IEC 61192-5

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Workmanship requirements for soldered electronic assemblies –
Part 5: Rework, modification and repair of soldered electronic assemblies

Exigences relatives à la qualité d'exécution des assemblages électroniques brasés –
Partie 5: Retouche, modification et réparation des assemblages électroniques brasés

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61192-5 has been prepared by IEC technical committee 91: Electronics assembly technology.

This bilingual version, published in 2008-05, corresponds to the English version.

The text of this standard is based on the following documents:

FDIS	Report on voting
91/652/FDIS	91/686/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61192 series, under the general title *Workmanship requirements for soldered electronic assemblies,* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

WORKMANSHIP REQUIREMENTS FOR SOLDERED ELECTRONIC ASSEMBLIES –

Part 5: Rework, modification and repair of soldered electronic assemblies

1 Scope

This part of IEC 61192 provides information and requirements that are applicable to modification, rework and repair procedures for soldered electronic assemblies. It is applicable to specific processes used to manufacture soldered electronic assemblies where components are attached to printed boards and to the relevant parts of resulting products. The standard is also applicable to activities that can form part of the work in assembling mixed technology products.

This part of IEC 61192 also contains guidance on design matters where they have relevance to rework.

NOTE Typical in-process surface-mount rework activities to which this standard applies are shown in Figure 1.

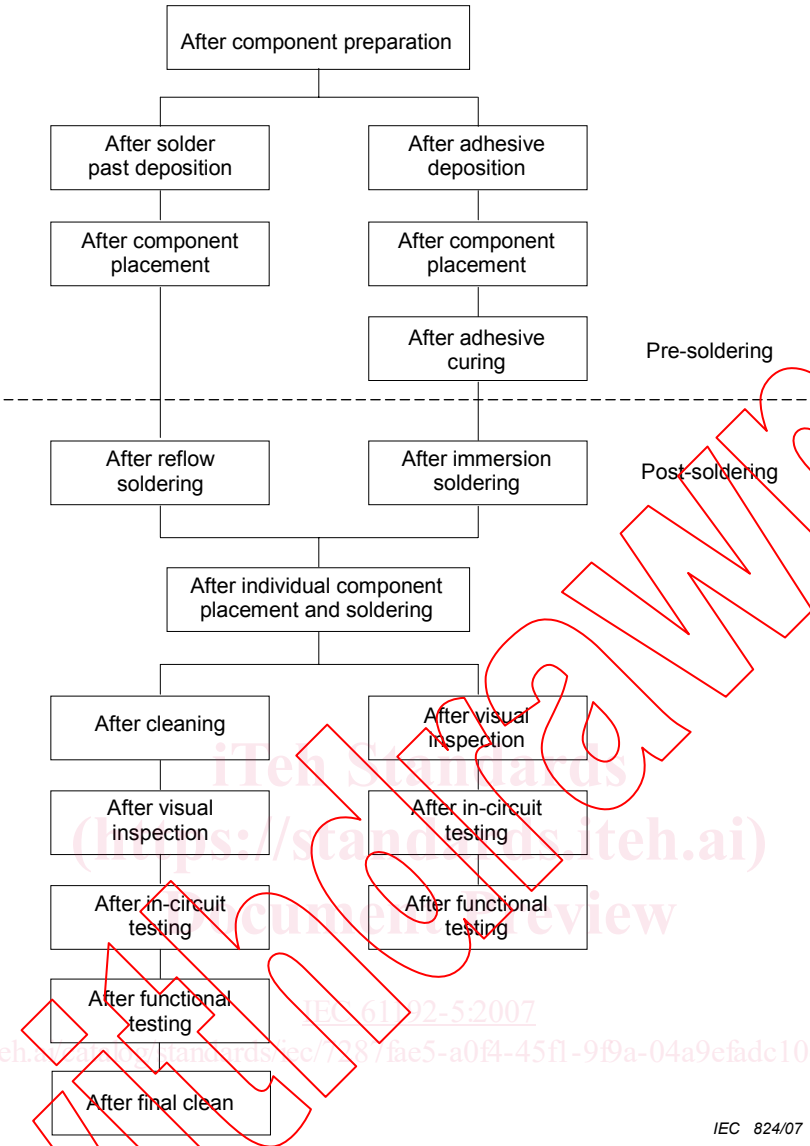

Figure 1 – Typical in-process modification, rework or repair activities

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 (only available in English)*

