

Printed boards

Part 1: Generic specification

The European Standard EN 62326-1:2002 has the status of a British Standard

ICS 31.180

National foreword

This British Standard is the official English language version of EN 62326-1:2002. It is identical with IEC 62326-1:2002. It supersedes BS EN 62326-1:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic assembly technology, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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CENELEC

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Foreword

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Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annexes M and ZA are normative and annexes A, B, C, D, E, F, G, H, I, J, K and L are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62326-1:2002 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

IEC 62326 is applicable to printed boards, irrespective of their method of manufacture, when they are ready for the mounting of components.

IEC 62326 is composed of separate parts covering information for the designer, manufacturer, and user generic, sectional and capability detail specifications for the IECQ and requirements for the various types of printed boards.

IECQ is the IEC quality assessment system for electronic components. It is a third-party certification system. Its rules (including a description of the role of the inspectorates) are published in the following:

- IEC QC 001001: Basic Rules;
- IEC QC 001002: Rules of Procedure (several parts).

This part of IEC 62326 comprises the generic specification for printed boards of assessed quality and forms part of the sectional specifications and capability detail specifications circulated to the National Committees.

EXAMPLE

For rigid multilayer printed board the following standards apply: IEC 62326-1, IEC 62326-4 and IEC 62326-4-1.

All three standards should be considered jointly.

For further information regarding specification structure and inter-relationship between the specifications, see annex B.

PRINTED BOARDS –

Part 1: Generic specification

1 Scope

This part of IEC 62326 defines capability approval (CA) procedures for printed boards. When IECQ recognition is required, the capability approval procedures of IEC 001002 should be used. In addition, a technology approval (TA) schedule may also be provided as an alternative for manufacturers employing a system of process control for establishing product conformity. Both CA and TA procedures apply to printed boards irrespective of their methods of manufacture, when they are ready for the mounting of components. The information and requirements may also be used for second-party approvals or for self-declaration by a manufacturer of products covered by these specifications.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60194, *Printed board design, manufacture and assembly – Terms and definitions*

IEC 61182-1:1994, *Printed boards – Electronic data description and transfer – Part 1: Printed board description in digital form*

IEC 61189-3:1997, *Test methods for electrical materials, interconnection structures and assemblies – Part 3: Test methods for interconnection structures (printed boards)*

IEC 61249-2-4, *Materials for printed boards and other interconnecting structures – Part 2-4: Reinforced base materials, clad and unclad – Polyester non-woven/woven fiberglass laminated sheet of defined flammability (vertical burning test), copper-clad*

IEC 61249-2-7, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials, clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test), copper-clad*

IEC 61249-2-12, *Materials for printed boards and other interconnecting structures – Part 2-12: Sectional specification set for reinforced base materials, clad and unclad – Epoxide non-woven aramid laminate of defined flammability, copper-clad*

IEC 62326 (all parts), *Printed boards*

IEC 62326-4, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification*

IEC 62326-4-1, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification – Section 1: Capability Detail Specification – Performance levels A, B and C*

IEC QC 001001, *IEC Quality Assessment System for Electronic Components (IECQ) – Basic Rules*

IEC 001002-1, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of procedure – Part 1: Administration*

IEC QC 001002-2, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of procedure – Part 2: Documentation*

IEC QC 001002-3, *IEC Quality Assessment System for Electronic Components (IECQ) – Rules of procedure – Part 3: Approval procedures*

IEC QC 001005, *Register of Firms, Products and Services approved under the IECQ System, including ISO 9000*

ISO 9001:2000, *Quality management systems – Requirements*

3 General

3.1 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 are agreed between manufacturer and customer;
- although they are made in considerable total quantities, the production quantity of a particular printed board may be small.

The qualification approval procedures detailed in clause 3 of IEC QC 001002-3 are not considered suitable for the approval of printed board manufacturers, and the capability approval procedures of clause 4 of IEC QC 001002-3 shall be applied. Additionally, the manufacturer shall demonstrate that the quality management system complies with ISO 9001, as appropriate. Manufacturers seeking IECQ capability approval shall hold IECQ organization approval in accordance with clause 2 of IEC QC 001002-3 as a prerequisite.

