



IPC-A-610H

Acceptability of Electronic Assemblies

If a conflict occurs between the English language and translated versions of this document, the English version will take precedence.

Developed by the IPC-A-610 Task Group (7-31b), IPC-A-610 Task Group – Europe (7-31b-EU) and IPC-A-610 Task Group – China (7-31b-CN) of the Product Assurance Committee (7-30) of IPC

Supersedes:

IPC-A-610G - October 2017
IPC-A-610F WAM1 -
February 2016
IPC-A-610F - July 2014
IPC-A-610E - April 2010
IPC-A-610D - February 2005
IPC-A-610C - January 2000
IPC-A-610B - December 1994
IPC-A-610A - March 1990
IPC-A-610 - August 1983

Users of this publication are encouraged to participate in the development of future revisions.

Contact:

IPC

Table of Contents

1 General	1-1	1.8.22 Tempered Leads	1-6
1.1 Scope	1-1	1.8.23 Wire Overlap	1-6
1.2 Purpose	1-1	1.8.24 Wire Overwrap	1-6
1.3 Classification	1-2	1.8.25 User	1-6
1.4 Measurement Units and Applications	1-2	1.9 Requirements Flowdown	1-6
1.4.1 Verification of Dimensions	1-2	1.10 Personnel Proficiency	1-6
1.5 Definition of Requirements	1-2	1.11 Acceptance Requirements	1-6
1.5.1 Acceptance Criteria	1-3	1.11.1 Missing Parts and Components	1-6
1.5.1.1 Acceptable Condition	1-3	1.12 Inspection Methodology	1-6
1.5.1.2 Defect Condition	1-3	1.12.1 Lighting	1-7
1.5.1.2.1 Disposition	1-3	1.12.2 Magnification Aids	1-7
1.5.1.3 Process Indicator Condition	1-3	2 Applicable Documents	2-1
1.5.1.4 Combined Conditions	1-3	2.1 IPC Documents	2-1
1.5.1.5 Conditions Not Specified	1-3	2.2 Joint Industry Documents	2-1
1.5.1.6 Specialized Designs	1-3	2.3 Electrostatic Association Documents	2-2
1.5.1.7 Should	1-4	2.4 International Electrotechnical Commission Documents	2-2
1.6 Process Control Methodologies	1-4	2.5 ASTM	2-2
1.7 Order of Precedence	1-4	2.6 Military Standards	2-2
1.7.1 Clause References	1-4	2.7 SAE International	2-2
1.7.2 Appendices	1-4	3 Handling Electronic Assemblies	3-1
1.8 Terms and Definitions	1-4	4 Hardware	4-1
1.8.1 Board Orientation	1-4	4.1 Hardware Installation	4-2
1.8.1.1 Primary Side	1-4	4.1.1 Electrical Clearance	4-2
1.8.1.2 Secondary Side	1-4	4.1.2 Interference	4-3
1.8.1.3 Solder Source Side	1-4	4.1.3 Component Mounting – High Power	4-4
1.8.1.4 Solder Destination Side	1-4	4.1.4 Heatsinks	4-6
1.8.2 Cold Solder Connection	1-4	4.1.4.1 Insulators and Thermal Compounds	4-6
1.8.3 Common Conductors	1-4	4.1.4.2 Contact	4-7
1.8.4 Diameter	1-5	4.1.5 Threaded Fasteners and Other Threaded Hardware	4-8
1.8.5 Electrical Clearance	1-5	4.1.5.1 Torque	4-10
1.8.6 Engineering Documentation	1-5	4.1.5.2 Solid Wires	4-12
1.8.7 FOD (Foreign Object Debris)	1-5	4.1.5.3 Stranded Wires	4-14
1.8.8 Form, Fit, Function (F/F/F)	1-5	4.2 Jackpost Mounting	4-15
1.8.9 High Voltage	1-5	4.3 Connector Pins	4-16
1.8.10 Intrusive Solder	1-5	4.3.1 Edge Connector Pins	4-16
1.8.11 Kink	1-5	4.3.2 Press Fit Pins	4-16
1.8.12 Locking Mechanism	1-5	4.3.2.1 Land/Annular Ring	4-18
1.8.13 Manufacturer	1-5	4.3.2.2 Soldering	4-19
1.8.14 Meniscus (Component)	1-5	4.4 Wire Bundle Securing	4-20
1.8.15 Noncommon Conductors	1-5	4.5 Routing – Wires and Wire Bundles	4-20
1.8.16 Nonfunctional Land	1-5		
1.8.17 Pin-in-Paste	1-5		
1.8.18 Solder Balls	1-6		
1.8.19 Standard Industry Practice (SIP)	1-6		
1.8.20 Stress Relief	1-6		
1.8.21 Supplier	1-6		

