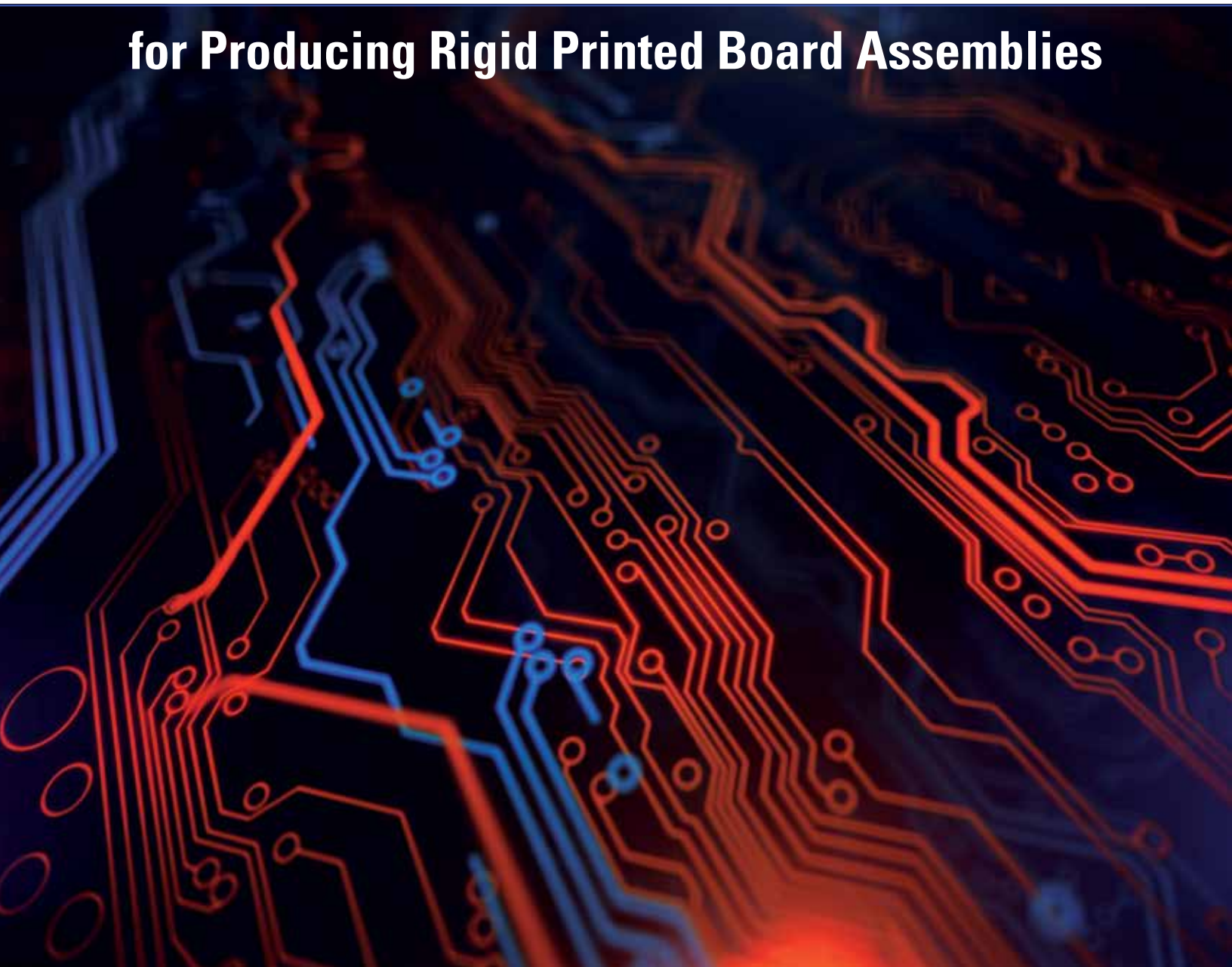




IPC CHECKLIST

for Producing Rigid Printed Board Assemblies



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Purpose of IPC Checklists

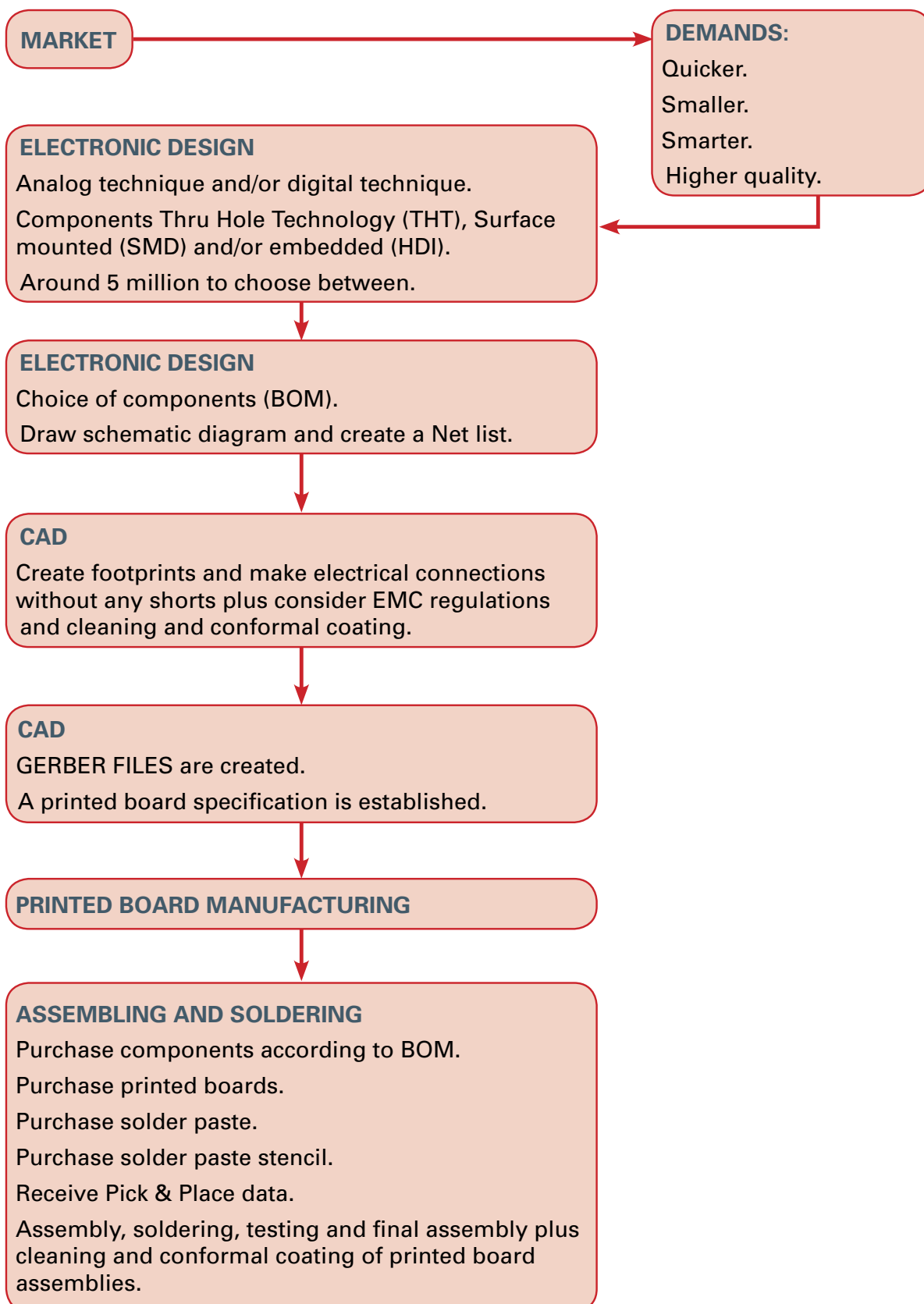
In the entire production chain of a completed rigid printed board assembly number of parameters and varieties exist.

