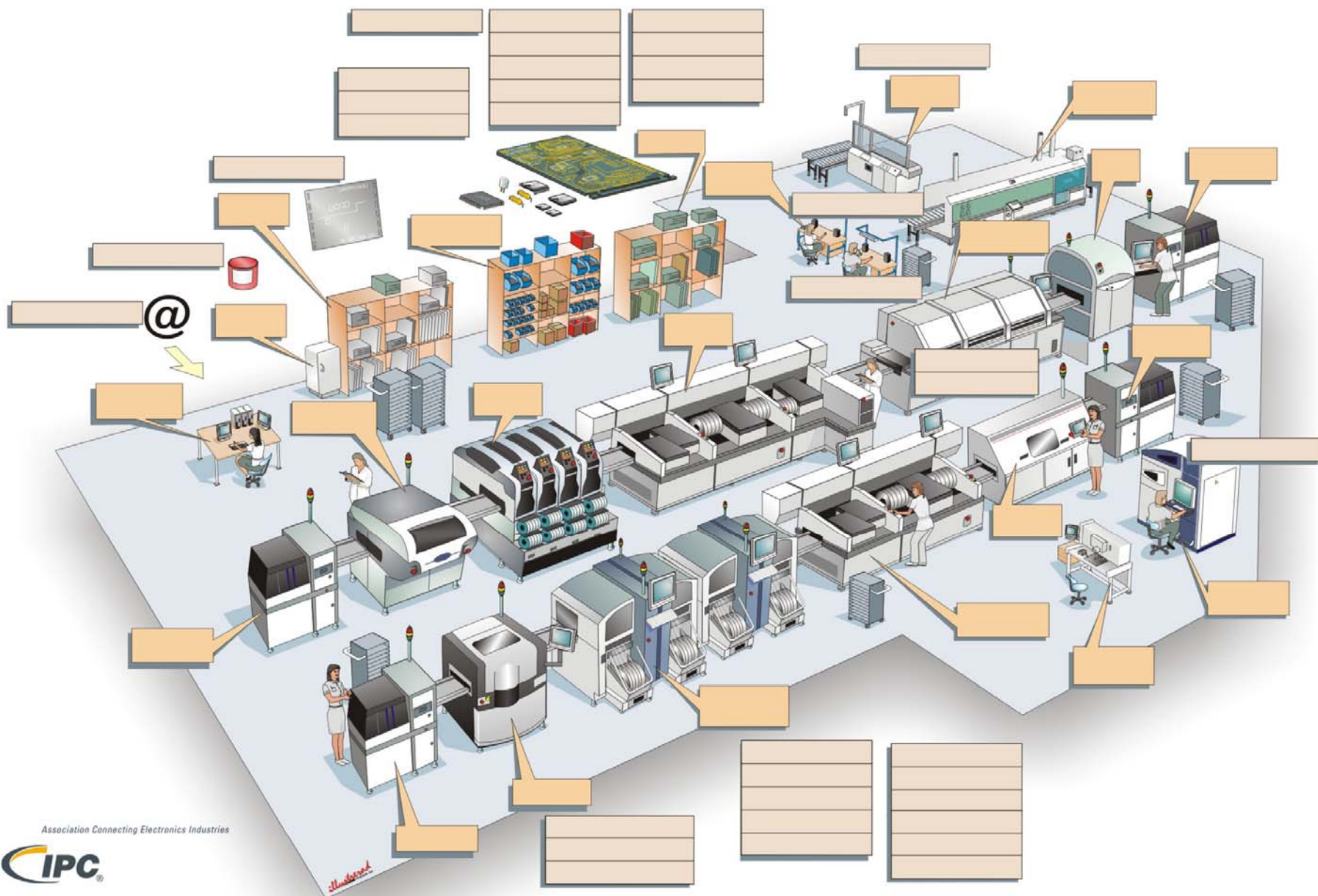
IPC-7525A



TOOLS for Assembly and Soldering

Association Connecting Electronics Industries

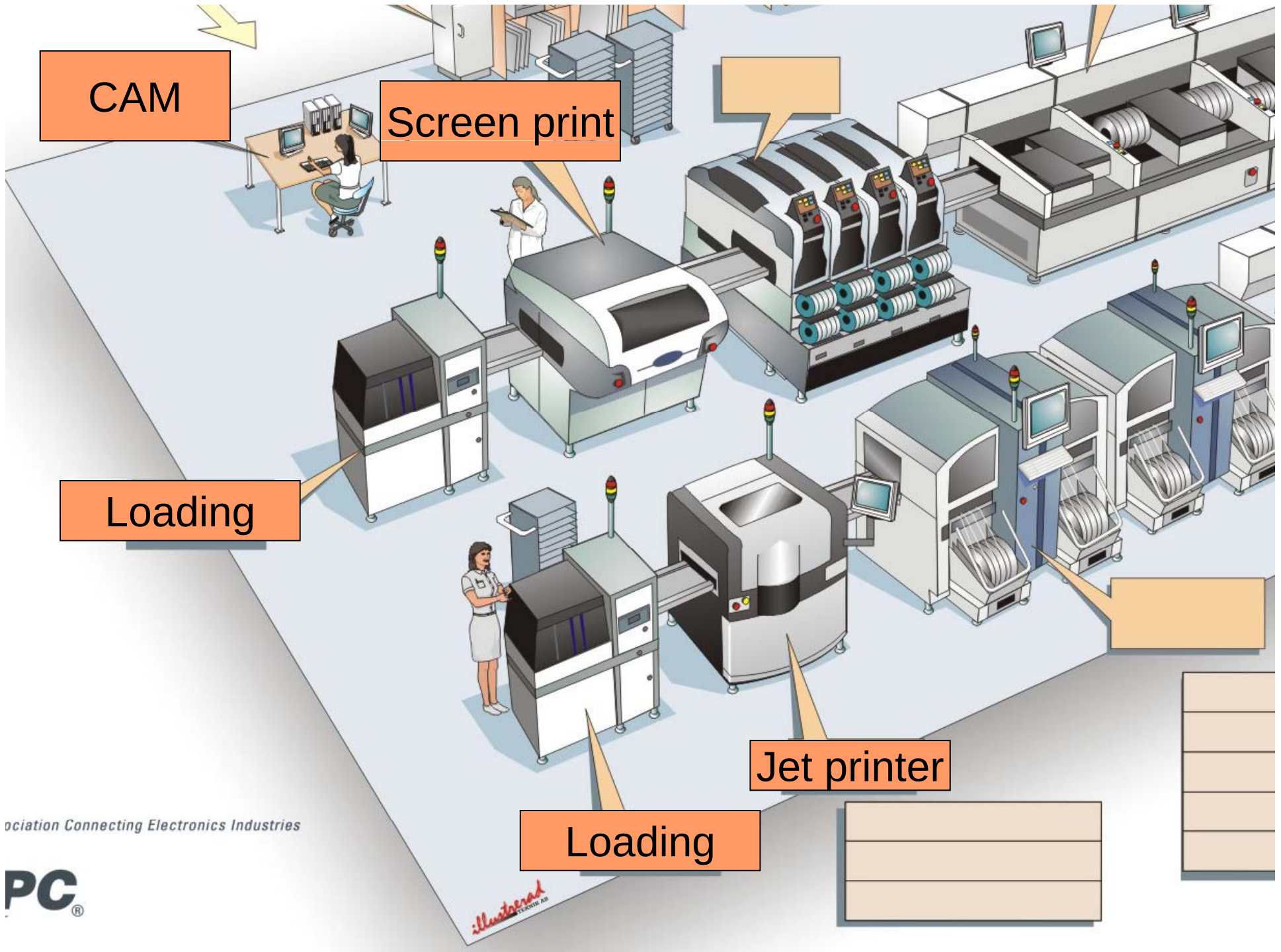


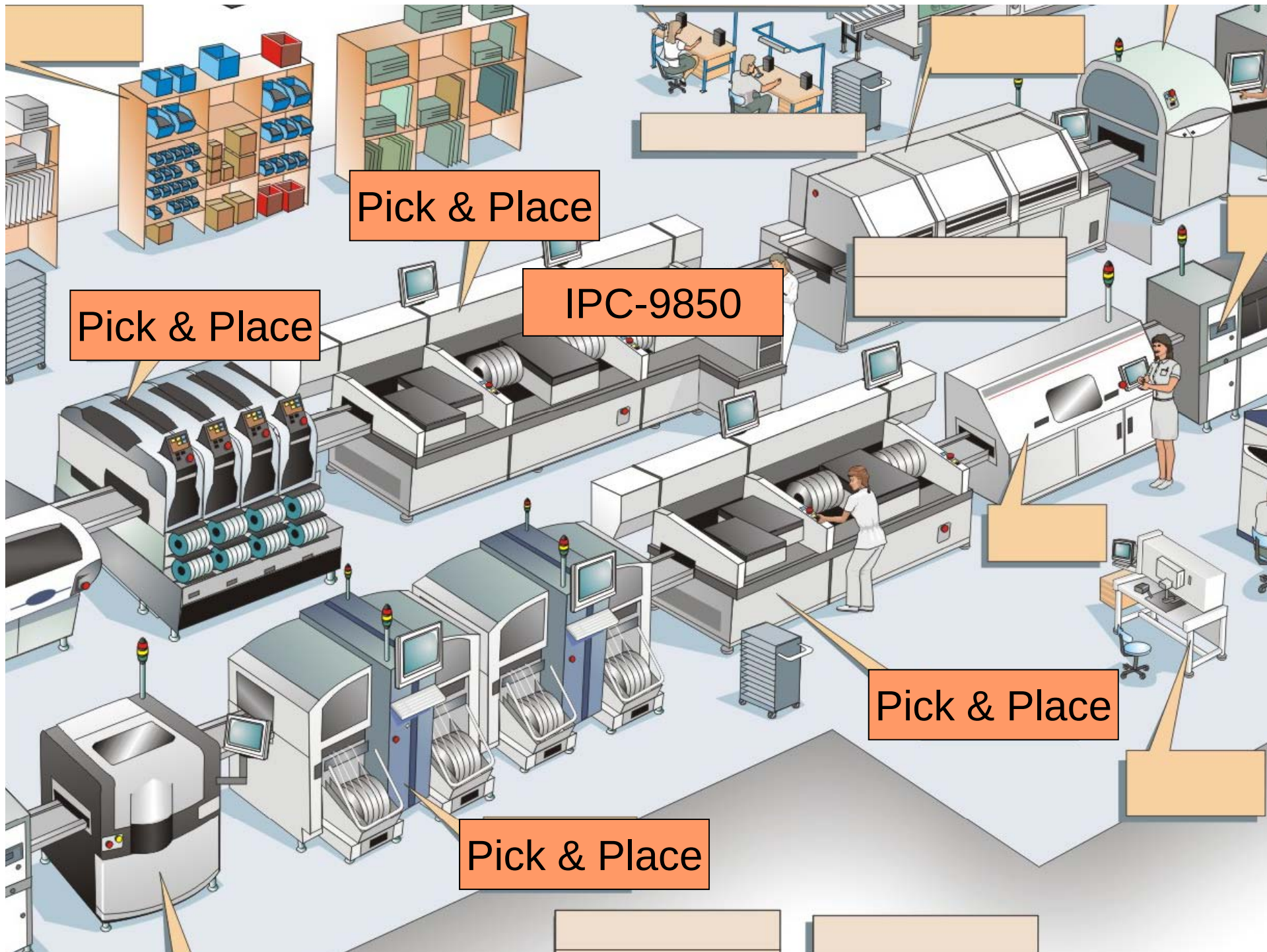


Association Connecting Electronics Industries



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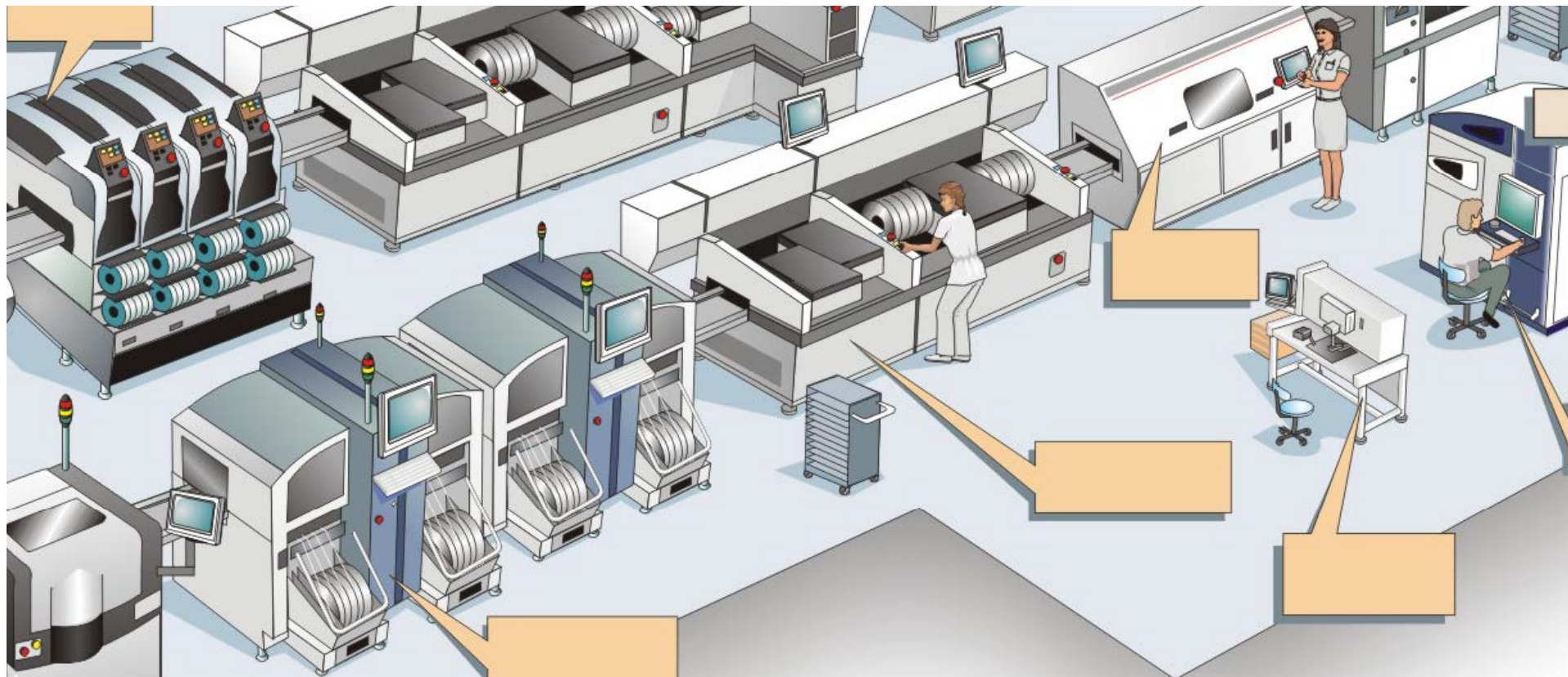
Pick & Place

