

Specification for

**Harmonized system of
quality assessment for
electronic components:
Capability detail
specification: Flexible
printed boards with
through-connections**

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Electronic Components Standards Policy Committee (ECL/-) to Technical Committee ECL/19, upon which the following bodies were represented:

- British Telecommunications plc
- EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electronic Components Industry Federation
- GAMBICA (BEAMA Ltd.)
- Institute of Metal Finishing
- Ministry of Defence
- National Supervising Inspectorate
- Printed Circuit Interconnection Federation
- Surface Mount and Related Technologies (Smart Group) Ltd.

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Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Policy Committee. It is a capability detail specification (Cap DS) within the BS CECC system and should be read in conjunction with BS EN 123500.

It has been produced to reflect the capability level established in the United Kingdom for the supply of printed boards to the defence, computer, communications and similar industries over many years. It is generally equivalent to that defined by BS 9000 *General requirements for a system for electronic components of assessed quality* and, in particular, by BS 9761 *Sectional specification for capability approval of manufacturers of multilayer rigid printed wiring boards of assessed quality with plated through holes*.

The capability level defined is enhanced compared to that described by BS EN 123500-800. In particular capability has been extended to include the following:

- a) more surface finishes, now split into two groups and referred to the connector area and the remainder of the board respectively;
- b) more metallic finishes;
- c) organic finishes used as solder resist;
- d) marking inks;
- e) bonded heatsinks;
- f) accelerated ageing;
- g) additional capability in the definition of minimum conductors and spacing widths;
- h) traceability.

Cross-references

International Standard	Corresponding British Standard
EN 123000:1991	BS EN 123000:1992 <i>Harmonized system of quality assessment for electronic components. Generic specification: printed boards</i> (Identical)
EN 123500:1992	BS EN 123500:1992 <i>Harmonized system of quality assessment for electronic components. Sectional specification: flexible printed boards with through connections</i> (Identical)
IEC 68	BS 2011 <i>Environmental testing</i> (Most Parts are identical)
IEC 249	BS 4584 <i>Metal-clad base materials for printed wiring boards</i> (Most Parts are identical)
ISO 1463:1982	BS EN ISO 1463:1995 <i>Metallic and oxide coatings. Measurement of coating thickness. Microscopical method</i> (Identical)
ISO 3543:1981	BS EN ISO 3543:1995 <i>Metallic and non-metallic coatings. Measurement of thickness. Beta backscatter method</i> (Identical)

There is no British Standard equivalent to CECC 00010:1980 which comprises a list of the tests in IEC 326-2 and its supplement IEC 326-2A. A related British Standard to IEC 326-2 and its supplements is BS 6221-2 and its amendments.

The Technical Committee has reviewed the provisions of ISO 3542:1982, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 General

1.1 Scope

This Capability Detail Specification is based on BS EN 123500. It relates to double-sided flexible printed boards with through connections made with materials and surface finishes as specified in 2.

1.2 Object

To specify the Capability Qualifying Component “CQC”, its characteristics to be tested, the test methods and conditions to be applied and the requirements to be fulfilled for testing basic and additional capability.

2 Capability Qualifying Component (CQC)

Test boards to be used as CQCs for basic capability shall

- be made of one of the copper-clad base materials specified in 2.1 of this Cap DS, with a nominal base film thickness of 75 µm Polyester film or 50 µm Polyimide film, clad with 35 µm copper foil on both sides.
- bear the composite test pattern (CTP) specified in Appendix A of this document;
- have one of the surface finishes specified by groups 11, 12, 13, 14, 15, 16, 17 or 18 in 2.2 of this Capability Detail Specification.

Test boards to be used as CQCs for additional capability shall be modified to demonstrate the claimed capability

- see 3.5.3 of BS EN 123000.

2.1 Materials

Material group designation	Specification IEC	Material (see footnote)		Material thickness range µm	Cu thickness µm
		Type	Grade		
A	249-2-8	Polyester film	General purpose	12.5...125	18, 35, 70
B	249-2-13 249-2-15	Polyimide film Polyimide film	General purpose Defined flammability (vertical)	12.5...125	18, 35, 70
C	249-2-8	Polyester film	General purpose	12.5...125	0, 18, 35, 70
D	249-2-13 249-2-15	Polyimide film Polyimide film	General purpose Defined flammability (vertical)	12.5...125	0, 18, 35, 70
E	249-2-1 249-2-2 249-2-6 249-2-7 249-2-14 249-2-3	Phenolic paper Phenolic paper Phenolic paper Phenolic paper Phenolic paper Epoxide paper	High electrical Economic Defined flammability (horizontal) Defined flammability (vertical) Economic, Defined flammability (vertical) Defined flammability (vertical)	200...6,400	0, 18, 35, 70
F	249-2-4 249-2-5	Epoxide woven glass Epoxide woven glass	General purpose Defined flammability (vertical)	200...6,400	0, 18, 35, 70

Material group designations A and B cover the base materials for flexible circuits;

C and D cover materials for film stiffeners;

E and F cover rigid board materials used for the fabrication of rigidizers.

