

Printed wiring boards —

Part 6: Specification for multilayer rigid printed boards

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Cooperating organizations

The Electronic Components Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

- British Electrical and Allied Manufacturers' Association (BEAMA)
- Electricity Supply Industry in England and Wales*
- Electronic Components Industry Federation*
- Electronic Engineering Association*
- Institution of Electronic and Radio Engineers
- Ministry of Defence*
- National Supervising Inspectorate*
- Post Office*
- Society of British Aerospace Companies Limited*
- Telecommunications Engineering and Manufacturing Association (TEMA)*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

- Association of Circuit Technologists
- British Plastics Federation
- British Radio Equipment Manufacturers' Association
- Electrical Research Association
- Institute of Metal Finishing
- Institution of Production Engineers
- Scientific Instrument Manufacturers' Association
- Society of Motor Manufacturers and Traders Limited

This British Standard, having been prepared under the direction of the Electronic Components Standards Committee, was published under the authority of the Board of BSI and comes into effect on 29 January 1982

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The following BSI references relate to the work on this standard:
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National foreword

This British Standard, published under the direction of the Electronic Components Standards Committee is identical with Publication 326-6 “*Specification for multi-layer printed boards*” published in 1980 and Amendment No. 1 to that standard published in 1983 by the International Electrotechnical Commission (IEC).

This Part of this standard represents a partial revision of BS 4597:1970. When sufficient Parts of BS 6221 are published, BS 4597:1970 will be withdrawn.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

In clause 1 and 1.1 where the words “IEC Publication 326” and “IEC Publication 326-6” appear, they should be read as “BS 6221” and “BS 6221-6” respectively.

Cross-references

International Standard	Corresponding British Standard
IEC 68	BS 2011 <i>Basic environmental testing procedures</i>
IEC 97:1970	BS 5830:1979 <i>Specification for grid system for printed circuits</i> (Identical)
	BS 6221 <i>Printed wiring boards</i>
IEC 326-2:1976 (and IEC 326-2A:1980)	BS 6221-2:1982 <i>Methods of test</i> (Identical)
IEC 326-3:1980	BS 6221-3:1982 <i>Guide for the design and use of printed wiring boards</i> (Identical)
IEC 326-4:1980	BS 6221-4:1982 <i>Method for specifying single and double sided printed wiring boards with plain holes</i> (Identical)
IEC 326-5:1980	BS 6221-5:1982 <i>Method for specifying single and double sided printed wiring boards with plated-through holes</i> (Identical)

There is no British Standard corresponding to IEC Publication 194 “*Terms and definitions for printed circuits*”, referred to in clause 8. The Technical Committee has reviewed the provisions of IEC 194 and has decided that they are suitable for use with this standard.

The remaining standards listed in 1.2 have been given for information purposes only. A related British Standard for IEC 249 is BS 4584 “*Metal-clad base materials for printed circuits*”. Consideration will be given to implementing IEC 326-1, IEC 326-7 and IEC 326-8 as British Standards when these International Standards have been published by IEC.

Additional information. Amendment No. 1 to IEC Publication 194 “*Terms and definitions for printed circuits*”, referred to in clause 8, is not yet available. For ease of reference, the following definitions are those proposed for international adoption by the IEC in document 52 (Central Office) 248.

- a) **Test pattern.** A conductive pattern used for carrying out a test. A test pattern may consist of:
 - 1) a part of the conductive pattern on a production board (and used in the application of that printed board); or
 - 2) a special test pattern particularly designed and prepared for the purpose of testing only.

This (special) test pattern may be located:

- i) on a test coupon (i.e. a portion of a printed board or a panel usually cut off prior to using the printed board, see IEC Publication 194-05-03); or
- ii) on a separate test board (see IEC Publication 194-05-02).

b) **Composite test pattern.** A combination of two or more different test patterns.

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 22, 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 Introduction

IEC Publication 326 is applicable to printed boards, irrespective of their method of manufacture, when they are ready for the mounting of the components.

It is divided into separate parts covering information for the designer, recommendations for the specification writer, test methods and requirements for the various types of printed boards, for example single and double sided, multilayer and flexible printed boards.

1.1 Purpose of Part 6

IEC Publication 326-6 contains fundamental information on characteristics to be assessed and requirements for multilayer printed boards.