Table of Contents (cont.)

5 Soldering	5-1	6.3.3 Strand Separation (Birdcaging) – Presolder	6-22
5.1 Soldering Acceptability Requirements	5-3	6.3.4 Strand Separation (Birdcaging) – Post-Solder	6-23
5.2 Soldering Anomalies	5-4	6.3.5 Tinning	6-24
5.2.1 Exposed Basis Metal	5-4	6.4 Service Loops	6-26
5.2.2 Pin Holes/Blow Holes/Voids	5-6	6.5 Routing – Wires and Wire Bundles – Bend Radius	6-27
5.2.3 Reflow of Solder Paste	5-7	6.6 Stress Relief	6-28
5.2.4 Nonwetting	5-8	6.6.1 Wire	6-28
5.2.5 Cold/Rosin Connection	5-9	6.7 Lead/Wire Placement – General Requirements	6-30
5.2.6 Dewetting	5-9	6.8 Solder – General Requirements	6-31
5.2.7 Excess Solder	5-10	6.9 Turrets and Straight Pins	6-33
5.2.7.1 Solder Balls	5-11	6.9.1 Lead/Wire Placement	6-33
5.2.7.2 Bridging	5-12	6.9.2 Solder	6-35
5.2.7.3 Solder Webbing/Splashes	5-13	6.10 Bifurcated	6-36
5.2.8 Disturbed Solder	5-14	6.10.1 Lead/Wire Placement – Side Route Attachments	6-36
5.2.9 Cooling Lines and Secondary Reflow	5-15	6.10.2 Lead/Wire Placement – Staked Wires	6-38
5.2.10 Fractured Solder	5-16	6.10.3 Lead/Wire Placement – Bottom and Top Route Attachments	6-39
5.2.11 Solder Projections	5-17	6.10.4 Solder	6-40
5.2.12 Pb-Free Fillet Lift	5-18	6.11 Slotted	6-42
5.2.13 Pb-Free Hot Tear/Shrink Hole	5-19	6.11.1 Lead/Wire Placement	6-42
5.2.14 Probe Marks and Other Similar Surface Conditions in Solder Joints	5-20	6.11.2 Solder	6-43
5.2.15 Partially Visible or Hidden Solder Connections	5-20	6.12 Pierced/Perforated	6-44
5.2.16 Heat Shrinkable Soldering Devices	5-21	6.12.1 Lead/Wire Placement	6-44
5.2.17 Inclusions	5-22	6.12.2 Solder	6-46
6 Terminal Connections	6-1	6.13 Hook	6-47
6.1 Swaged Hardware	6-3	6.13.1 Lead/Wire Placement	6-47
6.1.1 Terminals	6-3	6.13.2 Solder	6-49
6.1.1.1 Terminal Base to Land Separation	6-3	6.14 Solder Cups	6-50
6.1.1.2 Turret	6-5	6.14.1 Lead/Wire Placement	6-50
6.1.1.3 Bifurcated	6-6	6.14.2 Solder	6-51
6.1.2 Rolled Flange	6-7	6.15 AWG 30 and Smaller Diameter Wires – Lead/Wire Placement	6-53
6.1.3 Flared Flange	6-8	6.16 Series Connected	6-55
6.1.4 Controlled Split	6-9	6.17 Edge Clip – Position	6-56
6.1.5 Solder	6-10		
6.2 Insulation	6-12		
6.2.1 Damage	6-12		
6.2.1.1 Presolder	6-12		
6.2.1.2 Post-Solder	6-14		
6.2.2 Clearance	6-15		
6.2.3 Insulation Sleeving	6-17		
6.2.3.1 Placement	6-17		
6.2.3.2 Damage	6-19		
6.3 Conductor	6-20		
6.3.1 Deformation	6-20		
6.3.2 Damage	6-21		
6.3.2.1 Stranded Wire	6-21		
6.3.2.2 Solid Wire	6-22		