No	Rigid Printed Board assembly Parameters	Relevant IPC Standard(s)	Variables
1	Choice of component package		50
2	Choice of surface finish on components: IPC J-STD-002		10
3	CAD acc to IPC-2221 & 2222 Class 1, 2 or 3		3
4	CAD acc to IPC-2221 & 2222 Level A, B or C		3
5	Footprint/land acc to IPC-7351 Density Level A, B or C		3
6	Demands for cooling in/on printed boards		2
7	Design/CAD of QFN: IPC-7093		3
8	Design/CAD of BGA/CSP: IPC-7095		3
9	Design/CAD of stencils: IPC-7525		5
10	Placement of components		10
11	Choice of printed board base material: IPC-4101		8
12	Choice of printed board base material Cu foil: IPC-4562		2
13	Choice of printed board solder mask: IPC-SM-840		3
14	Choice of printed board surface finish: IPC-4552, 4553, 4554 or 4556		5
15	Choice of printed board handling and storage: IPC-1601		2
16	Age/Wetting of printed board: IPC J-STD-003		3
17	Printed board process steps at supplier: IPC-6011 and 6012		20
18	Different stencil/printing options: IPC-7526 and 7527		5
19	Solder paste/stick/wire options: IPC J-STD-005 and 006		17
20	Flux with solder paste/stick/wire options: IPC J-STD-004		5
21	Reflow/vapor phase/wave/selective/hand options.		5
22	Choice of soldering environments (O ₂ free, N ₂ or Air)		3
23	Choice of lead or lead-free process.		2
24	Choice of process cycle: IPC J-STD-020 and 075		10
25	Choice of moisture sensitive level (MSL): IPC J-STD-033		5
26	Choice of cleaning method: IPC-CH-65, IPC-5702, IPC-5703		4
27	Conformal coating IPC-CC-830, J-STD-001		3
28	Printed board assembly requirements Class 1, 2 or 3: IPC J-STD-001		3
29	Printed board assembly acceptability Class 1, 2 or 3: IPC-A-610		3
30	Printed board assembly touch up and repair: IPC-7711/21		3
31	Printed board assembly requirements/acceptability for electronic enclosures: IPC-A-630		6
32	Printed board assembly requirements/acceptability for cable: IPC/WHMA-A-620		3
	Total variables		212

Theoretically, if each of these 32 parameters and their 212 variables depend on each other (worst case and not true), the number of potential combinations is as high as 4 200 000 000 000 000 000 0, (4,2E19) — too many to be handled by the human brain.

The purpose of this IPC Checklist is to assist all involved in the entire production chain of Printed board's (see facing page) in minimizing the risk of combinations that don't give good solder joints according to IPC-A-610 Class 1, 2 or 3.

Chain of Production



IPC Reference Standards

1. **IPC-2221**, Generic Standard on Printed Board Design
2. **IPC-2222**, Sectional Design Standard for Rigid Organic Printed Boards
3. **IPC-2141**, Design Guide for High-Speed Controlled Impedance Circuit Boards
4. **IPC-2251**, Design Guide for the Packaging of High Speed Electronic Circuits
5. **IPC-2152**, Standard for Determining Current Carrying Capacity in printed board Design
6. **IPC-2615**, Printed Board Dimensions and Tolerances
7. **IPC-2581**, Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology
8. **J-STD-002**, Solderability Tests for Components Leads, Terminations, Lugs and Wires
9. **J-STD-033**, Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices
10. **IPC-7092**, Design and Assembly Process Implementation for Embedded Components
11. **IPC-7093**, Design and Assembly Process Implementation for Bottom Termination (Typical QFN and LCC) Components
12. **IPC-7094**, Design and Assembly Process Implementation for Flip Chip and Die Size Components
13. **IPC-7095**, Design and Assembly Process Implementation for BGAs
14. **J-STD-030**, Selection and Application of Board Level Underfill Materials
15. **IPC-7351**, Land Pattern Calculator and Tools
16. **IPC-7525**, Stencil Design Guidelines
17. **IPC-7526**, Stencil and Misprinted Board Cleaning Handbook
18. **IPC-7527**, Requirements for Solder Paste Printing
19. **IPC-4562**, Metal Foil for Printed Board Applications
20. **IPC-4563**, Resin Coated Copper Foil for Printed Boards Guideline
21. **IPC-4101**, Specification for Base Material for Rigid and Multilayer Printed Boards
22. **IPC-4121**, Guidelines for Selecting Core Construction for Multilayer Printed Wiring Board Applications
23. **IPC-6011**, Generic Performance Specification for Printed Boards
24. **IPC-6012**, Qualification and Performance Specification for Rigid Printed Boards
25. **IPC-SM-840**, Qualification and Performance Specification of Permanent Solder Mask and Flexible Cover Materials
26. **IPC-4552**, Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Boards
27. **IPC-4553**, Specification for Immersion Silver Plating for Printed Boards
28. **IPC-4554**, Specification for Immersion Tin Plating for Printed Boards
29. **IPC-4556**, Specification for Electroless Nickel/Electroless Palladium/Immersion Gold (ENEPIG) Plating for Printed Boards
30. **IPC-A-600**, Acceptability of Printed Boards
31. **J-STD-003**, Solderability Tests for Printed Boards
32. **IPC-1601**, Printed Board Handling and Storage Guidelines
33. **IPC-TM-650**, Test Methods Manual
34. **IPC-9691**, User Guide for the IPC-TM-650, Method 2.6.25, Conductive Anodic Filament (CAF) Resistance Test (Electrochemical Migration Testing)

Please NOTE:

- Applicable documents are referenced in the standard but the requirements are not invoked unless specifically stated.
- Related standards would have no call out, only useful references.

-
35. **IPC-1752**, Material Declaration Management
 36. **J-STD-609**, IPC/JEDEC Marking and Labeling of Components, Printed Boards and Printed board's to Identify (Pb), Lead Free (Pb-Free) and Other Attributes
 37. **J-STD-001**, Requirements for Soldered Electrical and Electronic Assemblies
 38. **IPC-HDBK-001**, Handbook and Guide to Supplement J-STD-001
 39. **J-STD-004**, Requirements for Soldering Fluxes
 40. **J-STD-005**, Requirements for Soldering Pastes
 41. **IPC-HDBK-005**, Guide to Solder Paste Assessment
 42. **J-STD-006**, Requirements for Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Solder Applications
 43. **IPC-A-610**, Acceptability of Electronic Assemblies
 44. **IPC-7711/21**, Rework, Modification and Repair of Electronic Assemblies
 45. **IPC/WHMA-A-620**, Requirements and Acceptability for Cable and Wire Harness Assemblies
 46. **J-STD-020**, Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices
 47. **J-STD-075**, Classification of Non-IC Electronic Components for Assembly Processes
 48. **IPC-2611**, Generic Requirements for Electronic Product Documentation
 49. **IPC-2612**, Sectional Requirements for Electronic Diagramming Documentation (Schematic and Logic Descriptions)
 50. **IPC-2614**, Sectional Requirements for Board Fabrication Documentation
 51. **IPC-CH-65**, Guidelines for Cleaning of Circuit Boards and Assemblies
 52. **IPC-5701**, User Guide for Cleanliness of Unpopulated Printed Boards
 53. **IPC-5702**, Guidelines for OEMs in Determining Acceptable Levels of Cleanliness of Unpopulated Printed Boards
 54. **IPC-5703**, Cleanliness Guidelines for Printed Board Fabricators
 55. **IPC-5704**, Cleanliness Requirements for Unpopulated Printed Boards
 56. **IPC-8497-1**, Cleaning Methods and Contamination Assessment for Optical Assembly
 57. **IPC-9201**, Surface Insulation Resistance Handbook
 58. **IPC-9202**, Material and Process Characterization/Qualification Test Protocol for Assessing Electrochemical Performance
 59. **IPC-9203**, User Guide to IPC-9202 and the IPC-B-52 Standard Test Vehicle
 60. **IPC-PE-740**, Troubleshooting for Printed Board Manufacture and Assembly
 61. **IPC-CC-830**, Qualification and Performance of Electrical Insulating Compounds for Printed Wiring Assemblies – Includes Amendment 1
 62. **IPC-HDBK-830**, Guidelines for Design, Selection and Application of Conformal Coatings
 63. **IPC-AJ-820**, Assembly and Joining Handbook
 64. **IPC-A-630**, Acceptability Standard for Manufacture, Inspection and Testing of Electronic Enclosures
 65. **IPC-T-50**, Terms and Definitions for Interconnecting and Packaging Electronic Circuits
 66. **IPC-9701**, Performance Test Methods and Qualification Requirements for Surface Mount Solder Attachments
 67. **IPC-9704**, Printed Circuit Assembly Strain Gage Test Guideline
 68. **IPC-9706**, Mechanical Shock In-situ Electrical Metrology Test Guidelines for FCBGA SMT Component Solder Crack and Pad Crater/Trace Crack Detection
 69. **IPC-9709**, Test Guidelines for Acoustic Emission Measurement during Mechanical Testing
 70. **IPC-SM-817**, General Requirements for Dielectric Surface Mount Adhesives
 71. **IPC-HDBK-850**, Guidelines for Design, Selection and Application of Potting Materials and Encapsulation Processes Used for Electronics Printed Circuit Board Assembly

IPC Performance Classes

Performance Classes

Three general classes have been established to reflect progressive increases in sophistication, functional performance requirements and testing/inspection frequency. It should be recognized that there may be an overlap of equipment categories in different classes. The user has the responsibility to specify in the contract or purchase order, the performance class required for each product and **shall** indicate any exceptions to specific parameters, where appropriate.