In the case of printed boards, capability approval is based on the use of capability test board (CTB) or suitable production printed board (PPB) as capability qualifying components with an appropriate selection of test methods and requirements for each type of printed board, for example:

- rigid single and double-sided printed boards without interlayer connections;
- rigid single and double-sided printed boards with interlayer connections;
- rigid multilayer printed boards with interlayer connections;
- flexible multilayer printed boards with interlayer connections.

NOTE This list is not intended to be exhaustive. Conductive holes may be achieved by plating-through, by other metallization techniques or by deposit of conductive polymeric materials. Requirements for non-plated-through conductive holes are under consideration.

An important requirement of capability approval is that a manufacturer shall demonstrate the claimed capability to manufacture a given product. This capability approval system is described in clause 5.

In the case of printed boards, product and process capability are differentiated (see also 5.1, 5.5.2 and 5.5.3) and are defined in an IEC capability detail specification (Cap DS).

Capability detail specifications (Cap DSs) have been prepared for use with the IEC 62326 series. Further Cap DSs may be prepared by approved manufacturers, user groups or national standards bodies, and shall be registered by IEC. The format of such Cap DSs shall be based upon those published by IEC and shall comply with the system requirements for the publication of detail specifications.

Product capability is the capability to manufacture a product of defined characteristics.

Examples of product characteristics include:

- 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.

Process capability is the capability to use processes for the manufacture of printed boards as defined in the Cap DS.

Examples include:

- processing of computer-aided design (CAD) data;
- electrolytic copper plating;
- tin lead plating;
- solder resist application.

Materials used to produce printed boards are specific to the product type and have an influence on printed board performance. Appropriate materials are described in the Cap DS.

Examples of base materials include:

IEC 61249-2-7;
IEC 61249-2-12.

3.2 Structure of the specification series

Although printed boards differ from other electronic components, the specifications as described in the rules of procedure for components under the qualification approval procedure will be used as far as practicable.

All levels of specifications have essentially the same significance for both components under qualification approval and printed boards under capability approval.

These are as follows:

- basic specifications;
- generic specification;
- sectional specifications;
- blank detail specifications;
- detail specifications.

Basic specifications (BS) are applicable to all electronic components, for example, basic environmental tests, SI units, etc.

The generic specification (GS) for printed boards is this standard.

Each sectional specification (SS) covers one type of printed board, for example, rigid single and double-sided printed boards with interlayer connections, rigid multilayer printed boards with interlayer connections, etc.

The SS gives the requirements, test specimens and test sequence which are applicable for a performance level (PL).

A performance level is a level of requirements of a characteristic.

The combination of test schedule (for example, number and type of tests), performance level and sample size selection is called assessment criteria. Applicable assessment criteria are specified in table 1 of the relevant SS.

A blank detail specification is not applicable to printed boards. For printed boards two different types of detail specifications are in use:

- capability detail specification (Cap DS);
- customer detail specification (CDS).

The capability detail specification (Cap DS) fully describes the capability qualifying component (CQC) and applies one of the performance levels of the SS to that CQC, for example:

- performance level A;
- performance level B;
- performance level C;
- performance level X.

Performance level A is intended for printed boards used in products with a low environmental stress and low consumer expectation (for example, toys, electronic games and non-critical consumer or industrial control devices, etc.). These boards represent low-cost alternatives due to reduced inspection and testing.

Performance level B is intended for printed boards which meet a higher environmental stress and higher consumer expectations (for example, critical industrial control devices, telecommunication equipment, computers, etc.) than performance level A but lower than performance level C.

Performance level C is intended for printed boards used in products where continued performance is critical, equipment downtime cannot be tolerated or the equipment is a life-support item (for example, medical electronics, automotive engine part, etc.). These boards incur much higher costs due to the required materials, process complexity, inspection and testing.

Performance level X is available for use by manufacturers and their customers where levels A, B and C do not adequately address the needs of their product and/or business. The levels of capability demonstration and requirements for quality conformance inspection shall be defined in a capability detail specification registered by the IEC.