Pick & Place

IPC-9850

Pick & Place

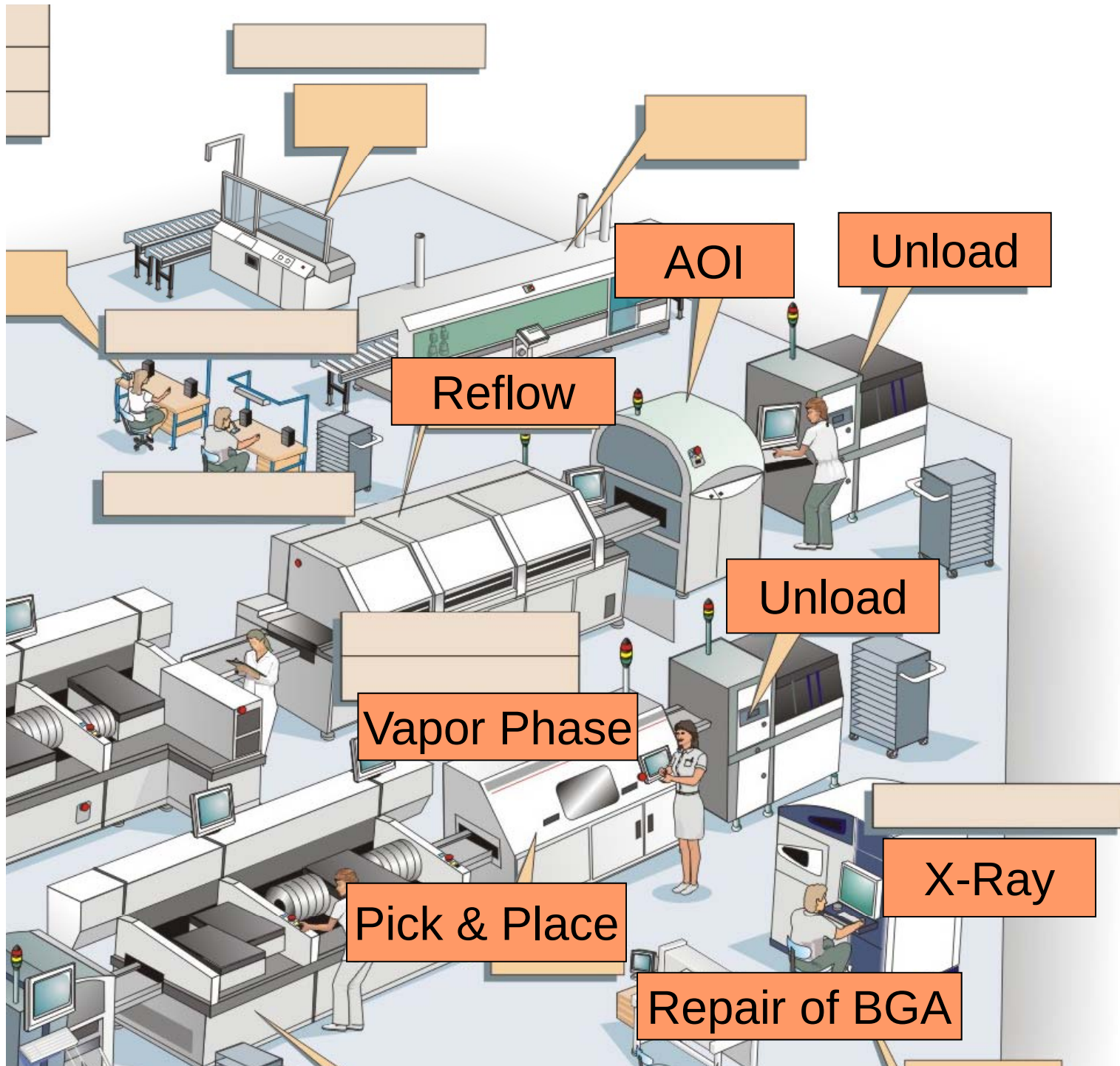
Pick & Place

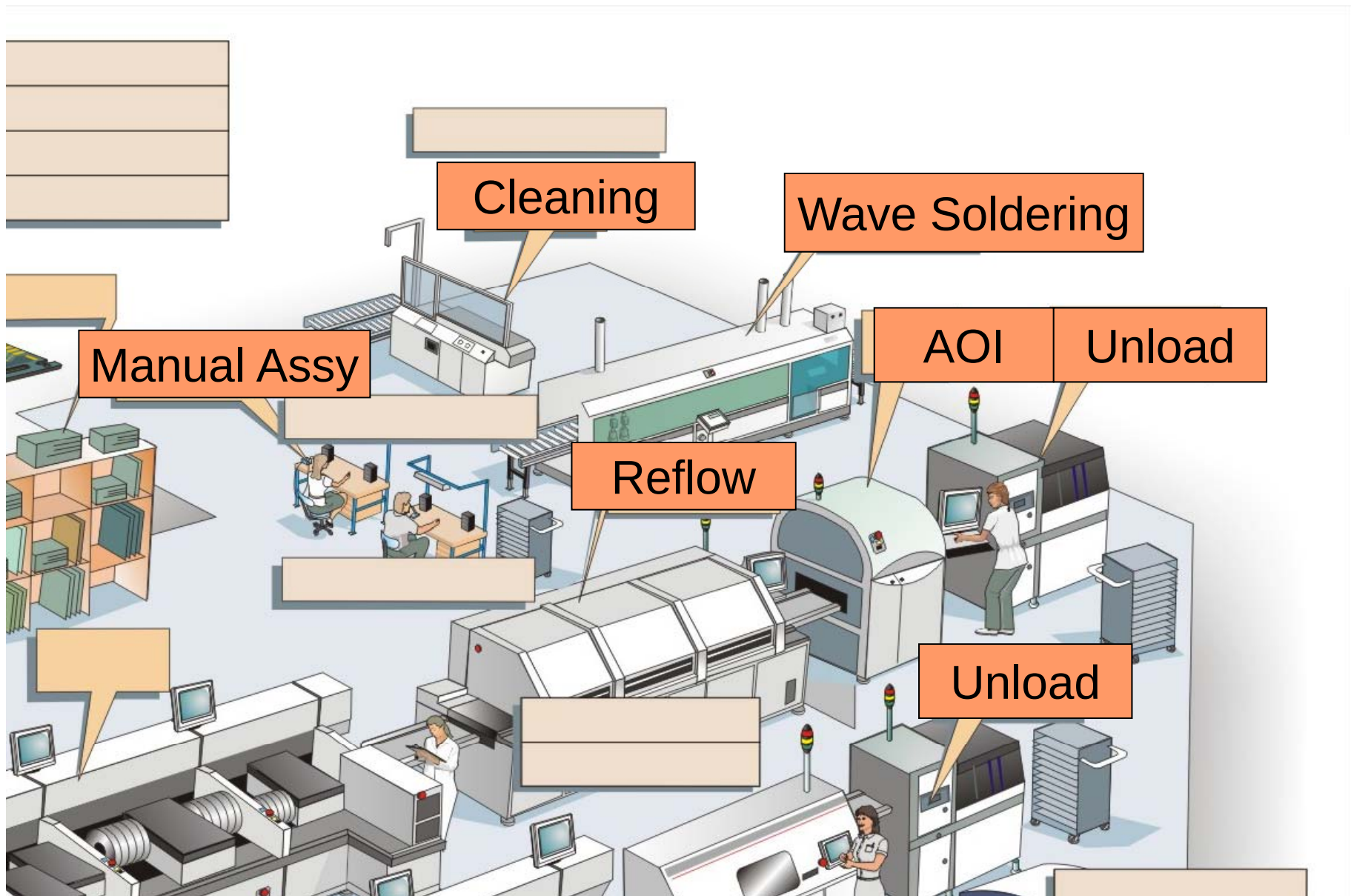


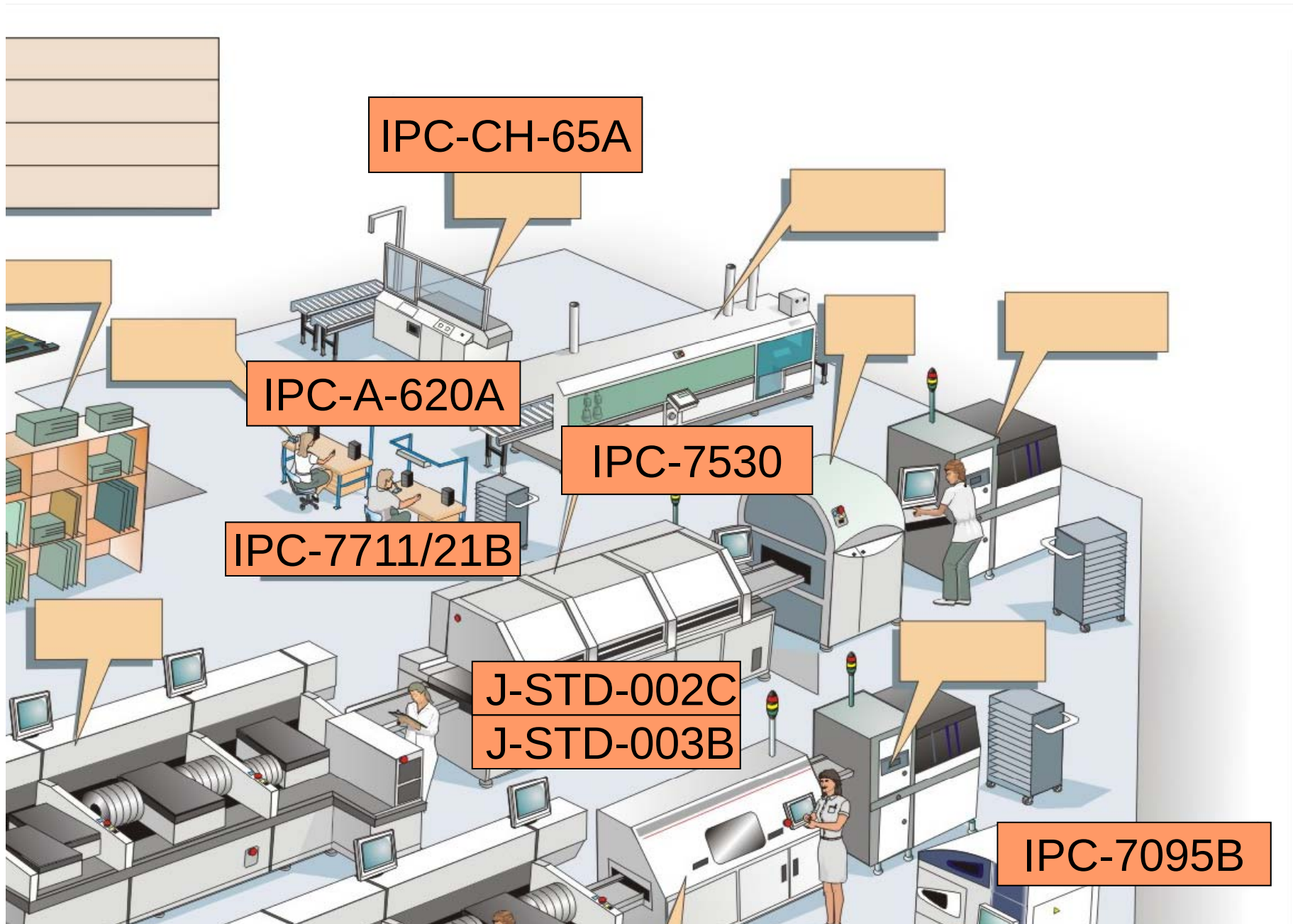
IPC-HDBK-610
IPC-HDBK-005
IPC-HDBK-830

IPC-610D
IPC-7095B
IPC-7711/21B
IPC-620A

J-STD-001D
J-STD-002C
J-STD-003B
J-STD-004A
J-STD-005
J-STD-006B







IPC-CH-65A

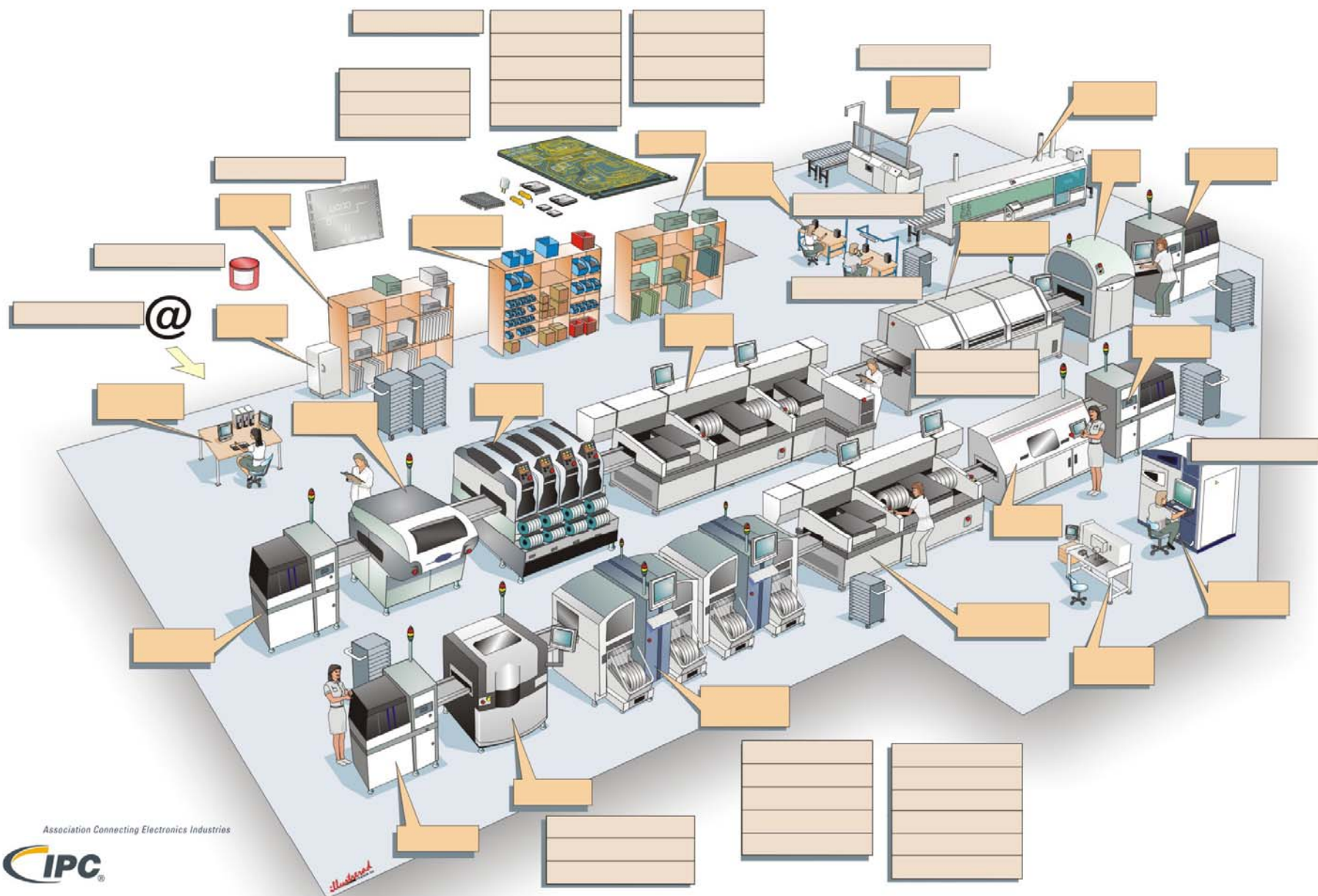
IPC-A-620A

IPC-7530

IPC-7711/21B

J-STD-002C
J-STD-003B

IPC-7095B



Association Connecting Electronics Industries



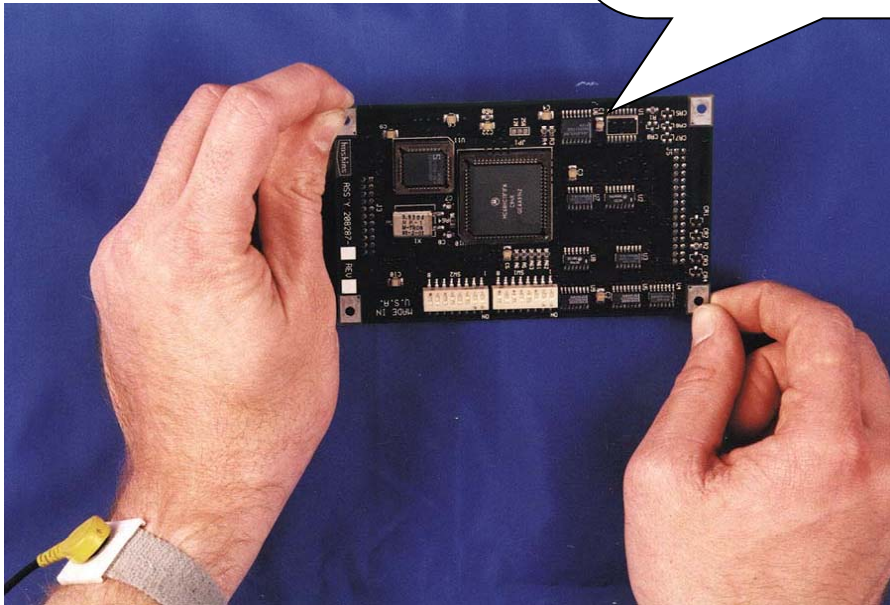
Copyright IPC

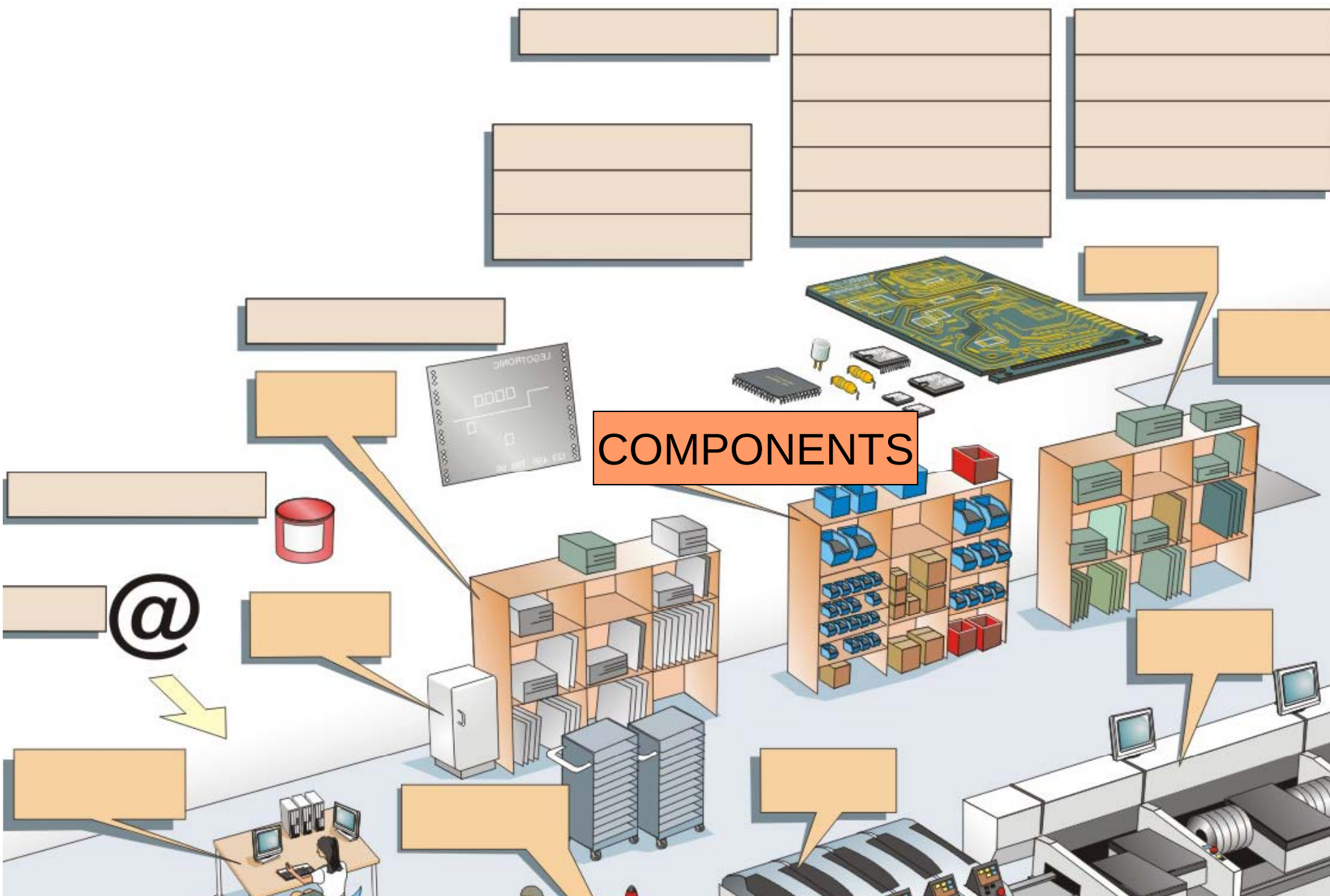
IPC Standards for components

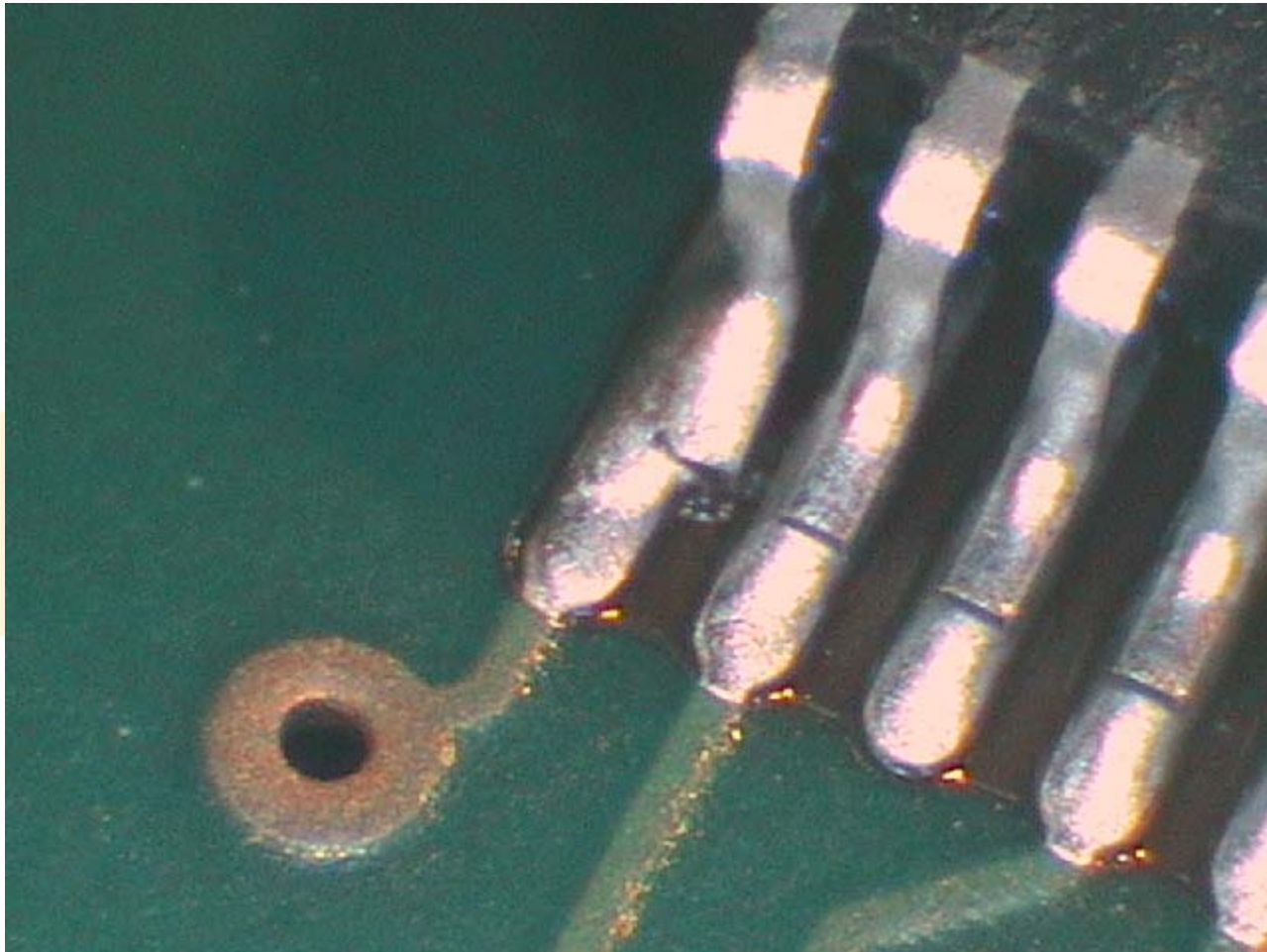
Association Connecting Electronics Industries



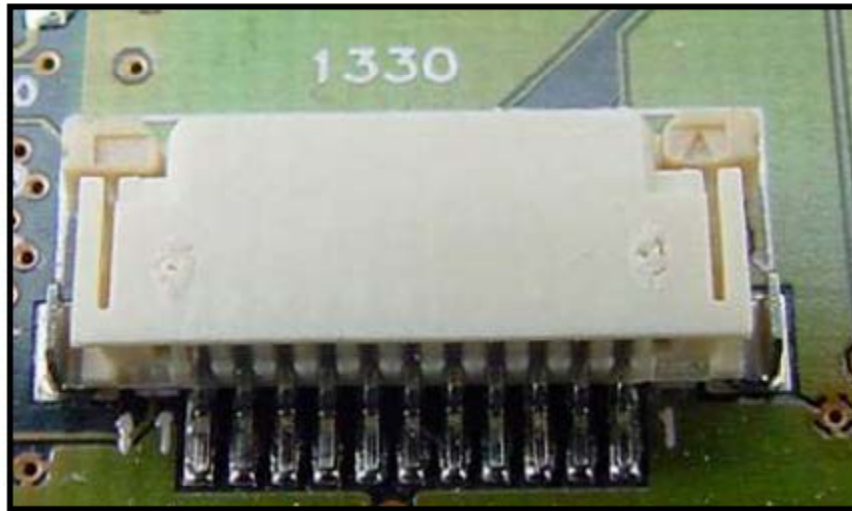
It is not
OK!!



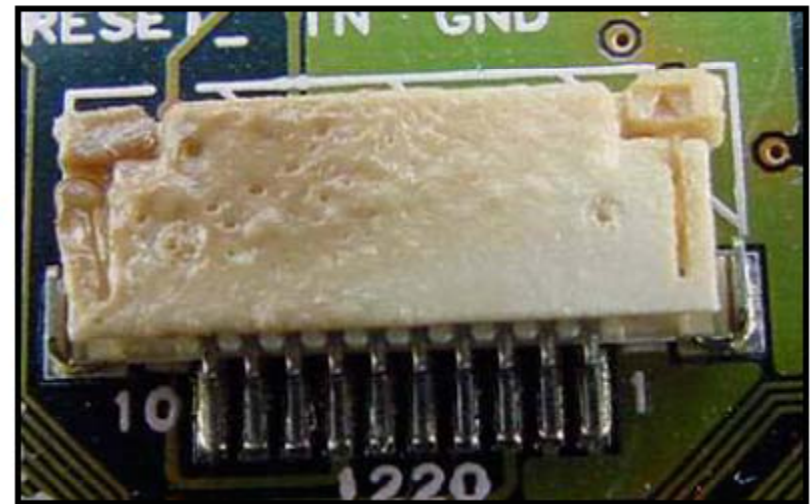




What do you see here?



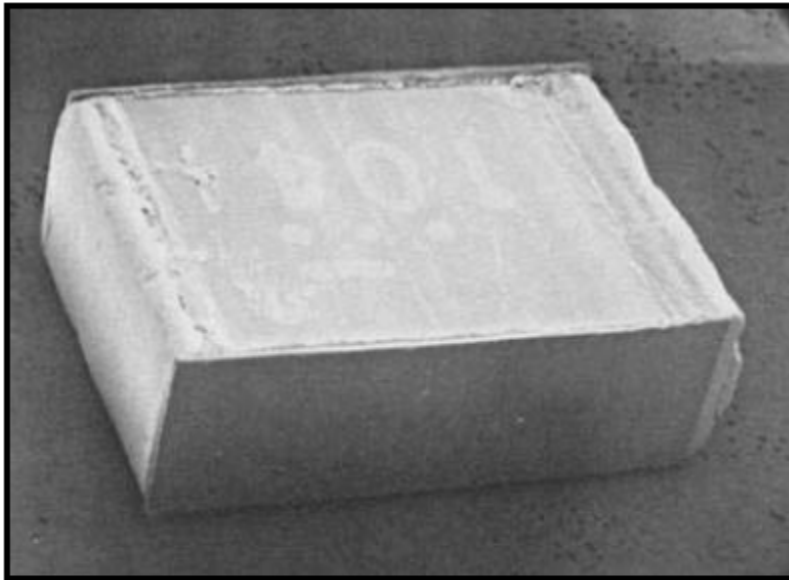
240 °C



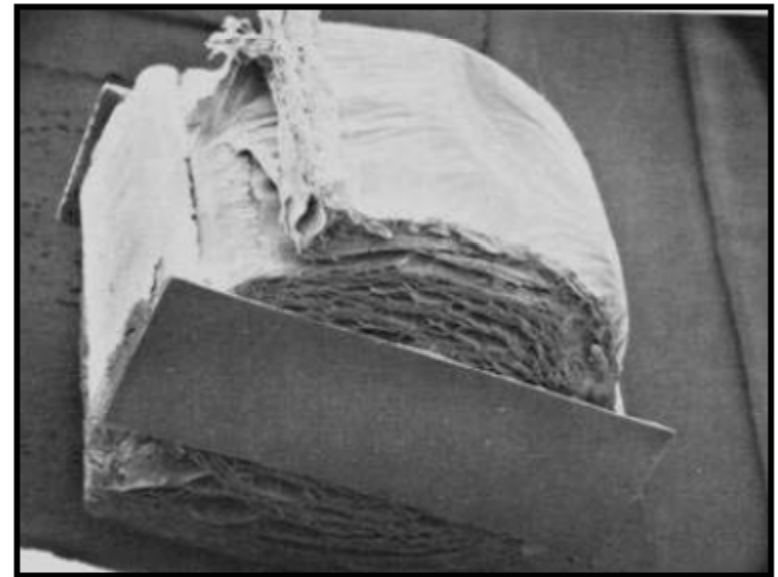
270 °C

Deformation of thermo-plastic component bodies

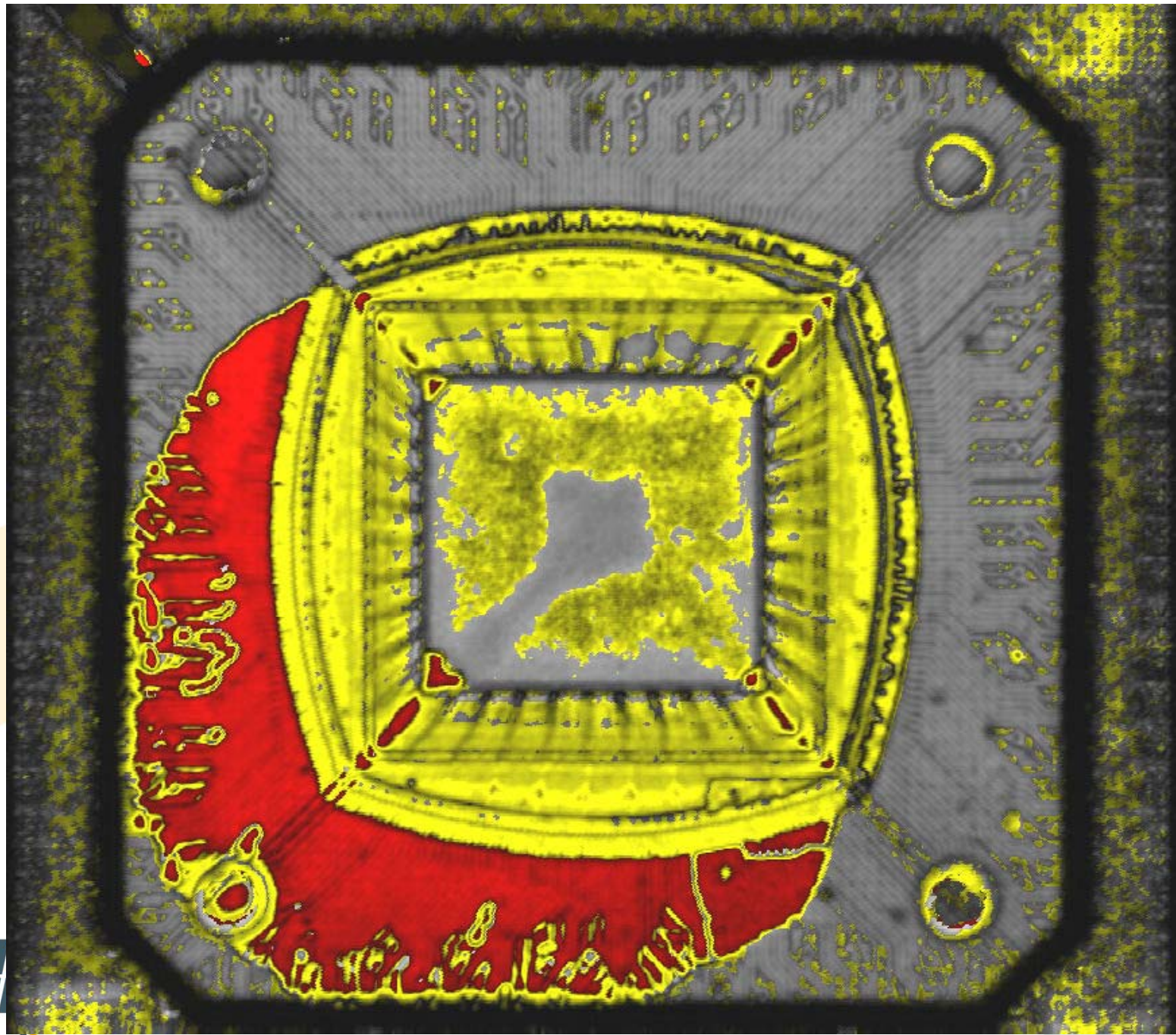
What do you see here?