IPC Class 1:

General Electronic Products — Includes consumer products and some computer and computer peripherals suitable for applications where cosmetic imperfections are not important and the major requirement is function of the completed printed board.

IPC Class 2:

Dedicated Service Electronic Products — Includes communications equipment, sophisticated business machines, instruments where high performance and extended life are required and for which uninterrupted service is desired but not critical. Certain cosmetic imperfections are allowed.

IPC Class 3:

High Reliability or Harsh Operating Environment Electronic Products — Includes the equipment and products where continued performance or performance on demand is critical. Equipment downtime cannot be tolerated and must function when required such as in life support items or flight control systems. Printed boards in this class are suitable for applications where high levels of assurance are required and service is essential.

Please NOTE that the final performance class for printed board assemblies (assembled, soldered, cleaned and tested) cannot be any greater than the performance class called out for the bare printed board.

That is, in order to obtain a Class 3 with the assembly printed board assembly, an IPC Class 3 recognition of the bare printed board (anything with a Class 2 or 1 with the bare printed board prevents obtaining a Class 3 with the printed board assembly) must be first obtained.

IPC Producibility Levels

Producibility Levels

When appropriate, IPC standards (IPC-2221, IPC-2222 and IPC-7351) provide three design producibility levels of features, tolerances, measurements, assembly and testing of completion or verification of the manufacturing process. These reflect progressive increases in the sophistication of tooling, materials and/or processing and therefore, progressive increases in fabrication cost.

These levels are:

Level A: General Design Producibility — Preferred

Level B: Moderate Design Producibility — Standard

Level C: High Design Producibility — Reduced

The producibility levels are not to be interpreted as a design requirement, but a method of communicating the degree of difficulty of a feature between design and fabrication/assembly facilities. The use of one level for a specific feature does not mean that other features must be of the same level. Selection should always be based on the minimum need, while recognizing that the precision, performance, conductive pattern density, equipment, assembly and testing requirements determine the design producibility level. The numbers listed within the numerous tables are to be used as a guide in determining what the level of producibility will be for any feature. The specific requirement for any feature that must be controlled on the end item shall be specified on the master drawing of the printed board or the printed board assembly drawing.

Checklist at the Project Start Level

E	Responsible	Demand on Assembly	IPC Standard	Information	Check
1	Project Leader	IPC Class 1, 2 or 3?	IPC-2221	Any Additional/Exceptions	
2	Project Leader	IPC Level A, B or C?	IPC-2221	Any Additional/Exceptions	
3	Project Leader	IPC Level A, B, C or D?	IPC-1752	Material Declaration	
4	Project Leader	RoHS 1 or RoHS 2?			
5	Project Leader	Touch up and Repair allowed?	IPC-7711/21	Valid for both printed board and printed board assembly?	
6	Project Leader	Surface finish on components?	J-STD-002	Different surfaces have different wetting. Can be of importance for achieving IPC Class 3.	
7	Project Leader	Process Sensitivity Level (PSL)	IPC-020 and IPC-075	Max Temp, Thermal gradient and H ₂ O Sensitivity.	
8	Project Leader	Surface finish on Printed Boards?	IPC-4552, IPC-4553 and IPC-4554	Different Surface Finishes have Different wetting and durability.	
9	Project Leader	MSL on components	J-STD-033	Moisture Sensitive Level of more importance for a Pb-Free process.	
10	Project Leader	Marking and Labeling of Components, printed boards and Printed board's to Identify Pb, Pb-Free and Other Attributes.	J-STD-609		
11	Project Leader	Voids?	IPC-7095	In the balls of BGA and CSP components	
12	Project Leader	UL class?		Underwriters Laboratories	
13	Project Leader	Cleaning and Conformal Coating	IPC-CH-65	See Checklist I, page 19.	
14	Electronic Designer	EMC on the printed board and components?	Needed for CE marking	Different Standards/Demands in different countries?	
15	Electronic Designer	Impedance?	IPC-2141		
16	Electronic Designer	High speed/frequency?	IPC-2251		
17	Electronic Designer	High amperes?	IPC-2152		
18	Electronic Designer	Base material properties for mechanical, electrical and thermal?	IPC-4101	All Base Material have different values for Tg, Td, Dk and CTE.	
19	Project Leader	Cooling in- & outside printed boards?	IPC-2221		
20	Electronic Designer	Cu foil quality?	IPC-4562	Different Cu Foils in the market	
21	Electronic Designer	CAF base material?	IPC-9691	Conductive Anodic Filament	
22	Electronic Designer	Embedded in the Assembly?	IPC-7092		
23	Electronic Designer	BGA/CSP on the Assembly	IPC-7095		
24	Electronic Designer	QFN on the Assembly?	IPC-7093		
25	Electronic Designer	Flip Chip on the Assembly?	IPC-7094		
26	Electronic Designer	Minimum isolation distances between holes and tracks?	IPC-2221 and IPC-2222		
27	Electronic Designer	Final size (LxWxT)?			
28	Electronic Designer	Number of layers?	IPC-4121	Buildup of an multilayer printed board	
29	Electronic Designer	Mechanical tolerances?	IPC-2615	Mechanical Drawings Standard	
30	Electronic Designer	Assembly SMDx1, SMDx2 THT or in combination?			
31	Electronic Designer	Predestinated component placements and forbidden areas?	IPC-7351		
32	Project Leader & Electronic Designer	Documentation requests material declaration	IPC-2611, IPC-2612, IPC-2612-1, IPC-2614 and IPC-2615	If not all needed data are included, the interface between CAD and CAM at the printed board and printed board assembly supplier will be unclear.	

Checklist at the CAD Level

F	Responsible	Demand on printed board assembly	IPC Standard	Information	Check
1	CAD Department	IPC Class 1, 2 or 3?	IPC-2221	Any Additional/Exceptions	
2	CAD Department	IPC Level A, B or C?	IPC-2221 and IPC-2222	Any Additional/Exceptions	
3	CAD Department	Footprints Level Density A, B or C?	IPC-7351	Footprint = Land	
4	CAD Department	Marking and labeling of Components, Printed Boards and Printed Board Assemblies to Identify Pb, Pb-Free and Other Attributes.	J-STD-609	Where the Marking and Labeling shall be done. Place, in the Cu or in the Solder Mask	
5	CAD Department	Voids?	IPC-7095	In the balls of BGA and CSP components	
6	CAD Department	EMC on the printed board?		To solve the EMC on the printed board level is preferable.	
7	CAD Department	Impedance?	IPC-2141	Tolerances?	
8	CAD Department	High speed/frequency?	IPC-2251		
9	CAD Department	High amperes?	IPC-2152		
10	CAD Department	Base material properties for mechanical, electrical and thermal?	IPC-4101	All Base Material have different values for Tg, Td, Dk and CTE.	
11	CAD Department	Minimum isolation distances between holes and tracks?	IPC-2221 and IPC-2222		
12	CAD Department	Number of layers?	IPC-4121	Guideline for Selecting Core Construction for Multilayer Applications	
13	CAD Department	CAF base material?	IPC-9691	Conductive Anodic Filament	
14	CAD Department	Embedded in the assembly?	IPC-7092		
15	CAD Department	BGA/CSP on the printed board assembly?	IPC-7095		
16	CAD Department	QFN on the printed board assembly?	IPC-7093		
17	CAD Department	Flip Chip On The Printed Board Assembly?	IPC-7094		
18	CAD Department	Mechanical Tolerances?	IPC-2615	Mechanical Drawings Standard	
19	CAD Department	Solder Paste Application By Screen Printing With A Stencil Or Via Dispensing?	IPC-7525 and IPC-7527		
20	CAD Department	Component Placement And Routing		Does the operators have valid IPC CID and/or CID+ Certification	
21	CAD Department	Cleaning & Conformal Coating	IPC-2221	See Checklist I page 18	
22	CAD Department	Format Of The Data Files	IPC-2581	Gerber, ODB+++ or GenCam	
23	CAD Department	Are all needed data for printed board and printed board assembly included? Mechanical and electrical drawings understandable? Complete BOM list?	IPC-2611, IPC-2612 IPC-2612-1, IPC-2614 and IPC-2615	If not all needed data are included, the interface between CAD and CAM at the printed board and printed board assembly supplier will be unclear.	

