

**Harmonized system of quality
assessment for electronic components**

**Generic specification:
Printed boards**

The European Standard EN 123000:1991 together with its amendments A1:1995 and A2:1996 has the status of a British Standard

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Committees responsible for this British Standard

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- British Telecommunications plc
- ERA Technology Ltd.
- Electrical and Electronic Insulation Association (BEAMA Ltd.)
- Electronic Components Industry Federation
- Electronic Engineering Association
- GAMBICA (BEAMA Ltd.)
- Institute of Circuit Technology
- Institute of Metal Finishing
- Institution of Production Engineers
- Ministry of Defence
- National Supervising Inspectorate
- Printed Circuit Association
- Telecommunication Engineering and Manufacturing Association (TEMA)

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National foreword

This British Standard has been prepared by Technical Committee EPL/501 (formerly known as ECL/19), and is the English language version of EN 123000:1991 *Generic specification: Printed boards*, including amendments A1:1995 and A2:1996, published by the European Committee for Electrotechnical Standardization (CENELEC).

This standard is a harmonized specification within the CECC system. In 1991 the CENELEC Electronic Components Committee (CECC) accepted CECC 23000:1985 as European Standard EN 123000:1991. The related BS 9760:1977 specification is now declared obsolescent.

Cross-references. The British Standard which implements CECC 00100 is BS 9000 “*General requirements for a system for electronic components of assessed quality*” Part 2 “*Specification for national implementation of CECC basic rules and rules of procedure*”.

International Standard	Corresponding British Standard
IEC 249	BS EN 60249 <i>Base materials for printed circuits</i>
IEC 326-2:1976	BS 6221: <i>Printed wiring boards</i> Part 2:1982 <i>Methods of test</i> (Technically equivalent)

CECC 00107-I and CECC 00107-III have been replaced by EN 10114-1:1994 and CECC 00114-3:1994 respectively, and are also implemented by BS 9000-2:1996.

There is no British Standard equivalent to CECC 00010:1980 which comprises only a list of the tests in IEC 326-2:1976 and its supplement IEC 326-2A.

The Technical Committee has reviewed the provision of IEC 194:1988, IEC 410:1973 and CECC 00007:1978, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A related British Standard to IEC 410:1973 and CECC 00007:1978 is BS 6001 “*Sampling procedures for inspection by attributes*” Part 1:1972 “*Specification for sampling plans indexed by acceptable quality level (AQL) for lot by lot inspection*”.

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 and ii, the EN title page, pages 2 to 34, 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.

Descriptors: Printed boards, generic specification, capability approval, quality conformance inspection, preparation of detail specifications

English version

Generic Specification: Printed boards

(includes amendment A1:1995 and amendment A2:1996)

Spécification générique:

Cartes imprimées

(inclut l'amendement A1:1995 et l'amendement A2:1996)

Fachgrundspezifikation:

Leiterplatten

(enthält Änderung A1:1995 und Änderung A2:1996)

This European Standard was approved by the CENELEC Electronic Components Committee (CECC) on 1991-18-04. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The CENELEC Electronic Components Committee (CECC) is composed of those member countries of the European Committee for Electrotechnical Standardization (CENELEC) who wish to take part in a harmonized System for electronic components of assessed quality.

The object of the System is to facilitate international trade by the harmonization of the specifications and quality assessment procedures for electronic components, and by the grant of an internationally recognized Mark, or Certificate, of Conformity. The components produced under the System are thereby accepted by all member countries without further testing.

The specification has been formally approved by the CECC, and has been prepared for those countries taking part in the System who wish to issue national harmonized GENERIC SPECIFICATIONS for PRINTED BOARDS. It should be read in conjunction with the current regulations for the CECC System.

At the date of printing of this specification the member countries of the CECC are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom, and copies of it can be obtained from the addresses shown on the blue fly sheet.

Preface

This generic specification was prepared by CECC Working Group 23: Printed Circuits.

It is based on the publications of the International Electrotechnical Commission (IEC).

The text of this specification was circulated to the CECC for voting in the documents indicated below and was ratified by the President of the CECC for printing as a CECC Specification.