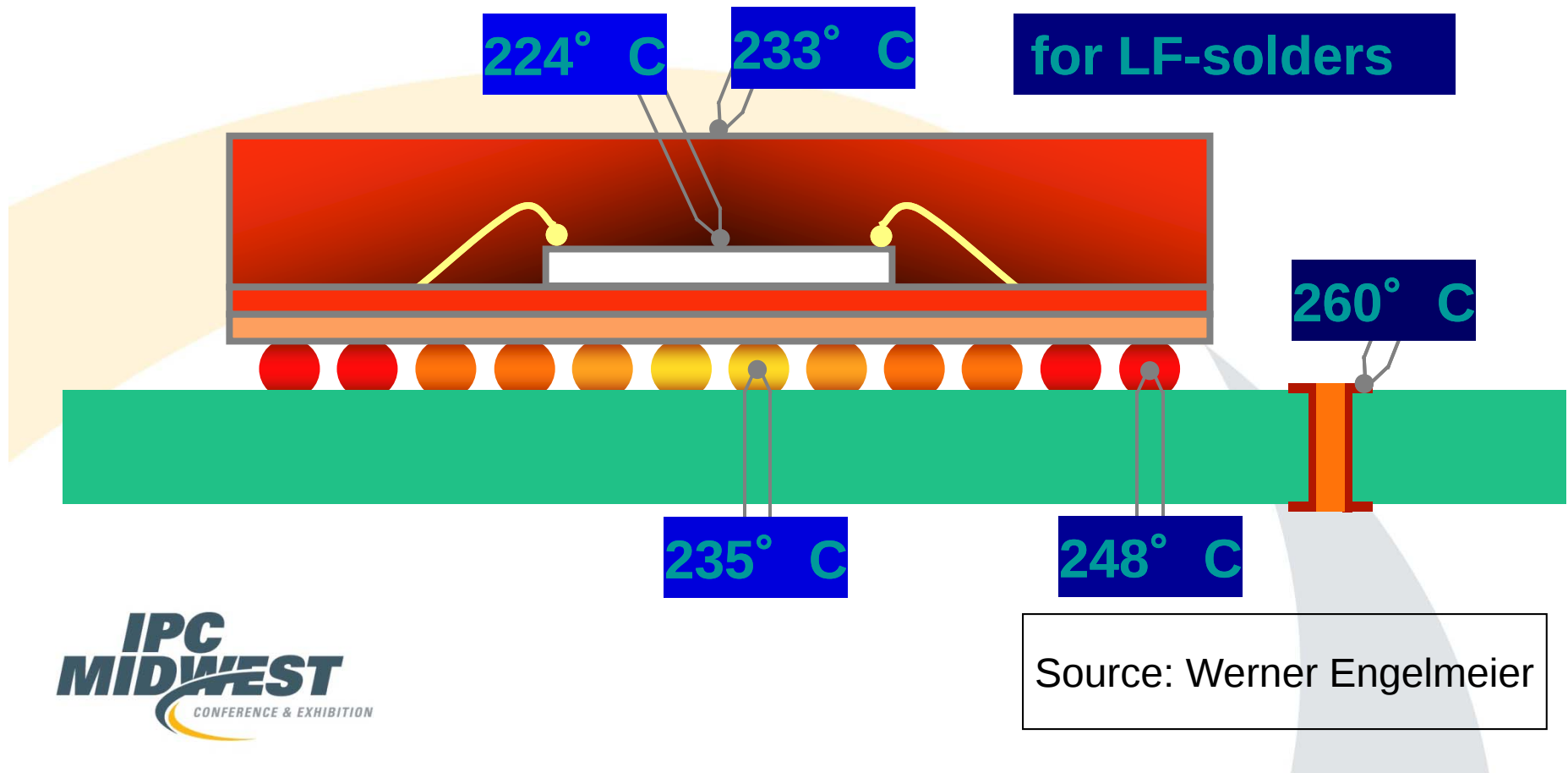
225 °C

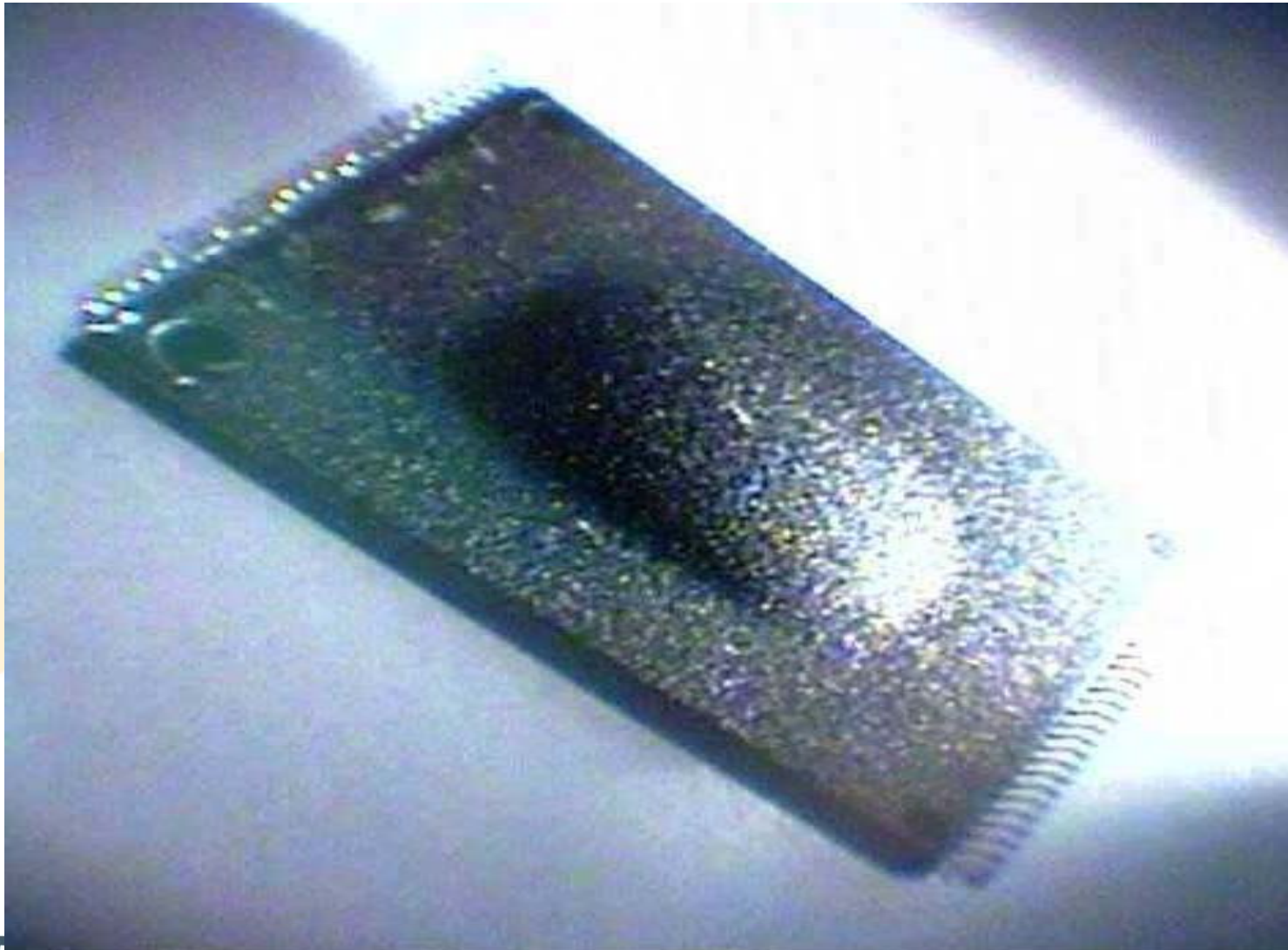


255 °C

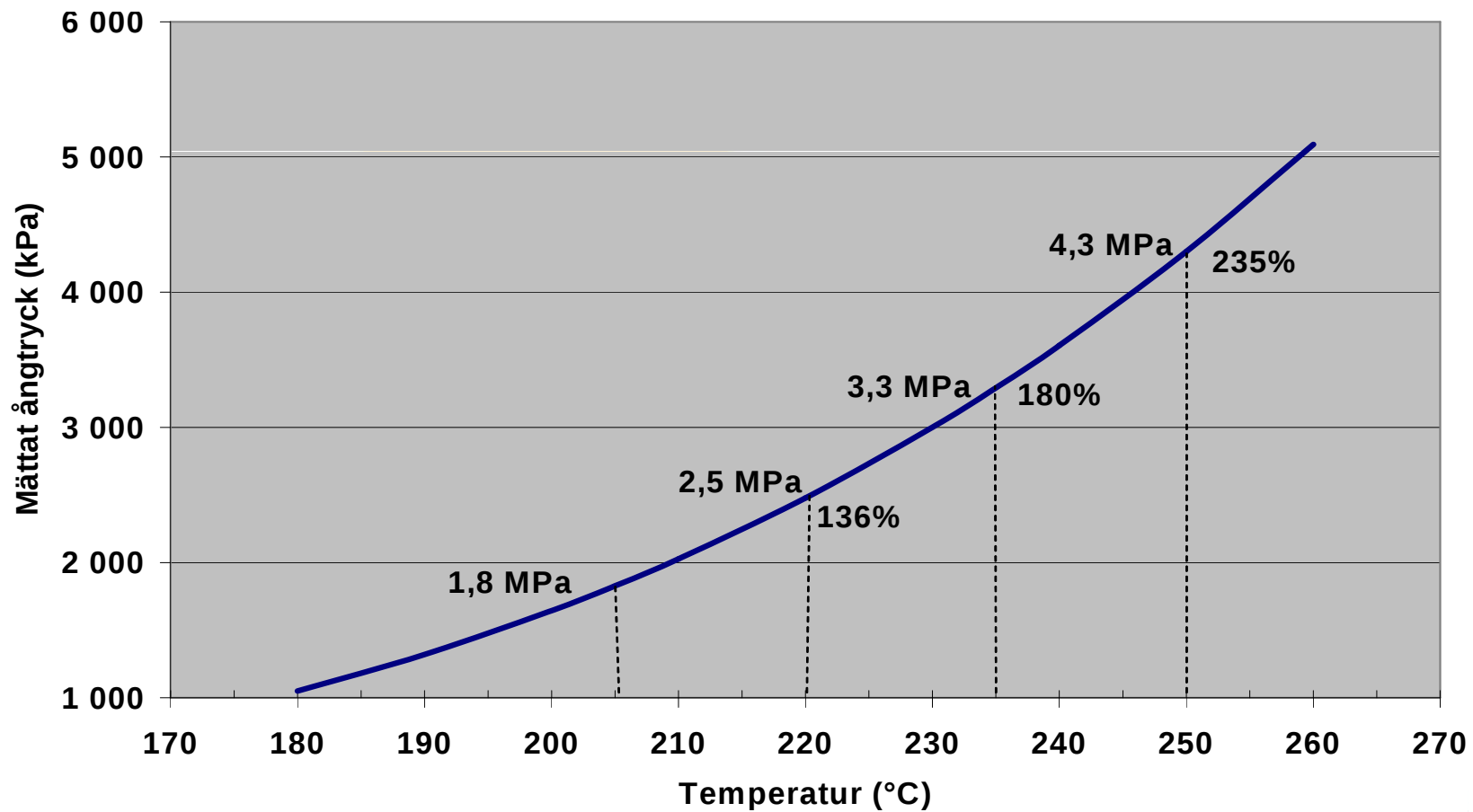


Temperature Gradients During Reflow Soldering





Water vapor pressure



New IPC Standards adapted for the Lead Free process

- For Components:
- J-STD-020D.
- J-STD-075 New!
- J-STD-033B.

Association Connecting Electronics Industries



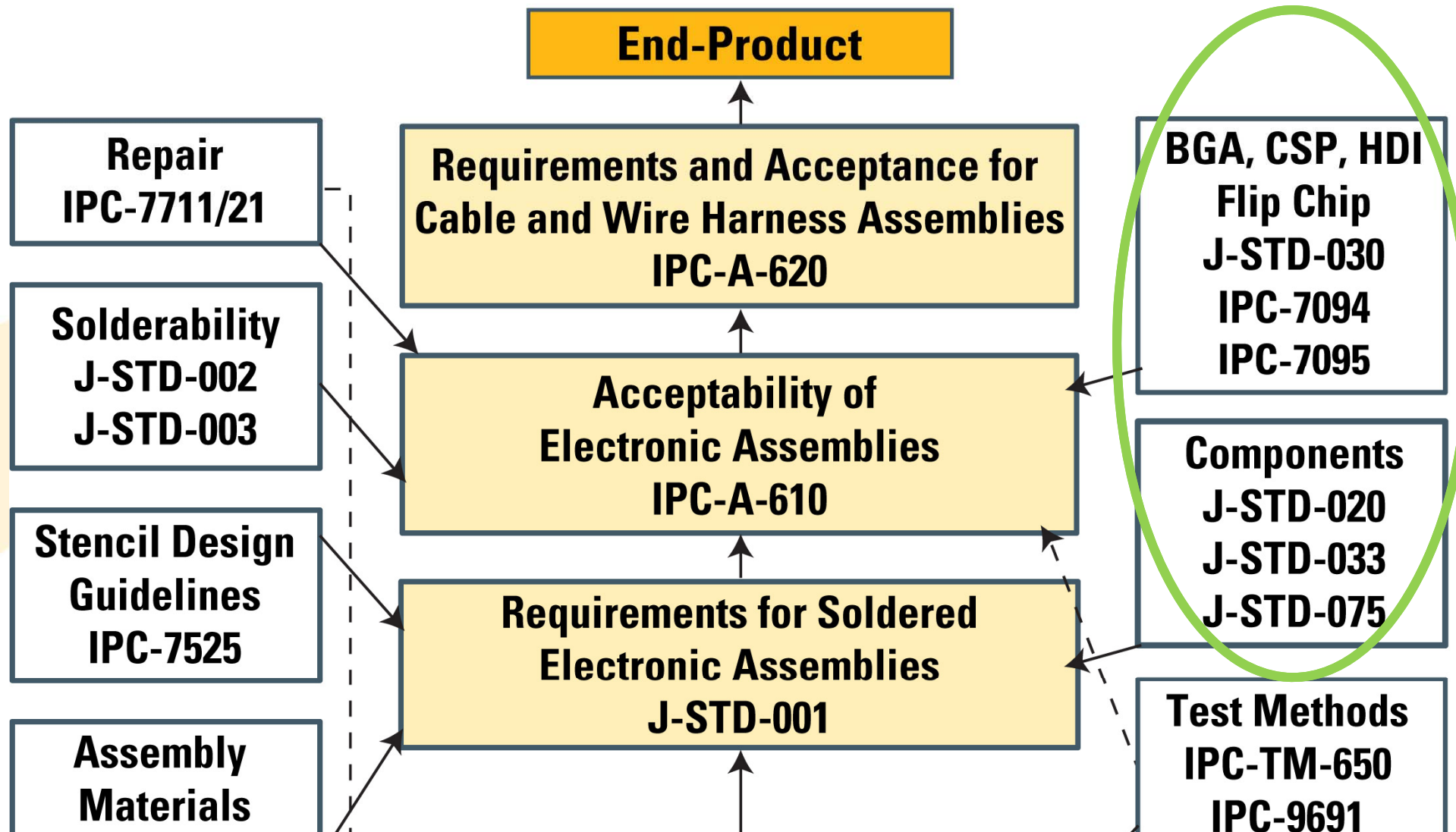
Equivalent open time for components @20-35° C and 5-90%RH

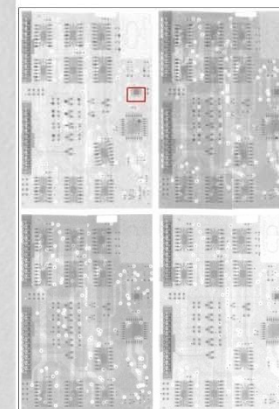
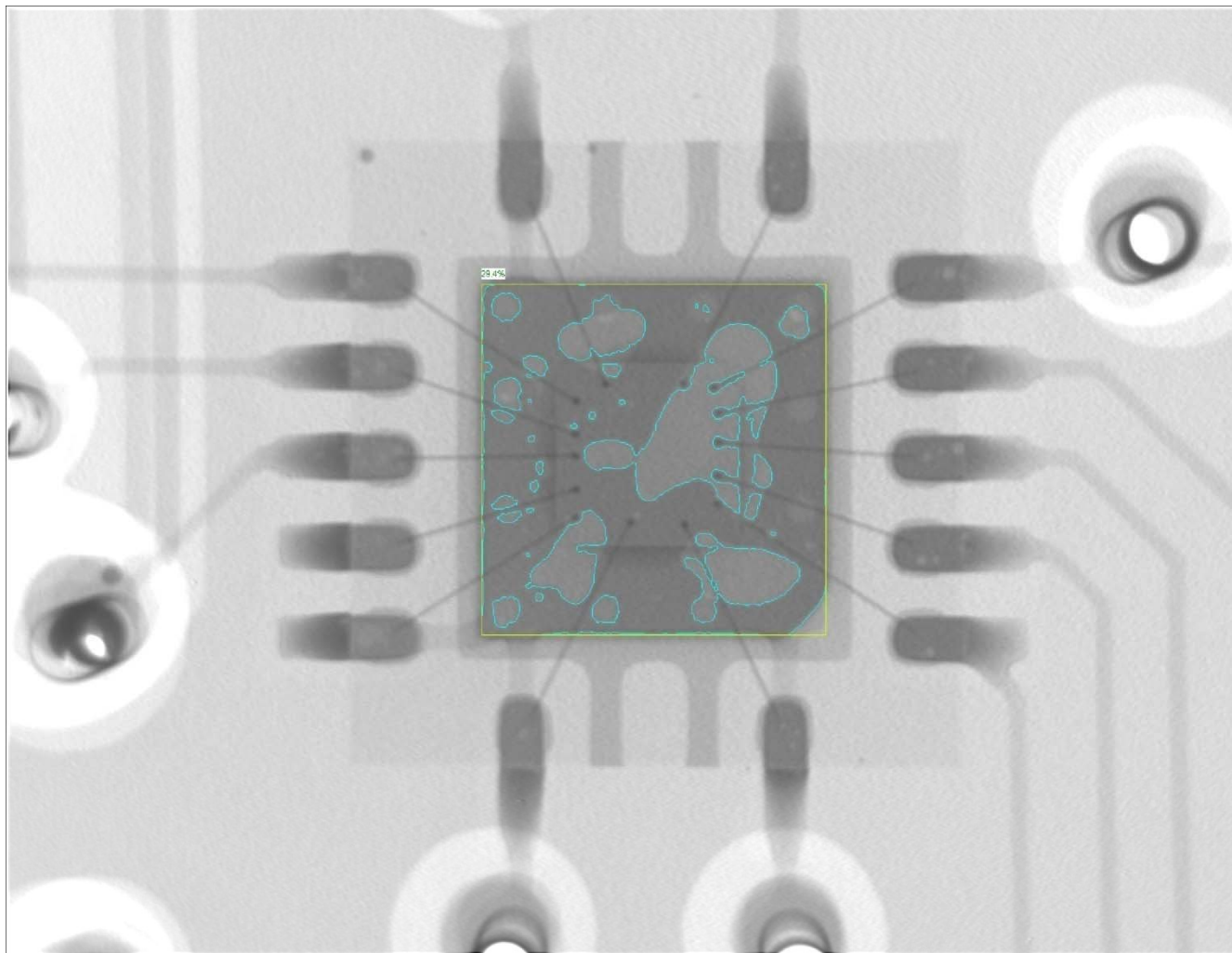
IPC J-STD-033B

Package Type and Body Thickness	Moisture Sensitivity Level	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	
Body Thickness ≥3.1 mm including PQFPs >84 pins, PLCCs (square) All MQFPs or All BGAs ≥1 mm	Level 2a	∞	∞	94	44	32	26	16	7	5	4	35°C
		∞	∞	124	60	41	33	28	10	7	6	30°C
		∞	∞	167	78	53	42	36	14	10	8	25°C
		∞	∞	231	103	69	57	47	19	13	10	20°C
	Level 3	∞	∞	8	7	6	6	6	4	3	3	35°C
		∞	∞	10	9	8	7	7	5	4	4	30°C
		∞	∞	13	11	10	9	9	7	6	5	25°C
		∞	∞	17	14	13	12	12	10	8	7	20°C
	Level 4	∞	3	3	3	2	2	2	2	1	1	35°C
		∞	5	4	4	4	3	3	3	2	2	30°C
		∞	6	5	5	5	5	4	3	3	3	25°C
		∞	8	7	7	7	7	6	5	4	4	20°C
	Level 5	∞	2	2	2	2	1	1	1	1	1	35°C
		∞	4	3	3	2	2	2	2	1	1	30°C
		∞	5	5	4	4	3	3	2	2	2	25°C
		∞	7	7	6	5	5	4	3	3	3	20°C
	Level 5a	∞	1	1	1	1	1	1	1	1	1	35°C
		∞	2	1	1	1	1	1	1	1	1	30°C
		∞	3	2	2	2	2	2	1	1	1	25°C
		∞	5	4	3	3	3	2	2	2	2	20°C

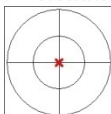


IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH



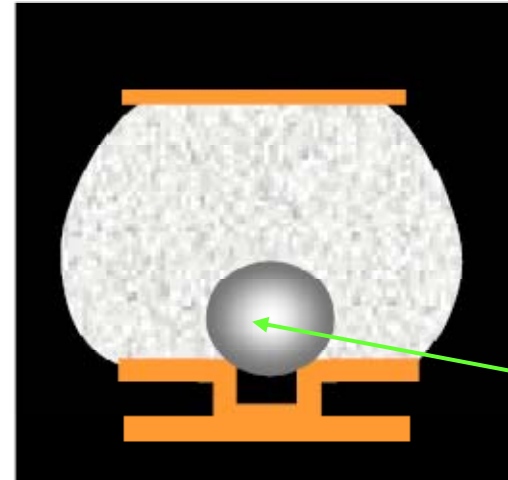
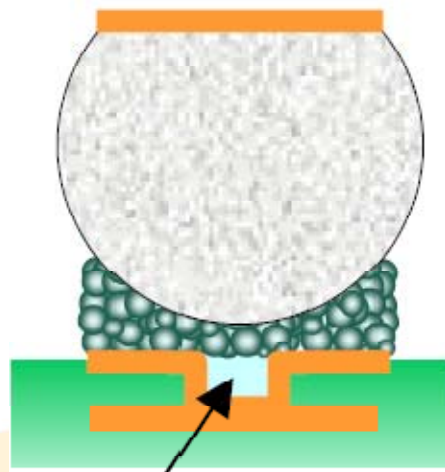


1.0mm

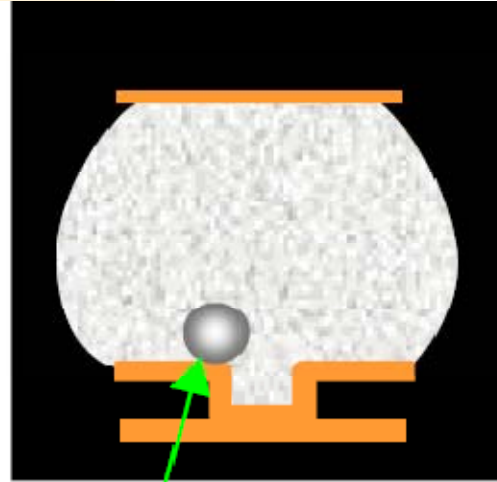
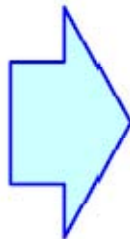
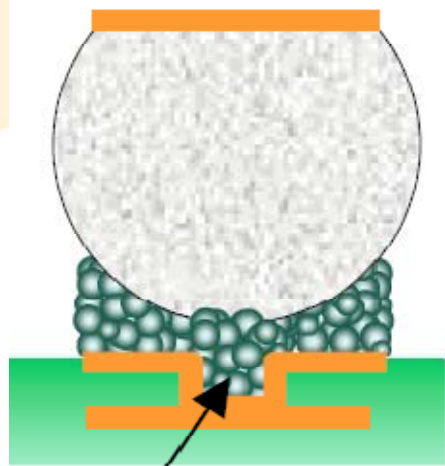


Tube voltage: 85 kV
Tube power: 2.17 W
Filter method used: MaxMag
Averaging: 128 frames

Voiding in micro vias



void



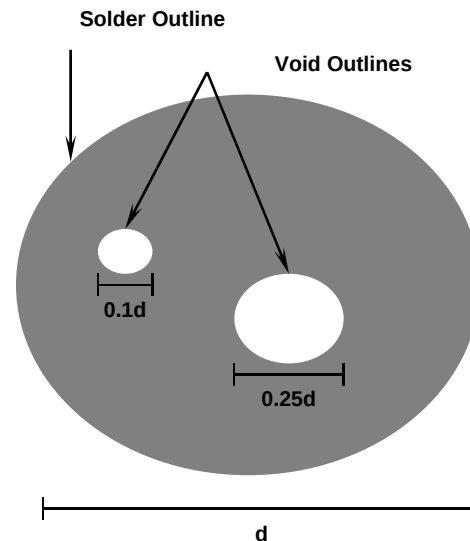
Two print strokes fills micro via with solder paste

