

IPC-A-600K

Acceptability of Printed Boards

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

Developed by the IPC-A-600 Task Group (7-31a) of the Product Assurance Committee (7-30) of IPC

Supersedes:

IPC-A-600J - May 2016 IPC-A-600H - April 2010 IPC-A-600G - July 2004 IPC-A-600F - November 1999 Users of this publication are encouraged to participate in the development of future revisions.

Contact:

IPC

Table of Contents

1.5 Acceptance Criteria 2 2.7.2 Burrs on Edge-Board Contacts 46 1.6 Applicable Documents 3 2.7.3 Adhesion of Overplate 47 1.6.1 IPC 3 2.8 Marking 49 1.6.2 American Society of Mechanical Engineers 4 2.8.1 Etched Marking 50 1.7 Dimensions and Tolerances 4 2.8.2 Ink Marking 52 1.7 Dimensions and Tolerances 4 2.9.2 Ink Marking 52 1.8 Terms and Definitions 4 2.9.1 Coverage Over Conductors 54 1.9 Revision Level Changes 4 2.9.1 Coverage Over Conductors 55 1.10 Workmanship 4 2.9.2 Registration to Holes (All Finishes) 56 2.1.1 Burns 5 2.9.3 Registration to Rectangular 57 2.1.1 Burns 5 2.9.3 Registration to Round Surface Mount Lands (BGA) – Solder 4 2.1.1 Meashing 9 2.9.3 Registration to Round Surface 4	Acknowledgment			iii	2.6	Holes - Unsupported		42
1.1 Scope	1	Introdu	etion	1			_	
1.2 Purpose					2.7	Edge Bo		43
1.3 Approach To This Document 1.4 Classification 1		•				2.7.1	_	
Lands (Gap/Overlap Area) 45		•					_	43
1.5 Acceptance Criteria 2 2.7.2 Burns on Edge-Board Contacts 4 1.6.1 IPC 3 2.7.3 Adhesion of Overplate 47 1.6.2 American Society of Mechanical Engineers 4 2.8.1 Etched Marking 50 1.7 Dimensions and Tolerances 4 2.9 Solder Mask 54 1.8 Terms and Definitions 4 2.9.2 Goverage Over Conductors (Skip Coverage) 55 1.9 Revision Level Changes 4 2.9.1 Coverage Over Conductors (Skip Coverage) 55 1.10 Workmanship 4 2.9.2 Registration to Holes (All Finishes) 56 2.1.1 Burns 5 2.9.3 Registration to Holes (All Finishes) 56 2.1.1 Burns 5 2.9.3 Registration to Holes (All Finishes) 56 2.1.1 Burns 5 2.9.3 Registration to Holes (All Finishes) 56 2.1.1 Burns 6 2.9.3 Registration to Round Surface Mount Lands (BGA) – Soider Mask-Defined Lands	1.3					2.7.1.1		
2.7.3 Adhesion of Overplate 4.77	1.4	Classif	ication	1				
1.6.2 IPC	1.5	Accept	ance Criteria	2			_	
1.6.2 American Society of Mechanical Engineers	1.6	Applicable Documents		3		2.7.3	Adhesion of Overplate	47
Engineers					2.8	_		
1.7 Dimensions and Tolerances 4 2.9 Solder Mask 54 1.8 Terms and Definitions 4 2.9.1 Coverage Over Conductors (Skip Coverage) 55 1.10 Workmanship 4 2.9.2 Registration to Holes (All Finishes) 56 2.1 Printed Board Edges 5 2.9.3 Registration to Round Surface Mount Lands (BGA) - Solder Mask-Defined Lands 57 2.1.1 Nonmetallic Burrs 7 2.9.3.2 Registration to Round Surface Mount Lands (BGA) - Solder Mask-Defined Lands 58 2.1.1.2 Nicks 8 2.9.3.3 Registration to Round Surface Mount Lands (BGA) - Copper-Defined Lands 58 2.1.3 Haloing 9 2.9.3.3 Registration to Round Surface Mount Lands (BGA) - Copper-Defined Lands 59 2.2.2 Weave Texture 10 2.9.3.3 Registration to Round Surface Mount Lands (BGA) - Copper-Defined Lands 59 2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.4 Bilisters/Delamination 60 2.3.1 Measling 20 2.9.5 Adhesion (Flaking or Peeling) 63 2.3.1 Measling 20 2.9.6 Waves/Wrinkles/Ripples 64 2.3.1 Measling 20 2.9.6 Waves/Wrinkles/Ripples 64 2.3.1 Measling		1.6.2	American Society of Mechanical			2.8.1	_	