IEC 61190-1-1, *Attachment materials for electronic assembly – Part 1-1: Requirements for soldering fluxes for high-quality interconnections in electronics assembly*

IEC 61190-1-2, *Attachment materials for electronic assembly – Part 1-2: Requirements for soldering pastes for high-quality interconnects in electronics assembly (only available in English)*

IEC 61190-1-3, *Attachment materials for electronics assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications (only available in English)*

IEC 61191-1:1998, *Printed board assemblies – Part 1: Generic specification – Requirements for soldered electrical and electronic assemblies using surface mount and related assembly technologies*

IEC 61191-2:1998, *Printed board assemblies – Part 2: Sectional specification – Requirements for surface mount soldered assemblies*

IEC 61191-3, *Printed board assemblies – Part 3: Sectional specification – Requirements for through-hole mount soldered assemblies*

IEC 61191-4, *Printed board assemblies – Part 4: Sectional specification – Requirements for terminal soldered assemblies*

IEC 61192-1, *Workmanship requirements for soldered electronic assemblies – Part 1: General*

IEC 61192-2, *Workmanship requirements for soldered electronic assemblies – Part 2: Surface-mount assemblies*

IEC 61192-3, *Workmanship requirements for soldered electronic assemblies – Part 3: Through-hole mount assemblies*

IEC 61192-4, *Workmanship requirements for soldered electronic assemblies – Part 4: Terminal assemblies*

IEC 61193-1, *Quality assessment systems – Part 1: Registration and analysis of defects on printed board assemblies*

IEC 61249 (all parts), *Materials for printed boards and other interconnecting structures*

3 Terminology

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60194, some of which (marked with an asterisk) are repeated below for convenience, as well as the following, apply.

3.1.1
rework*
act of reprocessing non-complying articles, through the use of original or alternate equivalent processing, in a manner that assures compliance of the article with applicable drawings or specifications

3.1.2
repair*
act of restoring the functional capability of a defective article in a manner that precludes compliance of the article with applicable drawings or specifications

3.1.3
modification*
revision of the functional capability of a product in order to satisfy new acceptance criteria

3.1.4
anomaly chart
copy of an assembly drawing (or of an actual printed board assembly) that is used to record the location of faults or process indicators used for process improvement analysis

3.1.5
added component
electronic component that is mounted on a printed board by soldering or other attachment methods

3.1.6
embedded component
electronic component that is an integral part of a printed board, for example, embedded resistors, capacitive layers, printed inductors

3.2 Abbreviations

The following abbreviations are commonly used in relation to printed board assemblies. Not all of them are used in the text. Some are included for information only.

ASIC	application-specific integrated circuit
BGA	ball grid array
CLCC	ceramic leaded chip carrier
CLLCC	ceramic leadless chip carrier
LCCC	leadless ceramic chip carrier
LED	light-emitting diode
MELF	metal electrode face-bonded component
PLCC	plastic leaded chip carrier
PTFE	polytetrafluoroethylene
QFP	plastic quad flat package
RMA	rosin, mildly active
SMD	surface-mounted device
SMT	surface-mount technology
SO	small outline
SOD	small outline diode
SOIC	small outline integrated circuit
SOT	small outline transistor
TSOP	plastic thin small outline package

4 Classification of rework activities

4.1 Pre-soldering rework

This includes rework following:

a) component preparation;
b) deposition of solder (e.g. paste, preform, tinning);
c) deposition of adhesive;
d) component placement;

e) curing of adhesive.