Table of Contents (cont.)

7 Through-Hole Technology	7-1	7.4 Unsupported Holes	7-56
7.1 Component Mounting	7-2	7.4.1 Axial Leads – Horizontal	7-56
7.1.1 Orientation	7-2	7.4.2 Axial Leads – Vertical	7-57
7.1.1.1 Orientation – Horizontal	7-3	7.4.3 Wire/Lead Protrusion	7-58
7.1.1.2 Orientation – Vertical	7-4	7.4.4 Wire/Lead Clinches	7-59
7.1.2 Lead Forming	7-5	7.4.5 Solder	7-61
7.1.2.1 Bend Radius	7-5	7.4.6 Lead Cutting after Soldering	7-63
7.1.2.2 Space between Seal/Weld and Bend	7-6		
7.1.2.3 Stress Relief	7-7	8 Surface Mount Assemblies	8-1
7.1.2.4 Damage	7-9	8.1 Staking Adhesive	8-3
7.1.3 Leads Crossing Conductors	7-10	8.1.1 Component Bonding	8-3
7.1.4 Hole Obstruction	7-11	8.1.2 Mechanical Strength	8-4
7.1.5 DIP/SIP Devices and Sockets	7-12		
7.1.6 Radial Leads – Vertical	7-14	8.2 SMT Leads	8-6
7.1.6.1 Spacers	7-15	8.2.1 Plastic Components	8-6
7.1.7 Radial Leads – Horizontal	7-16	8.2.2 Damage	8-6
7.1.8 Connectors	7-17	8.2.3 Flattening	8-7
7.1.8.1 Right Angle	7-18		
7.1.8.2 Vertical Shrouded Pin Headers and Vertical Receptacle Connectors	7-19	8.3 SMT Connections	8-7
7.1.9 Conductive Cases	7-20	8.3.1 Chip Components – Bottom Only Terminations	8-8
7.2 Component Securing	7-20	8.3.1.1 Side Overhang (A)	8-9
7.2.1 Mounting Clips	7-20	8.3.1.2 End Overhang (B)	8-10
7.2.2 Adhesive Bonding	7-22	8.3.1.3 End Joint Width (C)	8-11
7.2.2.1 Adhesive Bonding – Nonelevated Components	7-23	8.3.1.4 Side Joint Length (D)	8-12
7.2.2.2 Adhesive Bonding – Elevated Components	7-26	8.3.1.5 Maximum Fillet Height (E)	8-13
7.2.3 Other Devices	7-29	8.3.1.6 Minimum Fillet Height (F)	8-13
		8.3.1.7 Solder Thickness (G)	8-14
		8.3.1.8 End Overlap (J)	8-14
7.3 Supported Holes	7-30	8.3.2 Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)	8-15
7.3.1 Axial Leaded – Horizontal	7-30	8.3.2.1 Side Overhang (A)	8-16
7.3.2 Axial Leaded – Vertical	7-31	8.3.2.2 End Overhang (B)	8-18
7.3.3 Wire/Lead Protrusion	7-33	8.3.2.3 End Joint Width (C)	8-19
7.3.4 Wire/Lead Clinches	7-34	8.3.2.4 Side Joint Length (D)	8-21
7.3.5 Solder	7-36	8.3.2.5 Maximum Fillet Height (E)	8-22
7.3.5.1 Vertical Fill (A)	7-39	8.3.2.6 Minimum Fillet Height (F)	8-23
7.3.5.2 Solder Destination Side – Lead to Barrel (B)	7-41	8.3.2.7 Solder Thickness (G)	8-24
7.3.5.3 Solder Destination Side – Land Area Coverage (C)	7-43	8.3.2.8 End Overlap (J)	8-25
7.3.5.4 Solder Source Side – Lead to Barrel (D)	7-44	8.3.2.9 Termination Variations	8-26
7.3.5.5 Solder Source Side – Land Area Coverage (E)	7-45	8.3.2.9.1 Mounting on Side (Billboarding)	8-26
7.3.5.6 Solder Conditions – Solder in Lead Bend	7-46	8.3.2.9.2 Mounting Upside Down	8-28
7.3.5.7 Solder Conditions – Touching Through-Hole Component Body	7-47	8.3.2.9.3 Stacking	8-29
7.3.5.8 Solder Conditions – Meniscus in Solder	7-48	8.3.2.9.4 Tombstoning	8-30
7.3.5.9 Lead Cutting after Soldering	7-50	8.3.2.10 Center Terminations	8-31
7.3.5.10 Coated Wire Insulation in Solder	7-51	8.3.2.10.1 Solder Width of Side Termination	8-31
7.3.5.11 Interfacial Connection without Lead – Vias	7-52	8.3.2.10.2 Minimum Fillet Height of Side Termination ...	8-32
7.3.5.12 Board in Board	7-53		