Possible void is not trapped in micro via

Voids according to IPC-7095B

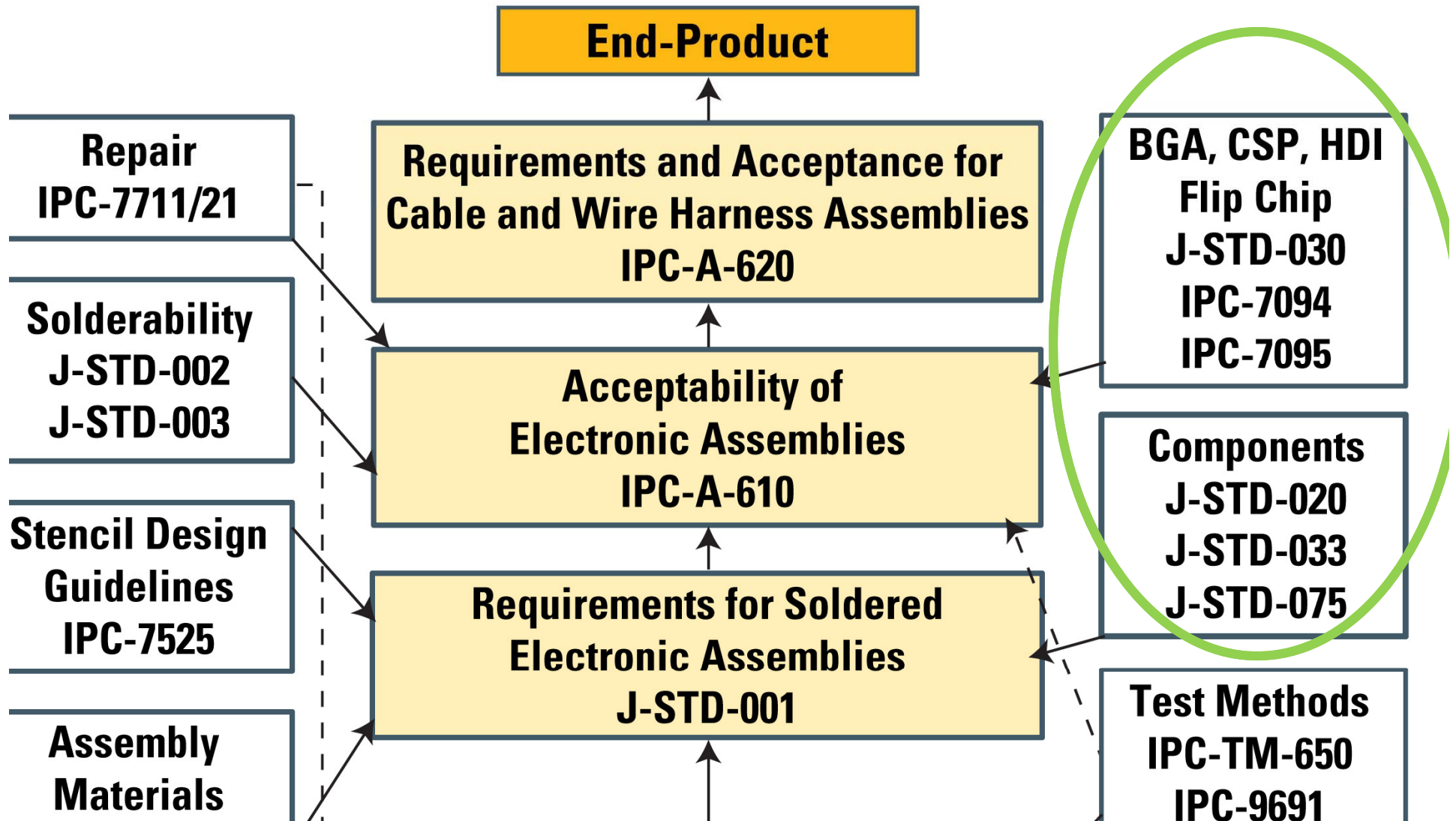
Location of Void	Class I	Class II	Class III
Void in Solder (Solder Sphere)	50% of diameter = 25% of Area	50% of diameter = 25% of Area	50% of diameter = 25% of Area
Void at interface of Solder (Sphere) and	50% of diameter = 25% of Area	45% of diameter = 20% of Area	40% of diameter = 15% of Area

Example:
Total Void Diameter
 $0.1d + 0.25d = 0.35d$





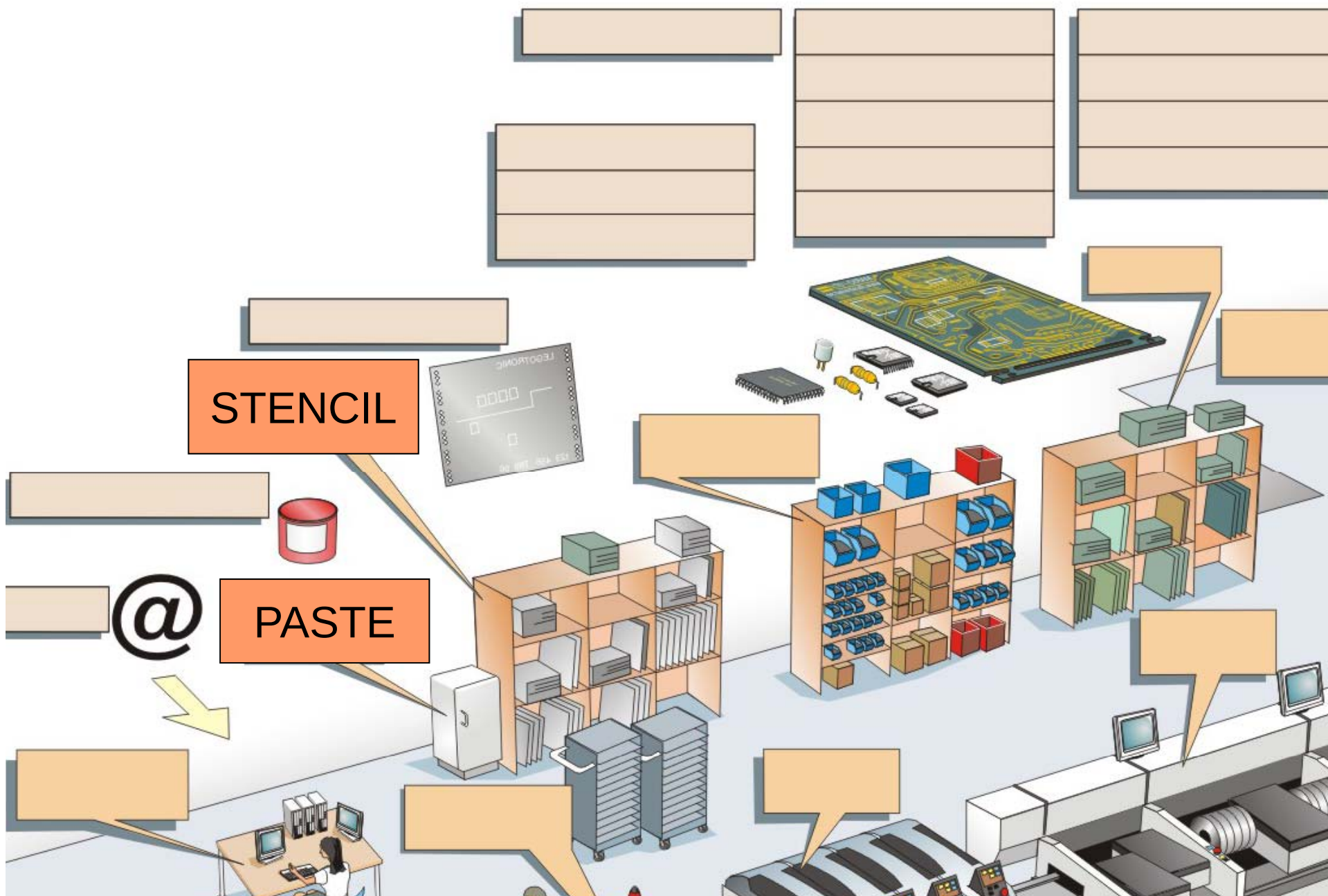
IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH



IPC Standards for Assembly Materials

Association Connecting Electronics Industries



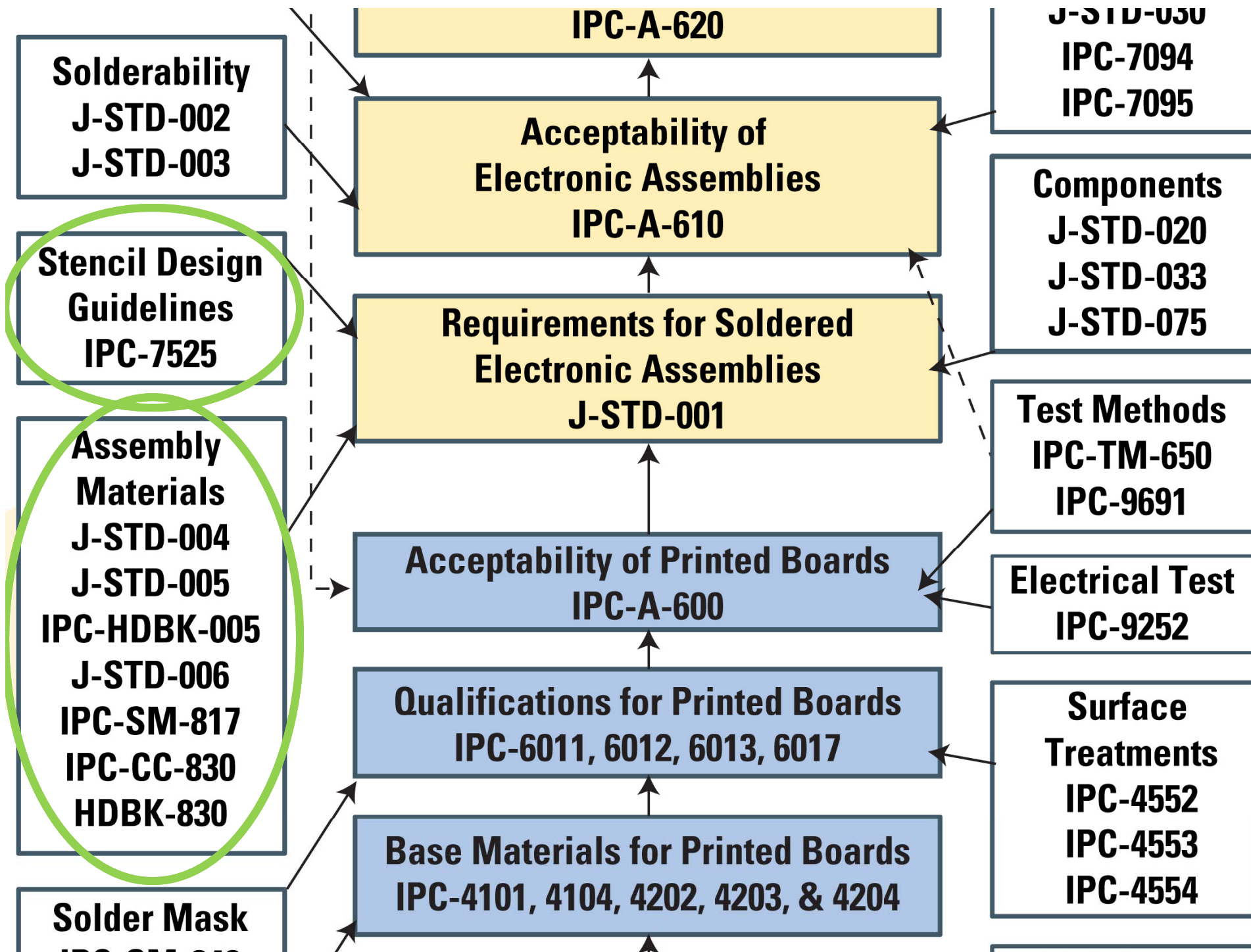


New IPC Standards that include Lead Free

- For Solderability.
 - J-STD-002C.
 - J-STD-003B.
- For Solder Alloys.
 - J-STD-006B.
 - IPC-HDBK-005.
- For Stencils
 - IPC-7525A

Association Connecting Electronics Industries

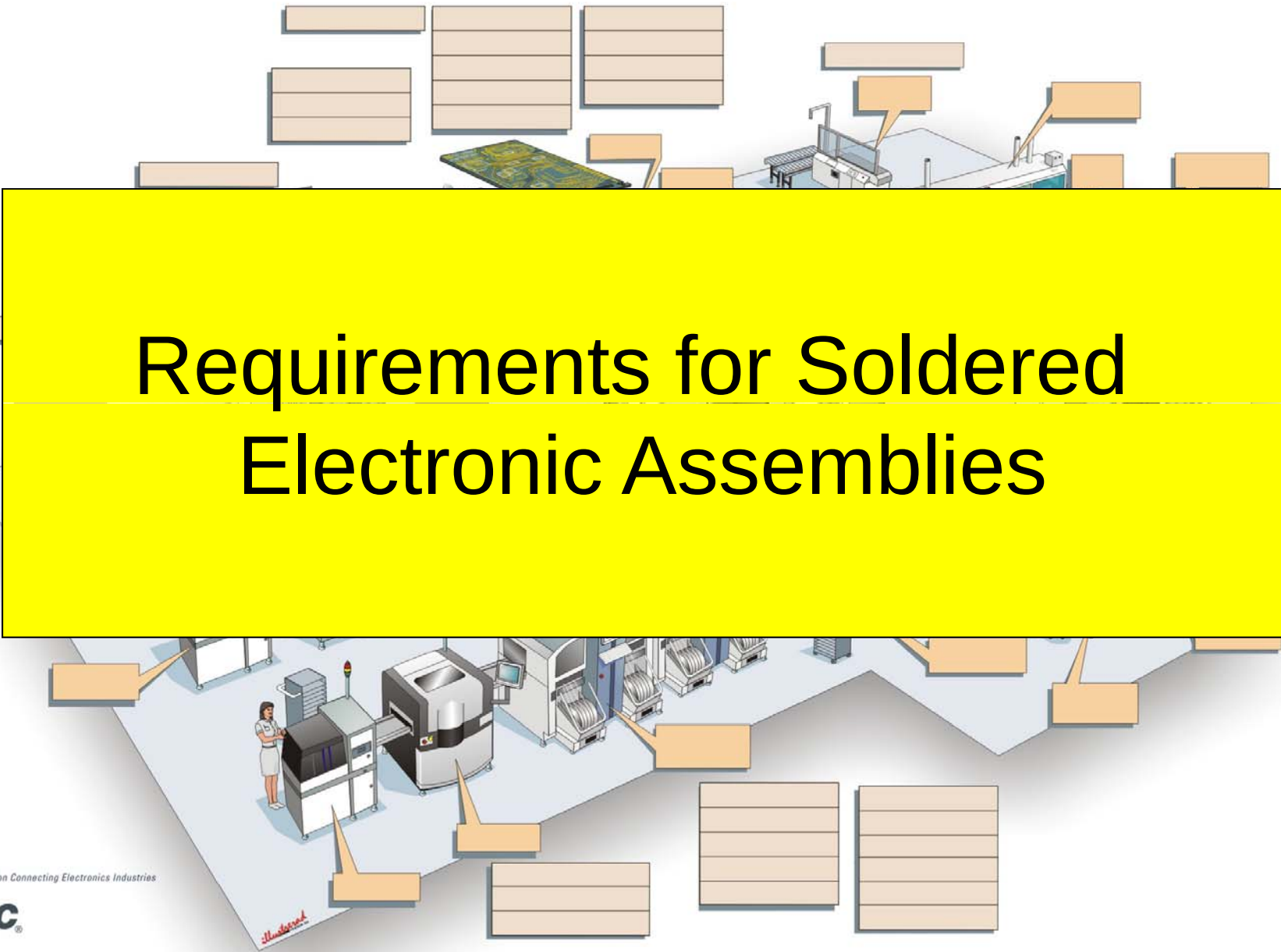




IPC Standard for Requirements for Soldered Electronic Assemblies

Association Connecting Electronics Industries





Requirements for Soldered Electronic Assemblies

IPC J-STD-001D

February 2005

Supersedes Revision C March 2000

JOINT INDUSTRY STANDARD

Requirements for
Soldered Electrical
and Electronic
Assemblies



IPC Standards that include Lead Free

- For Requirements for Assembly .
 - J-STD-001D.

Association Connecting Electronics Industries



IPC Training & Certification

J-STD-001D:

Hand-soldering training and certification

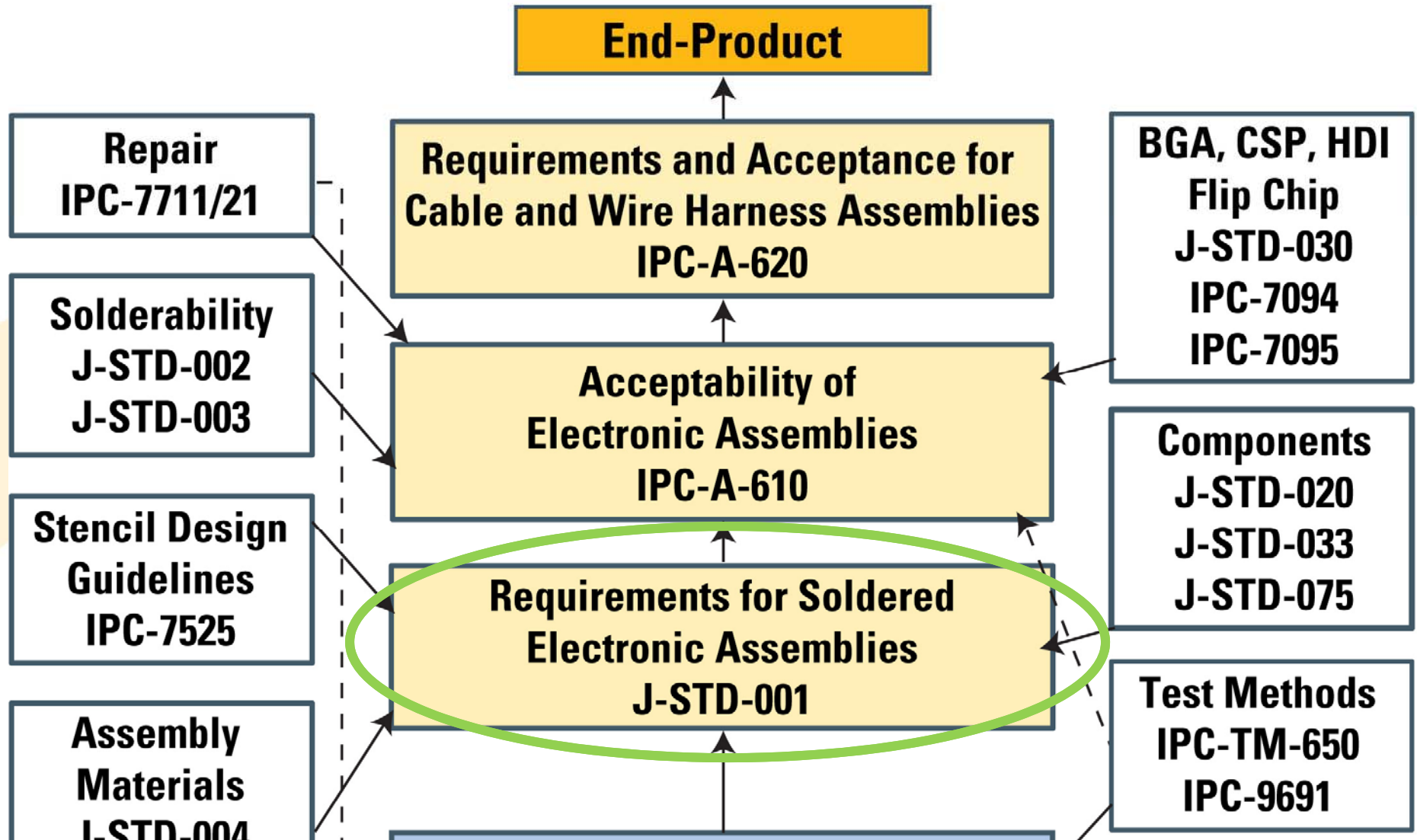
- CIS – Certified IPC Specialist.
- CIT – Certified IPC Trainer.
- Valid for 2 years.
- Up to 6 Modules.
- 1-5 days depending on number of Modules.

Available in:

English, Chinese, Danish, Dutch, French,
German, Polish, Spanish and Swedish.



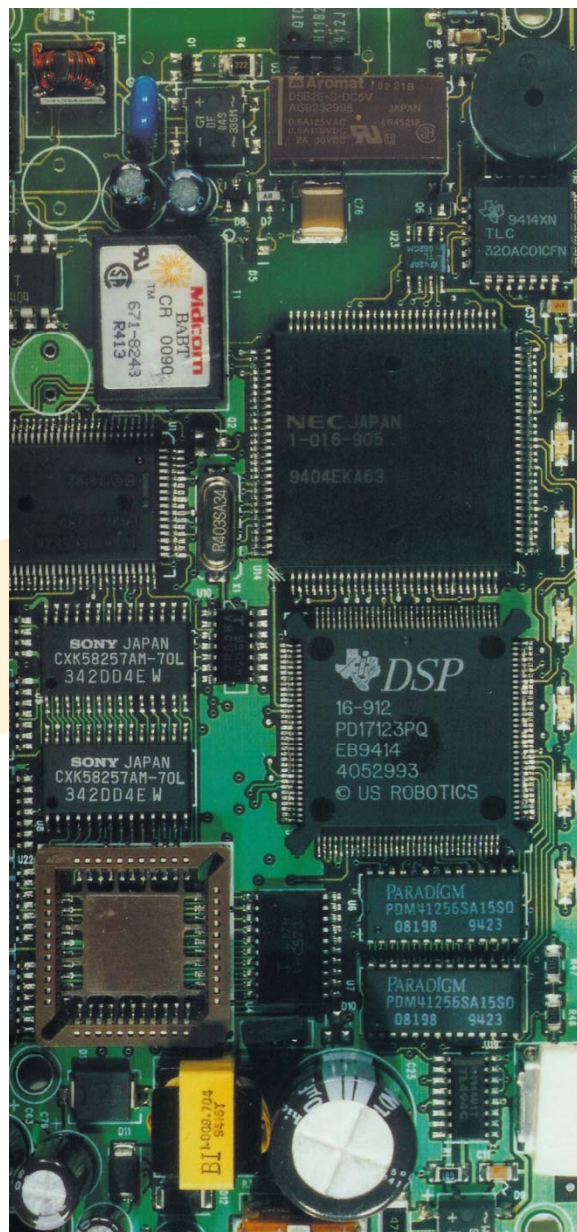
IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH



IPC Standards for Acceptability of Electronic Assemblies

Association Connecting Electronics Industries





IPC-A-610

Revision D
February 2005
Supersedes Revision C
January 2000

Acceptability of Electronic Assemblies

Developed by



IPC Standard that include Lead Free

- For Acceptability for Assembly.
 - IPC-A-610D.
 - English, Chinese, Czech, Danish, Finnish, French, German, *Hebrew*, Hungarian, Italian, Japanese, Polish, Romanian, Russian, Spanish, Swedish, *Turkish* and Vietnamese.

IPC Training & Certification

IPC-A-610D:

Acceptability of Electronic Assemblies.

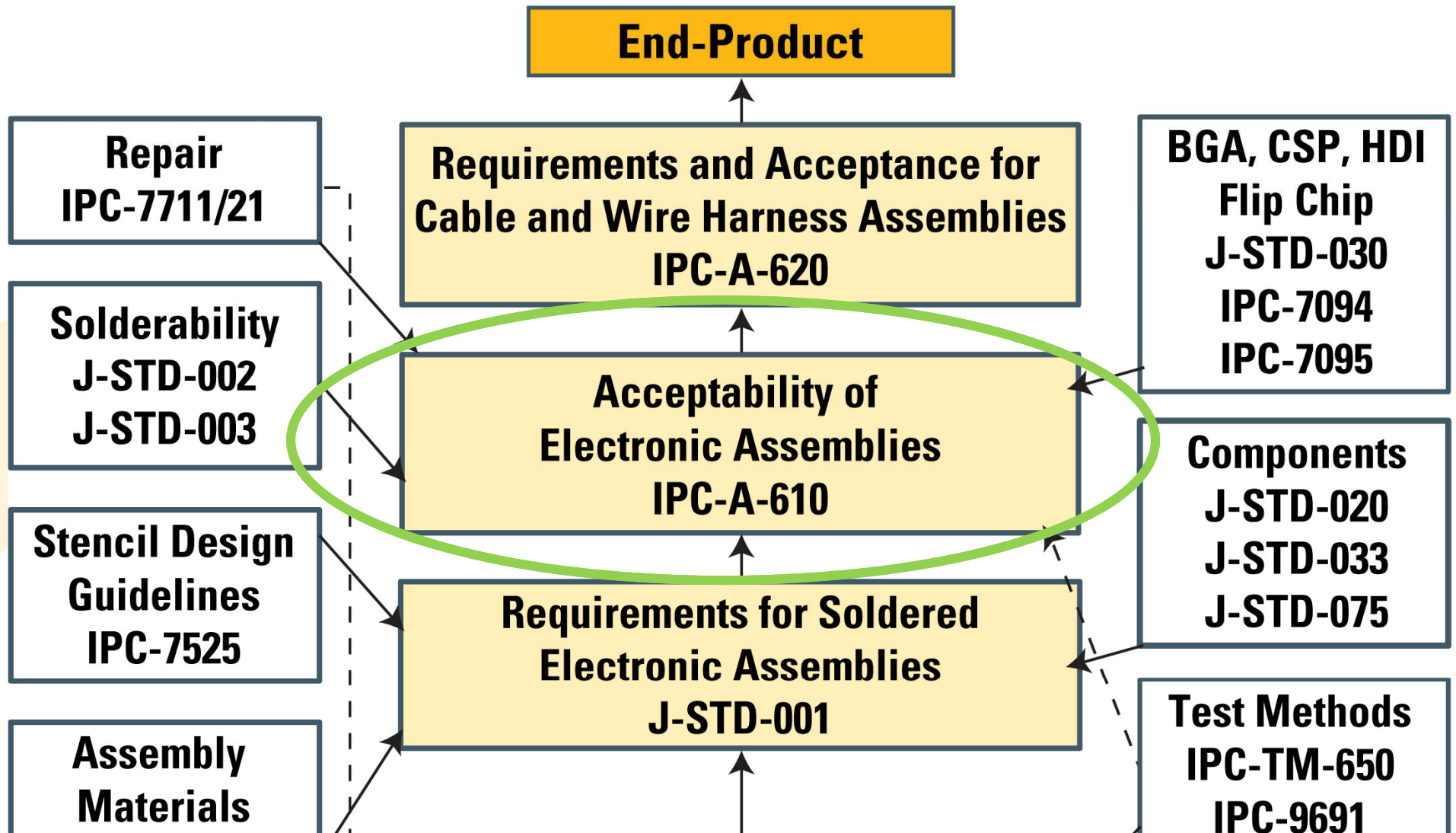
- CIS – Certified IPC Specialist.
- CIT – Certified IPC Trainer.
- Valid for 2 years.
- Up to 9 Modules.
- 1-3 days depending on number of Modules.

