This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

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

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents

1 General 1-1

1.1 Scope 1-1

1.2 Purpose 1-1

1.3 Classification 1-2

1.4 Measurement Units and Applications 1-2
1.4.1 Verification of Dimensions 1-2

1.5 Definition of Requirements 1-2
1.5.1 Acceptance Criteria 1-3
1.5.1.1 Acceptable Condition 1-3
1.5.1.2 Defect Condition 1-3
1.5.1.2.1 Disposition 1-3
1.5.1.3 Process Indicator Condition 1-3
1.5.1.4 Combined Conditions 1-3
1.5.1.5 Conditions Not Specified 1-3
1.5.1.6 Specialized Designs 1-3
1.5.1.7 Should 1-4

1.6 Process Control Methodologies 1-4

1.7 Order of Precedence 1-4
1.7.1 Clause References 1-4
1.7.2 Appendices 1-4

1.8 Terms and Definitions 1-4
1.8.1 Board Orientation 1-4
1.8.1.1 Primary Side 1-4
1.8.1.2 Secondary Side 1-4
1.8.1.3 Solder Source Side 1-4
1.8.1.4 Solder Destination Side 1-4
1.8.2 Cold Solder Connection 1-4
1.8.3 Common Conductors 1-4
1.8.4 Diameter 1-5
1.8.5 Electrical Clearance 1-5
1.8.6 Engineering Documentation 1-5
1.8.7 FOD (Foreign Object Debris) 1-5
1.8.8 Form, Fit, Function (F/F/F) 1-5
1.8.9 High Voltage 1-5
1.8.10 Intrusive Solder 1-5
1.8.11 Kink 1-5
1.8.12 Locking Mechanism 1-5
1.8.13 Manufacturer 1-5
1.8.14 Meniscus (Component) 1-5
1.8.15 Noncommon Conductors 1-5
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
1.8.22 Tempered Leads 1-6
1.8.23 Wire Overlap 1-6
1.8.24 Wire Overwrap 1-6
1.8.25 User 1-6

1.9 Requirements Flowdown 1-6

1.10 Personnel Proficiency 1-6

1.11 Acceptance Requirements 1-6
1.11.1 Missing Parts and Components 1-6

1.12 Inspection Methodology 1-6
1.12.1 Lighting 1-7
1.12.2 Magnification Aids 1-7

2 Applicable Documents 2-1

2.1 IPC Documents 2-1

2.2 Joint Industry Documents 2-1

2.3 Electrostatic Association Documents 2-2

2.4 International Electrotechnical Commission Documents 2-2

2.5 ASTM 2-2

2.6 Military Standards 2-2

2.7 SAE International 2-2

3 Handling Electronic Assemblies 3-1

4 Hardware 4-1

4.1 Hardware Installation 4-2
4.1.1 Electrical Clearance 4-2
4.1.2 Interference 4-3
4.1.3 Component Mounting – High Power 4-4
4.1.4 Heatsinks 4-6
4.1.4.1 Insulators and Thermal Compounds 4-6
4.1.4.2 Contact 4-7
4.1.5 Threaded Fasteners and Other Threaded Hardware 4-8
4.1.5.1 Torque 4-10
4.1.5.2 Solid Wires 4-12
4.1.5.3 Stranded Wires 4-14

4.2 Jackpost Mounting 4-15

4.3 Connector Pins 4-16
4.3.1 Edge Connector Pins 4-16
4.3.2 Press Fit Pins 4-16
4.3.2.1 Land/Annular Ring 4-18
4.3.2.2 Soldering 4-19

