

Printed wiring boards —

Part 21: Guide for the repair of printed wiring boards

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- Electronic Components Industry Federation
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Foreword

This British Standard has been prepared under the direction of the Electronic Components Standards Committee.

This Part of BS 6221, together with Parts 3 and 20, supersedes BS 5370:1976 “*Guide to printed wiring (design, manufacture and repair)*” which is withdrawn.

The text of this Part has been submitted to the International Electrotechnical Commission (IEC) for consideration as an international 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.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 18, 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 Scope

This Part of BS 6221 provides guidance on printed wiring board repairs that have to be carried out in the normal course of component assembly and test prior to release to the user. Some of the techniques described are suitable for use on repairs carried out in other circumstances, e.g. after acceptance by the user.

The repair of printed wiring boards covered in this guide falls into one of the following categories:

- a) corrective touch-up carried out as part of the normal production and inspection procedures, and used where minor defects occur;
- b) corrective action on more serious defects that in themselves would be cause for rejection;
- c) modifications requested by the customer;
- d) rectification of prescribed defects.

All the methods described are applicable to printed wiring boards for which the base material is metal clad/epoxy glass, epoxy paper or phenolic paper laminates.

A list of suitable tools and materials for carrying out the techniques described is given in Appendix A.

NOTE 1 Throughout this standard, the word "repair" is also used to cover modifications or rectifications.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of BS 6221, the definitions given in BS 6221-3 apply, together with the following.

2.1

rework

rectification of defects occurring during manufacture of the printed board

NOTE Rework is carried out by the board manufacturer before delivering the printed boards to the user.

2.2

repair, printed board

rectification of defects occurring after acceptance of the printed board by the user, i.e. during assembly and use

NOTE Repair is normally carried out by the user.

2.3

repair, printed board assembly

rectification of defects occurring after assembly, i.e. during testing and use, mainly the replacement of defective components

NOTE Repair is normally carried out by the user.

2.4

modification

change to the printed board or printed board assembly, including deletion and addition of components and conductors

2.5

lifted conductor

a conductor that has become detached from the base laminate but not broken

2.6

inclusion

any foreign body contained within the base copper-clad material or prepreg, or introduced between the base materials during processing

3 General

3.1 For unassembled printed wiring boards, the methods described in this standard may be used subject to the requirements of BS 6221-4 to BS 6221-8. It should be remembered that the defects on the unassembled printed wiring board fall into two groups:

Group 1: those that may be repaired without customer notification;

Group 2: those that require customer notification and approval before reworking.

It is essential that in both groups the methods of repair are limited to those not affected by soldering temperatures so that boards may be processed in the normal way. Typical examples of such methods are those involving welding, conductive compounds and plating.

NOTE Some of the recommended repair techniques involve a considerable amount of operator time; therefore, the cost-effectiveness of the operation should be taken into consideration.

In many cases alternative methods are quoted, and the choice may be influenced by the assembly method.

3.2 With the exception of the methods recommended for the repair of short circuits on the surface laminate (see clause 14), additional work on printed wiring boards, of any type, should only be performed with the full agreement of the customer.

3.3 With the exception of the methods recommended for multilayer repair (see clause 15), all of the repair methods have proved to be practicable in operation and acceptable in service. Multilayer repairs require a very high degree of skill and specialized equipment and should therefore be a matter of negotiation with the customer and be clearly defined in any repair contract or agreement.

3.4 It is recommended that the number of repairs carried out on an assembled printed wiring board should not exceed two. High-value printed wiring boards are an exception and should be treated on an individual basis.

3.5 Repairs should be carried out by trained and competent operators who have been nominated to do the work and who should be equipped with all the appropriate facilities. A detailed operator's procedure/capability manual, based upon the methods described in this guide, should be prepared for the type of repair to be carried out.

3.6 The recommended methods are, in general, not suitable for printed wiring boards with conductor widths/spacings of less than 0.25 mm. The conductor pattern may be critical in some assemblies, and this should be taken into account when assessing and agreeing the feasibility of the proposed repair.

3.7 A clear indication should be obtained from the customer, in a repair contract or agreement, of the extent of repairs that he is prepared to accept. Any method considered to be inapplicable should be clearly stated. It should be borne in mind that the customer may elect *not* to accept any repairs.

NOTE Repair should be permitted only when the cause of failure is understood, as a fault could be indicative of latent weaknesses elsewhere in the board(s), or in the production method.

3.8 If it is intended to use a material not described in this guide, the agreement of the customer should be obtained.

3.9 All repaired printed wiring boards should be clearly identified with a distinctive indelible marking. The marking should be non-conductive.

NOTE Component changes that cause no damage to the basic board are not deemed as repairs.

3.10 Repairs should not reduce the conductor current carrying capability and conductor spacings below the original allowed tolerance.

3.11 Where an original surface coating is removed, either completely or locally during the application of a repair method, it should be restored on completion of the work. In the event of the original coating being unobtainable, or its use being impracticable, a substitute acceptable to the customer should be employed.

3.12 On completion of the work, the printed wiring board(s) should be visually inspected at a suitable magnification. Other tests that may be required in order to meet the customer's specification should also be applied.

3.13 Assembled printed wiring boards offered for repair may contain static sensitive devices. Static charges occurring between the leads of the device can cause total component failure or degrade reliability.

Printed wiring boards containing static sensitive components will generally be identified by a warning label on part of the board and by the use of special packing materials.

When carrying out component changes/repairs to boards containing static sensitive devices, it is essential that these devices are protected against static electricity.

For more detailed information on the handling of static sensitive devices, see BS 5783.

4 Special precautions

It should be noted that some of the techniques used to effect repairs could be considered as hazards if used by untrained personnel; furthermore, some chemicals used may be harmful to the skin and eyes, or could be dangerous if taken orally. The instructions for use provided by the manufacturers of potentially hazardous materials should be strictly observed, and at all times strict hygiene has to be observed and full use made of protective measures, such as the use of barrier creams, gloves and eye protectors.

Personal hygiene on completion of such operations is essential.

NOTE Barrier creams can cause contamination problems on board surfaces that are subsequently to be bonded or soldered. Therefore, in those cases it is essential to avoid transfer of the cream from the operator to the board.

5 Removal and restoration of protective coatings

5.1 Removal. Where printed wiring boards requiring rework have a surface coating, this needs to be removed from the local rework area. Such coatings can be removed by the following methods.

a) *Use of a suitable solvent.* Typical solvents, depending upon the coating material, are xylene, trichloroethane and methylene chloride.

When using solvents care should be taken to ensure that boards, components and the operator are adequately protected from the hazards associated with the use of these materials.

b) *Abrasive removal.* This may be performed either manually or using miniature rotary powered methods.