Available in:

English, Chinese Danish, Dutch, French, German, Hebrew, Italian, Polish, Romanian, Russian Spanish and Swedish.



IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH



IPC Standard for Repair

Association Connecting Electronics Industries





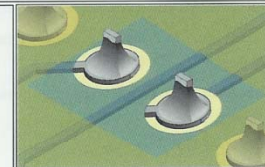
7721

Repair and
Modification of
Printed Boards and
Electronic Assemblies

Revision:
Date: 2/98

Number: 2.4.1

Coating Replacement, Solder Resist



Product Class: R, F, W, C
Skill Level: Intermediate
Level of Conformance: High

OUTLINE

This method is used to replace solder resist or coatings on printed wiring boards. Most replacement coatings can be applied by dipping, brushing or spraying.

REFERENCES

- 2.1 Handling Electronic Assemblies
- 2.2 Cleaning
- 2.5 Baking and Preheating
- 2.6 Epoxy Mixing and Handling

TOOLS & MATERIALS

Cleaner	Foam Swab
Cleaning Wipes	Heat Lamp
Color Agent, Various Colors	Microscope
Brush	Oven
Epoxy or Replacement Coating	

PROCEDURE

1. Clean the area.

CAUTION

Surfaces to be coated must be thoroughly cleaned prior to coating to ensure adequate adhesion, minimized corrosion, and optimized electrical properties.

2. If needed, apply Polyimide tape to outline the area where the solder resist will be applied. (See Figure 1.)
3. Mix the epoxy or replacement coating. If desired, add color agent to the mixed epoxy to match the printed wiring board color.
4. Apply the replacement coating to the board surface as required. A brush or foam swab may be used to apply and spread the epoxy or replacement coating. (See Figure 2.)
5. Cure the replacement coating per the manufacturer's instructions.

CAUTION

Some components may be sensitive to high temperature.

EVALUATION

1. Visual examination for texture, color match, adhesion and coverage.
2. Electrical tests to conductors around the repaired area as applicable.

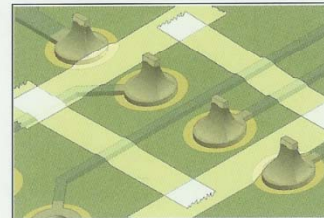


Figure 1 Apply polyimide tape if needed.

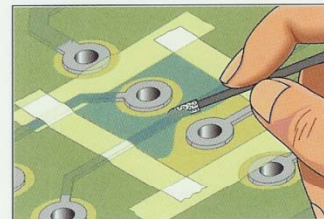
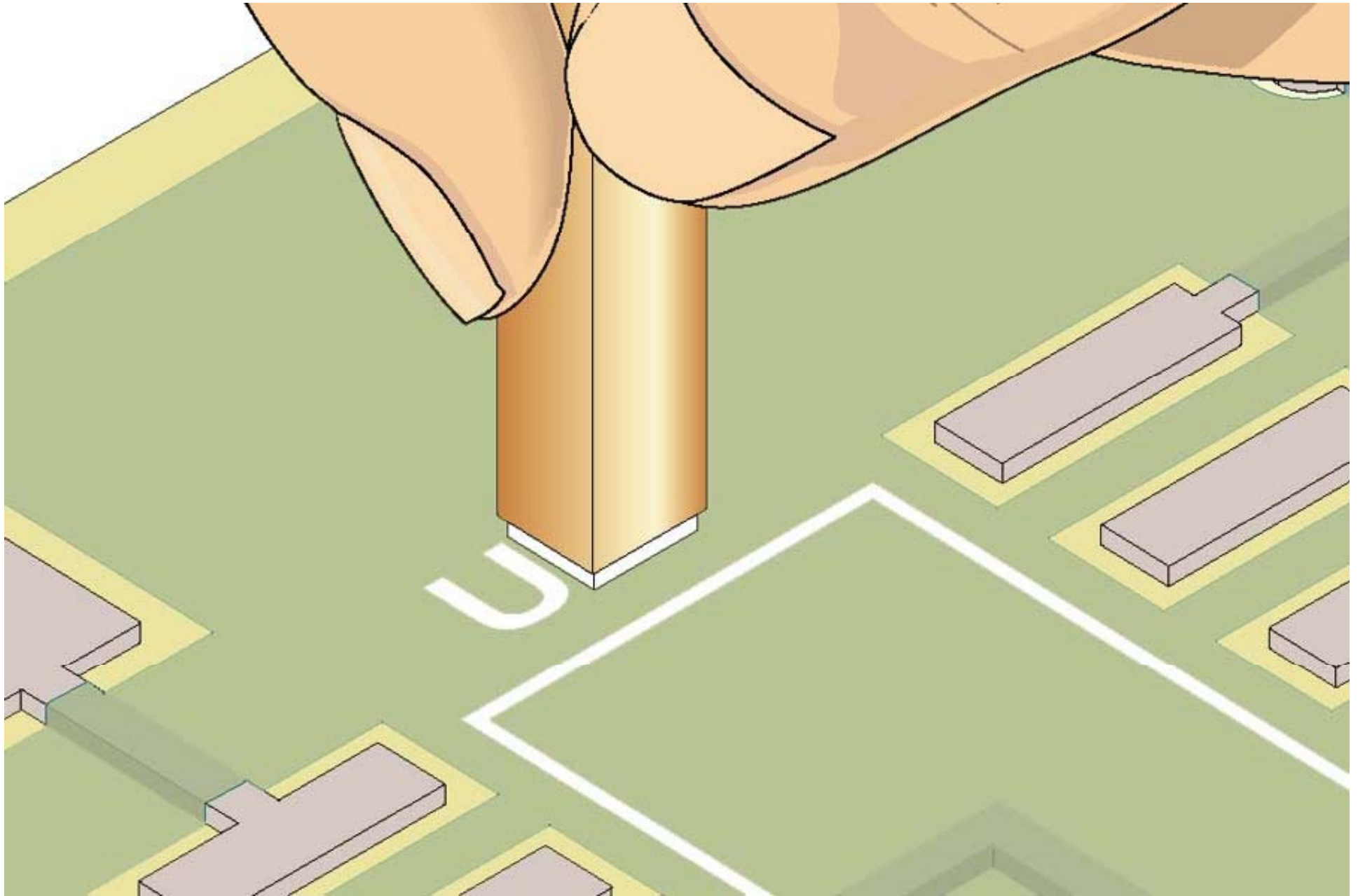
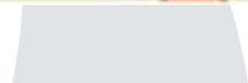
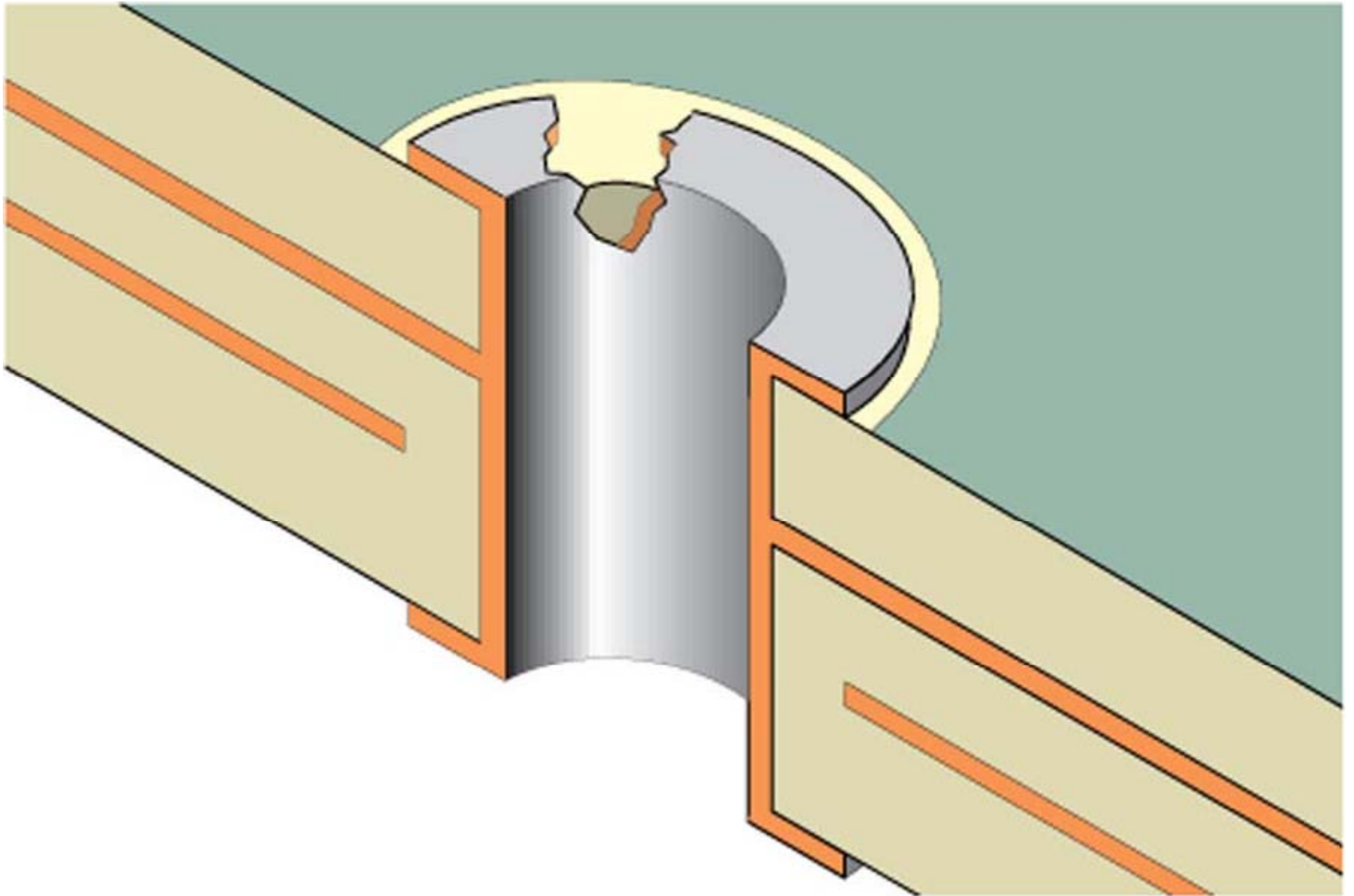


Figure 2 Apply replacement coating with a foam swab to create a texture.







New IPC Standard that include Lead Free

- For Repair.
 - IPC-7711/21B.

Association Connecting Electronics Industries



IPC Training & Certification

IPC-7711/21B:

Rework and Repair.

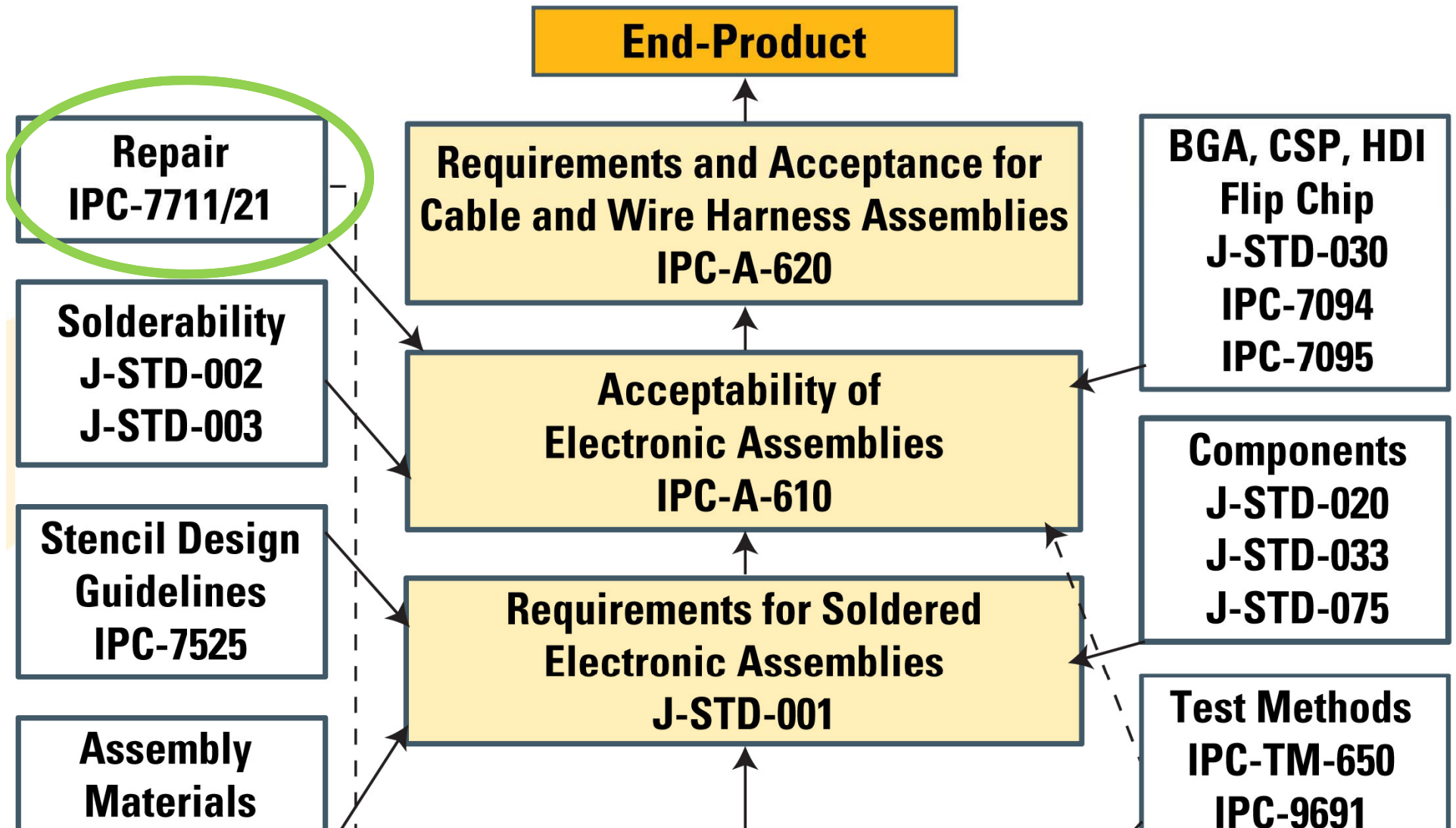
- CIS – Certified IPC Specialist.
- CIT – Certified IPC Trainer.
- Valid for 2 years.
- Up to 8 Modules.
- 1-8 days depending on number of Modules.

Available in:

English, Danish, Dutch, German, Italian,
Polish, Spanish and Swedish.



IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH



IPC Standard for Cable

Association Connecting Electronics Industries



UPDATE THIS
YEAR
TO IPC-A-620A

SPACE ADDENDUM

Association Connecting Electronics Industries



IPC/WHMA-A-620

January 2002

Requirements
and Acceptance
for Cable and
Wire Harness
Assemblies



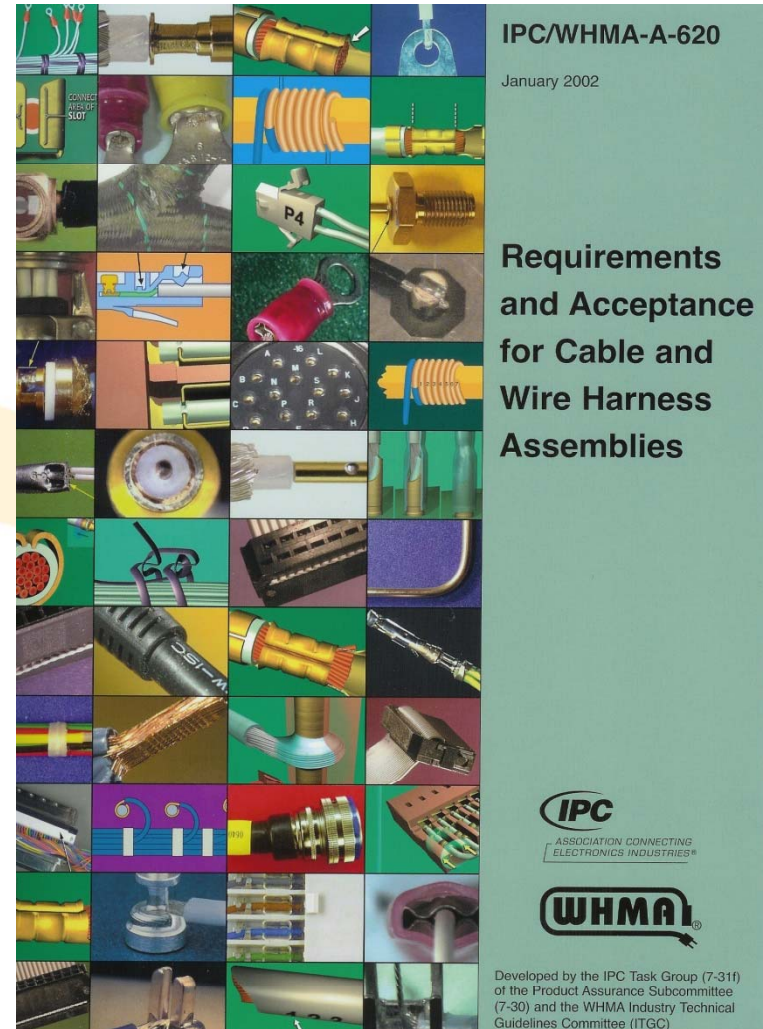
Developed by the IPC Task Group (7-31)
of the Product Assurance Subcommittee
(7-30) and the WHMA Industry Technical
Guidelines Committee (ITGC)



CONFERENCE & EXHIBITION

16 TOPICS

- WIRE PREPARATION
- SOLDERING
- CRIMPING
- IDC
- ULTRASONIC WELDING
- SPLICES
- CONNECTORIZATION
- MOLDING
- CABLE ASSEMBLY
- COAXIAL - TWINAXIAL
- BUNDLE SECURING
- SHIELDING
- PHYSICAL PROTECTIONS
- INSTALLATION
- MARKING
- WIRE WRAP



New IPC Standard that include Lead Free

- For Cables.
 - IPC-A-620A.

Association Connecting Electronics Industries



IPC Training & Certification

IPC/WHMA-A-620A:

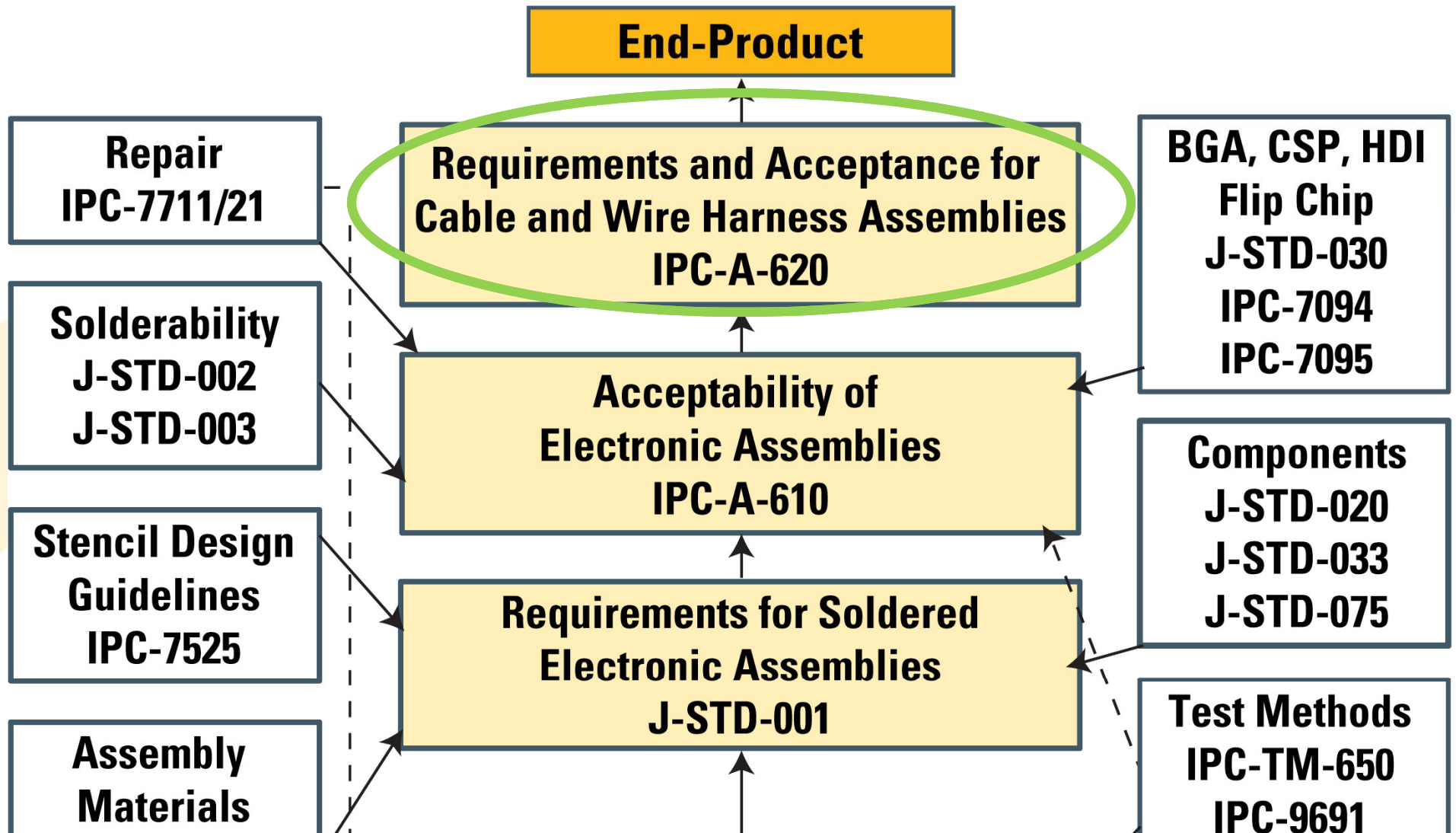
Acceptability and Requirements for Cable and Wire Harness Assemblies

- CIS – Certified IPC Specialist.
- CIT – Certified IPC Trainer.
- Valid for 2 years.
- Up to 9 Modules.
- 1-3 days depending on number of Modules.

Available in:
English, Spanish, Chinese.