NOTE In the context of this standard, the word “component” includes all added components, printed boards and any components that are manufactured integrally with the printed board.

4.2 Post-soldering rework

Post-soldering rework activities, not necessarily occurring in the order given, include:

a) preparation prior to rework or repair, for example, removal of conformal coating, preheating, baking, cleaning, removal of adjacent components and parts to enable access;
b) component realignment;
c) component removal;
d) addition of flux and solder to a joint;
e) removal of excess solder from a joint;
f) removal of excess solder or adhesive from the printed board prior to remounting a component;
g) placement and soldering of a replacement component;
h) post-rework cleaning (if required);
i) visual, thermal, mechanical and dimensional inspection and electrical test of reworked items.

4.3 Essential prerequisites for successful and reliable rework

The essential prerequisites for successful and reliable rework include the following:

a) suitable printed-board layout design to allow the preferred tool to be used for each component type;
b) confirmation of the type of solder used for the interconnection and selection of the appropriate process (tin/lead, lead free, other), and replacement material;
c) availability of the most efficient tool or equipment for the task plus antistatic protection;
d) sufficient knowledge at operator or inspector level to enable correct judgement on whether rework is necessary or will do more harm than good;
e) avoidance of rework processes that may create reliability hazards not detectable prior to shipment, for example, excessive thermal shock, intermetallic growth at the copper-to-solder interface;
f) appropriate operator skill level, particularly in rework or repair operations;
g) quality assurance conditions of printed boards, components and materials;
h) ergonomically designed rework /repair stations;
i) management of rework working conditions;
j) effective training and verification (certification);
k) documented rework, repair procedures;
l) control of safety and environmental aspects.

The wide range of component terminations and lead configurations in use, and their differing resistance to thermal stress means that no single rework equipment is likely to be suitable for all purposes.

5 Pre-soldering rework

5.1 General

In all cases, appropriate corrective action should ensure that the causes of non-conformity are rectified. Further guidance is given in IEC 61192-1 and IEC 61192-2.

5.2 Reworking solder paste and non-conducting adhesive deposits

5.2.1 General

This should be carried out in accordance with 5.2.2 to 5.2.5. Further guidance is given in IEC 61192-2.

5.2.2 General misalignment or smudging of deposits

All the paste or adhesive should be thoroughly cleaned off the printed board. The printed board may be reused if it is cleaned properly, but paste and adhesive removed from boards should be discarded.

a) Unpopulated PCB

The unpopulated PCB should be cleaned in the cleaning machine as soon as possible. Only appropriate cleaning fluids should be used to clean the PCB.

b) Populated PCB

Before any cleaning, approval must be obtained from the process manager responsible for the component and assembly release before a PCB is cleaned in a cleaning machine. Usually localized cleaning will be permitted; however cleaning of the completed assembly should take place shortly after reflow in order to remove any cleaning residue. Other cleaning is not allowed as cleaning fluids could penetrate the component resulting in, as well as other things, corrosion, which may significantly influence the operational functionality of the component.

5.2.3 Local misalignment or smudging of deposit

If the defect is confined to one or a few sites and the required quantity of deposit and its location can be sufficiently controlled using manual methods, the local or smudged material can be removed and replaced using a syringe or other means of dispensing a single charge. If this is not the case, the recommendations given in 5.2.2 should be followed.

5.2.4 General paste or adhesive quantity incorrect

Reworking should be carried out in accordance with 5.2.2.

5.2.5 Local paste or adhesive quantity incorrect

Reworking should be carried out in accordance with 5.2.3.

5.3 Reworking placed components

5.3.1 General overall component misalignment

All the added components should be removed from the printed board and all items thoroughly cleaned. Care should be taken to identify the moisture level of the parts. The printed board may be reused if its cleanliness requirements are met, but all paste and adhesive removed from boards should be scrapped. If added components are to be reused (not recommended), for example, as spares for rework activity, they should be checked for mechanical damage (100 %) and retested electrically (100 %).