1.2 Associated IEC publications

This standard shall be used in conjunction with the following IEC publications:

- 68: *Basic Environmental Testing Procedures.*
- 97: *Grid System for Printed Circuits.*
- 194: *Terms and Definitions for Printed Circuits.*
- 249: *Metal-clad Base Materials for Printed Circuits.*
- 326-1: *Printed Boards, Part 1: Instructions for the Specification Writer* (under consideration).
- 326-2: *Part 2: Test Methods.*
- 326-3: *Part 3: Design and the Use of Printed Boards.*
- 326-4: *Part 4: Specification for Single and Double Sided Printed Boards with Plain Holes.*
- 326-5: *Part 5: Specification for Single and Double Sided Printed Boards with Plated-through Holes.*
- 326-7: *Part 7: Specification for Flexible Printed Boards without Through Connections* (under consideration).
- 326-8: *Part 8: Specification for Double-sided Flexible Printed Boards with Through Connections* (under consideration).

2 Scope

This standard is applicable to multilayer printed boards irrespective of their method of manufacture. It is intended as a basis on which agreements between purchaser and vendor can be made. The term “relevant specification” used herein refers then to such agreements.

3 Object

To define the characteristics to be assessed, the test methods to be used and to establish uniform requirements for judging properties and dimensions.

4 General

The following tables contain all important characteristics and make reference to the appropriate tests to verify these characteristics.

Unless otherwise specified, all of the tests listed in Table I, page 3, shall be carried out. Where the relevant specification specifically claims additional characteristics which require additional tests, the relevant tests shall be selected from Table II, page 9.

Where additional details for a test must be specified in the relevant specification, this is indicated by an asterisk in the relevant column. These details shall then be specified in accordance with IEC Publication 326-2.

The tables are not intended to prescribe a test sequence, the tests may be carried out in any sequence, unless otherwise specified.

The sample quantity shall also be specified by the relevant specification.

5 Test specimens

The tests shall preferably be carried out on production boards.

Where the use of test coupons is agreed, they shall be prepared in accordance with Sub-clause 4.2 of IEC Publication 326-2. A suitable test pattern is shown in Figure 1, page 14.

6 Relevant specification

The relevant specification contains all information necessary to define the printed board clearly and completely. The recommendations given in IEC Publication 326-3 shall be followed.

Care should be taken to avoid unnecessary requirements. Permissible deviations shall be stated where necessary and nominal values without tolerances or simple maxima or minima shall be given where sufficient. Where precise specifications are necessary for certain areas or parts of the printed board only, they shall be applied and restricted to those areas or parts.

If there are several possibilities of presentation, of tolerance classes, etc., the selections given in IEC Publication 326-3 shall be applied.

7 Characteristics of printed boards

(Table I and Table II.)

Table I — Basic characteristics

Characteristics	Test No. IEC Publication 326-2	Additional test details to be specified in the relevant specification	Specimen of composite test pattern	Requirements	Remarks
<i>General examination</i>					
<i>Visual examination</i>					
Conformity, identification	1	^a	Complete composite test pattern	Pattern, marking identification and material finishes shall comply with the relevant specification. There shall be no apparent defects	
Appearance and workmanship	1a			The boards shall appear to have been processed in a careful and workmanlike manner, in accordance with good current practice	
Plated-through holes				Plated-through holes shall be clean and free from inclusions of any sort that could affect component insertion and solderability	
				Total area of the voids shall not exceed 10 % of the total wall area. The largest dimension shall not exceed 25 % of the hole circumference in the horizontal plane and 25 % of the thickness of the board in the vertical plane	
				Plated-through holes shall have no plating voids at the interface of the hole wall and the conductive pattern or internal layer ring	
				The interface shall be considered to extend into the hole below the surface of the board a distance of one and a half times the total copper thickness on the surface or to be two times the inner layer copper thickness at level of contact ring	
	1c			Resin smear at the edge of the clad-copper and the continuous plated copper is permitted provided the smear does not interrupt electrical continuity	
				There shall be no circumferential cracks of the copper, or circumferential separation of the copper from the wall in the plated-through hole	
				Holes with plating voids shall not exceed 5 % of the total number of plated-through holes	
Conductor defects	1b			There shall be no cracks nor breaks. Imperfections such as voids or edge defects are permissible provided the conductor width or the leakage path between conductors is not reduced by more than specified in the relevant specification, for example 20 % or 35 %	Where necessary, this shall be verified by dimensional examination, using Test 2a

^a See the third paragraph of Clause 4.