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IPC Standards for Process control

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Process control

- IPC-AJ-820
- IPC-TP-1114
- IPC-7530
- IPC-9701A
- IPC-TP-1090
- IPC-PE-740
- IPC-HDBK-001
- IPC-HDBK-830
- IPC-TP-1115
- IPC-S-816
- IPC-CM-770E
- IPC-7912A
- IPC-9261
- IPC-CH-65

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Conclusions

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IPC-600G

IPC-2220

IPC-7351A

J-STD-075

IPC-4101B

J-STD-020D

IPC-4562A

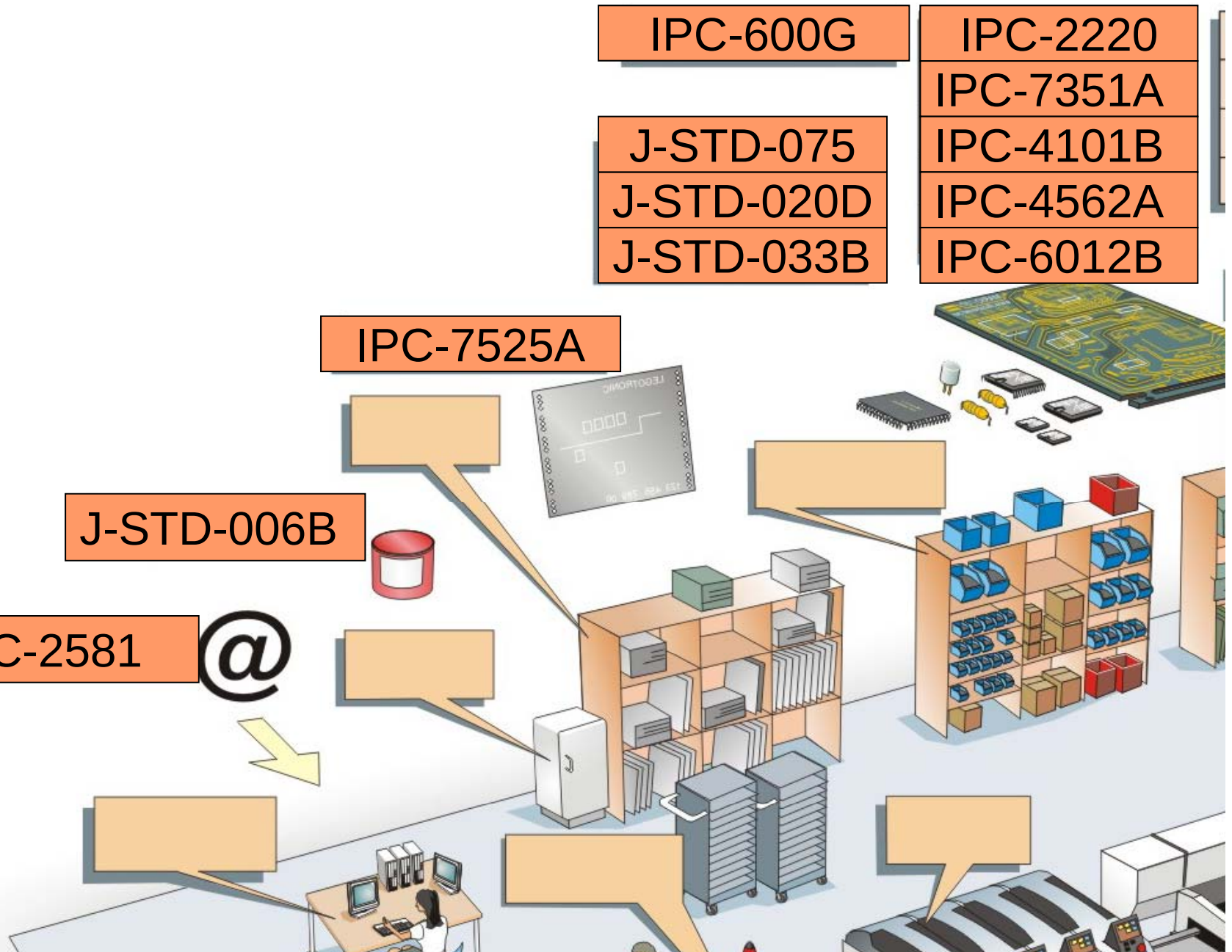
J-STD-033B

IPC-6012B

IPC-7525A

J-STD-006B

IPC-2581



IPC-600G

IPC-2220

J-STD-003B

IPC-7351A

IPC-840D

J-STD-075

IPC-4101B

IPC-4552

J-STD-020D

IPC-4562A

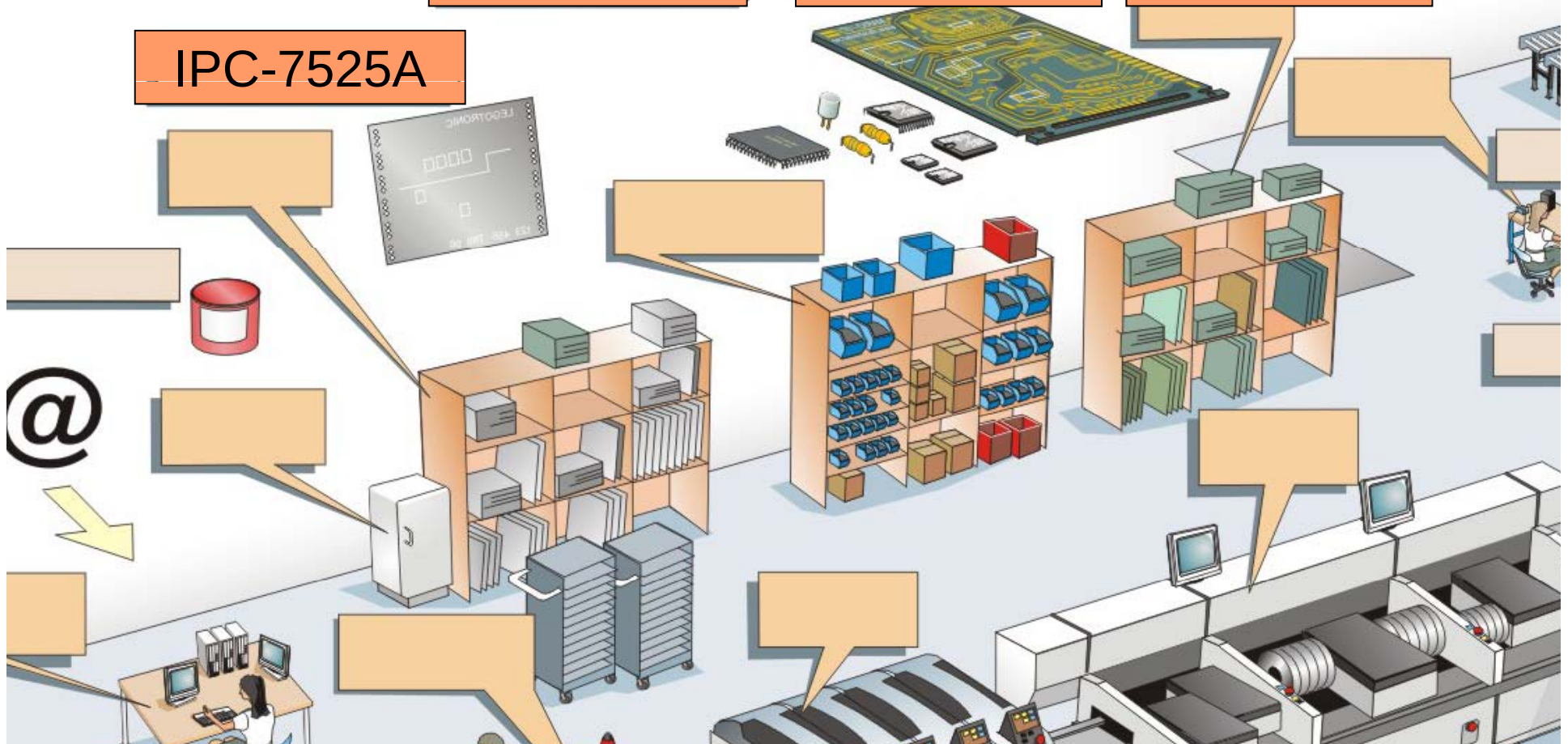
IPC-4553

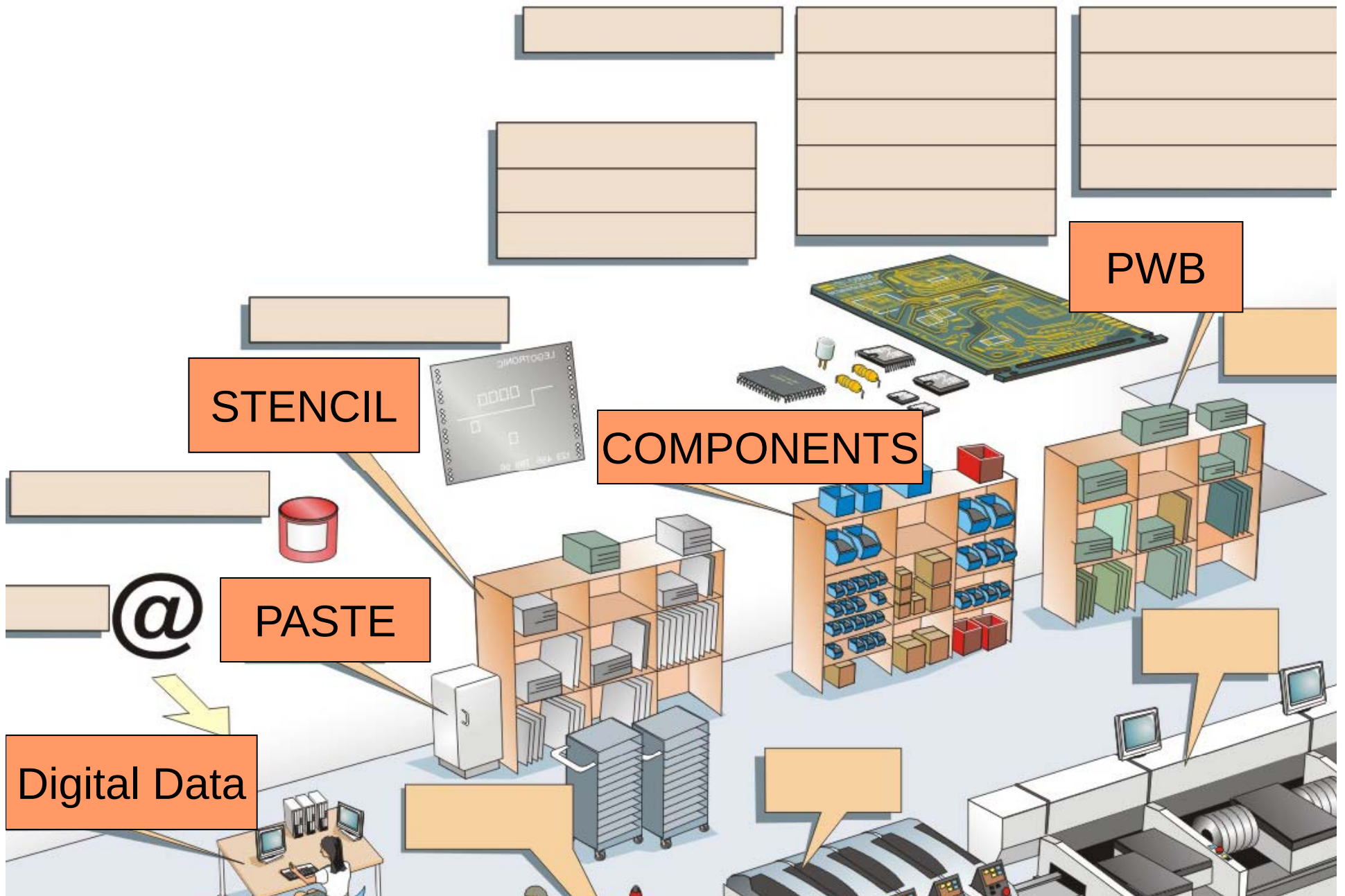
J-STD-033B

IPC-6012B

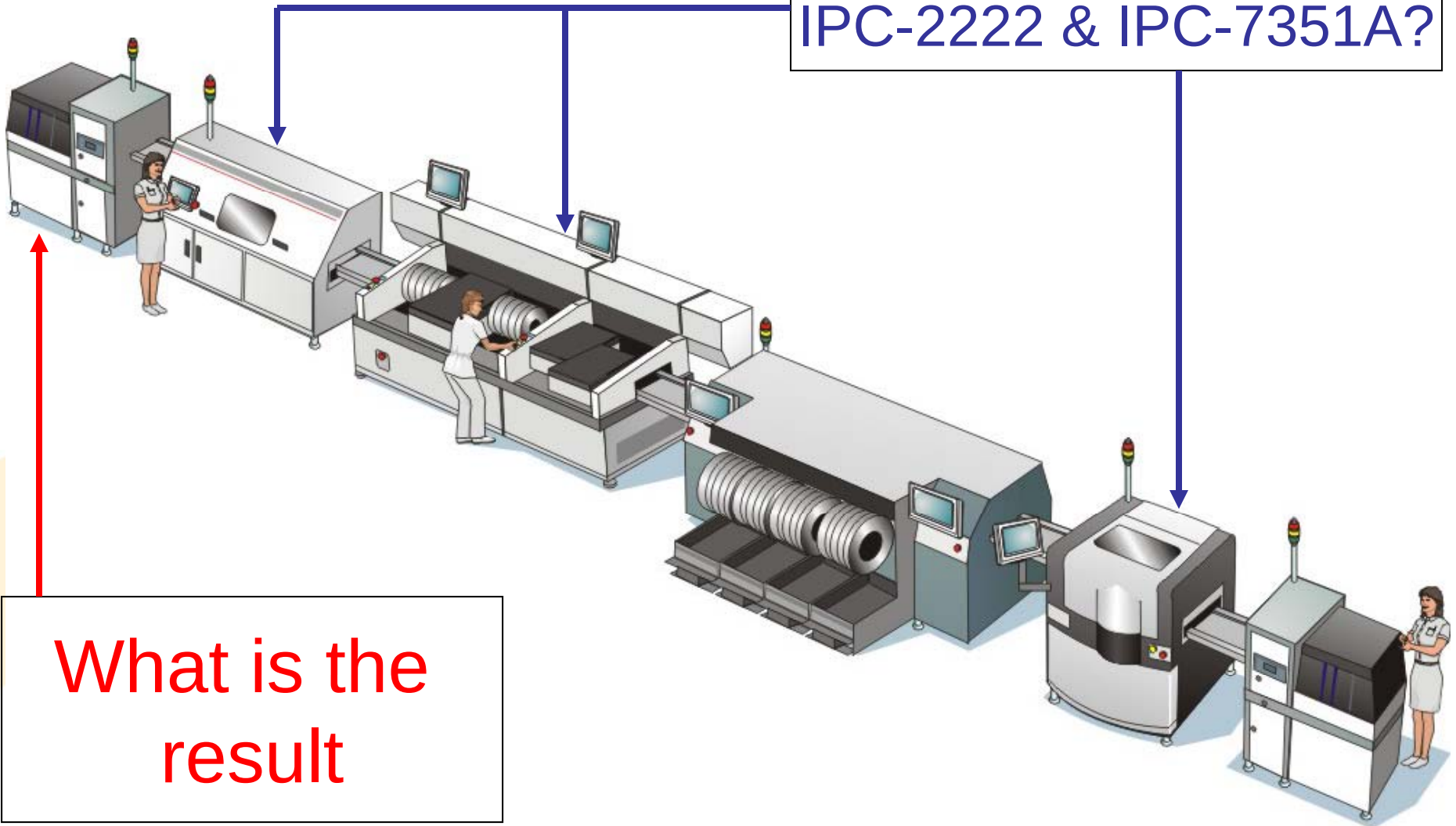
IPC-4554

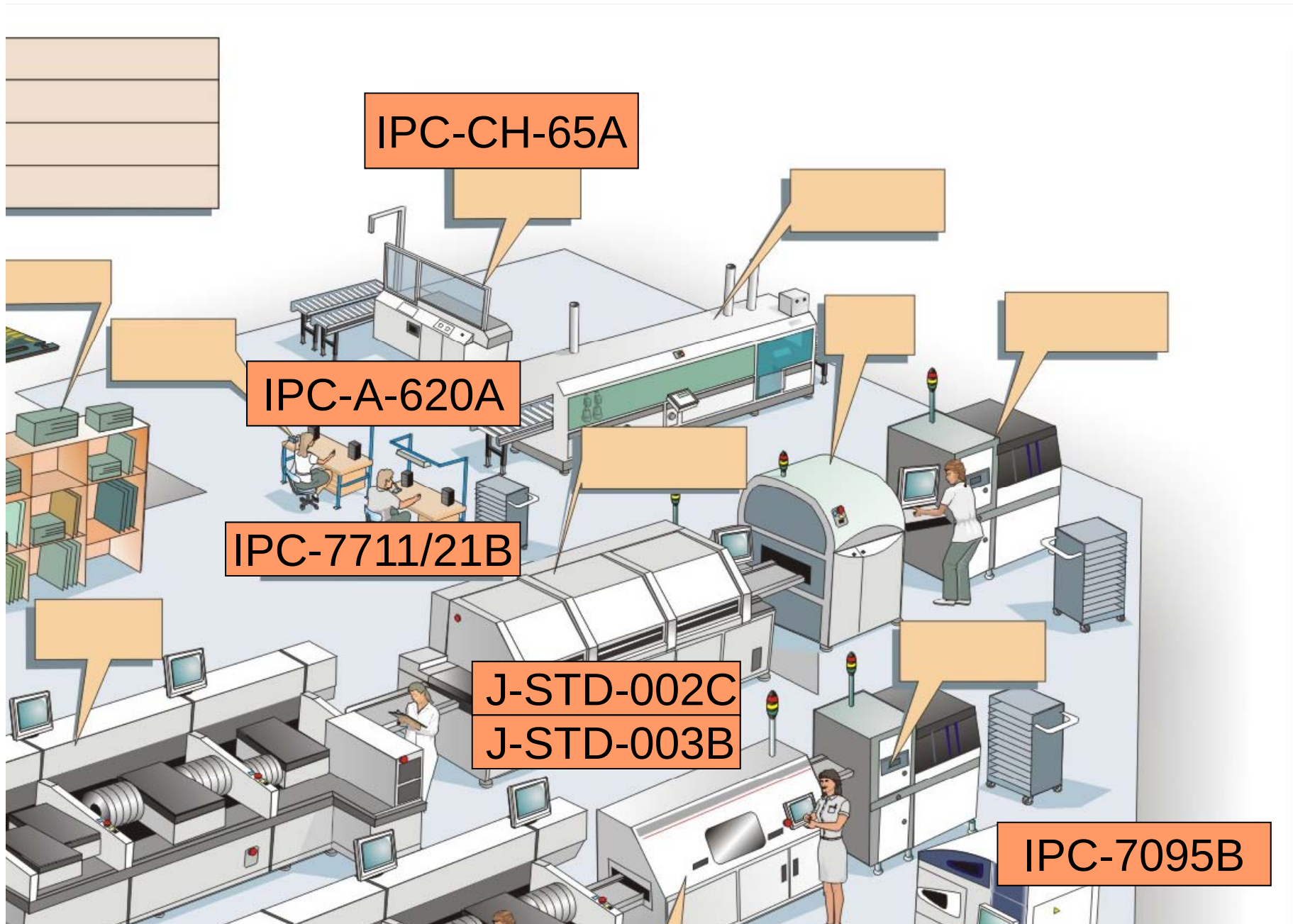
IPC-7525A





Influence of
IPC-2222 & IPC-7351A?





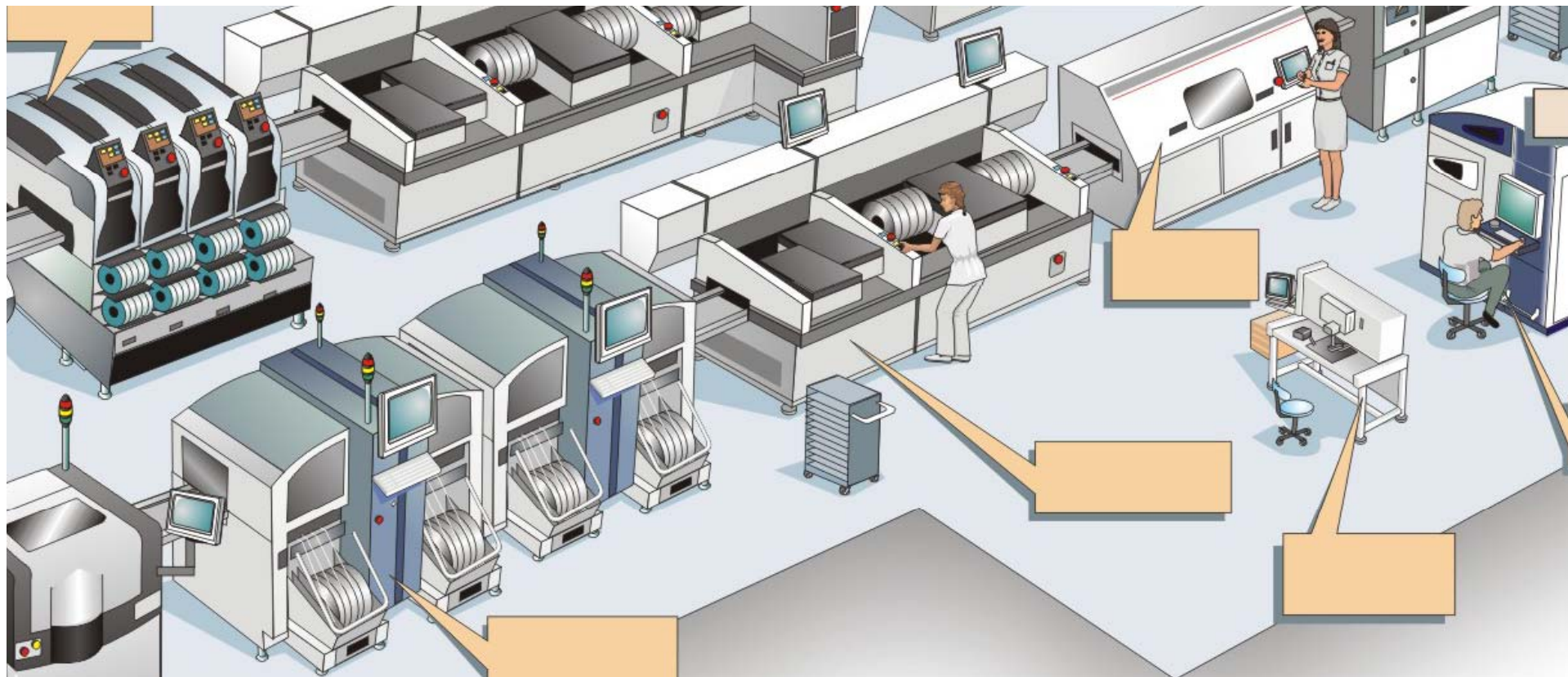
IPC-CH-65A

IPC-A-620A

IPC-7711/21B

J-STD-002C
J-STD-003B

IPC-7095B

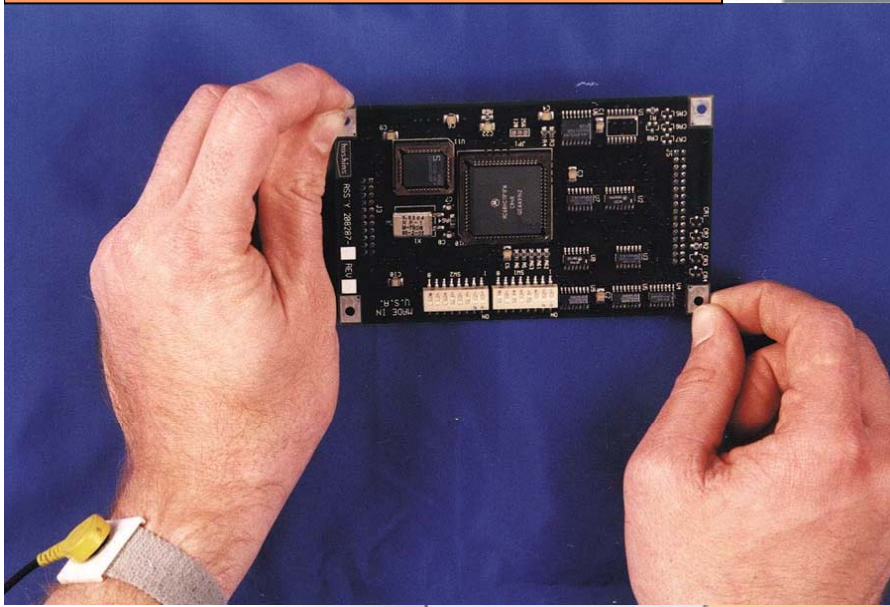


IPC-HDBK-610
IPC-HDBK-005
IPC-HDBK-830

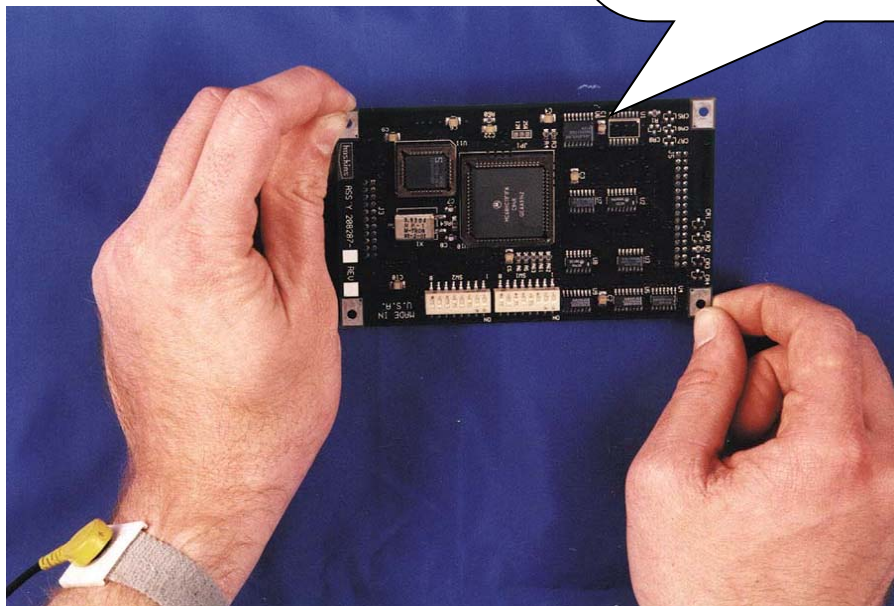
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IPC-7095B
IPC-7711/21B
IPC-620A