Checklist at the Printed Board Ordering Level

G	Responsible	Demand on Printed Board	IPC Standard	Information	Check
1	Purchasing Department	Performance according to IPC Class 1, 2, 3 or 3/A?	IPC-6011 and IPC-6012	Any Additional/Exceptions 3/A See Appendix A in 6012C See Appendix B in 6012C	
2	Purchasing Department	Base Material Properties for Mechanical, Electrical and Thermal?	IPC-4101	Must be a number like IPC-4101C/xx	
3	Purchasing Department	Impedance?	IPC-2141	Tolerances?	
4	Purchasing Department	Number of Layers?	IPC-4121	Guideline for Selecting Core Construction for Multilayer Applications	
5	Purchasing Department	CAF Base Material?	IPC-9691	Conductive Anodic Filament	
6	Purchasing Department	Surface Finish?	IPC-4552, IPC-4553, IPC-4554 and IPC-4556	Different Surface Finishes have different wetting and durability.	
7	Purchasing Department	Mechanical Tolerances?	IPC-2615	Mechanical Drawings Standard	
8	Purchasing Department and CAD	Are all needed data for printed board manufacturing included?	IPC-2611, IPC-2612 IPC-2612-1 and IPC-2614	If not all needed data are included, the interface between CAD and CAM at the printed board supplier will be unclear.	
9	Purchasing Department Plus at the delivery department at the printed board fabricator	Acceptability of printed board according to IPC Class 1, 2 or 3?	IPC-6011, IPC-6012 and IPC-A-600	Does the operators have valid IPC-A-600 CIS and/or CIT Training and Certification	
10	Purchasing Department	Solderability of printed board	J-STD-003	The wetting of the printed board is essential for achieving the perfect solder joint.	
11	Purchasing Department	Are the Printed boards clean and dry?	IPC-6012, IPC-A-600 and IPC-5703	See Checklist I, page 19.	
12	Purchasing Department	Printed Board Handling and Storage?	IPC-1601		
13	Incoming department at the printed board assembly operation	Acceptability of printed board according to IPC Class 1, 2 or 3?	IPC-A-600	IPC-A-600 CIS and CIT Training and Certification. Routines for studying and saving printed board protocols and micro sections.	

Checklist at Printed Board Assembly Ordering Level

H	Responsible	Demand on Printed board assembly	IPC Standard	Information	Check
1	Purchasing Department	Performance according to IPC Class 1, 2 or 3?	J-STD-001	Does responsible staff have valid J-STD-001 CIS and/or CIT Training and Certification?	
2	Purchasing Department	Requirements for Soldered Electronic Assemblies	J-STD-001 IPC-HDBK-001	Which requirements are valid/demanded for article X? Handbook available!	
3	Purchasing Department	ESD Demands?	IPC ESD Certification found in IPC EDGE IEC-61340C/ANSI 20.20	Does the EMS/OEM have a ESD plan, control routines and education to fulfill the necessary ESD level?	
4	Purchasing Department	MSL on components in the factory?	J-STD-033, J-STD-020 and J-STD-075	Demands for Moisture Sensitive Level? Shall printed board also be included?	
5	Purchasing Department	Solderability Tests on Component Terminations	J-STD-002	Not all Surfaces Finishes have the same wetting.	
6	Purchasing Department	Solderability of printed board	J-STD-003 IPC-1601	The wetting of the printed board is essential for achieving the perfect solder joint.	
7	Purchasing Department	Flux, Paste, Solder	J-STD-004 J-STD-005 J-STD-006	Choices of this parameters have influence for the solder joint and cleaning	
8	Purchasing Department	Type of Stencil?	IPC-7525	Fluxofobic Coatings?	
9	Purchasing Department	Stencil Printing Tolerances?	IPC-7527	SPI Parameters	
10	Purchasing Department	Stencil and Misprinted Board Cleaning?	IPC-7526	Handbook!	
11	Purchasing Department	Moisture/Reflow Sensitivity Classification of Components	J-STD-033, J-STD-020 and J-STD-075	More important in a Pb-Free process	
12	Purchasing Department	Assembly and Joining	IPC-AJ-820	Handbook available!	
13	Purchasing Department	Acceptability of printed board assembly acc. to IPC Class 1, 2 or 3?	IPC-A-610	Does the operators have valid IPC-A-610 CIS and/or CIT Training and Certification	
14	Purchasing Department	Rework, Modifications and Repair of printed board and printed board assembly?	IPC-7711/21	Is it allowed to do Touch up and Repair? Does the operators have valid IPC-7711/21 CIS and CIT Training and Certification	
15	Purchasing Department	Cleaning and Conformal Coating?	IPC-CH-65 IPC-CC-830 IPC-HDBK-830 IPC-9505	Many parameters to control to get the printed board assembly clean.	
16	Purchasing Department	Cabling	IPC/WHMA-A-620	Does the operators have valid IPC-A-620 CIS and/or CIT Training and Certification	
17	Purchasing Department	Material Declaration	IPC-1752 Level A, B, C or D?	Different regulations in different countries.	

Checklist for Cleaning and Conformal Coating

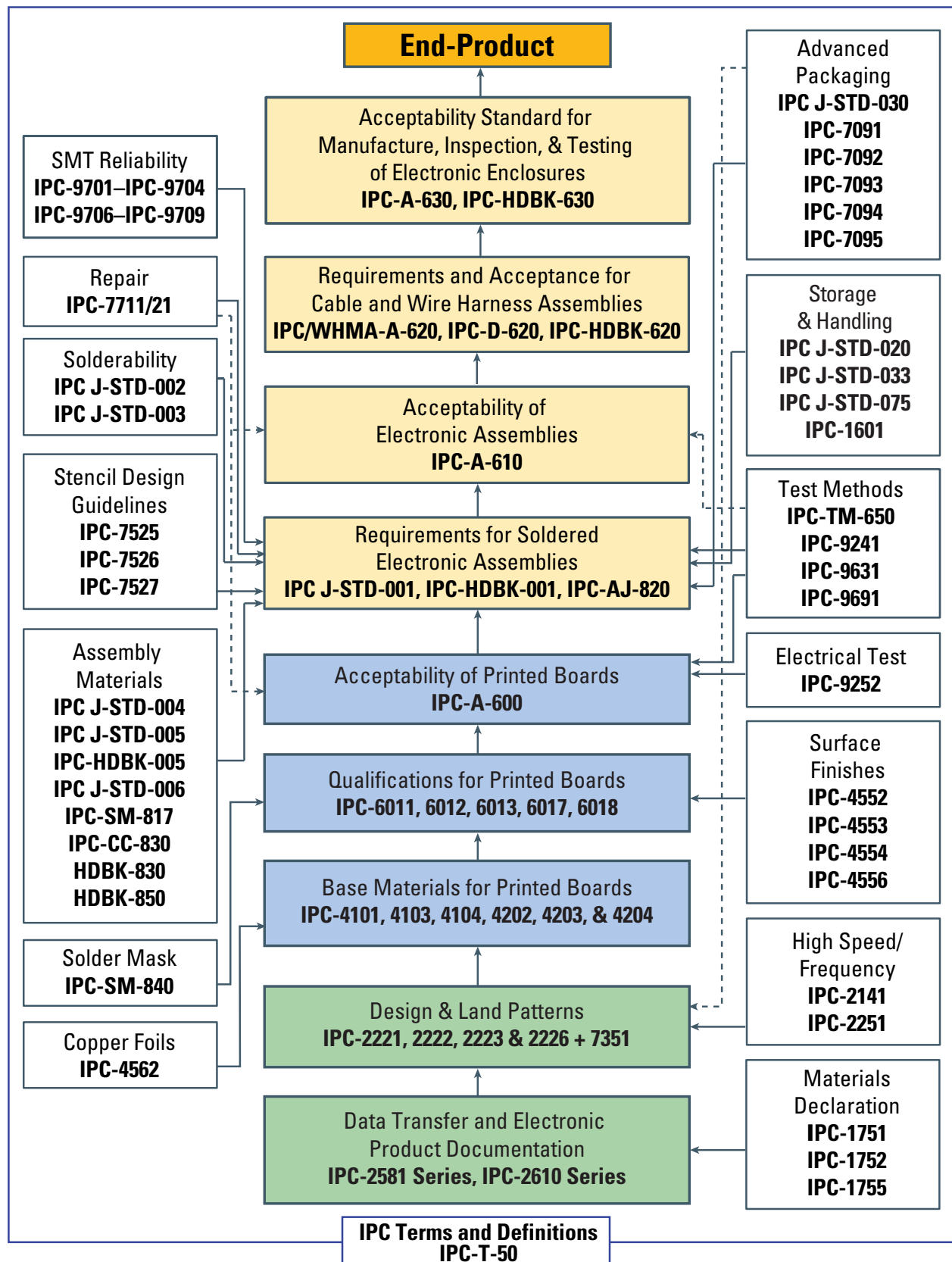
I	Responsible	Demand on printed board assembly	IPC Standard	Information	Check
1	Project Leader	Is cleaning a demand? If yes, which type alcohol, solvent, semi aqueous or aqueous?	IPC-6012, J-STD-001, IPC-AJ-820 and IPC-TM-650	Does responsible staff have valid IPC-6012 and J-STD-001 CIS and/or CIT Training and Certification	
2	Project Leader	Which cleaning levels shall apply?	J-STD-001 IPC-HDBK-001	Which requirements are valid/demanded for article X? Handbook available!	
3	Electronic Designer	Are the compatible with cleaning?		Define a test procedure.	
4	Project Leader	Process Sensitivity Level (PSL)	IPC-020 and IPC-075	Max Temp, Temperature gradient and H ₂ O Sensitivity.	
5	Electronic Designer	Do components need stand off?	IPC-2221		
6	Electronic Designer and CAD Department	Component placement considerations due to cleaning and Conformal Coating	IPC-2221	It must be possible for the cleaning agent to reach all surfaces.	
7	CAD Department	Printed board thickness to PTH Ø Tenting?	IPC-2221	Aspect Ratio < 5 are preferred	
8	Purchasing Department	Cleanliness of unpopulated printed boards bare printed boards	IPC-5701, IPC-5702, IPC-5703 and IPC-5704	Printed boards need to be clean when they arrive from printed board fabricator.	
9	Purchasing Department	Test methods of cleanliness	IPC-9201, IPC-9202 and IPC-9203	Which methods will be needed?	
10	Purchasing Department	Assembling and cleaning	IPC-CH-65 and IPC-AJ-820	Type of cleaning method? Handbook!	
11	Purchasing Department	Does the printed board assembly include optical Assembly?	IPC-8497		
12	Purchasing Department	Conformal Coating	IPC-CC830 and IPC-HDBK-830	More important in a Lead (Pb) free process	
13	Purchasing Department	Material Declaration	IPC-1752 Level A, B, C or D?	Different regulations in different countries.	
14	Purchasing Department	Acceptability of printed board assembly acc. to IPC Class 1, 2 or 3?	IPC-A-610	Does the operators have valid IPC-A-610 CIS and/or CIT Training and Certification	