Document	Voting date	Report on the Voting
CECC (Secretariat) 1003	February 1981	CECC (Secretariat) 1210
CECC (Secretariat) 1507	March 1984	CECC (Secretariat) 1579

SECRETARIAT NOTE:

DUE TO THE URGENT INDUSTRIAL NEED FOR THIS SPECIFICATION, THE PRESIDENT OF THE CECC HAS RULED THAT IT BE PUBLISHED WITHOUT THE FULL EDITORIAL PROCEDURE BEING APPLIED. USERS OF THE SPECIFICATION ARE ASKED TO REPORT TO THE CECC GENERAL SECRETARIAT ANY ERRORS THEY FIND SO THAT AMENDING ACTION CAN BE INITIATED.

The text is published initially in English and German. The French version will follow as soon as it has been prepared.

Foreword to amendment A1

This amendment was prepared by CLC/TC CECC/WG 23.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A1 to EN 123000:1991 on 1995-07-04.

- The following dates were fixed:
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1996-07-01
 - latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1996-07-01

Foreword to amendment A2

This amendment was prepared by CLC/TC CECC/SC 52 (former WG 23).

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A2 to EN 123000:1991 on 1996-10-01.

This document is a guide to the preparation of a Capability Manual for Printed Boards and has been prepared in accordance with the requirements of CECC 00114-III, Appendix B.

- The following dates were fixed:
- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-03-01
 - latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 1997-03-01

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1. General

1.1 Scope

This document is a Generic Specification (GS) applying to printed boards within the CENELEC system for Electronic Components of Assessed Quality. It relates to printed boards irrespective of their method of manufacture, when they are ready for mounting of the components.

1.2 Object

To define system and procedure for approval of manufacturers and products and to provide rules for the preparation of specifications for printed boards.

1.3 Related documents

IEC 194, *Terms and definitions for printed boards.*

IEC 249, *Metal-clad base materials for printed boards.*

IEC 326-2, *Printed circuits — Test methods.*

IEC 410, *Sampling plans and procedures for inspection by attributes.*

CECC 00007, *Sampling plans and procedures for inspection by attributes.*

CECC 00010, *Printed board — Test methods.*

1.4 General considerations

Printed boards differ from most other electronic components in important factors, such as

- there are no standard boards with standard patterns and dimensions but an infinite variety of shapes and circuit configurations,
- they are “custom tailored”, i.e. all details for a particular board must be agreed between customer and manufacturer,
- although they are made in considerable total quantities, the production quantity of a particular printed board may be small.

Therefore, the CECC Qualification Approval Procedure as detailed in CECC 00107-1 cannot be applied. Instead of this, it is necessary to use the CECC Capability Approval Procedure as laid down in CECC 00107-III.

In case of printed boards capability approval is based on the use of composite test patterns as capability qualifying components with an appropriate selection of test methods and requirements for each type of printed board, e.g.

- single/double sided, with plain holes
- single/double sided, with plated-through holes
- multilayer printed boards
- flexible printed boards.

NOTE This list is not intended to be exhaustive.

An important requirement of capability approval is that a manufacturer shall demonstrate the claimed capability of his facilities and processes.

In the case of printed boards “basic” and “additional” capability are distinguished (see also 3.1, 3.5.2, and 3.5.3 of this GS).

— Basic capability is the capability defined in a CECC or ONH.Cap DS. The term “basic” is not intended to indicate any minimum level of assessment, testing or requirement.

— Additional capability is any capability in addition to the basic capability.

Examples of additional capability:

- maximum size of printed boards that can be processed
- minimum diameter of plated-through holes relative to board thickness
- minimum conductor width and/or spacing
- maximum number of layers
- surface finish.

They should be claimed, proved and recognized as additional capability (in addition to the basic capability).

1.5 Specification structure

Although printed boards differ from electronic components under the qualification approval procedure in important factors and the application of the capability approval procedure is indispensable, the specifications as described in the Rules of Procedure for components under the qualification approval procedure will be used as far as ever practicable.

All higher level specifications have essentially the same level and the same significance for both, components under qualification approval procedure and printed boards under capability approval procedure.

These are

- the Basic Specification BS
- the Generic Specification GS
- the Sectional Specification SS.

Each SS covers one type of printed boards, e.g. single/double sided printed boards with plain holes, multilayer printed boards, etc.

A Blank Detail Specification, a convenient instrument for components under qualification approval procedure is not applicable for printed boards. Instead of this, rules for the preparation of Detail Specifications are given in 5 of this GS.

The Detail Specification (DS) for components under the qualification procedure has two functions:

- qualification is tested and granted against it, and
- it describes the product to be delivered.