The customer detail specification (CDS) describes the product to be delivered, i.e. the custom designed printed board. The customer prescribes the assessment in accordance with one of the performance levels given in the SS. Products to be manufactured should be addressed to manufacturers that have approved capability for the corresponding performance level or higher.

The performance levels quoted in a CDS can be as follows:

- performance level A in accordance with table 1 of the SS
- performance level B (for example, see IEC 62326-4)
- performance level C
- a combination thereof
- performance level X

Performance level A is the minimum assessment criteria.

Performance level B consists of a more stringent performance and assessment criteria than performance level A.

Performance level C consists of a more stringent performance and assessment criteria than performance level B.

Performance level X is defined by a published Cap DS and may make reference to existing IEC 62326 standards. The IEC 62326 series Cap DSs shall be used wherever possible to reduce the proliferation of similar documents.

Where assessment criteria differ from the performance levels given in table 1 of the SS, for example, comprising additional tests (see 7.2.6.2), and/or more severe sample size selection is necessary, it shall be described in the CDS. This performance level is called level X. In no case shall the performance level required by a CDS be lower than performance level A as specified in the relevant SS.

When performance level X requires testing of characteristics not listed in the relevant SS, an appropriate test of IEC 61189-3 shall be used.

If a new test not covered by IEC 61189-3 is necessary, the CDS shall contain complete information regarding test method, conditions and requirements, specimens to be tested, test circuits, sample size selection and performance level.

For special performance requirements the customer has the responsibility for establishing these requirements.

NOTE The customer is reminded of the possibly increased cost of including additional tests or specifying unnecessarily tight sample size selection.

The Cap DS and CDS each have two functions:

- to define the conditions of testing and qualification;
- to describe the product to be delivered.

A survey of the structure of the specification series is given in annex B. Further details of both Cap DS and CDS, as well as rules for their preparation, are given in clause 7.

4 Particular stipulations

4.1 Primary stage of manufacture

The primary stage of manufacture is defined as the incoming inspection of the materials used for the manufacturing of the printed board materials (i.e. copper-clad laminates, plating chemicals, solder resist, etc.) prior to processing.

This stage, and all subsequent processes, shall be carried out under the authority of the designated management representative (DMR) with defined authorities (formerly known in the IECQ as the chief inspector). Where this first and subsequent stages of processing are carried out by a subcontractor, capability approval may be granted provided that in each case the equivalent disciplines apply.

4.2 Structurally similar printed boards

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

- the same types of base material, for example, 61249-2-4-IEC-EP-GC-Cu;
- the same type of printed board, for example, rigid single and double-sided printed boards without interlayer connections or rigid single and double-sided printed boards with interlayer connections or rigid multilayer printed boards with interlayer connections;
- the same type of surface finish, for example tin-lead and/or gold and/or copper;
- approximately similar product complexity.

4.3 Certified records of released lots (CRRL)

The content of *certified records* shall be as prescribed in 6.1 and 6.2 of this GS and in the relevant SS, stating the number of specimens tested.

4.4 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 3X07 as specified for quality conformance inspection, in the relevant CDS; (to include the specified baking requirement of Test 3X07).
- visual examination of the appearance, as specified for quality conformance inspection in the relevant CDS.

4.5 Release for delivery before the completion of all tests

The manufacturer is permitted, with the agreement of the customer, to release printed boards before the completion of periodic (monthly or quarterly) tests or lot inspection tests which take more time (for example, solder test after accelerated ageing).

4.6 Re-submission of rejected lots

Where a sample fails to meet the requirements of a periodic test, action shall be taken in accordance with 4.2.10 of IEC QC 001002-3.

4.7 Marking of printed boards and package

4.7.1 Printed boards

Each printed board shall be clearly and permanently marked with the reference specified by the customer.

The marking may, for example, be printed with permanent ink, be formed with a metal pattern, be integrated as part of the permanent polymer coatings, etc.

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

The location of any marking shall be agreed between manufacturer and customer.

4.7.2 Package

The package shall be marked with the information given in 4.7.1 and any special marking required by the CDS (for example, customer's identification number).