1.8 Terms and Definitions 4 2.9.1 Coverage Over Conductors (Skip Coverage) 55 1.9 Revision Level Changes 4 2.9.2 Registration to Holes (All Finishes) 56 2.1.10 Workmanship 4 2.9.3 Registration to Holes (All Finishes) 56 2.1.1 Burns 5 2.9.3.1 Registration to Round Surface 2.1.1.1 Monmetallic Burns 6 2.9.3.2 Registration to Round Surface 2.1.1.2 Mickallic Burns 7 2.9.3.2 Registration to Round Surface 2.1.1.2 Mickallic Burns 7 2.9.3.2 Registration to Round Surface 2.1.1.2 Mickallic Burns 7 2.9.3.2 Registration to Round Surface 2.1.1.2 Mickallic Burns 8 Mount Lands (BGA) - Copper-Defined Lands 59 2.1.2 Vicks 8 Mount Lands (BGA) - Copper-Defined Lands 59 2.2.1 Weave Exposure 10 2.9.3.3 Registration to Round 2.2.1 Weave Exposure 11 (BGA) - (Solder Dam) 60<			Engineers	4		2.8.2	Ink Marking	52
Skip Coverage .55	1.7	Dimen	sions and Tolerances	4	2.9	Solder M	lask	54
1.9 Revision Level Changes	1.8	Terms	and Definitions	4		2.9.1	•	
1.10 Workmanship	1 9							
2 Externally Observable Characteristics 5 Surface Mount Lands 5 2.1 Printed Board Edges 5 2.9.3.1 Registration to Round Surface Mount Lands (BGA) – Solder Mask-Defined Lands 5 2.1.1.1 Nonmetallic Burrs 5 Mask-Defined Lands 58 2.1.1.2 Metallic Burrs 7 2.9.3.2 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 58 2.1.2 Nicks 8 Mount Lands (BGA) – Copper-Defined Lands 59 2.1.3 Haloing 9 2.9.3.3 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.1 Weave Exposure 11 2.9.3.3 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.2 Weave Texture 12 2.9.3.3 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.4 Blisters/Delamination 60 2.2.4 Surface Voids 14 2.9.5 Adhesion (Flaking or Peeling) 63 2.3.1 Measiling 20 2.9.7 Tenting (Via Holes) 65 2.3.1 Measiling 20						2.9.2	,	56
2.1 Printed Board Edges 5 2.9.3.1 Registration to Round Surface Mount Lands (BGA) – Solder Mask-Defined Lands 5 2.1.1.1 Nonmetallic Burrs 6 Mask-Defined Lands 58 2.1.1.2 Metallic Burrs 7 2.9.3.2 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.1.3 Haloing 9 2.9.3.3 Registration to Round Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.1 Weave Exposure 11 Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.2 Weave Texture 12 Surface Mount Lands (BGA) – Copper-Defined Lands 59 2.2.3 Mechanically Induced Disrupted Fibers 13 Surface Wount Lands (BGA) – Colder Dam) 60 2.2.4 Surface Voids 14 2.9.5 Adhesion (Flaking or Peeling) 63 2.3.1 Measing 20 2.9.6 Waves/Wrinkles/Ripples 64 2.3.1 Measing 20 2.3.1 Measing 20 2.3.2 Crazing 22 2.3.2 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.10.1 Conductor Width and Spacing 68 2.5.1 Nodules/Rough Plating 33			•			2.9.3		
2.1.1 Burrs			•					57
2.1.1.1 Nonmetallic Burrs 6 Mask-Defined Lands 58 2.1.1.2 Metallic Burrs 7 2.9.3.2 Registration to Round Surface 2.1.2 Nicks 8 Mount Lands (BGA) – Copper-Defined Lands 59 2.2.1 Haloing 9 2.9.3.3 Registration to Round 2.2.1 Weave Exposure 11 Surface Mount Lands (BGA) – (Solder Dam) 60 2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination to Round 2.2.2 Weave Exposure 11 (BGA) – (Solder Dam) 60 2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination to Round 2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination to Round 2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination 60 2.2.3 Mechanically Induced 2.9.5 Adhesion (Flaking or Peleling) 63 2.2.4 Surface Voids 14 2.9.5 Adhesion (Flaking or Peeling) 63 2.3.4 Measling 2.9.8 Soda Strawing 66 2.3.4 Foreign	2.1		_			2.9.3.1	•	