Table of Contents (cont.)

8.3.3 Cylindrical End Cap Terminations	8-33	8.3.8 Butt/I Connections	8-75
8.3.3.1 Side Overhang (A)	8-34	8.3.8.1 Modified Through-Hole Terminations	8-75
8.3.3.2 End Overhang (B)	8-35	8.3.8.1.1 Maximum Side Overhang (A)	8-76
8.3.3.3 End Joint Width (C)	8-36	8.3.8.1.2 Toe Overhang (B)	8-76
8.3.3.4 Side Joint Length (D)	8-37	8.3.8.1.3 Minimum End Joint Width (C)	8-77
8.3.3.5 Maximum Fillet Height (E)	8-38	8.3.8.1.4 Minimum Side Joint Length (D)	8-77
8.3.3.6 Minimum Fillet Height (F)	8-39	8.3.8.1.5 Maximum Fillet Height (E)	8-77
8.3.3.7 Solder Thickness (G)	8-40	8.3.8.1.6 Minimum Fillet Height (F)	8-78
8.3.3.8 End Overlap (J)	8-41	8.3.8.1.7 Solder Thickness (G)	8-78
8.3.4 Castellated Terminations	8-42	8.3.8.2 Solder Charged Terminations	8-79
8.3.4.1 Side Overhang (A)	8-43	8.3.8.2.1 Maximum Side Overhang (A)	8-80
8.3.4.2 End Overhang (B)	8-44	8.3.8.2.2 Maximum Toe Overhang (B)	8-80
8.3.4.3 Minimum End Joint Width (C)	8-44	8.3.8.2.3 Minimum End Joint Width (C)	8-81
8.3.4.4 Minimum Side Joint Length (D)	8-45	8.3.8.2.4 Minimum Fillet Height (F)	8-81
8.3.4.5 Maximum Fillet Height (E)	8-45	8.3.9 Flat Lug Leads	8-82
8.3.4.6 Minimum Fillet Height (F)	8-46	8.3.10 Tall Profile Components Having Bottom Only Terminations	8-83
8.3.4.7 Solder Thickness (G)	8-46	8.3.11 Inward Formed L-Shaped Ribbon Leads	8-84
8.3.5 Flat Gull Wing Leads	8-47	8.3.12 Surface Mount Area Array	8-86
8.3.5.1 Side Overhang (A)	8-48	8.3.12.1 Alignment	8-87
8.3.5.2 Toe Overhang (B)	8-51	8.3.12.2 Solder Ball Spacing	8-87
8.3.5.3 Minimum End Joint Width (C)	8-52	8.3.12.3 Solder Connections	8-88
8.3.5.4 Minimum Side Joint Length (D)	8-53	8.3.12.4 Voids	8-90
8.3.5.5 Maximum Heel Fillet Height (E)	8-54	8.3.12.5 Underfill/Staking	8-90
8.3.5.6 Minimum Heel Fillet Height (F)	8-55	8.3.12.6 Package on Package	8-91
8.3.5.7 Solder Thickness (G)	8-56	8.3.13 Bottom Termination Components (BTC)	8-93
8.3.5.8 Coplanarity	8-57	8.3.14 Components with Bottom Thermal Plane Terminations (D-Pak)	8-95
8.3.6 Round or Flattened (Coined) Gull Wing Leads	8-58	8.3.15 Flattened Post Connections	8-97
8.3.6.1 Side Overhang (A)	8-59	8.3.15.1 Maximum Termination Overhang – Square Solder Land	8-97
8.3.6.2 Toe Overhang (B)	8-60	8.3.15.2 Maximum Termination Overhang – Round Solder Land	8-98
8.3.6.3 Minimum End Joint Width (C)	8-60	8.3.15.3 Maximum Fillet Height	8-98
8.3.6.4 Minimum Side Joint Length (D)	8-61	8.3.16 P-Style Terminations	8-99
8.3.6.5 Maximum Heel Fillet Height (E)	8-62	8.3.16.1 Maximum Side Overhang (A)	8-100
8.3.6.6 Minimum Heel Fillet Height (F)	8-63	8.3.16.2 Maximum Toe Overhang (B)	8-100
8.3.6.7 Solder Thickness (G)	8-64	8.3.16.3 Minimum End Joint Width (C)	8-101
8.3.6.8 Minimum Side Joint Height (Q)	8-64	8.3.16.4 Minimum Side Joint Length (D)	8-101
8.3.6.9 Coplanarity	8-65	8.3.16.5 Minimum Fillet Height (F)	8-102
8.3.7 J Leads	8-66	8.3.17 Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations	8-103
8.3.7.1 Side Overhang (A)	8-66		
8.3.7.2 Toe Overhang (B)	8-68		
8.3.7.3 End Joint Width (C)	8-69		
8.3.7.4 Side Joint Length (D)	8-70		
8.3.7.5 Maximum Heel Fillet Height (E)	8-71		
8.3.7.6 Minimum Heel Fillet Height (F)	8-72		
8.3.7.7 Solder Thickness (G)	8-74		
8.3.7.8 Coplanarity	8-74		

Table of Contents (cont.)