4.8 Ordering information

Printed boards shall be ordered in accordance with the CDS. The CDS shall contain or reference all information necessary to define the printed board clearly and completely.

5 Capability approval and maintenance of capability approval

5.1 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 manufacturer's capability is divided into two parts:

- product capability. This capability is defined in the IEC Cap DS. The materials used to make the product covered by the SS are also specified in the Cap DS. Examples of product characteristics are board size, hole diameter, number of layers, etc.;
- process capability. This capability, also defined in the Cap DS, is granted for defined processes. Examples of processes are "in-house" photoplotting, gold plating, solder coating (levelled), etc.

See also 3.1.

5.2 Capability approval requirements

The general rules as laid down in clause 2 of IEC QC 001002-3 shall apply.

A manufacturer wishing to obtain capability approval for printed boards shall:

- prepare a description of capability (see 5.3);
- prepare an abstract of the description of capability for publication in IEC QC 001005; (see 5.4),
- demonstrate capability (product and process; see 5.5);
- prepare a capability approval test report (see 5.6).

These requirements are most readily accommodated by the development of a capability manual. Annexes E to L provide guidance on the format and content of a capability manual for use with the IEC 62326 series.

5.3 Description of capability

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

The description of capability shall be presented in accordance with the relevant Cap DS.

5.4 Register of firms, products and services information (RFPS)

When capability approval is requested, the manufacturer shall identify the product (printed board characteristic) and the processes (manufacturing stages) to be published in the RFPS.

A manufacturer will be listed as an organization in part 1 of IEC QC 001005. An abstract of the manufacturer's capability will be included in part 2 of IEC QC 001005.

The information shall, as a minimum, contain the following:

- reference to the SS;
- reference to the Cap DS;
- performance level;
- material for which approval has been granted;
- processes used to manufacture the product as quoted in the relevant Cap DS;
- product characteristics as quoted in the Cap DS and demonstrated by the CQC (see annex C);
- manufacturer's name, address, and country of manufacture;
- identification codes for the aspects covered (quoted in the order as given in the relevant Cap DS);
- information on type of capability that was approved;
- date of approval;
- approving authority.

Where a manufacturer is approved to level X, the RFPS and capability approval certificate shall clearly identify the number of the IECQ registered Cap DS against which the approval has been granted.

5.5 Demonstration of IECQ capability

Demonstration of IECQ capability shall meet or exceed all requirements stated in the relevant Cap DS for the claimed product capability. Capability already recognized under other established capability systems may contribute to obtain an IECQ-recognized capability, provided that the total capability demonstrated is judged to be sufficiently equivalent to the full IECQ requirements for the claimed capability. The judgement is made by the relevant national supervising inspectorate (NSI). In case of dispute, the details shall be forwarded to the IECQ certification management committee (CMC) who shall, in conduction with an appropriate National committee, be responsible for arbitration.

5.5.1 Test programme

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

The DMR shall prepare a programme for the assessment of the claimed capability. This programme shall be so designed that the claimed capability will be assessed completely and shall include the following:

- reference to the Cap DS and performance level to which the capability is claimed;
- details of the test specimens or production boards used to establish capability;
- details of inspection requirements and test conditions for the capability.

Tables showing inspection requirements and tests for the capability qualifying components (CQC) 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 same controls and discipline as used in the normal production shall be applied.

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

The test methods detailed in the IEC 62326 series are from IEC 61189-3. However, it is permitted by clause 2 of IEC QC 001002-3 to substitute these methods with testing of equal or greater severity. Therefore, test data produced for other approval regimes (for example military, CENELEC ¹⁾, etc.) may be used in lieu of the IEC 61189-3 tests, where this is acceptable to the approval authority. Such test data may only be accepted where the testing has been carried out by the approved manufacturer or by an approved test laboratory.

5.5.2 Product capability

A capability qualifying component (CQC) may be either a capability test board (CTB), a capability test segment (CTS), a production printed board (PPB) or an individual test specimen (ITS). See annex C.

Each manufacturer shall make a sufficient number of test specimens to meet the test conditions of the particular Cap DS.

¹⁾ European Committee for Electrotechnical Standardization.