2.1.1.2 Metallic Burrs 7								
2.1.2 Nicks 8 Mount Lands (BGA) – Copper-						0.0.0.0		58
2.1.3 Haloing 9 Defined Lands 59 2.2 Base Material Surface 10 2.2.1 Weave Exposure 11 2.2.2 Weave Texture 12 2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.4 Surface Voids 14 2.3.1 Measling 2.3.2 Crazing 22 2.3.3 Delamination/Blister 25 2.3.4 Foreign Inclusions 28 2.4.1 Nonwetting 2.4.2 Dewetting 30 2.4.1 Nonwetting 2.4.2 Dewetting 31 2.5.1 Nodules/Rough Plating 30 2.5.2 Pink Ring 2.5.5 Pink Ring 2.5.5 Vids – Copper Plating 35 2.5.6 Cap Plating of Filled Holes – Visual) 38 Defined Lands 59 Defined Lands 59 2.9.3.3 Registration to Round Surface Mount Lands (BGA) – (Solder Dam) 60 2.9.4.3 Begistration to Round Surface Mount Lands 59 2.9.5.3 Registration to Round Surface Mount Lands 59 2.9.5.4 Bilisters/Delamination 61 2.9.5.4 Waves/Wrinkles/Ripples 64 2.9.7 Tenting (Via Holes) 65 2.9.8 Soda Strawing 66 2.10.1 Conductor Width and Spacing 68 2.10.1.1 Conductor Width and Spacing 68 2.10.1.2 Conductor Width and Spacing 68 2.10.2 External Annular Ring – Measurement 71 2.10.3 External Annular Ring – Measurement 71 2.10.4 External Annular Ring – Unsupported Holes 74 2.10.5 Surface Plating – Rectangular Surface Mount Lands 75 2.10.6 Surface Plating – Rectangular Surface Plating – Rectangular Surface Mount Lands 97 2.10.6 Surface Plating – Wire Bond Pads 79						2.9.3.2	•	
2.2 Base Material Surface 10 2.9.3.3 Registration to Round 2.2.1 Weave Exposure 11 Surface Mount Lands (BGA) – (Solder Dam) 60 2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination 61 2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.5 Adhesion (Flaking or Peeling) 63 2.2.4 Surface Voids 14 2.9.6 Waves/Wrinkles/Ripples 64 2.3.1 Measling 20 2.9.8 Soda Strawing 65 2.3.3 Delamination/Blister 25 2.10.1 Conductor Width and Spacing 68 2.3.4 Foreign Inclusions 28 2.10.1.1 Conductor Width and Spacing 68 2.4.1 Nonwetting 30 2.10.1.2 Conductor Spacing 70 2.4.2 Dewetting 31 2.10.2 External Annular Ring – Measurement 71 2.5.1 Nodules/Rough Plating 33 2.10.4 External Annular Ring – Unsupported Holes and Microvia Capture Land 72 2.5.2 Pink Ring 34 2.10.5 Surface Plating – Rectangular Surface Mount Lands 74 2.5.4 Voids – Finished Coating 36 2.10.5 Surface Plating – Rectangular Surface Plating – Round Surface Mount Lands								50
2.2.1 Weave Exposure						2022		59
2.2.1 Weave Exposure	2.2					2.9.3.3	•	
2.2.2 Weave Texture 12 2.9.4 Blisters/Delamination 61 2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.5 Adhesion (Flaking or Peeling) 63 2.2.4 Surface Voids 14 2.9.6 Waves/Wrinkles/Ripples 64 2.3 Base Material Subsurface 15 2.9.8 Soda Strawing 65 2.3.1 Measling 20 2.9.8 Soda Strawing 66 2.3.2 Crazing 22 2.9.8 Soda Strawing 68 2.3.4 Foreign Inclusions 28 2.10.1 Conductor Width and Spacing 68 2.4.1 Nonwetting 30 2.10.1 Conductor Width 69 2.4.2 Dewetting 31 2.10.2 External Annular Ring – Measurement 71 2.5.1 Nodules/Rough Plating 33 2.5.1 Nodules/Rough Plating 33 2.10.4 External Annular Ring – Wire Bond Pads 74 2.5.3 Voids – Copper Plating 35 2.10.5 Surface Plating – Rectangular Surface Plating – Rectangular Surface Plating – Round Surface Surface Pl			•					60
2.2.3 Mechanically Induced Disrupted Fibers 13 2.9.5 Adhesion (Flaking or Peeling) 63 2.2.4 Surface Voids 14 2.9.6 Waves/Wrinkles/Ripples 64 2.9.7 Tenting (Via Holes) 65 2.9.8 Soda Strawing 66 2.9.8 Soda Strawing 66 2.9.8 Soda Strawing 66 2.9.8 Soda Strawing 68 2.9.8 Soda Strawing 58 2.9.8 Soda Strawing 58 2.10.1 2.9.8 Soda Strawing 58 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.10.1 2.1				12		294		