8.3.18 Flexible and Rigid Flex Printed Circuitry with Flat Unformed Leads	8-105	10.2.4 Haloing	10-10
8.3.19 Wrapped Terminals	8-106	10.2.5 Edge Delamination, Nicks and Cracking	10-12
8.3.19.1 Side Overhang (A)	8-107	10.2.6 Burns	10-14
8.3.19.2 End Joint Width (C)	8-107	10.2.7 Bow and Twist	10-15
8.3.19.3 Side Joint Length (D)	8-107	10.2.8 Depanelization	10-16
8.3.19.4 Maximum Heel Fillet Height (E)	8-107	10.3 Conductors/Lands	10-18
8.3.19.5 Minimum Heel Fillet Height (F)	8-108	10.3.1 Reduction	10-18
8.3.19.6 Solder Thickness (G)	8-108	10.3.2 Lifted	10-19
8.4 Specialized SMT Terminations	8-109	10.3.3 Mechanical Damage	10-21
8.5 Surface Mount Connectors	8-110	10.4 Flexible and Rigid-Flex Printed Boards	10-22
8.5.1 Surface Mount Threaded Standoffs (SMTs) or Surface Mount Fasteners	8-111	10.4.1 Damage	10-22
9 Component Damage	9-1	10.4.2 Delamination/Blister	10-24
9.1 Loss of Metallization	9-2	10.4.2.1 Flex	10-24
9.2 Chip Resistor Element	9-3	10.4.2.2 Flex to Stiffener	10-25
9.3 Leaded/Leadless Devices	9-4	10.4.3 Solder Wicking	10-26
9.4 Ceramic Chip Capacitors	9-8	10.4.4 Attachment	10-27
9.5 Connectors	9-10	10.5 Marking	10-28
9.6 Relays	9-13	10.5.1 Etched (Including Hand Printing)	10-30
9.7 Ferrite Core Components	9-13	10.5.2 Screened	10-31
9.8 Connectors, Handles, Extractors, Latches	9-14	10.5.3 Stamped	10-32
9.9 Edge Connector Pins	9-15	10.5.4 Laser	10-33
9.10 Press Fit Pins	9-16	10.5.5 Labels	10-33
9.11 Backplane Connector Pins	9-17	10.5.5.1 Bar Coding/Data Matrix	10-33
9.12 Heat Sink Hardware	9-18	10.5.5.2 Readability	10-34
9.13 Threaded Items and Hardware	9-19	10.5.5.3 Labels – Adhesion and Damage	10-35
10 Printed Boards and Assemblies	10-1	10.5.5.4 Position	10-35
10.1 Non-Soldered Contact Areas	10-2	10.5.6 Radio Frequency Identification (RFID) Tags	10-36
10.1.1 Contamination	10-2	10.6 Cleanliness	10-37
10.1.2 Damage	10-4	10.6.1 Flux Residues	10-37
10.2 Laminate Conditions	10-4	10.6.1.1 Cleaning Required	10-38
10.2.1 Measling and Cracking	10-5	10.6.1.2 No Cleaning Process	10-39
10.2.2 Blistering and Delamination	10-7	10.6.2 Foreign Object Debris (FOD)	10-40
10.2.3 Weave Texture/Weave Exposure	10-9	10.6.3 Chlorides, Carbonates and White Residues	10-41
		10.6.4 Surface Appearance	10-43
		10.7 Solder Mask Coating	10-44
		10.7.1 Wrinkling/Cracking	10-45
		10.7.2 Voids, Blisters, Scratches	10-47
		10.7.3 Breakdown	10-48
		10.7.4 Discoloration	10-49
		10.8 Conformal Coating	10-49
		10.8.1 General	10-49
		10.8.2 Coverage	10-50
		10.8.3 Thickness	10-52
		10.9 Electrical Insulation Coating	10-53
		10.9.1 Coverage	10-53
		10.9.2 Thickness	10-53

Table of Contents (cont.)