Terms and Definitions

PCB	Printed Circuit Board (Bare Board)
PCBA	Printed Circuit Board Assembly
QFN	Quad Flatpack - No Lead
BGA	Ball Grid Array
BTC	Bottom Termination Component
CE	Conformité Européenne (In accordance with EU Directives)
CSP	Chip Scale Package
ESD	Electrostatic Discharge
EMC	Electromagnetic Compatibility
LCC	Leadless Chip Carrier
LCCC	Leadless Ceramic Chip Carrier
JEDEC	Joint Electron Device Engineering Council
CAF	Conductive Anodic Filament
UL	Underwriters Laboratories
T_g	Glass Transition Temperature
T_d	Laminate Temperature of Decomposition
CTE	Coefficient of Thermal Expansion
D_k	Dielectric Constant
CID	Certified Interconnect Designer (Basic)
CID+	Certified Interconnect Designer (Advanced)
CIS	Certified IPC Application Specialist
CIT	Certified IPC Trainer
Pb	Lead
RoHS	Restriction of Hazardous Substances Directive
BOM	Bill of Materials
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing

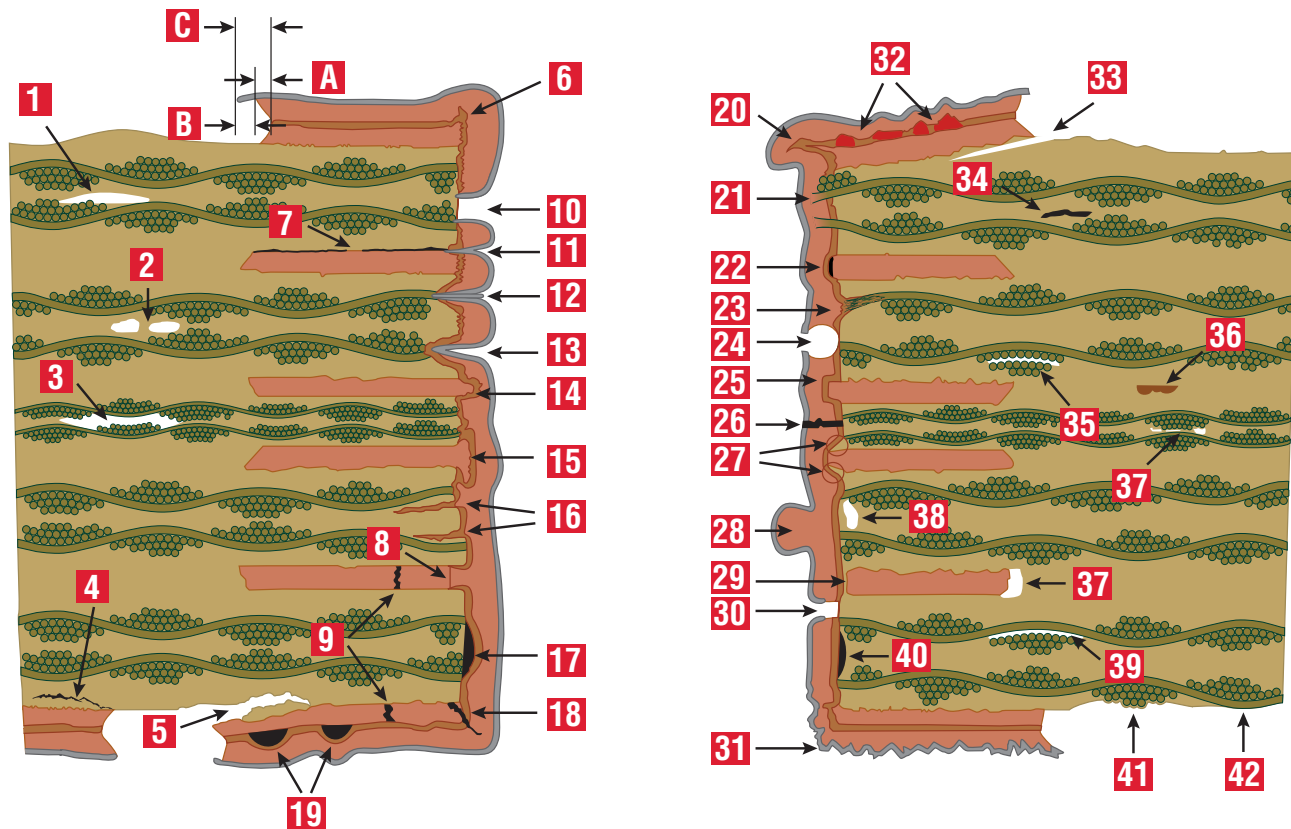
IPC STANDARDS —

Everything You Need from Start to Finish



Learn about IPC standards at www.ipc.org/standards

Phenomena in Cross Section of Plated Through Holes



- | | |
|--|---------------------------------|
| A Undercut | 20 Burr Pushed Into Hole |
| B Outgrowth | 21 Glass Fiber Protrusion |
| C Overhang | 22 Innerlayer (Post) Separation |
| 1 (Resin) Blistering | 23 Wicking |
| 2 Laminate Void | 24 Over Plating Resist Void |
| 3 (Resin) Delamination | 25 (Positive) Etchback |
| 4 Pad Cratering | 26 Barrel Crack |
| 5 Lifted Land Crack | 27 Shadowing |
| 6 Burr | 28 Nodule |
| 7 Bond Enhancement removed — "Pink Ring" | 29 Resin Smear |
| 8 Negative Etchback | 30 Copper & Over Plate Void |
| 9 Foil Crack | 31 Burned Plating |
| 10 Hole Plating Void | 32 Copper Foil Contamination |
| 11 Wedge Void | 33 Lifted Land |
| 12 Glass Fiber Void | 34 Resin Crack Delamination |
| 13 Glass Bundle Void | 35 Crazing |
| 14 Severe Etchback | 36 Foreign Inclusion |
| 15 Nail Heading | 37 Prepreg Void |
| 16 Drill Wall Tear/Wicking | 38 Copper Clad Laminate Void |
| 17 Hole Wall Pull Away | 39 Measling |
| 18 Corner Crack | 40 Resin Recession |
| 19 (Copper) Blistering | 41 Glass-Weave Texture |
| | 42 Glass-Weave Exposure |