2.2.4 Surface Voids		2.2.3	-					
2.2.4 Surface Volds 14 2.3 Base Material Subsurface 15 2.3.1 Measling 20 2.3.2 Crazing 22 2.3.3 Delamination/Blister 25 2.3.4 Foreign Inclusions 28 2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids - Copper Plating 35 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.5.7 Tenting (Via Holes) 65 2.9.8 Soda Strawing 68 2.10.1 Conductor Width and Spacing 68 2.10.1.2 Conductor Spacing 70 2.10.2 External Annular Ring - Measurement 71 2.10.3 External Annular Ring - Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring - Unsupported Holes 2.10.5 Surface Plating - Rectangular 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5			-					
2.3 Base Material Subsurface 15 2.3.1 Measling 20 2.3.2 Crazing 22 2.3.3 Delamination/Blister 25 2.3.4 Foreign Inclusions 28 2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids - Copper Plating 35 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.5.0 Soda Strawing 68 2.10.1 Conductor Width and Spacing 68 2.10.1.1 Conductor Width 69 2.10.1.2 Conductor Spacing 70 2.10.2 External Annular Ring - Measurement 71 2.10.3 External Annular Ring - Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring - Unsupported Holes 2.10.5 Surface Plating - Rectangular Surface Mount Lands 75 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.10.6 Surface Plating - Round Surface Mount Lands (BGA)							• •	
2.3.1 Measling 20 2.3.2 Crazing 22 2.3.3 Delamination/Blister 25 2.3.4 Foreign Inclusions 28 2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids - Copper Plating 35 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.5.1 Neasting 20 2.5.2 Pink Ring 34 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.5.6 Visual) 38 2.5.7 Surface Plating - Wire Bond Pads 79 2.5.8 Cap Plating of Filled Holes - (Visual) 38 2.5.9 Surface Plating - Wire Bond Pads 79	2.3	Base N	Material Subsurface	15				
2.3.2 Crazing		2.3.1 Measling			2 10		•	
2.3.4 Foreign Inclusions 28 2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids – Copper Plating 35 2.5.4 Voids – Finished Coating 36 2.5.5 Lifted Lands – (Visual) 37 2.5.6 Cap Plating of Filled Holes – (Visual) 38 2.6 Solder Coatings and Fused Tin Lead 30 2.10.1.2 Conductor Width 69 2.10.1.2 Conductor Spacing 70 2.10.2 External Annular Ring – Measurement 71 2.10.3 External Annular Ring – Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring – Unsupported Holes 74 2.10.5 Surface Plating – Rectangular Surface Mount Lands 75 2.10.6 Surface Plating – Round Surface Mount Lands (BGA) 77 38 2.10.7 Surface Plating – Wire Bond Pads 79		2.3.2	Crazing	22	2.10			
2.3.4 Foreign inclusions 28 2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5 Holes – Plated-Through – General 33 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids – Copper Plating 35 2.5.4 Voids – Finished Coating 36 2.5.5 Lifted Lands – (Visual) 37 2.5.6 Cap Plating of Filled Holes – (Visual) 38 2.5.7 Surface Plating – Wire Bond Pads 79		2.3.3	Delamination/Blister	25				