10.10 Encapsulation	10-54	Table 6-6 Staking Requirements of Side Route Straight Through Connections – Bifurcated Terminals	6-38
11 Discrete Wiring	11-1	Table 6-7 Bifurcated Terminal Lead/Wire Placement – Bottom Route	6-39
11.1 Solderless Wrap	11-1	Table 6-8 Pierced or Perforated Terminal Lead/Wire Placement	6-44
12 High Voltage	12-1	Table 6-9 Hook Terminal Lead/Wire Placement	6-47
13 Jumper Wires	13-1	Table 6-10 AWG 30 and Smaller Wire Wrap Requirements	6-53
13.1 Wire Routing	13-2	Table 7-1 Lead Bend Radius	7-5
13.2 Wire Staking – Adhesive or Tape	13-3	Table 7-2 Component to Land Clearance	7-31
13.3 Terminations	13-4	Table 7-3 Protrusion of Wires/Leads in Supported Holes	7-33
13.3.1 Lap	13-5	Table 7-4 Plated Through-Holes with Component Leads – Minimum Acceptable Solder Conditions	7-38
13.3.1.1 Component Lead	13-5	Table 7-5 Board in Board – Minimum Acceptable Solder Conditions	7-53
13.3.1.2 Land	13-7	Table 7-6 Protrusion of Leads in Unsupported Holes	7-58
13.3.2 Wire in Hole	13-8	Table 7-7 Unsupported Holes with Component Leads, Minimum Acceptable Conditions	7-61
13.3.3 Wrapped	13-9	Table 8-1 Dimensional Criteria – Chip Component – Bottom Only Termination Features	8-8
13.3.4 SMT	13-10	Table 8-2 Dimensional Criteria – Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s)	8-15
13.3.4.1 Chip and Cylindrical End Cap Components	13-10	Table 8-3 Dimensional Criteria – Cylindrical End Cap Termination	8-33
13.3.4.2 Gull Wing	13-11	Table 8-4 Dimensional Criteria – Castellated Terminations	8-42
13.3.4.3 Castellations	13-13	Table 8-5 Dimensional Criteria – Flat Gull Wing Leads	8-47
Appendix A Minimum Electrical Clearance	A-1	Table 8-6 Dimensional Criteria – Round or Flattened (Coined) Gull Wire Lead Features	8-58
Appendix B Protecting the Assembly – ESD and Other Handling Considerations	B-1		
Index	Index-1		
Tables			
Table 1-1 Summary of Related Documents	1-1		
Table 1-2 Inspection Magnification (Land Width)	1-7		
Table 1-3 Magnification Aid Applications For Wires And Wire Connections	1-8		
Table 1-4 Magnification Aid Applications – Other	1-8		