4.4 Wire Bundle Securing 4-20

4.5 Routing – Wires and Wire Bundles 4-20

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

5 Soldering 5-1

5.1 Soldering Acceptability Requirements 5-3

5.2 Soldering Anomalies 5-4
5.2.1 Exposed Basis Metal 5-4
5.2.2 Pin Holes/Blow Holes/Voids 5-6
5.2.3 Reflow of Solder Paste 5-7
5.2.4 Nonwetting 5-8
5.2.5 Cold/Rosin Connection 5-9
5.2.6 Dewetting 5-9
5.2.7 Excess Solder 5-10
5.2.7.1 Solder Balls 5-11
5.2.7.2 Bridging 5-12
5.2.7.3 Solder Webbing/Splashes 5-13
5.2.8 Disturbed Solder 5-14
5.2.9 Cooling Lines and Secondary Reflow 5-15
5.2.10 Fractured Solder 5-16
5.2.11 Solder Projections 5-17
5.2.12 Pb-Free Fillet Lift 5-18
5.2.13 Pb-Free Hot Tear/Shrink Hole 5-19
5.2.14 Probe Marks and Other Similar Surface Conditions in Solder Joints 5-20
5.2.15 Partially Visible or Hidden Solder Connections 5-20
5.2.16 Heat Shrinkable Soldering Devices 5-21
5.2.17 Inclusions 5-22

6 Terminal Connections 6-1

6.1 Swaged Hardware 6-3
6.1.1 Terminals 6-3
6.1.1.1 Terminal Base to Land Separation 6-3
6.1.1.2 Turret 6-5
6.1.1.3 Bifurcated 6-6
6.1.2 Rolled Flange 6-7
6.1.3 Flared Flange 6-8
6.1.4 Controlled Split 6-9
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
6.3.3 Strand Separation (Birdcaging) – Presolder 6-22
6.3.4 Strand Separation (Birdcaging) – Post-Solder 6-23
6.3.5 Tinning 6-24

6.4 Service Loops 6-26

6.5 Routing – Wires and Wire Bundles – Bend Radius 6-27

6.6 Stress Relief 6-28
6.6.1 Wire 6-28

6.7 Lead/Wire Placement – General Requirements 6-30

6.8 Solder – General Requirements 6-31

6.9 Turrets and Straight Pins 6-33
6.9.1 Lead/Wire Placement 6-33
6.9.2 Solder 6-35

6.10 Bifurcated 6-36
6.10.1 Lead/Wire Placement – Side Route Attachments 6-36
6.10.2 Lead/Wire Placement – Staked Wires 6-38
6.10.3 Lead/Wire Placement – Bottom and Top Route Attachments 6-39
6.10.4 Solder 6-40

6.11 Slotted 6-42
6.11.1 Lead/Wire Placement 6-42
6.11.2 Solder 6-43

6.12 Pierced/Perforated 6-44
6.12.1 Lead/Wire Placement 6-44
6.12.2 Solder 6-46

6.13 Hook 6-47
6.13.1 Lead/Wire Placement 6-47
6.13.2 Solder 6-49

6.14 Solder Cups 6-50
6.14.1 Lead/Wire Placement 6-50
6.14.2 Solder 6-51

6.15 AWG 30 and Smaller Diameter Wires – Lead/Wire Placement 6-53

6.16 Series Connected 6-55

6.17 Edge Clip – Position 6-56

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

7 Through-Hole Technology 7-1

7.1 Component Mounting 7-2
7.1.1 Orientation 7-2
7.1.1.1 Orientation – Horizontal 7-3
7.1.1.2 Orientation – Vertical 7-4
7.1.2 Lead Forming 7-5
7.1.2.1 Bend Radius 7-5
7.1.2.2 Space between Seal/Weld and Bend 7-6
7.1.2.3 Stress Relief 7-7
7.1.2.4 Damage 7-9
7.1.3 Leads Crossing Conductors 7-10
7.1.4 Hole Obstruction 7-11
7.1.5 DIP/SIP Devices and Sockets 7-12
7.1.6 Radial Leads – Vertical 7-14
7.1.6.1 Spacers 7-15
7.1.7 Radial Leads – Horizontal 7-16
7.1.8 Connectors 7-17
7.1.8.1 Right Angle 7-18
7.1.8.2 Vertical Shrouded Pin Headers and Vertical Receptacle Connectors 7-19
7.1.9 Conductive Cases 7-20

