

Workmanship requirements for soldered electronic assemblies —

Part 3: Through-hole mount assemblies

The European Standard EN 61192-3:2003 has the status of a
British Standard

ICS 31.190

National foreword

This British Standard is the official English language version of EN 61192-3:2003. It is identical with IEC 61192-3:2002.

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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Workmanship requirements for soldered electronic assemblies
Part 3: Through-hole mount assemblies
(IEC 61192-3:2002)

Exigences relatives à la qualité
d'exécution des assemblages
électroniques brasés
Partie 3: Assemblage au moyen
de trous transversants
(CEI 61192-3:2002)

Anforderungen an die Ausführungsqualität
von Lötbaugruppen
Teil 3: Baugruppen in Durchsteckmontage
(IEC 61192-3:2002)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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

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Foreword

The text of document 91/334/FDIS, future edition 1 of IEC 61192-3, prepared by IEC TC 91, Electronics assembly technology, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61192-3 on 2003-02-01.

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- latest date by which the EN has to be implemented
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with the EN have to be withdrawn (dow) 2006-02-01

This standard should be used in conjunction with the following parts of EN 61192, under the general title *Workmanship requirements for soldered electronic assemblies*:

Part 1: General

Part 2: Surface-mount assemblies

Part 4: Terminal assemblies

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

In this standard, annex ZA is normative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61192-3:2002 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

This part of IEC 61192, combined with IEC 61192-1, is used to meet the end-product requirements defined in IEC 61191-1 and IEC 61191-3.

This standard may be used to enable the suppliers and users of through-hole electronic assemblies to specify good manufacturing practices as part of a contract.

The respective requirements and guidelines for surface-mount and terminal assemblies are included in separate but related standard.

WORKMANSHIP REQUIREMENTS FOR SOLDERED ELECTRONIC ASSEMBLIES –

Part 3: Through-hole mount assemblies

1 Scope

This part of IEC 61192 specifies general requirements for workmanship in through-hole mount soldered assemblies on organic substrates, on printed boards, and on similar laminates attached to the surface(s) of inorganic substrates.

It applies to assemblies that are totally through-hole or mixed assemblies that include surface-mounting or other related assembly technologies, for example, terminals, wires.

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

IEC 61191-2, *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 61192-4, *Workmanship requirements for soldered electronic assemblies – Part 4: Terminal assemblies*

3 Terms and definitions

For the purposes of this part of IEC 61192, the definitions of IEC 60194 apply.

4 General requirements

The requirements of IEC 61192-1 are mandatory for this standard.

4.1 Classification

The classification of assemblies is divided into three levels, that is, levels A, B, and C. Definitions of the classification categories and the status of product for each level are given in IEC 61192-1. In general, status is divided into three workmanship conditions, as follows:

- a) target;
- b) acceptable;
- c) nonconforming.

4.2 Conflict

Accept and/or reject decisions shall be based on applicable documentation such as contracts, drawings, specifications and reference documents.

In the event of conflict, the following order of precedence shall apply:

- a) procurement documents as agreed between user and supplier;
- b) master assembly drawing;
- c) IEC 61191-1 and IEC 61192-1;
- d) this standard;
- e) other documents to the extent that they are specified in this standard.

4.3 Inspection techniques

For visual inspection, individual specifications may call for magnification aids for examining printed-board assemblies.

Binocular vision should be used, and may be accomplished with a single large field magnifier. Magnification of at least 3× shall be used for conventional inserted printed-board assemblies. Magnification higher than 10× will not be found practicable for routine high speed scanning inspection, but will be needed sometimes for detailed diagnosis or referee purposes.

4.4 Interpretation of requirements

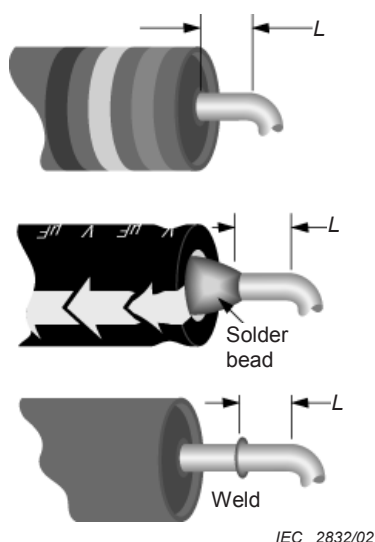
Unless otherwise specified by the user, the word "shall" signifies that the requirement is mandatory. Deviation from any "shall" requirement requires written acceptance by the user, for example, via assembly drawing, specification or contract provision.