Table 6-1 Swaged Hardware Minimum Soldering Requirements	6-10		
Table 6-2 Strand Damage	6-21		
Table 6-3 Minimum Bend Radius Requirements	6-27		
Table 6-4 Turret or Straight Pin Terminal Lead/Wire Placement	6-33		
Table 6-5 Bifurcated Terminal Lead/Wire Placement – Side Route	6-36		

Table of Contents (cont.)

Table 8-7 Dimensional Criteria – J Leads	8-66	Table 8-18 Dimensional Criteria Flattened Post Connections	8-97
Table 8-8 Dimensional Criteria – Butt/I Connections – Modified Through-Hole Leads	8-75	Table 8-19 Dimensional Criteria – P-Style Terminations	8-99
Table 8-9 Dimensional Criteria – Butt/I Connections – Solder Charged Terminations	8-79	Table 8-20 Dimensional Criteria – Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations	8-104
Table 8-10 Dimensional Criteria – Flat Lug Leads	8-82	Table 8-21 Dimensional Criteria – Flexible and Rigid-Flex Circuitry with Flat Unformed Leads	8-105
Table 8-11 Dimensional Criteria – Tall Profile Components Having Bottom Only Terminations	8-83	Table 8-22 Dimensional Criteria – Wrapped Terminals	8-106
Table 8-12 Dimensional Criteria – Inward Formed L-Shaped Ribbon Leads	8-84	Table 8-23 SMTS/Surface Mount Fasteners – Minimum Acceptable Solder Conditions	8-111
Table 8-13 Dimensional Criteria – Ball Grid Array Components with Collapsing Balls	8-86	Table 9-1 Chip-Out Criteria	9-8
Table 8-14 Ball Grid Array Components with Noncollapsing Balls	8-86	Table 10-1 Coating Thickness	10-52
Table 8-15 Column Grid Array	8-86	Appendix A Table 6-1 Electrical Conductor Spacing	A-2
Table 8-16 Dimensional Criteria – BTC	8-93	Table B-1 Typical Static Charge Sources	B-3
Table 8-17 Dimensional Criteria – Bottom Thermal Plane Terminations (D-Pak)	8-95	Table B-2 Typical Static Voltage Generation	B-3
		Table B-3 Recommended Practices for Handling Electronic Assemblies	B-6

1 Acceptability of Electronic Assemblies

1 General

1.1 Scope This standard is a collection of visual quality acceptability requirements for electronic assemblies. This standard does not provide criteria for cross-section evaluation.