7.2 Component Securing 7-20
7.2.1 Mounting Clips 7-20
7.2.2 Adhesive Bonding 7-22
7.2.2.1 Adhesive Bonding – Nonelevated Components 7-23
7.2.2.2 Adhesive Bonding – Elevated Components 7-26
7.2.3 Other Devices 7-29

7.3 Supported Holes 7-30
7.3.1 Axial Leaded – Horizontal 7-30
7.3.2 Axial Leaded – Vertical 7-31
7.3.3 Wire/Lead Protrusion 7-33
7.3.4 Wire/Lead Clinches 7-34
7.3.5 Solder 7-36
7.3.5.1 Vertical Fill (A) 7-39
7.3.5.2 Solder Destination Side – Lead to Barrel (B) 7-41
7.3.5.3 Solder Destination Side – Land Area Coverage (C) 7-43
7.3.5.4 Solder Source Side – Lead to Barrel (D) 7-44
7.3.5.5 Solder Source Side – Land Area Coverage (E) 7-45
7.3.5.6 Solder Conditions – Solder in Lead Bend 7-46
7.3.5.7 Solder Conditions – Touching Through-Hole Component Body 7-47
7.3.5.8 Solder Conditions – Meniscus in Solder 7-48
7.3.5.9 Lead Cutting after Soldering 7-50
7.3.5.10 Coated Wire Insulation in Solder 7-51
7.3.5.11 Interfacial Connection without Lead – Vias 7-52
7.3.5.12 Board in Board 7-53

7.4 Unsupported Holes 7-56
7.4.1 Axial Leads – Horizontal 7-56
7.4.2 Axial Leads – Vertical 7-57
7.4.3 Wire/Lead Protrusion 7-58
7.4.4 Wire/Lead Clinches 7-59
7.4.5 Solder 7-61
7.4.6 Lead Cutting after Soldering 7-63

8 Surface Mount Assemblies 8-1

8.1 Staking Adhesive 8-3
8.1.1 Component Bonding 8-3
8.1.2 Mechanical Strength 8-4

8.2 SMT Leads 8-6
8.2.1 Plastic Components 8-6
8.2.2 Damage 8-6
8.2.3 Flattening 8-7

8.3 SMT Connections 8-7

8.3.1 Chip Components – Bottom Only Terminations 8-8
8.3.1.1 Side Overhang (A) 8-9
8.3.1.2 End Overhang (B) 8-10
8.3.1.3 End Joint Width (C) 8-11
8.3.1.4 Side Joint Length (D) 8-12
8.3.1.5 Maximum Fillet Height (E) 8-13
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

8.3.2 Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s) 8-15
8.3.2.1 Side Overhang (A) 8-16
8.3.2.2 End Overhang (B) 8-18
8.3.2.3 End Joint Width (C) 8-19
8.3.2.4 Side Joint Length (D) 8-21
8.3.2.5 Maximum Fillet Height (E) 8-22
8.3.2.6 Minimum Fillet Height (F) 8-23
8.3.2.7 Solder Thickness (G) 8-24
8.3.2.8 End Overlap (J) 8-25
8.3.2.9 Termination Variations 8-26
8.3.2.9.1 Mounting on Side (Billboarding) 8-26
8.3.2.9.2 Mounting Upside Down 8-28
8.3.2.9.3 Stacking 8-29
8.3.2.9.4 Tombstoning 8-30
8.3.2.10 Center Terminations 8-31
8.3.2.10.1 Solder Width of Side Termination 8-31
8.3.2.10.2 Minimum Fillet Height of Side Termination 8-32

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

8.3.3 Cylindrical End Cap Terminations 8-33
8.3.3.1 Side Overhang (A) 8-34
8.3.3.2 End Overhang (B) 8-35
8.3.3.3 End Joint Width (C) 8-36
8.3.3.4 Side Joint Length (D) 8-37
8.3.3.5 Maximum Fillet Height (E) 8-38
8.3.3.6 Minimum Fillet Height (F) 8-39
8.3.3.7 Solder Thickness (G) 8-40
8.3.3.8 End Overlap (J) 8-41