For printed boards under the capability approval procedure it is necessary to separate both functions and to cover them by two different specifications:

- the Capability Detail Specification (Cap DS) against which capability is tested and granted
- the Customer Detail Specification (CDS) which describes the product to be delivered, i.e. the custom designed printed board.

A survey of the specification structure is given in Appendix B. Further details of both, Cap DS and CDS, and rules for their preparation are given in 5.

2. Particular stipulations

2.1 Primary stage of manufacture

The primary stage of manufacture is defined as the incoming inspection of the base material prior to processing.

This stage and all subsequent processes shall be carried out under the direct surveillance of an approved Chief Inspector. Where this first and subsequent stages of processing are carried out by a sub-contractor, capability approval may be granted provided that in each case the ONS are satisfied that the equivalent disciplines apply.

2.2 Structurally similar printed boards

Printed boards having all of the following common features are structurally similar:

- the same type of metal-clad base material, e.g. 249-2-4-IEC-GC-Cu
- the same type of printed board, e.g. single/double sided with plain holes or single/double sided with plated-through holes or multilayer printed boards
- the same type of surface finish, e.g. tin-lead or gold or copper.

2.3 Certified test records (RCE)

Where RCE is required, it shall comply with RP9. The content shall be as prescribed in 4.3 of this GS and in the relevant SS stating the number of specimens tested and the number of defectives.

2.4 Delayed delivery

When printed boards are held by the manufacturer for a period of more than six months after the quality conformance inspection the following tests shall be carried out prior to delivery:

- Solderability Test 14a as specified for quality conformance inspection, Sub-Group B2, of the relevant CDS
- Visual examination of the appearance, as specified for quality conformance inspection in Sub-Group A1, of the relevant CDS.

2.5 Release for delivery before the completion of Group B tests

When the conditions of CECC 00007 (IEC 410) for changing to reduced inspection have been satisfied for the Group B tests, the manufacturer is permitted to release printed boards before the completion of such tests.

2.6 Resubmission of rejected lots

Where a sample fails to meet the requirements of a periodic test action shall be taken in accordance with CECC 00107, and CECC 00007 (IEC 410).

2.7 Marking of printed board and package

Printed board As far as practicable each printed board shall be clearly marked with the reference specified by the customer.

The marking may be formed with the conductive pattern or may be printed with a suitable marking ink.

Marking with additional information, such as manufacturers name or identification code, number of SS, date code etc. may be applied If explicitly agreed between customer and manufacturer.

The position of any marking must be agreed between customer and manufacturer.

Package The package shall be marked with the above information and any special marking required by the CDS (e.g. customer's identification number).

2.8 Ordering information

Printed boards shall be ordered by quoting the CDS. This shall contain all information necessary to define the printed board clearly and completely or make reference to that information in an appropriate way.

3. Capability approval and maintenance of capability approval

3.1 General

This clause states the requirements and procedures for obtaining capability approval and for the maintenance of capability approval.

In the case of printed boards a manufacturers capability is divided into

- basic capability. This is assessed using test specimens standardized in the relevant SS
- additional capability. This is assessed using test specimens suitable for demonstrating the claimed additional capability of his facilities and processes.

See also 1.4.

3.2 Capability approval requirements

The general rules as laid down in CECC 00107-III shall apply.

A manufacturer wishing to obtain capability approval for printed boards shall

- prepare a description of capability (see 3.3.)
- prepare an abstract of the description of capability for publication in the relevant QPL (see 3.4)
- demonstrate capability (basic and additional, if applicable; see 3.5)
- prepare a capability approval test report (see 3.6).

3.3 Description of capability

The manufacturer shall describe in a suitable way the capability for which he is seeking approval and which he is prepared to demonstrate in the capability approval tests, and list the specifications for process control and materials used.

The description of capability may be presented by means of a capability manual if national practice provides for this.

3.4 QPL-information

When capability approval is granted, the manufacturer shall provide the following information for publication in the relevant QPL:

- Reference to the SS
 - 1) Reference to the CECC-Cap DS
 - 2) Reference to the National Cap DS (if any)
 - 3) Variants covered (quoted in the order as given in the relevant Cap DS)

- 4) Manufacturers name and address and country of manufacture
- 5) Abbreviations for the variants covered (quoted in the order as given in the relevant Cap DS)
- 6) Information on any additional capability
- 7) Date of approval
- 8) Approving authority.

The format of CECC 00200 i.e. the QPL of CECC (including an example of entries), is given in Appendix C.