This document presents acceptance requirements for the manufacture of electrical and electronic assemblies. Historically, electronic assembly standards contained a more comprehensive tutorial addressing principles and techniques. For a more complete understanding of this document's recommendations and requirements, one may use this document in conjunction with IPC-HDBK-001, IPC-AJ-820 and J-STD-001.

The criteria in this standard are not intended to define processes to accomplish assembly operations nor is it intended to authorize repair/modification or change of the product. For instance, the presence of criteria for adhesive bonding of components does not imply/authorize/require the use of adhesive bonding and the depiction of a lead wrapped clockwise around a terminal does not imply/authorize/require that all leads/wires be wrapped in the clockwise direction.

Users of this standard should be knowledgeable of the applicable requirements of the document and how to apply them, see 1.3 Classification.

IPC-A-610 has criteria outside the scope of J-STD-001 defining mechanical and other workmanship requirements. Table 1-1 is a summary of related documents.

Table 1-1 Summary of Related Documents

Document Purpose	Spec.#	Definition
Design Standard	IPC-2220-FAM IPC-7351 IPC-CM-770	Design requirements reflecting three levels of complexity (Levels A, B, and C) indicating finer geometries, greater densities, more process steps to produce the product. Component and Assembly Process Guidelines to assist in the design of the bare board and the assembly where the bare board processes concentrate on land patterns for surface mount and the assembly concentrates on surface mount and through-hole principles which are usually incorporated into the design process and the documentation.
Printed Board – Requirements	IPC-6010-FAM IPC-A-600	Requirements and acceptance documentation for rigid, rigid flex, flex and other types of substrates.
End Item Documentation	IPC-D-325	Documentation depicting bare board or assembly requirements. Details may or may not reference industry specifications or workmanship standards as well as the User's own preferences or internal standard requirements.
Process Requirement Standard	J-STD-001	Requirements for soldered electrical and electronic assemblies depicting minimum end product acceptable characteristics as well as methods for evaluation (test methods), frequency of testing and applicable ability of process control requirements.
Acceptability Standard	IPC-A-610	Pictorial interpretive document indicating various characteristics of the board and/or assembly as appropriate relating to desirable conditions that exceed the minimum acceptable characteristics indicated by the end item performance standard and reflect various out-of-control (process indicator or defect) conditions to assist the shop process evaluators in judging need for corrective action.
Training Programs (Optional)		Documented training for process, procedures, techniques, and requirements.
Rework and Repair	IPC-7711/7721	Documentation providing the procedures to accomplish conformal coating and component removal and replacement, solder resist repair, and modification/repair of laminate material, conductors, and plated through-holes.

IPC-AJ-820 is a supporting document that provides information regarding the intent of this specification content and explains or amplifies the technical rationale for transition of limits through Acceptable to Defect condition criteria. In addition, supporting information is provided to give a broader understanding of the process considerations that are related to performance but not commonly distinguishable through visual assessment methods.

The explanations provided in IPC-AJ-820 should be useful in determining disposition of conditions identified as Defect, processes associated with Process Indicators, as well as answering questions regarding clarification in use and application for defined content of this specification. Contractual reference to IPC-A-610 does not additionally impose the content of IPC-AJ-820 unless specifically referenced in contractual documentation.

1.2 Purpose The visual standards in this document reflect the requirements of existing IPC and other applicable specifications. For the content of this document to apply, the assembly/product should comply with other existing IPC requirements, such as