8.3.4 Castellated Terminations 8-42
8.3.4.1 Side Overhang (A) 8-43
8.3.4.2 End Overhang (B) 8-44
8.3.4.3 Minimum End Joint Width (C) 8-44
8.3.4.4 Minimum Side Joint Length (D) 8-45
8.3.4.5 Maximum Fillet Height (E) 8-45
8.3.4.6 Minimum Fillet Height (F) 8-46
8.3.4.7 Solder Thickness (G) 8-46

8.3.5 Flat Gull Wing Leads 8-47
8.3.5.1 Side Overhang (A) 8-48
8.3.5.2 Toe Overhang (B) 8-51
8.3.5.3 Minimum End Joint Width (C) 8-52
8.3.5.4 Minimum Side Joint Length (D) 8-53
8.3.5.5 Maximum Heel Fillet Height (E) 8-54
8.3.5.6 Minimum Heel Fillet Height (F) 8-55
8.3.5.7 Solder Thickness (G) 8-56
8.3.5.8 Coplanarity 8-57

8.3.6 Round or Flattened (Coined) Gull Wing Leads 8-58
8.3.6.1 Side Overhang (A) 8-59
8.3.6.2 Toe Overhang (B) 8-60
8.3.6.3 Minimum End Joint Width (C) 8-60
8.3.6.4 Minimum Side Joint Length (D) 8-61
8.3.6.5 Maximum Heel Fillet Height (E) 8-62
8.3.6.6 Minimum Heel Fillet Height (F) 8-63
8.3.6.7 Solder Thickness (G) 8-64
8.3.6.8 Minimum Side Joint Height (Q) 8-64
8.3.6.9 Coplanarity 8-65

8.3.7 J Leads 8-66
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

8.3.8 Butt/I Connections 8-75
8.3.8.1 Modified Through-Hole Terminations 8-75
8.3.8.1.1 Maximum Side Overhang (A) 8-76
8.3.8.1.2 Toe Overhang (B) 8-76
8.3.8.1.3 Minimum End Joint Width (C) 8-77
8.3.8.1.4 Minimum Side Joint Length (D) 8-77
8.3.8.1.5 Maximum Fillet Height (E) 8-77
8.3.8.1.6 Minimum Fillet Height (F) 8-78
8.3.8.1.7 Solder Thickness (G) 8-78
8.3.8.2 Solder Charged Terminations 8-79
8.3.8.2.1 Maximum Side Overhang (A) 8-80
8.3.8.2.2 Maximum Toe Overhang (B) 8-80
8.3.8.2.3 Minimum End Joint Width (C) 8-81
8.3.8.2.4 Minimum Fillet Height (F) 8-81

8.3.9 Flat Lug Leads 8-82

8.3.10 Tall Profile Components Having Bottom Only Terminations 8-83

8.3.11 Inward Formed L-Shaped Ribbon Leads 8-84

8.3.12 Surface Mount Area Array 8-86
8.3.12.1 Alignment 8-87
8.3.12.2 Solder Ball Spacing 8-87
8.3.12.3 Solder Connections 8-88
8.3.12.4 Voids 8-90
8.3.12.5 Underfill/Staking 8-90
8.3.12.6 Package on Package 8-91

8.3.13 Bottom Termination Components (BTC) 8-93

8.3.14 Components with Bottom Thermal Plane Terminations (D-Pak) 8-95

8.3.15 Flattened Post Connections 8-97
8.3.15.1 Maximum Termination Overhang – Square Solder Land 8-97
8.3.15.2 Maximum Termination Overhang – Round Solder Land 8-98
8.3.15.3 Maximum Fillet Height 8-98