2.2 Surface finishes

2.2.1 Metallic finishes

Finish group designation	Surface finish	Abbreviation for QPL
11	Bare copper	Cu
12	Copper with temporary protective coating	Cu(tpc)
13	Copper with oxide	Cu(CuO)
14	Tin, tin-lead (as plated)	Sn, SnPb
15	Tin-lead (fused)	SnPb(f)
16	Tin-lead (dipped and levelled)	SnPb(dl)
17	Tin-lead (roller coated)	SnPb(rt)
18	Immersion gold over electroless nickel	AuNi (Smt)
21	Specimen K 5 µm min. gold plated on copper, remainder using finish group 11 – 17 (see below)	5 Au/Cu, Cu, Sn, SnPb
22	Specimen K 0.7 µm min. gold plated on nickel, remainder using finish group 11 – 17 (see below)	0.7 Au/Ni Cu, Sn, SnPb
23	Specimen K 2.5 µm min. gold plated on copper, remainder using finish group 11 – 17 (see below)	2.5 Au/Cu Cu, Sn, SnPb
24	Specimen K 2.5 µm min. gold plated on nickel, remainder using finish group 11 – 17 (see below)	2.5 Au/Ni Cu, Sn, SnPb

The demonstration of metallic finish group 21, 22, 23 or 24, if claimed, shall be combined with a finish from group 11, 12, 13, 15, 16 or 17.

2.2.1.1 Accelerated ageing

The ability of finishes from group 11, 12, 13, 14, 15, 16, 17 or 18 to solder after extended or adverse storage conditions is demonstrated using accelerated ageing. This test shall be carried out on those finishes where accelerated ageing is claimed. Each finish that has complied with the requirements of the accelerated ageing test is highlighted by the inclusion of all asterisk (*) adjacent to that finish in the manufacturer's abstract of capability as published in the QPL.

2.2.2 Organic finishes

Finish group designation	Organic finish	Abbreviation for QPL
a	Adhesive-coated film coverlayer	AFC
b	Dry film solder mask	DSM
c	Wet resist solder mask/coverlayer	WRC
d	Liquid photopolymer solder mask/coverlayer	WPC
e	Marking inks	MI

The demonstration of organic finish group a, b, c, d, or e shall be over one finish from group 11, 12, 13, or one from group 14, 15, 16, 17 or 18. All claimed types of solder mask/coverlayer and marking ink shall be tested separately. Film coverlayers having different adhesive types shall be tested separately.

2.3 Variant designation

The combination of any material group designated in 2.1 and any of the surface finishes as designated in 2.2 constitutes a variant. The variant is designated by the combination of material and finish group designations e.g. A12(b) or A12/21(c).

3 Capability approval

3.1 Range of capability approval

Capability approval granted on the testing of one variant is valid within the limits specified in 3.7 of BS EN 123000 for

- metal-clad base material within one group designation, all base material thicknesses and all foil thicknesses in accordance with 2.1 as follows:
- approval for material group A covers material group A only;
- approval for material group B covers material groups A and B.
- all metallic surface finishes within one surface finish group as quoted in 2.2.1, that is:
 - finish group 11 covers finish group 11 only
 - finish group 12 covers finish group 11 and 12
 - finish group 13 covers finish group 11 and 13
 - finish group 13 covers finish group 11 and 14
 - finish group 15 covers finish group 11 and 15
 - finish group 16 covers finish group 11 and 16
 - finish group 17 covers finish group 11 and 17
 - finish group 18 covers finish group 18 only
 - finish group 21 covers finish group 21 only
 - finish group 22 cover finish group 22 and 24
 - finish group 23 covers finish group 21 and 23
 - finish group 24 covers finish group 24 only
- Each organic finish in 2.2.2 over a finish from group 11, 12 or 13 covers 11, 12 or 13 only.
- Each organic finish in 2.2.2 over a finish from group 14, 15, 16 or 17 covers 11, 12 or 13 in addition.

3.2 QPL information

The QPL information shall be given in accordance with 3.4 of BS EN 123000 and shall contain the following details:

- reference to the BS EN Generic Specification : 123000
- reference to the BS EN Sectional Specification : 123500
- reference to this BS CECC Capability Detail Specification : 123500-003
- materials for which approval is granted as given in 2.1
- surface finishes for which approval is granted as given in 2.2
- any additional capability, 3.5.3 of BS EN 123000 refers.

4 Capability test programme

Each separate process shall be assessed within the test programme.

4.1 Capability demonstration

Capability shall be demonstrated by the manufacturer using 9 composite test patterns (CTPs) of one variant from each material group claimed. Testing shall be in accordance with Table I.

4.1.1 Other metallic surface finishes

If claimed, other metallic surface finishes, as designated in 2.2.1, shall be demonstrated by the manufacture of 3 CTPs which include sufficient extra specimens A and H to meet the requirements of Table II. Testing shall be in accordance with Table II.

NOTE 1 The maximum claimed active board size for the finish shall be demonstrated.

NOTE 2 Demonstration of metallic surface finishes using materials from group A or group B apply to that group only.