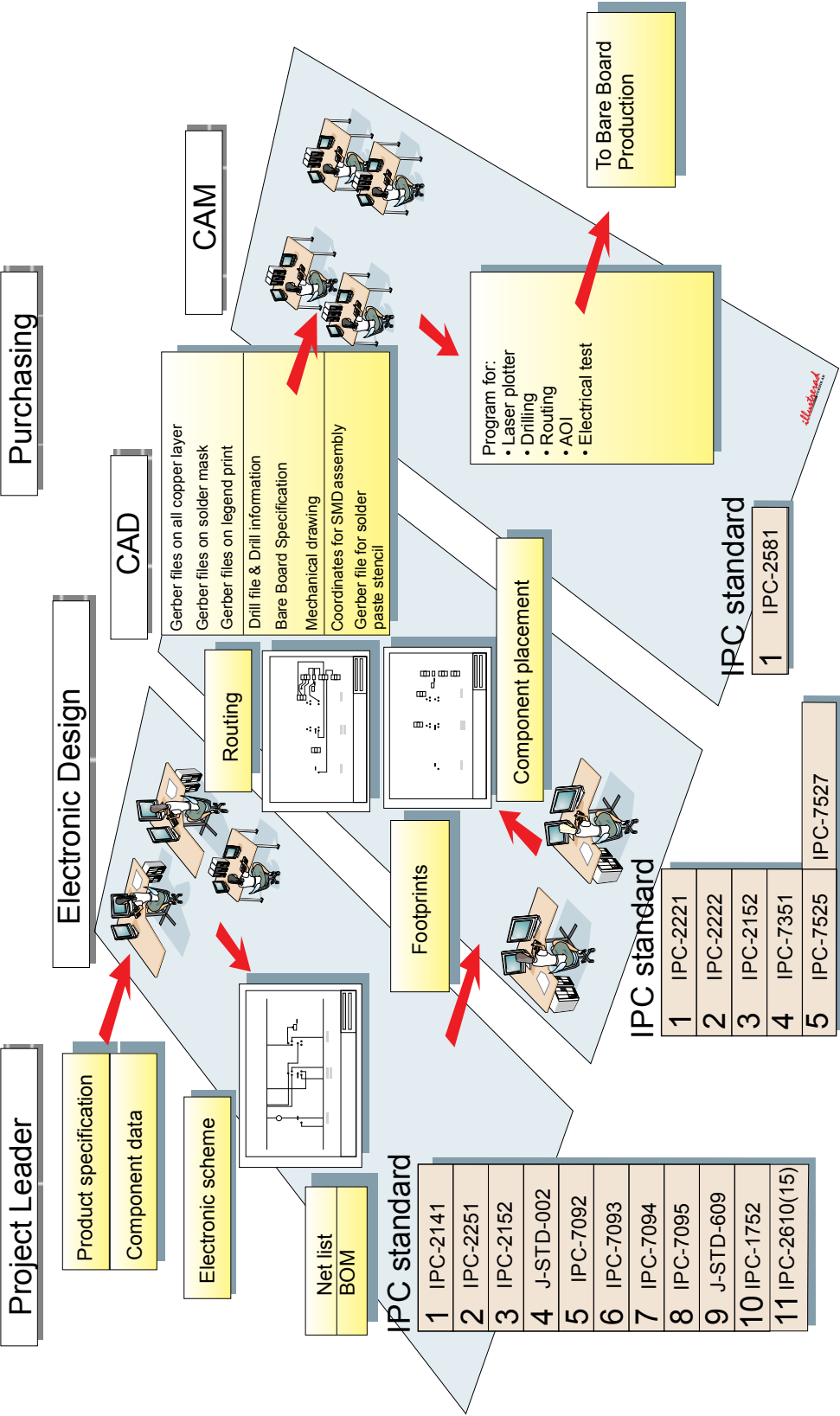
Originally Designed by
Viasystems Mommers BV, Netherlands

Reviewed by BTT-PTH
Atotech Deutschland GmbH, Berlin

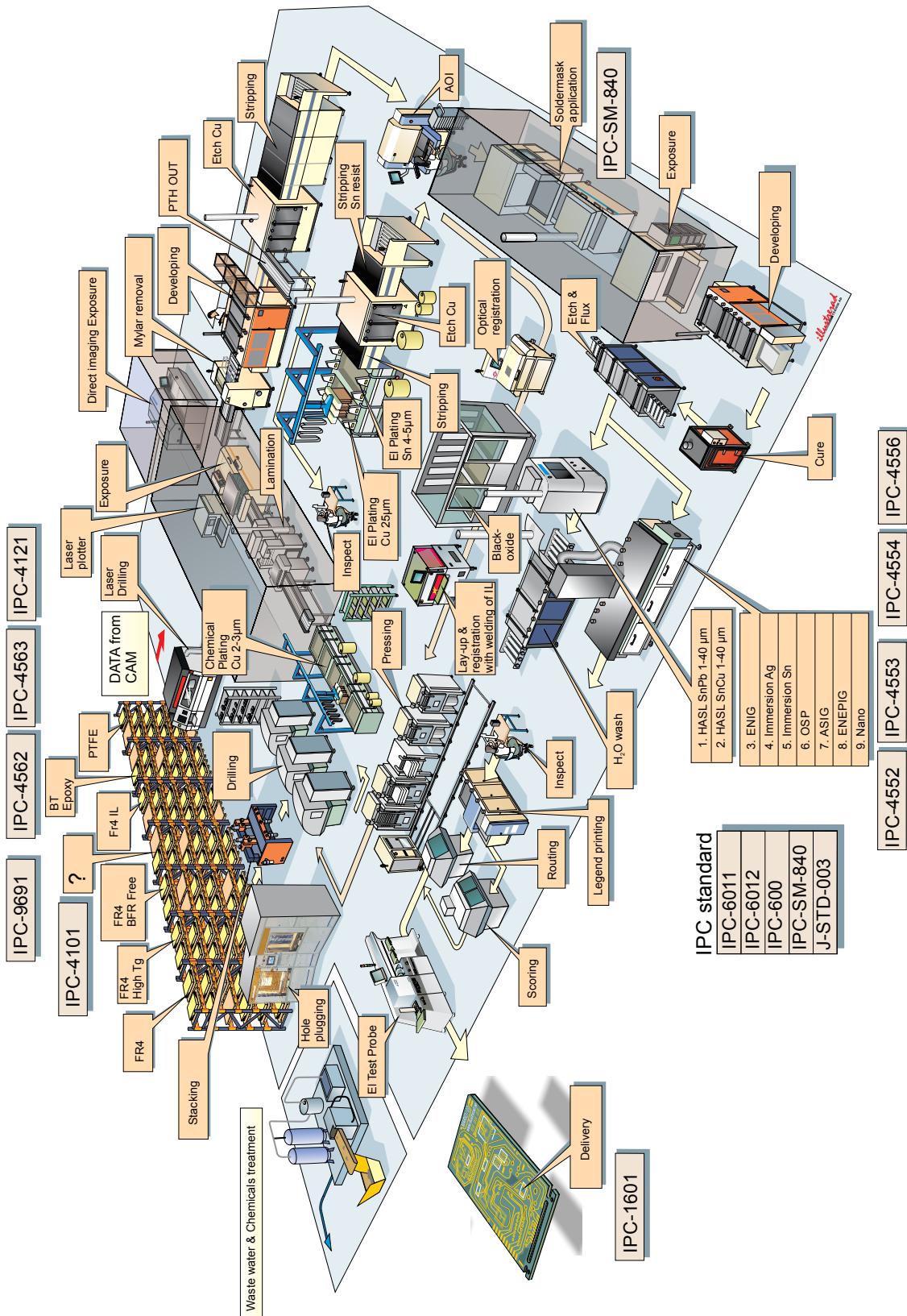
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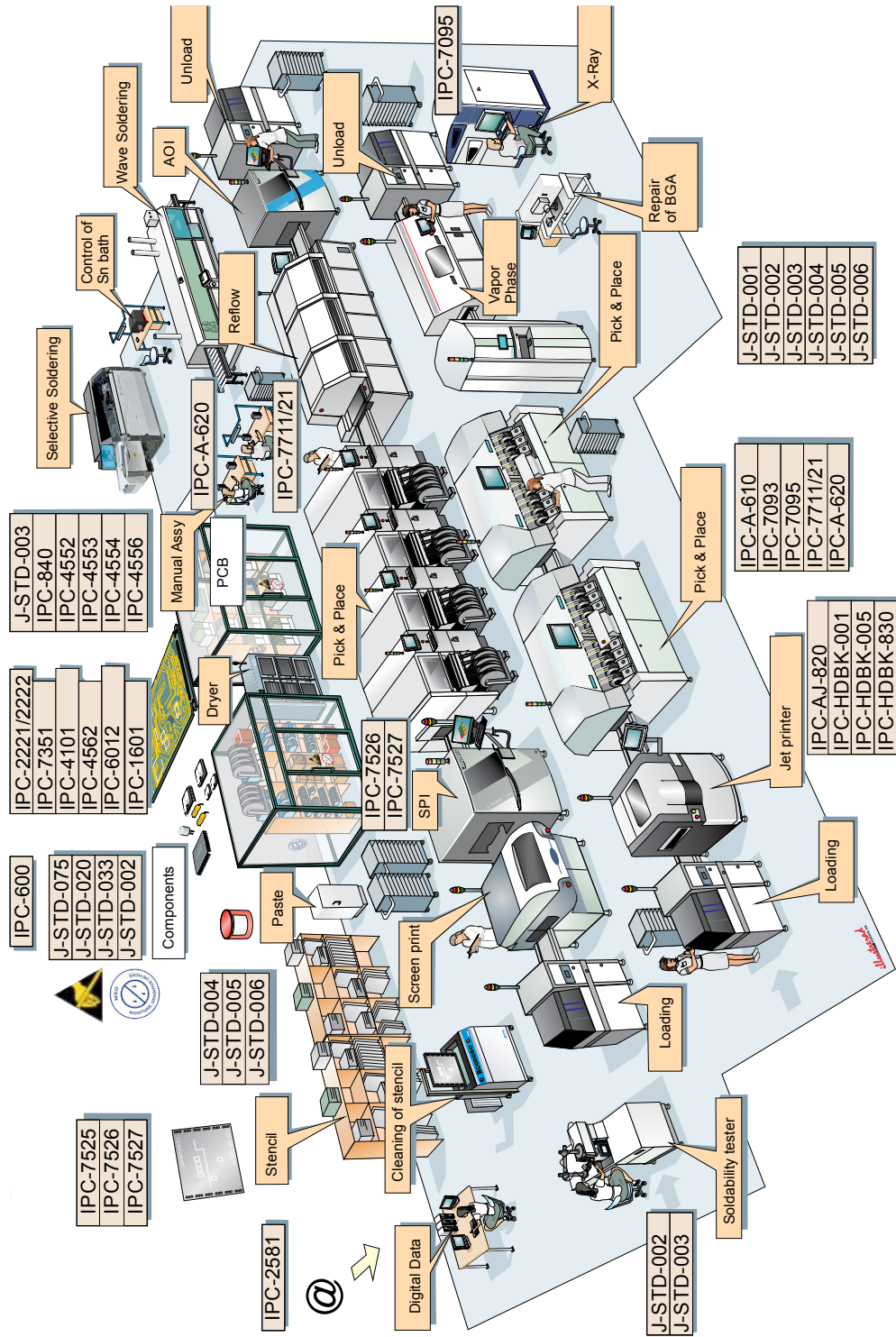
CAD Rigid Text Standards — Design