8.3.16 P-Style Terminations 8-99
8.3.16.1 Maximum Side Overhang (A) 8-100
8.3.16.2 Maximum Toe Overhang (B) 8-100
8.3.16.3 Minimum End Joint Width (C) 8-101
8.3.16.4 Minimum Side Joint Length (D) 8-101
8.3.16.5 Minimum Fillet Height (F) 8-102

8.3.17 Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations 8-103

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

8.3.18 Flexible and Rigid Flex Printed Circuitry with Flat Unformed Leads 8-105

8.3.19 Wrapped Terminals 8-106
8.3.19.1 Side Overhang (A) 8-107
8.3.19.2 End Joint Width (C) 8-107
8.3.19.3 Side Joint Length (D) 8-107
8.3.19.4 Maximum Heel Fillet Height (E) 8-107
8.3.19.5 Minimum Heel Fillet Height (F) 8-108
8.3.19.6 Solder Thickness (G) 8-108

8.4 Specialized SMT Terminations 8-109

8.5 Surface Mount Connectors 8-110
8.5.1 Surface Mount Threaded Standoffs (SMTS) or Surface Mount Fasteners 8-111

9 Component Damage 9-1

9.1 Loss of Metallization 9-2

9.2 Chip Resistor Element 9-3

9.3 Leaded/Leadless Devices 9-4

9.4 Ceramic Chip Capacitors 9-8

9.5 Connectors 9-10

9.6 Relays 9-13

9.7 Ferrite Core Components 9-13

9.8 Connectors, Handles, Extractors, Latches 9-14

9.9 Edge Connector Pins 9-15

9.10 Press Fit Pins 9-16

9.11 Backplane Connector Pins 9-17

9.12 Heat Sink Hardware 9-18

9.13 Threaded Items and Hardware 9-19

10 Printed Boards and Assemblies 10-1

10.1 Non-Soldered Contact Areas 10-2
10.1.1 Contamination 10-2
10.1.2 Damage 10-4

10.2 Laminate Conditions 10-4
10.2.1 Measling and Crazing 10-5
10.2.2 Blistering and Delamination 10-7
10.2.3 Weave Texture/Weave Exposure 10-9
10.2.4 Haloing 10-10
10.2.5 Edge Delamination, Nicks and Crazing 10-12
10.2.6 Burns 10-14
10.2.7 Bow and Twist 10-15
10.2.8 Depanelization 10-16

10.3 Conductors/Lands 10-18
10.3.1 Reduction 10-18
10.3.2 Lifted 10-19
10.3.3 Mechanical Damage 10-21

10.4 Flexible and Rigid-Flex Printed Boards 10-22
10.4.1 Damage 10-22
10.4.2 Delamination/Blister 10-24
10.4.2.1 Flex 10-24
10.4.2.2 Flex to Stiffener 10-25
10.4.3 Solder Wicking 10-26
10.4.4 Attachment 10-27

10.5 Marking 10-28
10.5.1 Etched (Including Hand Printing) 10-30
10.5.2 Screened 10-31
10.5.3 Stamped 10-32
10.5.4 Laser 10-33
10.5.5 Labels 10-33
10.5.5.1 Bar Coding/Data Matrix 10-33
10.5.5.2 Readability 10-34
10.5.5.3 Labels – Adhesion and Damage 10-35
10.5.5.4 Position 10-35
10.5.6 Radio Frequency Identification (RFID) Tags 10-36

10.6 Cleanliness 10-37
10.6.1 Flux Residues 10-37
10.6.1.1 Cleaning Required 10-38
10.6.1.2 No Cleaning Process 10-39
10.6.2 Foreign Object Debris (FOD) 10-40
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

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

10.10 Encapsulation 10-54

11 Discrete Wiring 11-1

11.1 Solderless Wrap 11-1

12 High Voltage 12-1

13 Jumper Wires 13-1

13.1 Wire Routing 13-2

13.2 Wire Staking – Adhesive or Tape 13-3

13.3 Terminations 13-4
13.3.1 Lap 13-5
13.3.1.1 Component Lead 13-5
13.3.1.2 Land 13-7
13.3.2 Wire in Hole 13-8
13.3.3 Wrapped 13-9
13.3.4 SMT 13-10
13.3.4.1 Chip and Cylindrical End Cap Components 13-10
13.3.4.2 Gull Wing 13-11
13.3.4.3 Castellations 13-13