The words "should" and "may" reflect recommendations and guidance, respectively, and are used whenever it is intended to express non-mandatory provisions.

5 Component preparation processes

Component preparation processes shall be carried out in accordance with the requirements of clause 6 of IEC 61192-1, using the methods described therein.

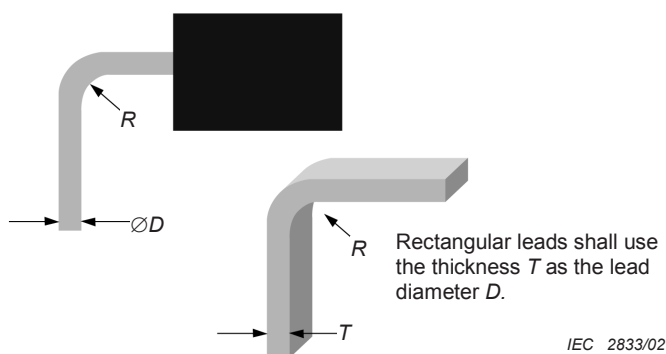
5.1 Lead forming



Acceptable – Level A, B, C

The straight portion of the lead L shall extend by at least one lead diameter or thickness, but not less than 0,8 mm from the body or weld before the start of the bend radius.

Figure 1 – Lead forming, lead extension



Acceptable – Level A, B, C

Lead is not kinked or cracked.

Figure 2 – Lead forming, bend radius

Table 1 – Lead bend requirements

D or T mm	Level A, B and C Min. R
$\leq 0,8$	$1 D$
0,8 to 1,2	$1,5 D$
$\geq 1,2$	$2 D$

5.2 Lead protrusion and clinching

This subclause applies to wires and component leads installation in printed boards in a straight through or clinched configuration.