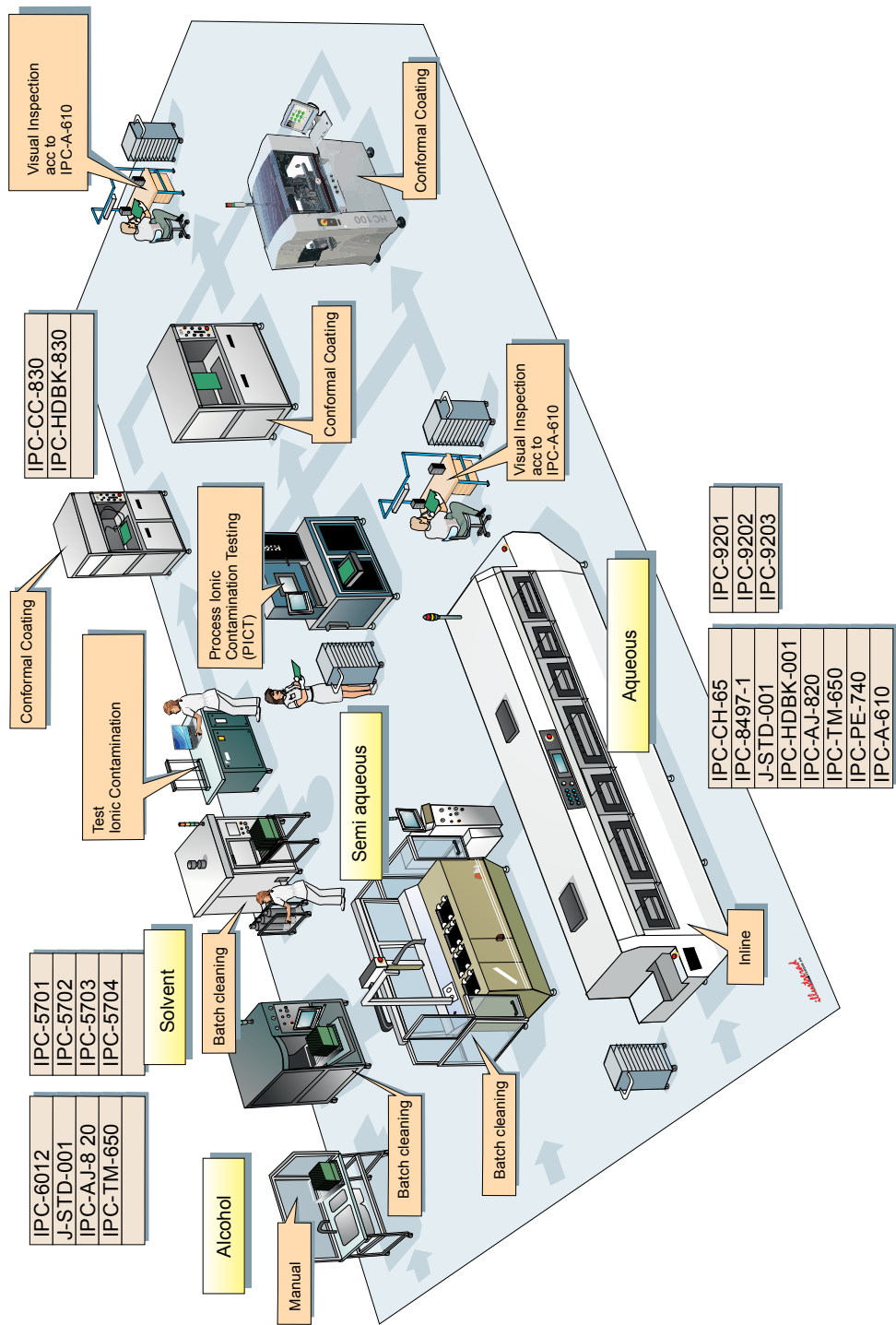
PCB Rigid with IPC Standards



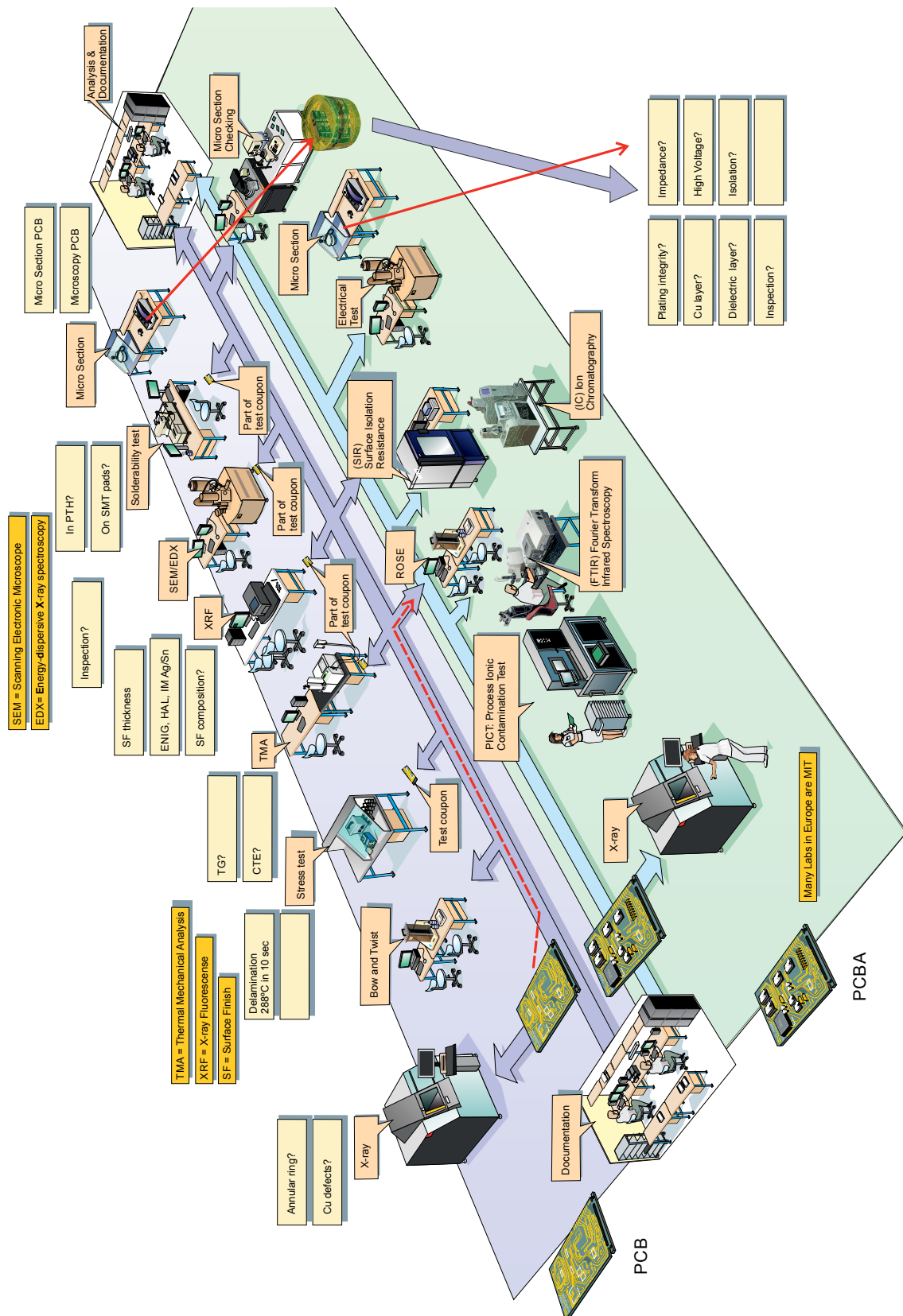
PCBA Rigid with IPC Standards — Soldering and Assembly