2.4 Solder Coatings and Fused Tin Lead 30 2.4.1 Nonwetting 30 2.4.2 Dewetting 31 2.5 Holes – Plated-Through – General 33 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids – Copper Plating 35 2.5.4 Voids – Finished Coating 36 2.5.5 Lifted Lands – (Visual) 37 2.5.6 Cap Plating of Filled Holes – 38 2.5.7 Visual) 38 2.10.2 External Annular Ring – Measurement 2.10.3 External Annular Ring – Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring – Unsupported Holes 2.10.4 External Annular Ring – Unsupported Holes 2.10.5 Surface Plating – Rectangular Surface Mount Lands 2.10.6 Surface Plating – Round Surface Mount Lands (BGA) 77 2.10.7 Surface Plating – Wire Bond Pads 79		2.3.4	Foreign Inclusions	28				
2.4.1 Nonwetting	2.4	Solder	Coatings and Fused Tin Lead	30				70
2.4.2 Dewetting 31 2.5 Holes - Plated-Through - General 33 2.5.1 Nodules/Rough Plating 33 2.5.2 Pink Ring 34 2.5.3 Voids - Copper Plating 35 2.5.4 Voids - Finished Coating 36 2.5.5 Lifted Lands - (Visual) 37 2.5.6 Cap Plating of Filled Holes - (Visual) 38 2.10.3 External Annular Ring - Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring - Supported Holes and Microvia Capture Land 72 2.10.4 External Annular Ring - Supported Holes and Microvia Capture Land 74 2.10.4 External Annular Ring - Supported Holes and Microvia Capture Land 74 2.10.5 Surface Plating - Rectangular Surface Mount Lands 75 2.10.6 Surface Plating - Round Surface Mount Lands (BGA) 77 (Visual) 38 2.10.7 Surface Plating - Wire Bond Pads 79		2.4.1	Nonwetting	30		2.10.2	<u> </u>	71
2.5 Holes – Plated-Through – General 33 Holes and Microvia Capture Land 72 2.5.1 Nodules/Rough Plating 33 2.10.4 External Annular Ring – Unsupported Holes 74 2.5.2 Pink Ring 34 Unsupported Holes 74 2.5.3 Voids – Copper Plating 35 Surface Plating – Rectangular 2.5.4 Voids – Finished Coating 36 Surface Mount Lands 75 2.5.5 Lifted Lands – (Visual) 37 2.10.6 Surface Plating – Round Surface 2.5.6 Cap Plating of Filled Holes – (Visual) 38 2.10.7 Surface Plating – Wire Bond Pads 79		2.4.2	Dewetting	31		2 10 3		/ 1
2.5.1 Nodules/Rough Plating 33 2.10.4 External Annular Ring – 2.5.2 Pink Ring 34 Unsupported Holes 74 2.5.3 Voids – Copper Plating 35 2.10.5 Surface Plating – Rectangular 2.5.4 Voids – Finished Coating 36 Surface Mount Lands 75 2.5.5 Lifted Lands – (Visual) 37 2.10.6 Surface Plating – Round Surface 2.5.6 Cap Plating of Filled Holes – Mount Lands (BGA) 77 (Visual) 38 2.10.7 Surface Plating – Wire Bond Pads 79	2.5	Holes -	- Plated-Through - General	33		2.10.0		72
2.5.2 Pink Ring 34 Unsupported Holes 74 2.5.3 Voids – Copper Plating 35 2.10.5 Surface Plating – Rectangular 75 2.5.4 Voids – Finished Coating 36 Surface Mount Lands 75 2.5.5 Lifted Lands – (Visual) 37 2.10.6 Surface Plating – Round Surface 2.5.6 Cap Plating of Filled Holes – (Visual) 38 2.10.7 Surface Plating – Wire Bond Pads 79		2.5.1	Nodules/Rough Plating	33		2 10 /		12
2.5.3 Voids – Copper Plating 35 2.10.5 Surface Plating – Rectangular 2.5.4 Voids – Finished Coating 36 Surface Mount Lands 75 2.5.5 Lifted Lands – (Visual) 37 2.10.6 Surface Plating – Round Surface 2.5.6 Cap Plating of Filled Holes – (Visual) Mount Lands (BGA) 77 (Visual) 38 2.10.7 Surface Plating – Wire Bond Pads 79		2.5.2	Pink Ring	34		2.10.4	<u> </u>	74
2.5.4 Voids – Finished Coating		2.5.3				2 10 5		
2.5.5 Lifted Lands – (Visual)		2.5.4					S S	75
2.5.6 Cap Plating of Filled Holes – (Visual) Mount Lands (BGA) 77 2.5.6 Surface Plating – Wire Bond Pads 79		2.5.5	Lifted Lands - (Visual)	37		2.10.6		
(Visual)		2.5.6					•	77
· · · · · · · · · · · · · · · · · · ·				38		2.10.7		
		2.5.7	Back-Drilled Holes - (Visual)	40	2.11		· ·	