5.2.1 Printed-board protrusion – Straight-through and partial clinching

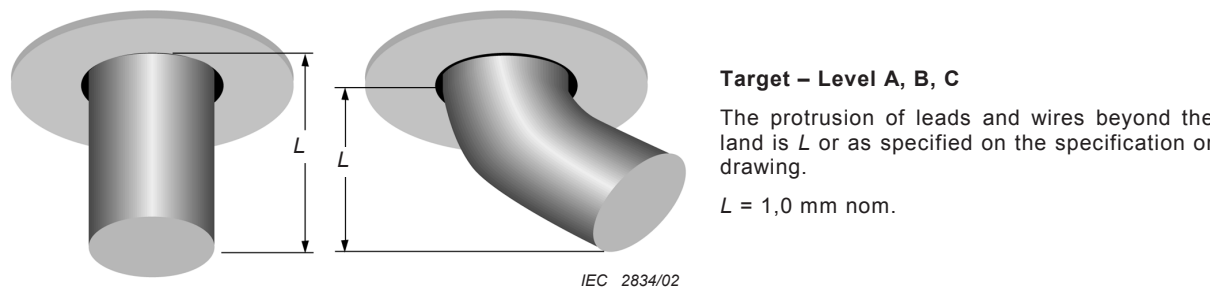


Figure 3 – Straight and partially clinched leads

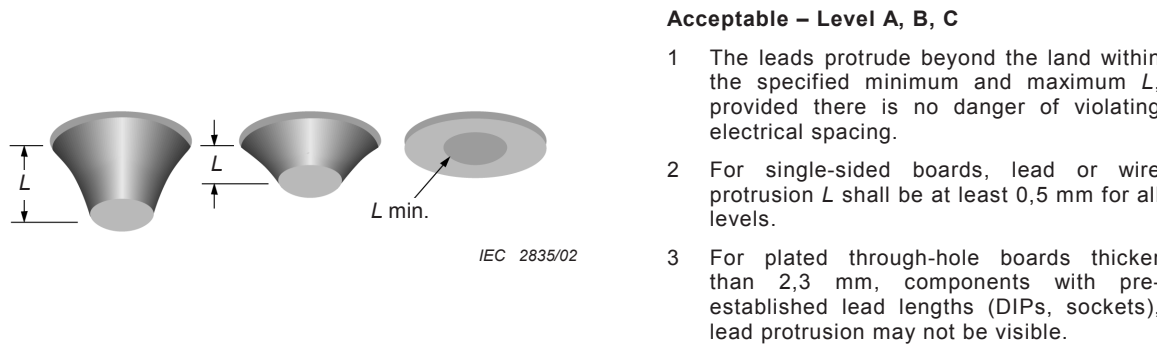


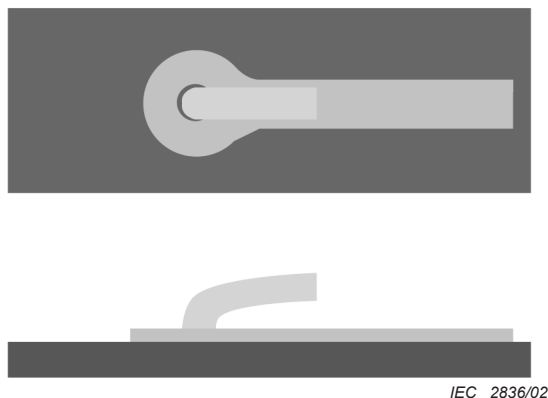
Figure 4 – Lead protrusion

Table 2 – Lead protrusion requirements

	Level B	Level C
$L \text{ min.}$ mm	End is visible in the solder	
$L \text{ max.}$ mm	2,5	1,5

5.2.2 Printed-board protrusion – Clinched leads

This subclause applies to terminations with a clinching requirement. Other requirements may be specified on relevant specifications or drawings.

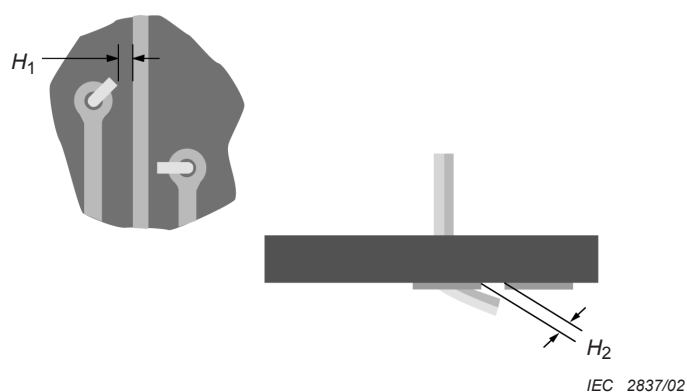


Target – Level A, B, C

- 1 The lead end is parallel to the board and the direction of the clinch is along the connecting conductor.

NOTE Multilead DIP packages may have two leads on opposite corners bent for retention before soldering.

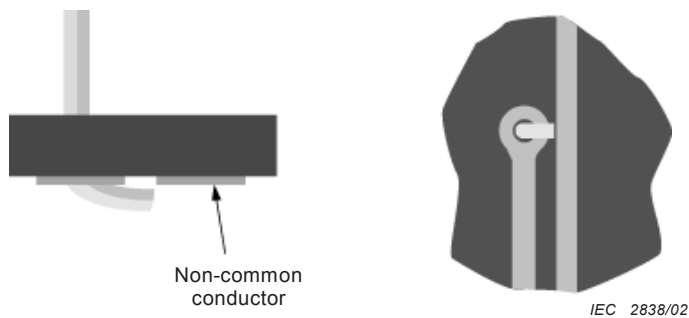
Figure 5 – Lead protrusion, clinched



Acceptable – Level A, B, C

- 1 Partially clinched leads shall be bent sufficiently to provide the necessary mechanical restraint during the soldering process. Alternate bend directions may be used. Diagonally opposite corner leads on DIPs may be partially clinched to retain parts during soldering operations. DIP leads should be bent outward away from the longitudinal axis of the body.
- 2 The height of the protrusion beyond the board is not greater than the similar length L allowed for straight-through leads (see 5.2.1).
- 3 The clinched lead does not reduce the separation between electrically non-common conductors ($H1$).