J-STD-001D
J-STD-002C
J-STD-003B
J-STD-004A
J-STD-005
J-STD-006B

IPC-A-610D

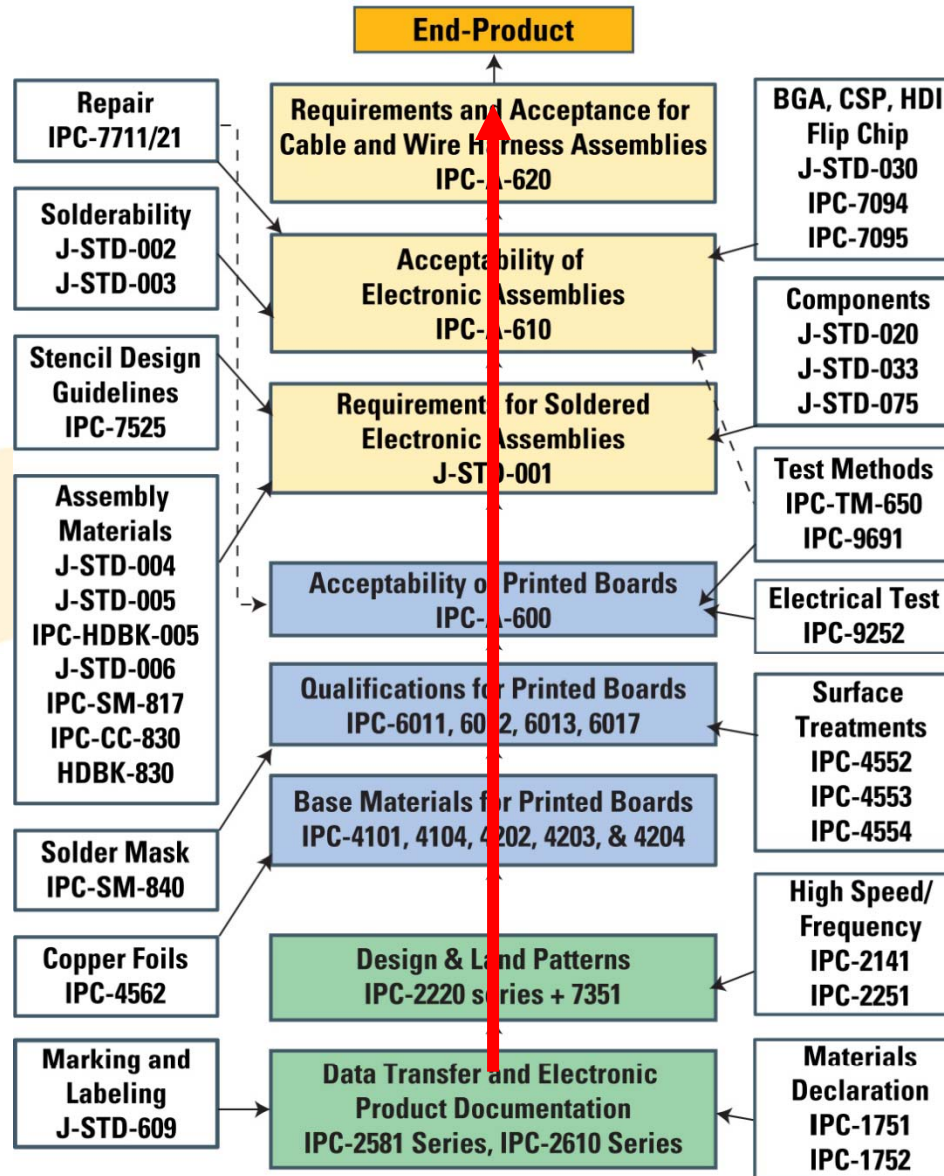


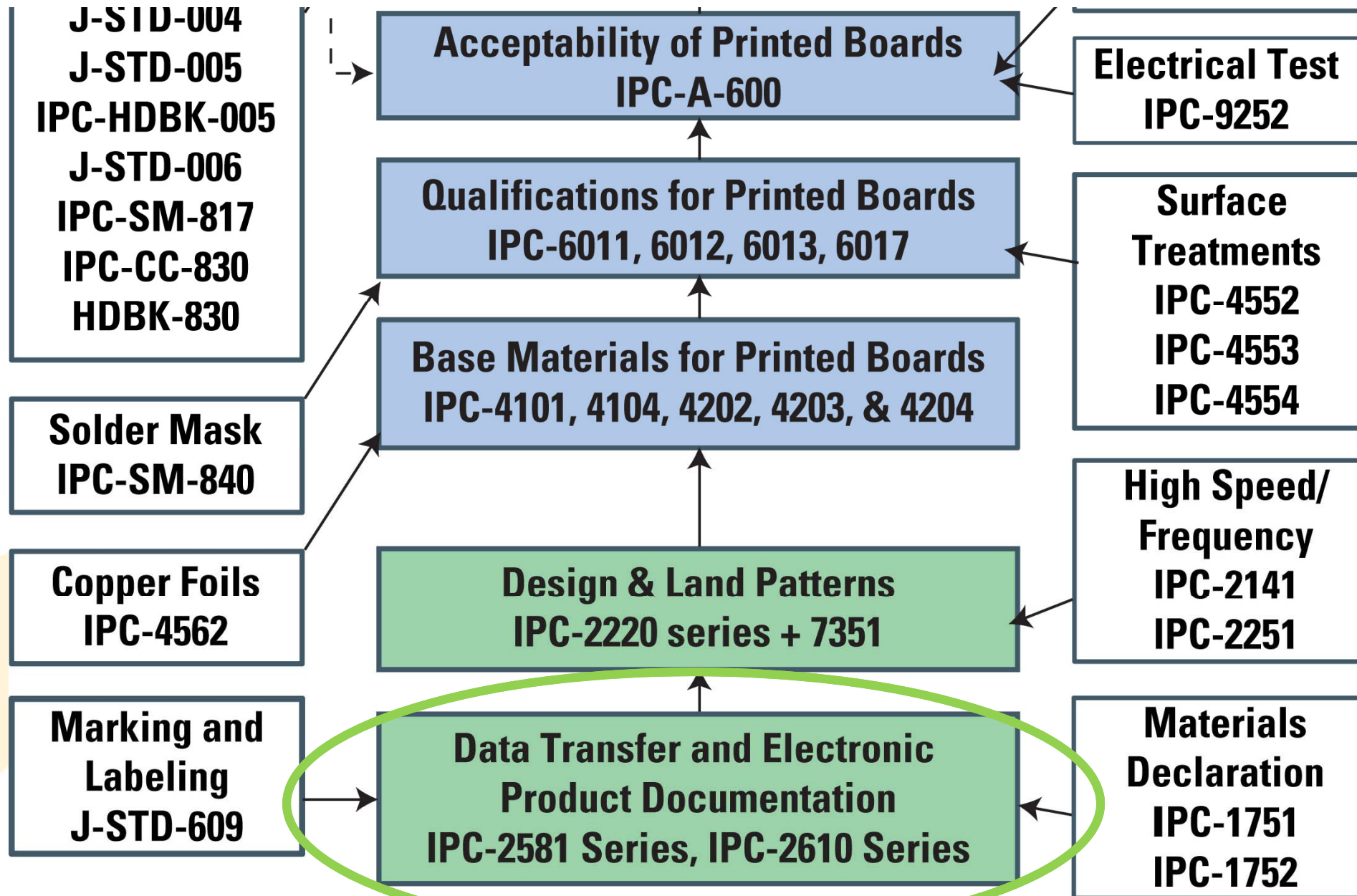
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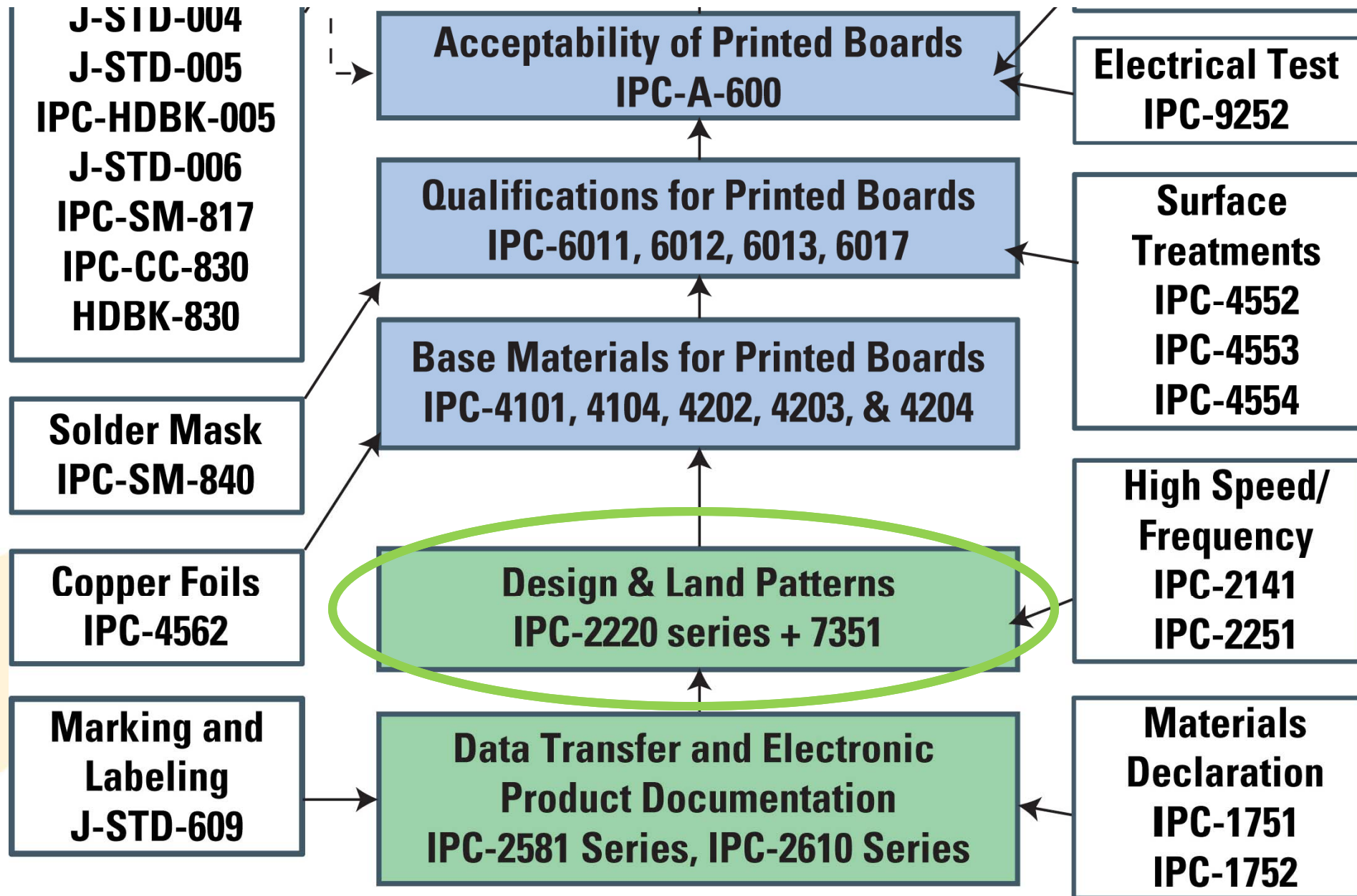


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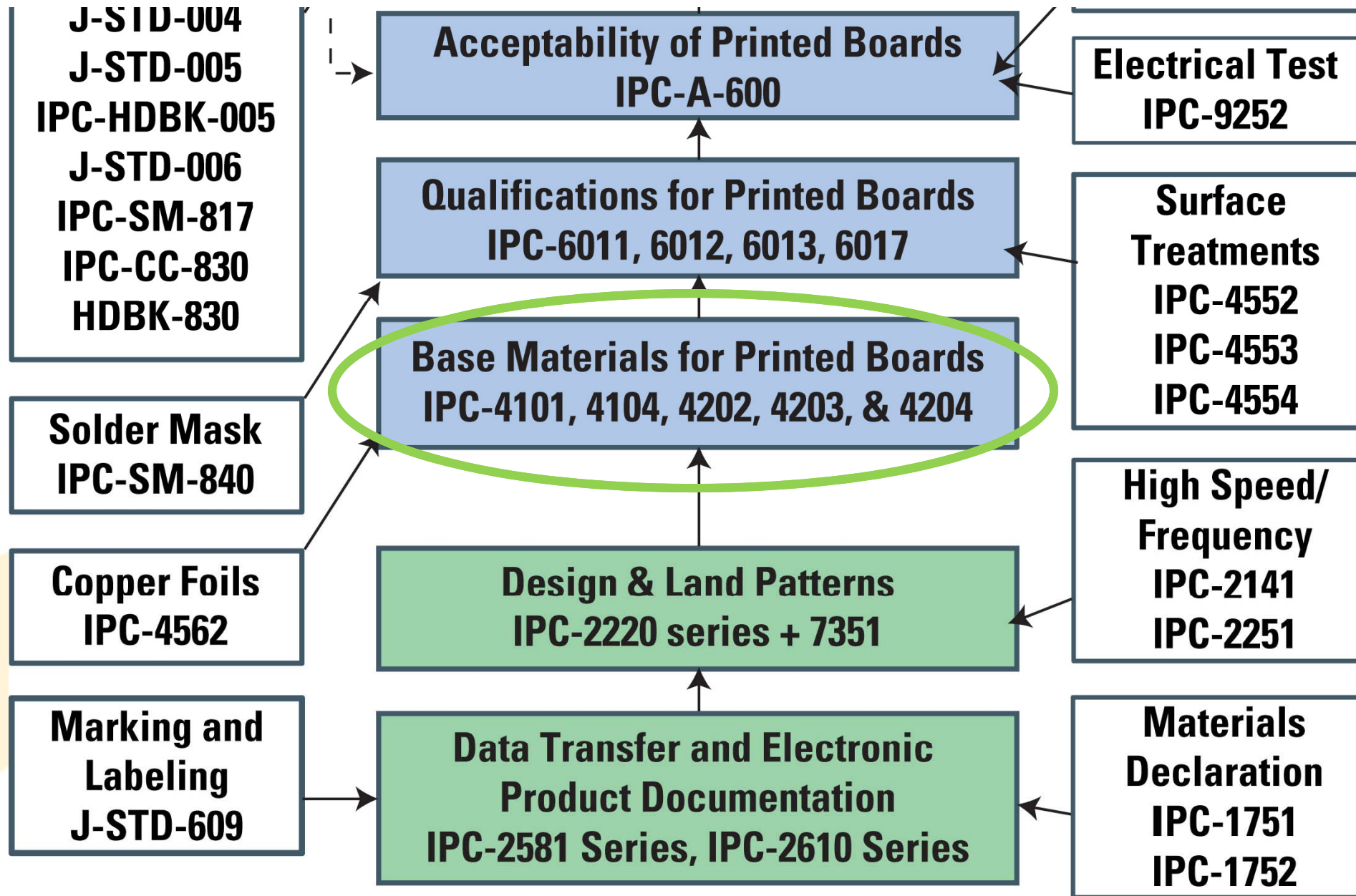




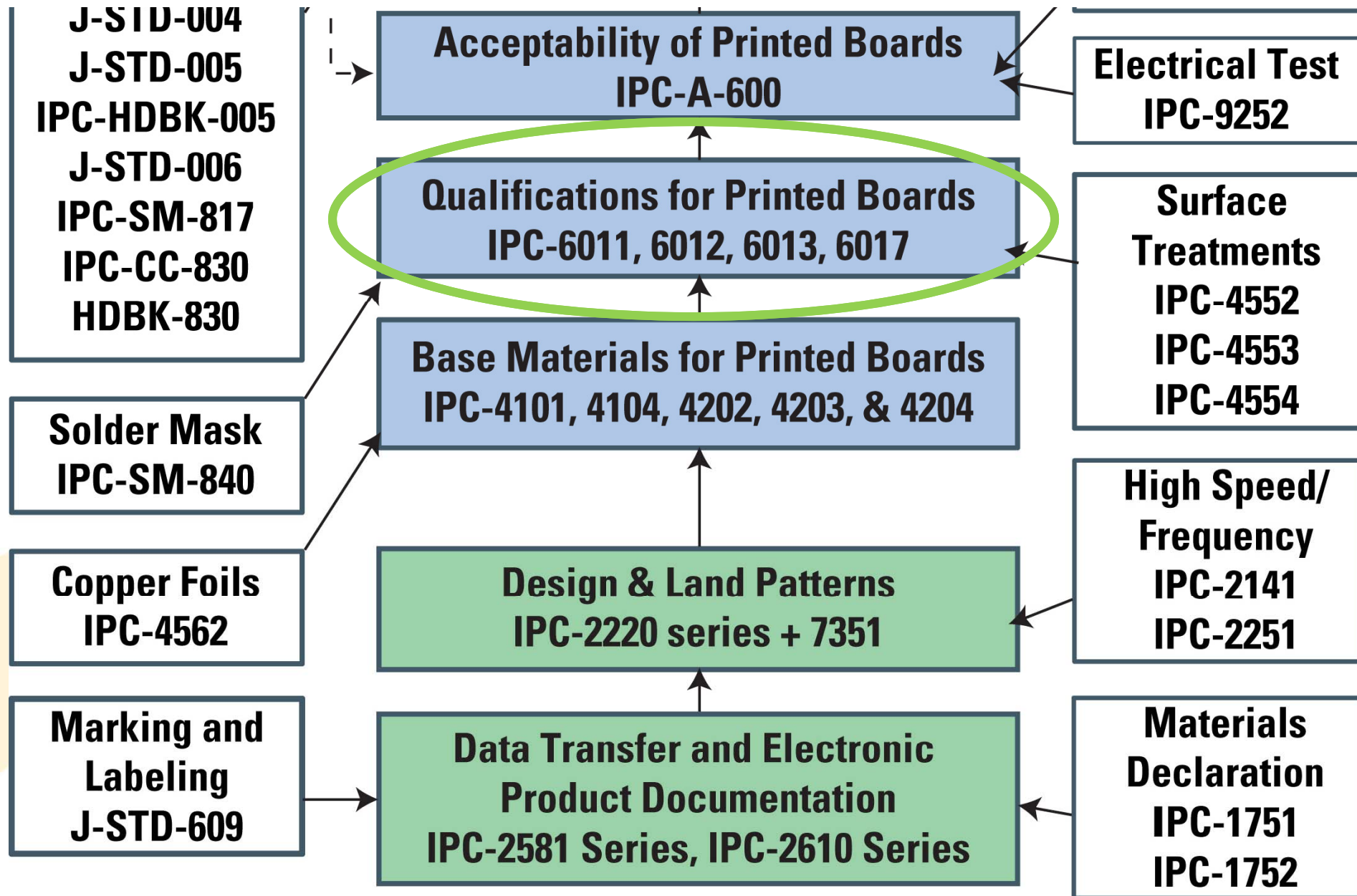
MORE IPC STANDARDS AVAILABLE AT
www.ipc.org/SpecTree (.pdf format)



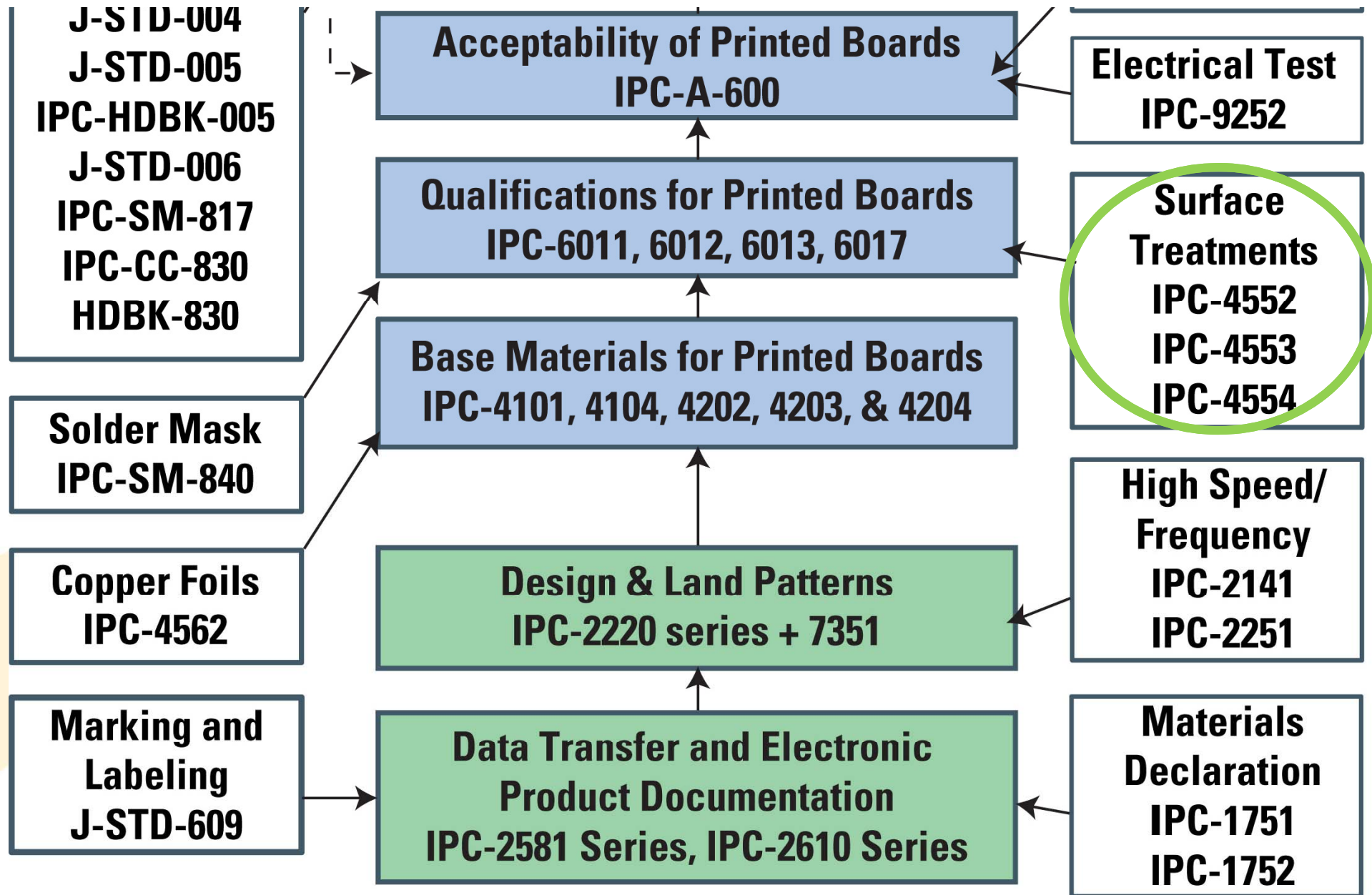
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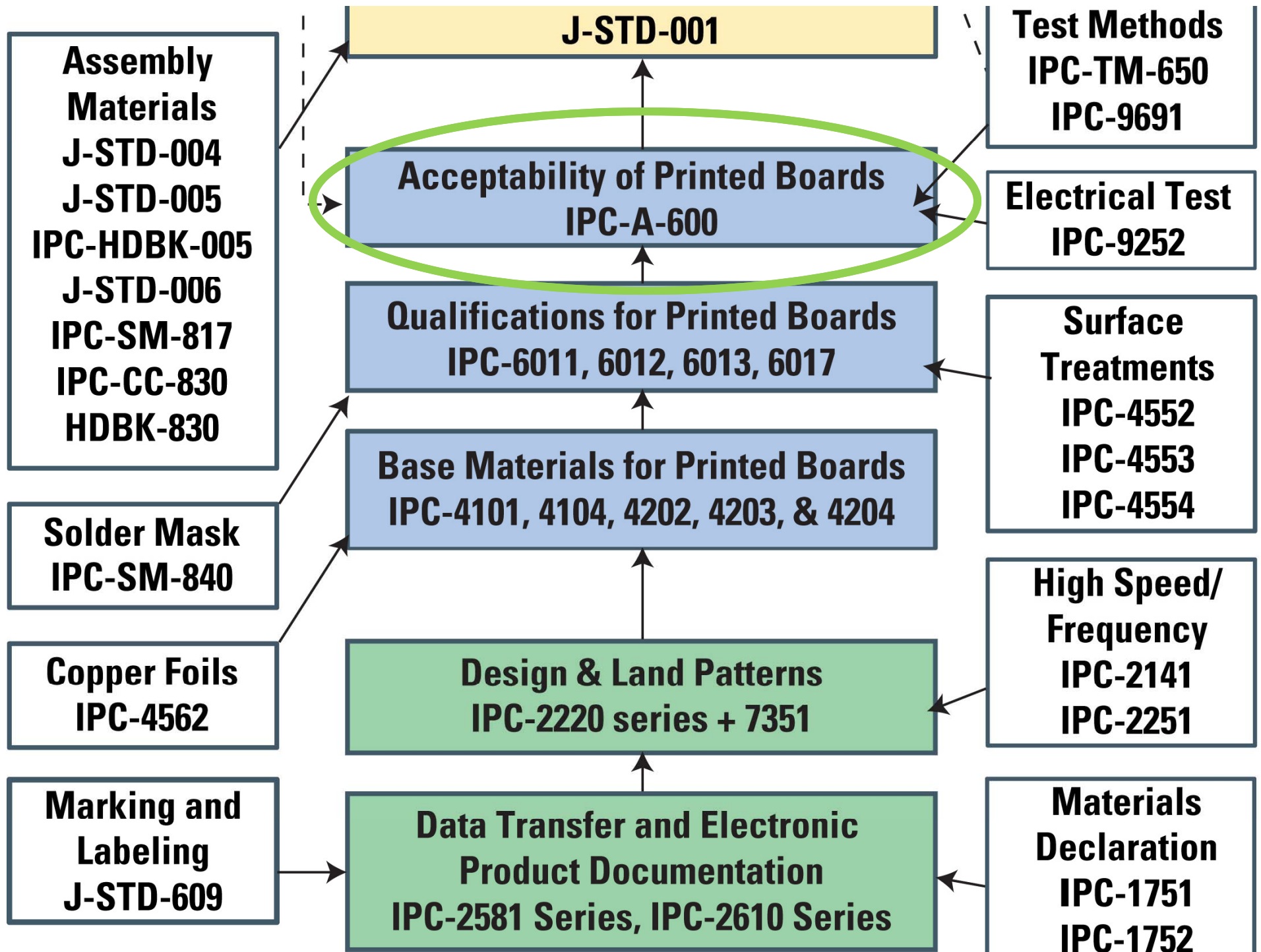
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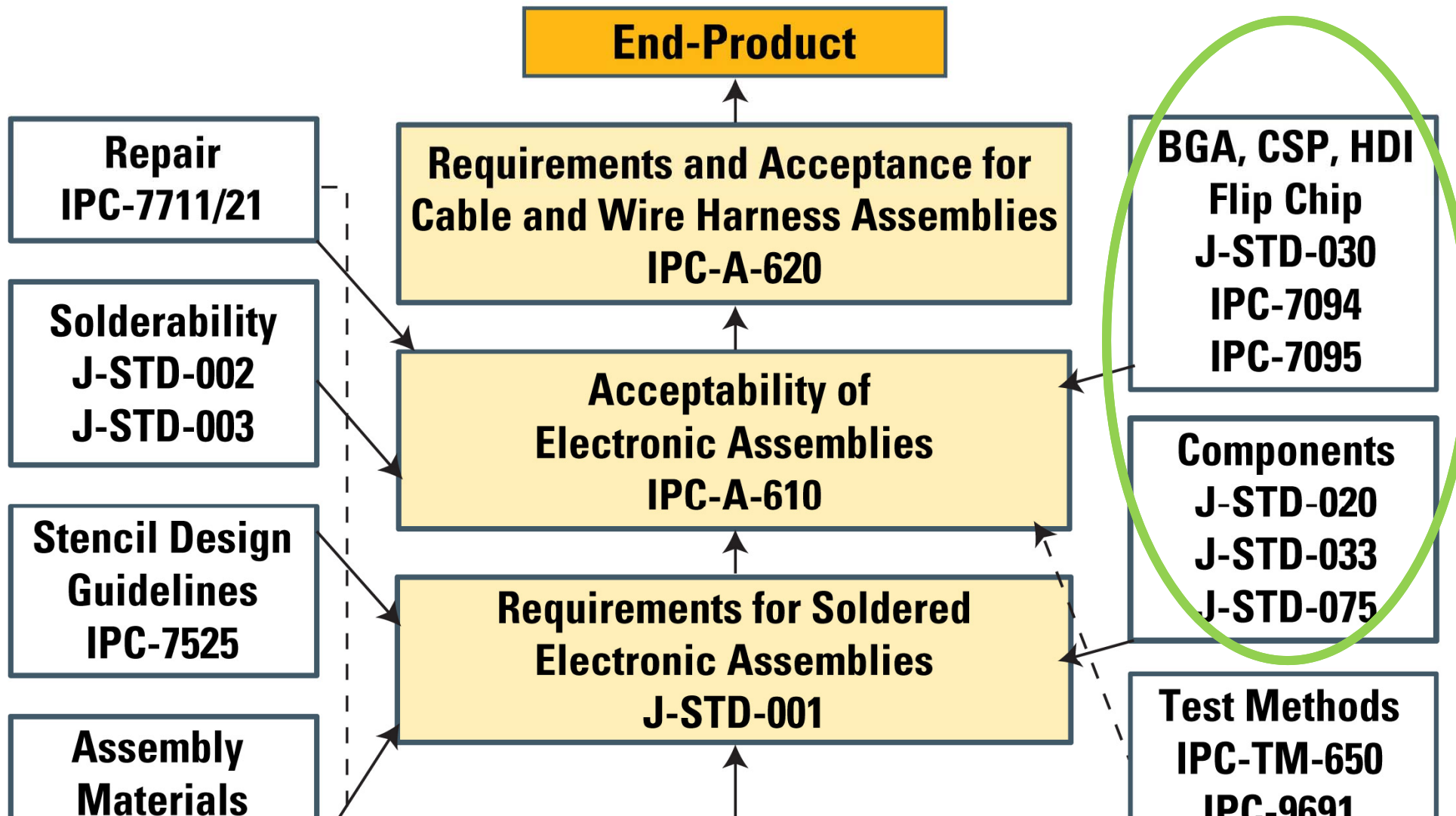