Appendix A Minimum Electrical Clearance A-1

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 6-6 Staking Requirements of Side Route Straight Through Connections – Bifurcated Terminals 6-38

Table 6-7 Bifurcated Terminal Lead/Wire Placement – Bottom Route 6-39

Table 6-8 Pierced or Perforated Terminal Lead/Wire Placement 6-44

Table 6-9 Hook Terminal Lead/Wire Placement 6-47

Table 6-10 AWG 30 and Smaller Wire Wrap Requirements 6-53

Table 7-1 Lead Bend Radius 7-5

Table 7-2 Component to Land Clearance 7-31

Table 7-3 Protrusion of Wires/Leads in Supported Holes 7-33

Table 7-4 Plated Through-Holes with Component Leads – Minimum Acceptable Solder Conditions 7-38

Table 7-5 Board in Board – Minimum Acceptable Solder Conditions 7-53

Table 7-6 Protrusion of Leads in Unsupported Holes 7-58

Table 7-7 Unsupported Holes with Component Leads, Minimum Acceptable Conditions 7-61

Table 8-1 Dimensional Criteria – Chip Component – Bottom Only Termination Features 8-8

Table 8-2 Dimensional Criteria – Rectangular or Square End Chip Components – 1, 2, 3 or 5 Side Termination(s) 8-15

Table 8-3 Dimensional Criteria – Cylindrical End Cap Termination 8-33

Table 8-4 Dimensional Criteria – Castellated Terminations 8-42

Table 8-5 Dimensional Criteria – Flat Gull Wing Leads 8-47

Table 8-6 Dimensional Criteria – Round or Flattened (Coined) Gull Wing Lead Features 8-58

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

Table of Contents (cont.)

Table 8-7 Dimensional Criteria – J Leads 8-66

Table 8-8 Dimensional Criteria – Butt/I Connections – Modified Through-Hole Leads 8-75

Table 8-9 Dimensional Criteria – Butt/I Connections – Solder Charged Terminations 8-79

Table 8-10 Dimensional Criteria – Flat Lug Leads 8-82

Table 8-11 Dimensional Criteria – Tall Profile Components Having Bottom Only Terminations 8-83

Table 8-12 Dimensional Criteria – Inward Formed L-Shaped Ribbon Leads 8-84

Table 8-13 Dimensional Criteria – Ball Grid Array Components with Collapsing Balls 8-86

Table 8-14 Ball Grid Array Components with Noncollapsing Balls 8-86

Table 8-15 Column Grid Array 8-86

Table 8-16 Dimensional Criteria – BTC 8-93

Table 8-17 Dimensional Criteria – Bottom Thermal Plane Terminations (D-Pak) 8-95

Table 8-18 Dimensional Criteria Flattened Post Connections 8-97

Table 8-19 Dimensional Criteria – P-Style Terminations 8-99

Table 8-20 Dimensional Criteria – Vertical Cylindrical Cans with Outward L-Shaped Lead Terminations 8-104

Table 8-21 Dimensional Criteria – Flexible and Rigid-Flex Circuitry with Flat Unformed Leads 8-105

Table 8-22 Dimensional Criteria – Wrapped Terminals 8-106

Table 8-23 SMTS/Surface Mount Fasteners – Minimum Acceptable Solder Conditions 8-111

Table 9-1 Chip-Out Criteria 9-8

Table 10-1 Coating Thickness 10-52

Appendix A Table 6-1 Electrical Conductor Spacing A-2

Table B-1 Typical Static Charge Sources B-3

Table B-2 Typical Static Voltage Generation B-3

Table B-3 Recommended Practices for Handling Electronic Assemblies B-6

This is a preview of "IPC A-610H-2020". Click here to purchase the full version from the ANSI store.

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