Table of Contents (cont.)

3	Interna	Ily Observable Characteristics	83	3.3.15	Annular Ring - Microvia to	
3.1	Dielectric Materials 84				Target Land	. 134
	3.1.1 Laminate Voids/Cracks			3.3.16	Microvia Target Land	
		(Outside Thermal Zone)	34		Contact Dimension	. 136
	3.1.2	Registration/Conductor to Holes 8	37	3.3.17	Microvia Target Land Piercing	. 139
	3.1.3	Clearance Hole, Unsupported,		3.3.18	Lifted Lands - (Cross-Sections)	. 140
		to Power/Ground Planes	38	3.3.19	Copper Plating Thickness -	
	3.1.4	Dielectric Material, Clearance,			Hole Wall	. 141
		Metal Plane for Supported Holes 8	39	3.3.20	Copper Wrap Plating	. 142
	3.1.5	Delamination/Blister 9	90	3.3.21	Copper Cap Plating of	
	3.1.6	Dielectric Removal	91		Filled Holes	. 145
	3.1.6.1	Etchback	93	3.3.22	Plated Copper Filled Vias (Through,	
	3.1.6.2	Smear Removal	95		Blind, Buried and Microvia)	. 147
	3.1.6.3	Negative Etchback	97	3.3.23	Material Fill of Through, Blind,	
	3.1.7	Layer-to-Layer Spacing	99		Buried and Microvia Structures	
	3.1.8	Resin Recession 10	01		(Other than Copper Plating)	. 149
	3.1.9	Hole Wall Dielectric/Plated Barrel		3.3.24	Back-Drilled Holes	
		Separation (Hole Wall Pullaway) 10	02		(Microsection Evaluation)	. 151
3.2	Conduc	ctive Patterns – General 10	03	3.3.25	Solder Coating Thickness	
	3.2.1	Etching Characteristics 10			(Only When Specified)	152
	3.2.2	Print and Etch10	3.4	Plated-	Through Holes – Drilled	. 153
	3.2.2.1	Overhang10	08	3.4.1	Burrs	. 154
	3.2.3	External Conductor Thickness		3.4.2	Nailheading	155
		(Foil Plus Plating) 10	⁰⁹ 3.5	Plated-	Through Holes - Punched	. 156
	3.2.4	Non-Plated Layer Copper Foil		3.5.1	Roughness and Nodules	. 157
		Thickness		3.5.2	Flare	
	3.2.5 Solder Mask Thickness			Miscell	aneous	
3.3		Through Holes – General 1				
	3.3.1	Copper Plating Voids1			e and Rigid-Flex Printed Boards	. 159
	3.3.2	Plating Nodules 1		4.1.1	Coverlay Coverage – Coverfilm	160
	3.3.3	Plating Folds/Inclusions 1		4.4.0	Separations	100
	3.3.4	Wicking1		4.1.2	Coverlay/Covercoat Coverage – Adhesives	160
		Wicking, Clearance Holes 1		4 4 0 4		102
		Innerlayer Inclusions 12	20	4.1.2.1	Adhesive Squeeze-Out – Land Area	160
	3.3.6	Innerlayer Separation – Vertical	2.4	4100		102
		(Axial) Microsection	21	4.1.2.2	Adhesive Squeeze-Out – Foil Surface	162
	3.3.7	Innerlayer Separation – Horizontal	20	4 1 0		103
	0.00	(Transverse) Microsection		4.1.3	Access Hole Registration for Coverlay and Stiffeners	16/
	3.3.8	Plating Separation	24	4 4 4		
	3.3.9	Foil Crack – (Internal Foil)	20	4.1.4	Plating Anomalies	
	0 0 40	"C" Crack	26	4.1.5	Stiffener Bonding	. 166
	3.3.10	Foil Crack (External Foil)	27	4.1.6	Transition Zone, Rigid Area to	407
	0 0 11	"A," "B," "D" Cracks			Flexible Area	. 167
	3.3.11	Plating Crack (Barrel) "E" Crack 12	28	4.1.7	Solder Wicking/Plating	400
	3.3.12	Plating Crack – (Corner)	20		Penetration Under Coverlay	
	0.0.40	"F" Crack		4.1.8	Laminate Integrity	169
		Plating Microanomalies		4.1.8.1	Laminate Integrity – Flexible	. —
	3.3.14	Annular Ring – Internal Layers 13	31		Printed Board	. 170