MORE IPC STANDARDS AVAILABLE AT
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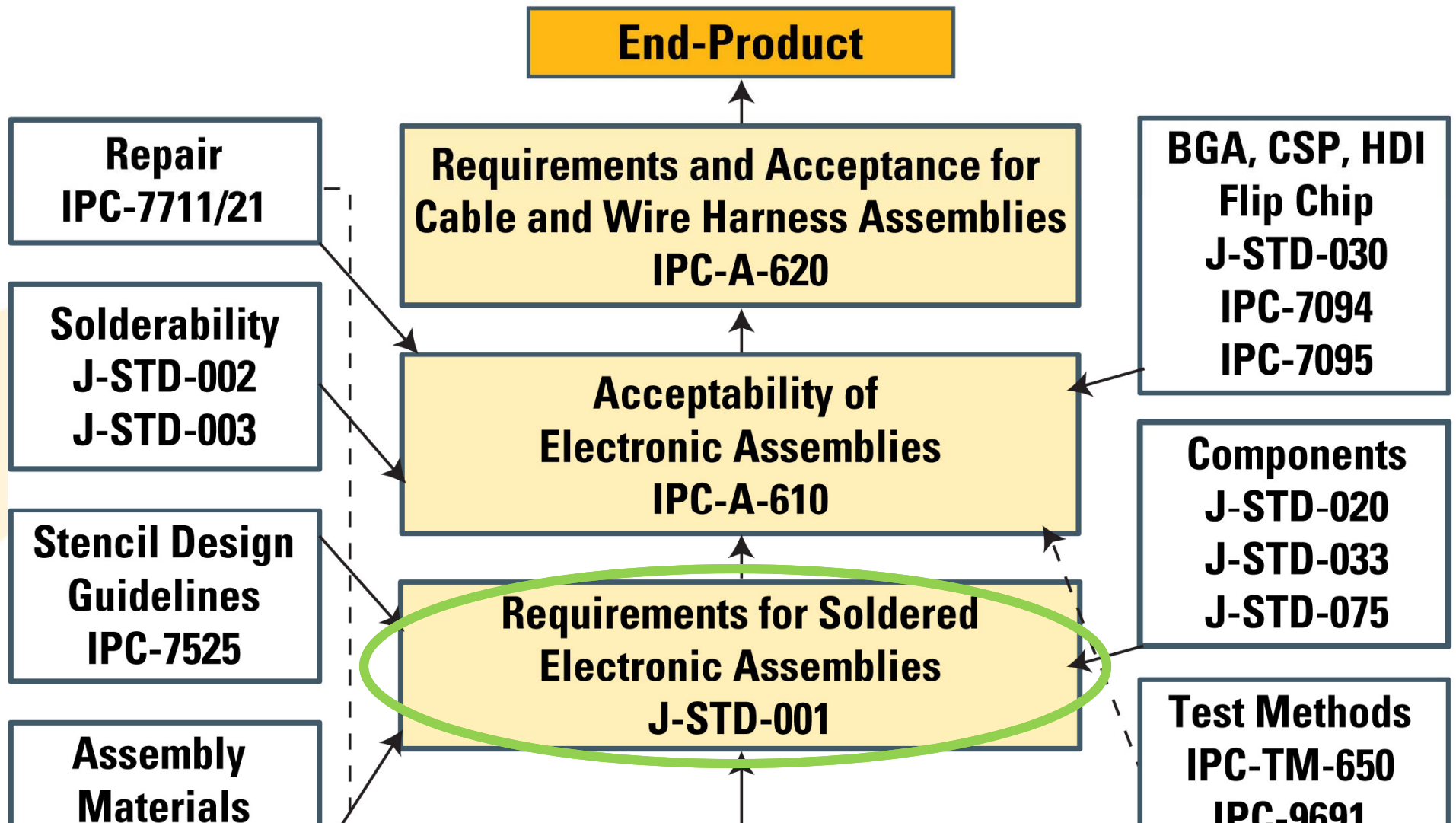


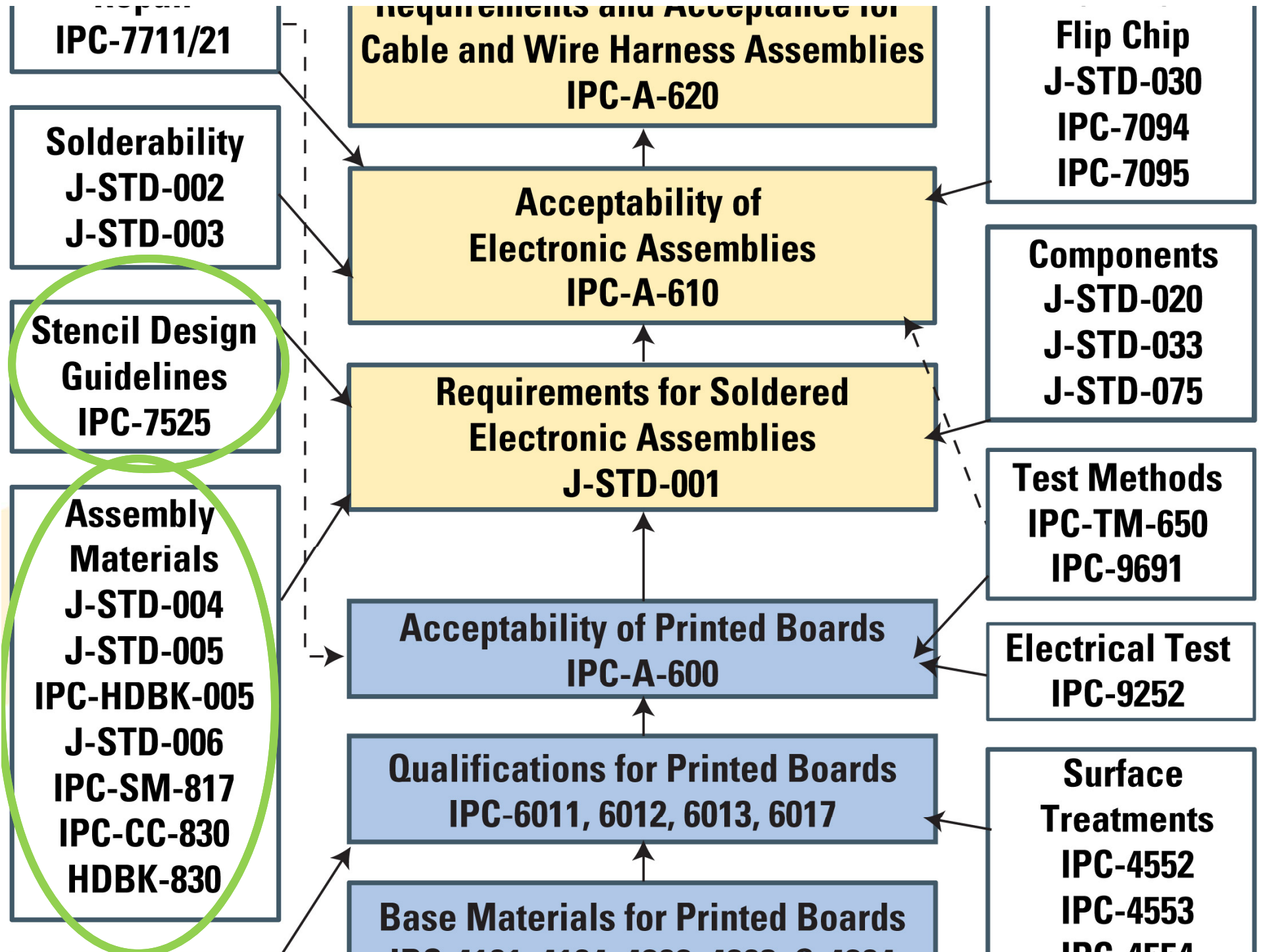
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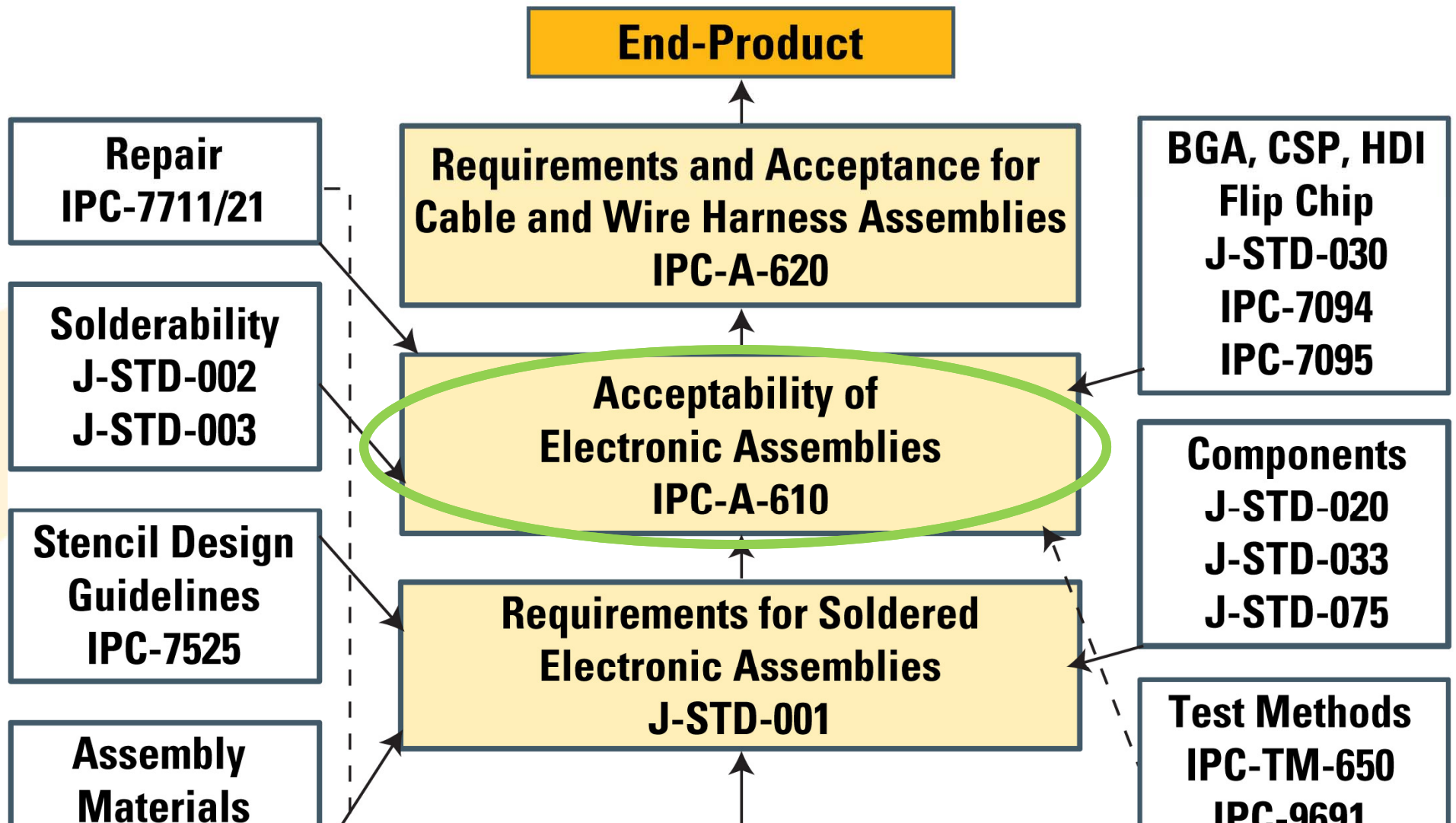
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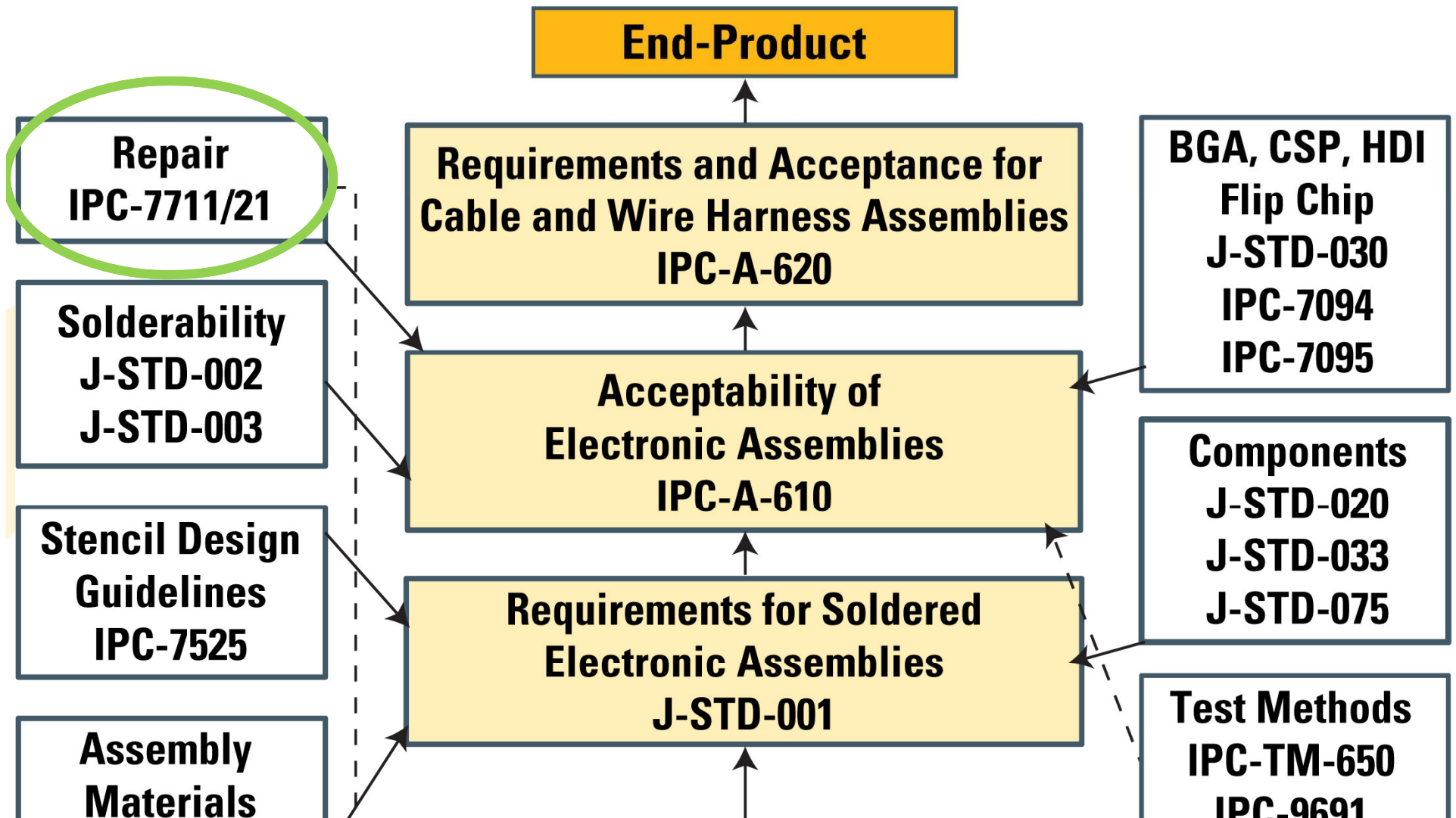


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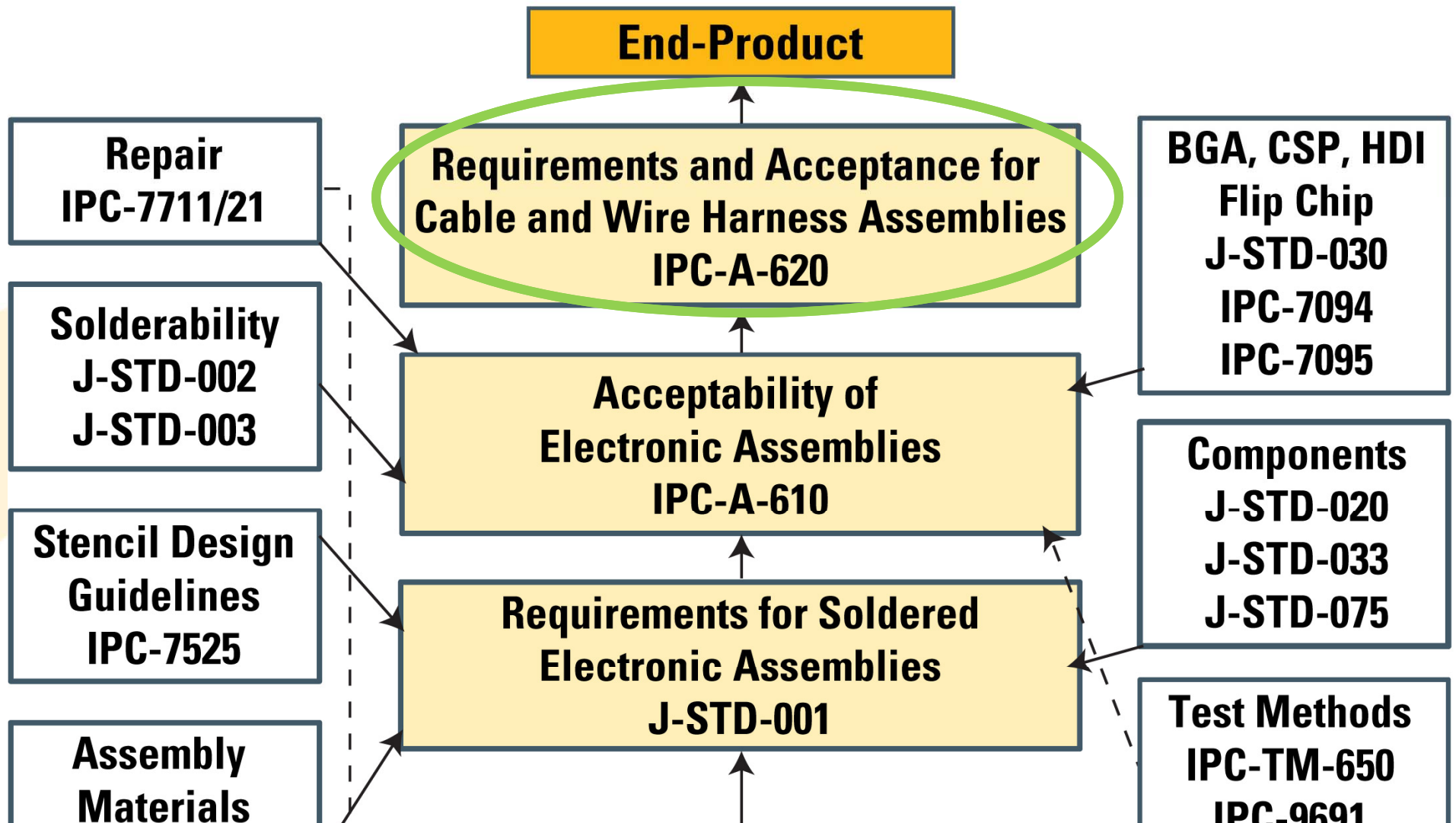


IPC STANDARDS — EVERYTHING YOU NEED FROM START TO FINISH

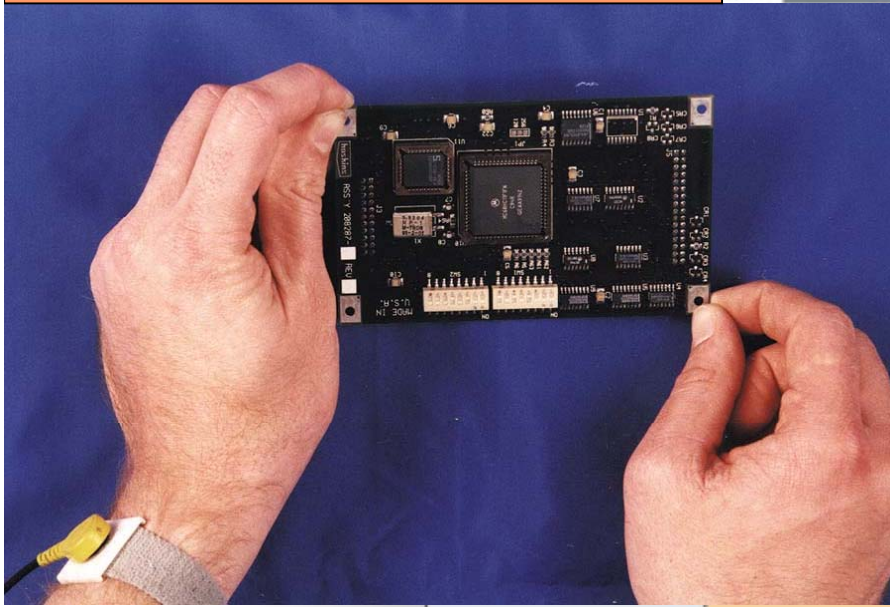




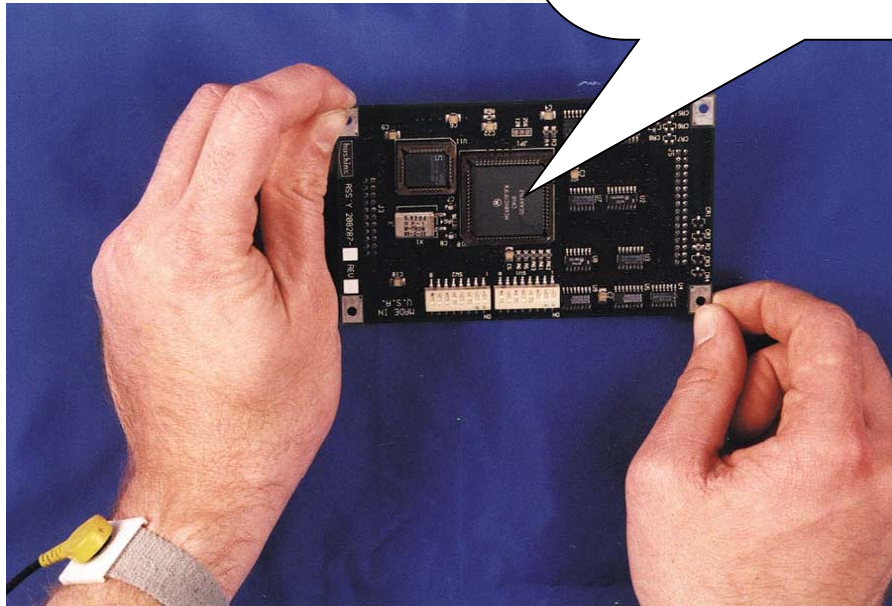
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IPC-A-610D



It is
OK!!



THANK YOU!



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