4.1.2 Organic surface finishes

Each claimed organic surface finish, as designated in **2.2.2**, shall be demonstrated by the manufacture of 3 CTPs using the pattern in Appendix B for marking inks and Appendix C for coverlayers/solder mask. Testing shall be in accordance with Table III.

NOTE 1 The maximum claimed active board size for the finish shall be demonstrated.

NOTE 2 Demonstration of organic surface finishes shall be made on each material group claimed.

4.1.3 Bonded stiffeners and rigidizers

Material for stiffeners shall be selected from material group C or D, as appropriate for base materials group A or B. Rigidizer materials shall be selected from material group E and F. Each combination of stiffener and adhesive system and of rigidizer and adhesive system shall be demonstrated by the manufacture of 3 CTPs using the pattern specified in Appendix D. Testing shall be in accordance with Table IV

5 Traceability

Traceability of all test specimens to the original production panel shall be maintained. The method used to identify individual test specimens shall not affect the test results.

Table I — Capability approval test schedule

Characteristics	Test No. CECC 00010	Specimen of Composite Test Pattern	Number of specimens		Test Conditions	Requirements/Material			Remarks
			Required	Failures Permitted		IEC 249-2-			
						8 (Polyester)	13 (Polyimide)	15 (Polyimide)	
GENERAL EXAMINATION (before subdivision into specimens)									
Visual inspection									
Conformity and identification	1	Complete CQC	All CQCs	0		Pattern, material and finishes shall comply with this Capability Detail Specification. Any identification for traceability purposes shall be verified.			
Appearance and workmanship	1a	Complete CQC	All CQCs	0		The boards shall appear to have been processed in a workmanlike manner, in accordance with good current practice.			
						The base material, conductors, metallic surface finishes and temporary organic coatings shall be of uniform appearance. They shall be free from cracks, burns, pits, nodules and blisters. Metallic surface finishes shall be free of scratches which penetrate to an underlying surface.			
Plated-through holes	1a	Complete CQC	All CQCs	0		Plated-through holes shall be clean and free from inclusions of any sort that could affect component insertion and solderability. There shall be no voids and no apparent defects in the plating.			
Board edges	1a	Complete CQC	All CQCs	0		Edges shall be clean cut. There shall be no tears or nicks.			
Eyelets	1a	Complete CQC	All CQCs	0		Eyelets shall be firmly secured. Flanges of eyelets may be soldered to the pattern. There shall be no damage to conductors or substrate around the eyelet.			
Bonding conductor to substrate	1a	Complete CQC	All CQCs	0		There shall be no separation of the conductor from the substrate by apparent blister or wrinkles other than those permitted in the material specification.			
Conductor defects	1b	Complete CQC	All CQCs	0		There shall be no breaks in conductors intended to be continuous.			
						The presence of local defects e.g. nicks and pinholes, shall not reduce the conductor width by more than 25 %. The length of a defect shall not be greater than the nominal conductor width. Indentations in conductors, other than those in edge board contacts, shall not be a reason for rejection of the printed board.			

Table I — Capability approval test schedule

Characteristics	Test No. CECC 00010	Specimen of Composite Test Pattern	Number of specimens		Test Conditions	Requirements/Material			Remarks
			Required	Failures Permitted		IEC 249-2-			
						8 (Polyester)	13 (Polyimide)	15 (Polyimide)	
Particles between conductors	1b	Complete CQC	All CQCs	0		There shall be no conductive material bridging conductors shown as intended to be mutually unconnected by the composite test pattern. Residual particles are permissible provided the leakage path is not reduced by more than 20 %.			
Edge connector defects	2a	K	All specimens	0		The surface of edge board contacts within the contact zone shall be smooth and free from pitting or scratches penetrating their surface finish. Within the contact zone of each contact there shall be no more than one indentation or bump as defined Appendix E.			
Dimensional examination									
Board dimensions	2	Complete CQC	All CQCs	0		CQC outline dimensions and thickness as in 2 of this Cap DS.			NOTE Thickness measurement of boards shall include added metallic and organic coatings.
Holes	2	Complete CQC	All CQCs	0		Hole diameter shall comply with 8.2 of BS EN 123500 with a tolerance of ± 0.1 mm. Smallest hole size in specimen C shall meet the manufacturers claimed capability.			
Conductor width	2a	F	All specimens	0		Conductors width greater than or equal to 0,25 mm shall not deviate from nominal values by more than + 0,08/– 0,05 mm. Conductor widths less than 0,25 mm nom. shall be within the manufacturers declared tolerance.			NOTE Conductor defects and particles between conductors shall be disregarded when evaluating conductor width and spacing — see “Visual inspection”.
Conductor spacing	2a	F	All specimens	0		Conductor spacings of 0,5 mm nom. shall not be below 0,42 mm. Conductor spacings of 0,25 mm nom. shall not be below 0,17 mm. Conductor spacings less than 0,25 mm nom. shall be within the manufacturers declared tolerance.			NOTE Artwork for CTPs may need etch factor allowances to meet these requirements.
Misalignment of hole and land	1a, 2a	Complete CQC	All CQCs	0		There shall be no breakout from the land perimeter. There shall be no interruption of the junction between the land and connecting conductor. The outer periphery of the land shall remain intact.			