Table of Contents (cont.)

	4.1.8.2	Laminate Integrity – Rigid-Flex Printed Board	. 171		
	4.1.9	Etchback (Type 3 and Type 4 Only)	. 172		
	4.1.10	Smear Removal (Type 3 and 4 Only)	. 173		
	4.1.11	Trimmed Edges/Edge Delamination	. 174		
	4.1.12	Silver Film Integrity	. 176		
4.2	Metal Core Printed Boards				
	4.2.1	Type Classifications	. 179		
	4.2.2	Spacing Laminated Type	. 180		
	4.2.3	Insulation Thickness, Insulated Metal Substrate	. 181		
	4.2.4	Insulation Material Fill, Laminated Type Metal Core	. 182		
	4.2.5	Cracks in Insulation Material Fill, Laminated Type	. 183		
	4.2.6	Core Bond to Plated-Through Hole Wall	. 184		
4.3	Flush F	Printed Boards	. 185		
	4.3.1	Flushness of Surface Conductor	. 185		
5	Cleanli	ness Testing	. 186		
5.1	Soldera	ability Testing	. 187		
	5.1.1	Plated-Through Holes (Applicable to Solder Float Test)	. 188		
5 2	Flectric	eal Integrity	100		

1 INTRODUCTION

Introduction

1.1 SCOPE

This document describes the target, acceptable, and nonconforming conditions that are either externally or internally observable on printed boards. It represents the visual interpretation of minimum requirements set forth in various printed board specifications, e.g.; IPC-6010 series, J-STD-003, etc.

1.2 PURPOSE

The visual illustrations in this document portray specific criteria of the requirements of current IPC specifications. In order to properly apply and use the content of this document, the printed board should comply with the design requirements of the applicable IPC-2220 series document and the performance requirements of the applicable IPC-6010 series document. In the event the printed board does not comply with these or equivalent requirements, then the acceptance criteria should be as agreed between user and supplier (AABUS).

1.3 APPROACH TO THIS DOCUMENT

Characteristics are divided into two general groups:

- Externally Observable (section 2)
- Internally Observable (section 3)

"Externally observable" conditions are those features or imperfections which can be seen and evaluated on or from the exterior surface of the board. In some cases, such as voids or blisters, the actual condition is an internal phenomenon and is detectable from the exterior.

"Internally observable" conditions are those features or imperfections that require microsectioning of the specimen or other forms of conditioning for detection and evaluation. In some cases, these features may be visible from the exterior and require microsectioning in order to assess acceptability requirements.

Specimens should be illuminated during evaluation to the extent needed for effective examination. The illumination should be such that no shadow falls on the area of interest except those shadows caused by the specimen itself. It is recommended that polarization and/or dark field illumination be employed to prevent glare during the examination of highly reflective materials.

The illustrations in this document portray specific criteria relating to the heading and subheading of each page, with brief descriptions of the acceptable and nonconforming conditions for each product class. (See 1.4.) The visual quality acceptance criteria are intended to provide proper tools for the evaluation of visual anomalies. The illustrations and photographs in each situation are related to specific requirements. The characteristics addressed are those that can be evaluated by visual observation and/or measurement of visually observable features.

Supported by appropriate user requirements, this document should provide effective visual criteria to quality assurance and manufacturing personnel.

This document cannot cover all of the reliability concerns encountered in the printed board industry; therefore, attributes not addressed in this issue **shall** be AABUS. The value of this document lies in its use as a baseline document that may be modified by expansions, exceptions, and variations which may be appropriate for specific applications.

When making accept and/or reject decisions, the awareness of documentation precedence must be maintained.

This document is a tool for observing how a product may deviate due to variation in processes. Refer to IPC-9191.

IPC-A-600 provides a useful tool for understanding and interpreting Automated Inspection Technology (AIT) results. AIT may be applicable to the evaluation of many of the dimensional characteristics illustrated in this document.

IPC-9121 is a useful troubleshooting guideline for problems, causes and possible corrective actions related to printed board manufacturing processes.

1.4 CLASSIFICATION

This standard recognizes that electrical and electronic products are subject to classifications by intended end-item use. Three general end-product classes have been established to reflect differences in producibility, complexity, functional performance requirements, and verification (inspection/test) frequency. It should be recognized that there may be overlaps of product between classes.