3.5 Demonstration of capability

3.5.1 Test programme

The manufacturer shall demonstrate his ability to produce printed boards of acceptable quality in conformance with the requirements of this GS, the appropriate SS, and the appropriate Cap Ds.

The Chief Inspector shall prepare a programme for the assessment of the claimed capability to the satisfaction of the ONS. This programme shall be so designed that the claimed capability will be assessed and shall include the following:

- reference to the Cap DS to which the Basic capability is claimed
- details of the test specimen for the additional capability
- details of inspection requirements and test conditions for the additional capability.

Tables showing inspection requirements and tests for the basic capability qualifying components are given in the relevant Cap DS.

Where the capability qualifying components are designed and produced solely for the purpose of obtaining capability approval, the manufacturer shall satisfy the ONS that the same controls and disciplines are applied the normal production.

The tests shall be carried out by the manufacturer using his own approved testing facilities or by a test laboratory approved by CECC.

3.5.2 Basic Capability

Each manufacturer shall make the number of composite test patterns specified in the relevant SS. The test patterns required for the capability approval shall be spaced out evenly in production so that an average assessment can be made. The test patterns are shown in the relevant SS. The test specimens shall be subjected to the tests stated in the relevant Cap DS.

3.5.3 Additional Capability

The additional capability covers features such as

- the maximum size of printed boards (active area) that can be processed if larger than the size of the composite test pattern as specified in the relevant SS
- the ratio of board thickness to diameter of plated-through holes experienced in production if larger than the ratio included in the composite test pattern as specified in the relevant SS
- the smallest nominal conductor width and/or spacing experienced in production if smaller than those included in the composite test pattern as specified in the relevant SS
- the maximum number of layers experienced in the production of multilayer printed boards if larger than that included in the composite test pattern as specified in the relevant SS
- solderability after accelerated ageing, with ageing conditions, packaging conditions (if applicable), and the use of non-activated flux (if applicable) being specified.

Capability approval covering two or more additional features does not necessarily imply that each and every combination of all extremes is possible.

The test specimens for the assessment of the additional capability shall preferably be the relevant specimen of the composite test pattern as specified in the SS but modified so as to be suitable for demonstrating the additional capability. If the composite test pattern does not provide for this possibility or if the use of a modified specimen of the composite test pattern is not desirable, suitable additional test specimens shall be used.

For the assessment of the additional capability the manufacturer shall

- produce suitable test specimens
- state the test method to be used and the requirements to be fulfilled, if a standard test method (see CECC 00010) is applicable
- fully define the test method, and state the requirements to be fulfilled and the acceptance level to be applied, if a special test method is necessary.

Where a test for demonstrating additional capability covers the relevant test for demonstrating basic capability, only the additional capability need to be tested.

3.6 Capability Approval Test Report

The manufacturer shall prepare and provide the test report in accordance with the national practice.

3.7 Range of Capability Approval

3.7.1 Range of Approval of Basic Capability

Approval for multilayer printed boards will normally cover approval for the other types of rigid printed boards.

Approval for printed boards with plated-through holes will normally cover approval for printed boards with plain holes.

Approval for rigid printed boards with plain holes will apply to that type of printed board only.

Approval for flexible printed boards with through -connections will normally cover approval for flexible printed boards without through connections.

Approval for flexible printed boards without through-connections will apply to that type of printed board only.

3.7.2 Range of Approval of Additional Capability

Approval of additional capability will normally cover approval for all boards within the additional capability including approval of the basic capability as detailed in 3.7.1.

NOTE In certain cases, e.g. for multilayer printed boards having a smaller number of layers than approved for additional capability, or having a different ratio of total thickness to laminate thickness or a different combination of materials used for laminates and prepregs, consultation between customer and manufacturer may be necessary.

3.7.3 Enlarged range of Approval of Additional Capability

Additional capability approval may be granted on a particular customer's order enlarging any existing capability approval for that particular order.

NOTE This may be necessary where the existing capability approval does not entirely cover all features of the printed boards of a particular order and the manufacturer does not want to apply for a general extension of his approval, either for economic reasons (when one or few orders only are concerned) or to keep up with a fast technical development.

In that case, the enlarged additional capability approval is limited to the order considered.

If capability approval is granted on a particular order, that order shall be treated as a separate inspection lot, and all the relevant tests shall be performed. The tests may be performed on the production board or test specimens included in the panel or a separate composite test pattern in the same lot. The tests shall include all lot by lot tests required by the CDS but may include "C" or other tests.

NOTE A revision of this sub-clause is under consideration.