Cleaning and Coating with IPC Standards



Lab — Board/Assembly Quality Check



Guide for CAD and PCB

Guide for CAD & PCB parameters, its technical level and price Rev July 27 2016 by Lars Wallin												
No	PCB Parameters	Mainstream	Price	Variable No 1	Price factor	Variable No 2	Price factor	Variable No 3	Price factor	Variable No 4	Price factor	Notes
1	Number of Layers	4	1	6	1,4	8	2	10	2,5	12	3,5	
2	Cu T Innerlayer (IL)	2x35 µm	1	2x18	1	2x70	2	2x105	3	2x140	4	
3	IL Thickness mm	0,78 mm	1	0,05	1,5	0,1	1,25	0,2	1	0,4	1	
4	Number of Prepregs	2+2	1	1+1	0,9	3+3	1,2					
5	Basic Cu Outerlayer	2x18 µm	1	2x12	1,1	2x5	1,3					
6	Bas material typ	FR4	1	Rog 4000	5-50	FR4/Rog	10-50					
7	Total Thickness mm	1,6	1	1,8	1,1	2	1,2	2,2	1,3	0,8	2	
8	Min hole Ø Mechanical	0,3	1	0,2	1,2	0,15	1,5					
9	Min hole Ø Laser	None	1	0,1	1,3	0,075	1,5	0,05	2	0,025	2,5	
10	Aspect Ratio (AR)	5-8	1	Max 5	0,9	Max 10	1,2	Max 15	2			
11	Tg °C	150	1	170	1,1	180	1,2	130	0,7			
12	Total CTE in Z-axis	4%	1	3	1,1	2	1,3	1	1,5			
13	Cu track width	0,15 mm	1	0,1	1,3	0,05	2					
14	Cu space distance	0,15 mm	1	0,1	1,3	0,05	2					
15	µ via x 1-2 with AR1	None	1	µ via x 1-2	1,5	µ via x 1-3	2					
16	µ via x 4-3 with AR1	None	1	µ via x 6-5	1,5	µ via x 8-6	2					
17	Buried via with AR 5-8	None	1	BV 2-4	1,5	BV 2-6	1,75					
18	Min soldermask bridge	0,125 mm	1	0,1	1,2	0,075	1,4					
19	Min SM tolerance	3 Mil	1	2,5 Mil	1,2	2 Mil	1,4	1,5 Mil	2			
20	Legend print	0,2 mm	1	0,15	1							
21	Surface finish	HASL SN100C	1	ENIG	1,2	IM Sn	1,1	Im Ag	1,1	OSP	0,95	
22	Panel	~ 210 x 300 mm	1	Larger	1,2							
23	Outline	Routing	1	Scoring	0,8							
24	IPC-2221, 22 & 26 Class	2	1	3	3							
25	IPC-2221, 22 & 26 Level	B	1	A	1,5	C	0,6					
26	IPC-7351 Level	B	1	A	1,5	C	0,6					
27	IPC-6012 Class	2	1	3	3							
28	IPC-600 Class	2	1	3	3							

Guide for PCBA

Guide for PCBA parameters, its technical level and price Rev February 10 2016 by Lars Wallin

No	PCBA Parameters	Mainstream	Price	Variable No 1	Price factor	Variable No 2	
1	J-STD-001/IPC-6012 Class	2	1	3	3		
2	MSL Level	3	1	4	1,2	5	
3	Repair/Touch up OK	Yes	1	No	1,5		
4	According to RoHS 2/REACH	Yes	1	No	0,8		
6	Conflict Minerals	Yes	1	No	1,2		
7	Design Rule Check (DRC)	No	1	Yes	1,2		
8	Reference points for Print/P&P	Yes	1	No	1,2		
9	Massive components	One side	1	Both sides	1,5		
10	Base material type	FR4	1	Other	1		
11	Tg °C	150	1	170	1	180	
12	Cu T Innerlayer (IL)	2x35 µm	1	2x18	1	2x70	
13	Total Thickness mm	1,6	1	≥ 1,2	1	≥0,8	
15	Footprint	IPC-7351 Level B	1	Other	1,3		
16	Solder Mask to pad mm	0,075	1	0,1	1	0,05	
17	Soldermask thickness	IPC-SM-840	1	x2	1,2		
18	Surface Finish PCB	HASL SN100C	1	ENIG	1,2	IM Sn	
19	Surface Finish Components	Sn	1	ENIG	1,1		
20	Age PCB in month	< 3	1	> 3	1,1	> 12	
21	Age components in month	< 3	1	> 3	1,2	> 12	
22	Stencil	Etched	1	Laser	1	Step	
23	PTH via in Pad filled	Yes	1	No	1,3		
24	Solder Paste SAC305 L0	Type 4	1	Typ 5	1,1	Type 3	
25	SPI acc to IPC-7527	Yes	1	IPC Class 2	1,2	IPC Class 3	
26	Chip	≥ 0402	1	≥ 0201	1,1	≥ 01005	
27	Chip same value different size	No	1	Yes	1,2		
28	BTC Footprint size mm	0,5 x 0,5	1	0,4 x 0,4	1,1	0,3 x 0,3	
29	BGA/CSP pitch mm	0,5	1	0,4	1,2	0,3	
30	POP	No	1	Yes	2		
31	All assembled in P&P	Yes	1	No	1,2		
32	Number of Articles	≤ 400	1	≤ 800	1,2	≤ 1200	
33	Reflow with	Air	1	N ₂	1,2	VP	
34	Can stand 2 x 240 °C in 90 sec	Yes	1	No	1,2		
35	2 x SMD assembly	No	1	Yes	2		
36	2 x SMD + PTH x 1	No	1	Yes	2,5		
37	SMD with mechanical support pin	No	1	Yes	1,4		
38	Schields for ESD	No	1	Yes	1,5		
39	AOI	IPC Class 2	1	IPC Class 3	1,5		
40	X-Ray for detecting Voids	IPC Class 2	1	IPC Class 3	3-5		
41	Selective Soldering	No	1	Yes	1,5		
42	Repair BGA/CSP OK	Yes	1	No	2		
43	PCBA cleanliness before cleaning	No	1	ROSE	1,1	SIR	
44	Cleaning	No	1	H ₂ O	1,5	Semi H ₂ O	
45	PCBA cleanliness after cleaning	No	1	ROSE	1,1	SIR	
46	Conformal Coating	No	1	Yes	1,2		
47	Testing with	Contact	1	Pincushion	1,2		
48	Final Manual Inspection IPC-610	Class 2	1	Class 3	1,3		

	Price factor	Variable No 3	Price factor	Variable No 4	Price factor	Notes
	1,4					
	1	130	1,1			
	2	2x105	3	2x140	4	
	1,2	≥ 0,4	1,6	≥ 2,0	1,5	
	1,25					
	1,1	Im Ag	1,1	OSP	0,95	
	1,2	> 24	1,5			
	1,2	> 24	1,5			
	1,2	Etched with Nano	1,2			
	1,4					
	1,3					
	1,3					
	1,5					
	1,3					
	1,5	VP with vacuum	1,7			
	20	IC	40	FTIR	100	
	1,5	Alcohol	1,5	Solvent	1,5	
	20	IC	40	FTIR	100	

Notes

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