Figure 6 – Lead protrusion, partially clinched



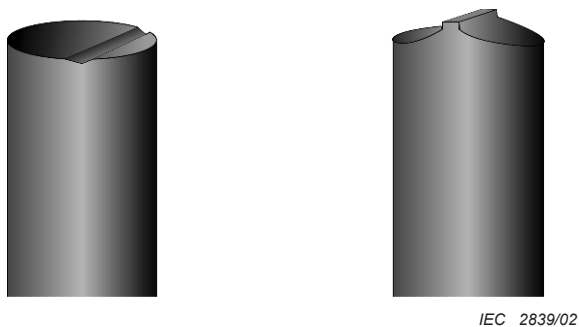
Nonconforming – Level A, B, C

- 1 The height of the end of the clinched lead extending beyond the board is less than L in Figure 3.
- 2 The clinched lead extends more than L in Figure 3, the maximum height allowed for straight-through leads.
- 3 The lead is clinched toward an electrically non-common conductor, reducing the separation so that shorting is likely.
- 4 Partial clinching of leads for part retention shall be considered as unclinched leads and shall meet the requirement of 5.2.1.

Figure 7 – Clinched lead – Nonconforming

5.3 Lead cutting/cropping

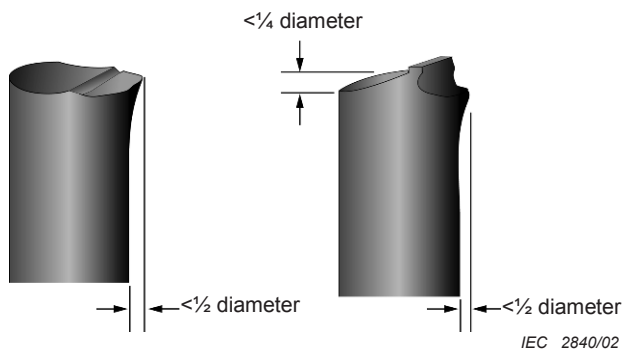
This subclause applies to component leads and wires which have been cut or cropped to defined lengths before or after insertion.



Target – Level A, B, C

- 1 Lead is not distorted.
- 2 Little cut remnant.
- 3 No evidence of wire debris.

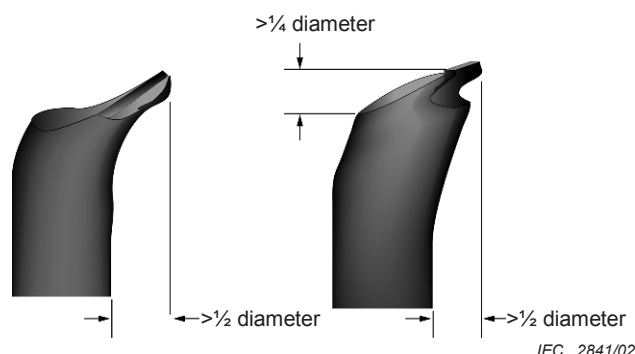
Figure 8 – Lead cutting, target



Acceptable – Level A, B, C

- 1 Lead distortion is less than half of the lead diameter.
- 2 The length of the cut remnant is less than one quarter of the lead diameter.
- 3 No evidence of wire debris.

Figure 9 – Lead cutting – Acceptable



Nonconforming – Level A, B, C

- 1 Lead distortion is more than half of the lead diameter.
- 2 Cut remnant is longer than one quarter of the lead diameter.
- 3 Evidence of loose wire debris.

Figure 10 – Lead cutting – Nonconforming

5.4 Pre-tinning

Component leads, terminations, and printed boards not meeting the designated solderability requirements may be prepared or reworked by hot solder dip tinning or other suitable methods prior to soldering. Tinned areas of wires shall not conceal the wire strand(s) with solder. Wicking of solder under wire insulation shall be minimized. When required, heat sinks shall be applied to leads of heat-sensitive parts during the tinning operation.

6 Masking attributes

When used, permanent and temporary solder masking shall preclude solder flow or wetting to the masked areas during all soldering processes.

The substrate and conductor materials shall not have been degraded by masking materials.

Temporary masks shall be readily removable without creating damage or leaving residues which are harmful to the integrity of the circuit wiring, conformal coating or assembly connectors, etc.

6.1 Misalignment

The solder mask shall not encroach onto lands, plated holes or other conductor surfaces intended to be wetted or coated with solder.

The solder mask shall cover all substrate conductor areas not intended to be wetted or coated with solder.

6.2 Improper adhesion

Some permanent solder-mask films may soften and wrinkle at soldering temperature, particularly where they cover a tin-lead finish on conductors. This is acceptable provided the following conditions are met.