

Solderless connections —

Part 1: Wrapped connections — General requirements, test methods and practical guidance

The European Standard EN 60352-1:1997 has the status of a
British Standard

ICS 29.120.20

National foreword

This British Standard is the English language version of EN 60352-1:1997. It is identical with IEC 60352-1:1997 including Corrigendum October 1998. It supersedes BS EN 60352-1:1997 (formerly BS 6516-1:1984) which will be withdrawn on 1998-07-01.

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This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 30, an inside back cover and a back cover.

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Board, was published under the authority of the Standards Board and comes into effect on 15 January 1998

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ISBN 0 580 28738 6

Amendments issued since publication

Amd. No.	Date	Comments
10406 Corrigendum	February 2000	Indicated by a sideline

Descriptors: Connections, solderless connections, wrapped connections, general requirements, test methods

English version

Solderless connections
Part 1: Wrapped connections — General requirements,
test methods and practical guidance

(IEC 60352-1:1997)

Connexions sans soudure
Partie 1: Connexions enroulées Règles
générales, méthodes d'essai et guide pratique
(CEI 60352-1:1997)

Lötfreie Verbindungen
Teil 1: Wickelverbindungen — Allgemeine
Anforderungen, Prüfverfahren und
Anwendungshinweise
(IEC 60352-1:1997)

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

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Foreword

The text of document 48B/590/FDIS, future edition 3 of IEC 60352-1, prepared by SC 48B, Connectors, of IEC TC 48, Electromechanical components and mechanical structures for electronic equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60352-1 on 1997-10-01.

This European Standard supersedes EN 60352-1:1994.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1998-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1998-07-01

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 60352-1:1997 was approved by CENELEC as a European Standard without any modification.

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Introduction

This part of IEC 60352 includes requirements, tests and practical guidance information.

Two test schedules are provided.

The basic test schedule applies to wrapped connections which conform to all the requirements of clause 4.

These requirements are derived from experience with successful applications of such wrapped connections.

The full test schedule applies to wrapped connections which do not fully conform to all the requirements of clause 4, for example those which are manufactured using materials or finishes not included in clause 4.

This approach permits cost- and time-effective performance verification using a limited basic test schedule for established wrapped connections and an expanded full test schedule for wrapped connections requiring more extensive performance validation.

1 Scope and object

This part of IEC 60352 is applicable to wrapped connections made with single solid round wires with nominal diameters of 0,16 mm minimum and appropriately designed posts for use in telecommunications equipment and in electronic devices employing similar techniques.

Information on materials and data from industrial experience are included in addition to the test procedures to provide electrically stable connections under prescribed environmental conditions.

The object of this standard is to determine the suitability of wrapped connections under specified mechanical, electrical and atmospheric conditions, and to provide a means of comparing test results when the tools used to make the connections are of different design or manufacture.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60352. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60352 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050(581):1978, *International Electrotechnical Vocabulary (IEV) — Chapter 581: Electromechanical components for electronic equipment*.

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance Amendment 1 (1992)*.

IEC 60352-5:1995, *Solderless connections — Part 5: Solderless press-in connections — General requirements, test methods and practical guidance*.

IEC 60512-1:1994, *Electromechanical components for electronic equipment — Basic testing procedures and measuring methods — Part 1: General*.

IEC 60512-2:1985, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods — Part 2: General examination, electrical continuity and contact resistance tests, insulation tests and voltage stress tests Amendment 1 (1994)*.

IEC 60512-6:1984, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods — Part 6: Climatic tests and soldering tests*.

IEC 60512-8:1993, *Electromechanical components for electronic equipment; basic testing procedures and measuring methods — Part 8: Connector tests (mechanical) and mechanical tests on contacts and terminations*.

IEC 60979:1989, *Wires for wire wrapping applications*.

ISO 468:1982, *Surface roughness — Parameters, their values and general rules for specifying requirements*.

ISO 1337:1980, *Wrought coppers (having minimum copper contents of 99,85 %) — Chemical composition and forms of wrought products*.

ISO 6507-1:1982, *Metallic materials — Hardness test — Vickers test — Part 1: HV 5 to HV 100*.

3 Definitions

For the purpose of this part of IEC 60352, the terms and definitions included in IEC 60050(581) and IEC 60512-1 and the following additional terms and definitions apply.

3.1

wrap post

a termination generally rectangular with sharp corners made to accept a wrapped connection [IEV 581-03-34, modified]

NOTE In this standard, the term “wrap post” is shortened to “post”.

3.2

wrapped connection

a solderless connection achieved by wrapping a solid conductor around a wrap post (see Figure 1) [IEV 581-03-10, modified]

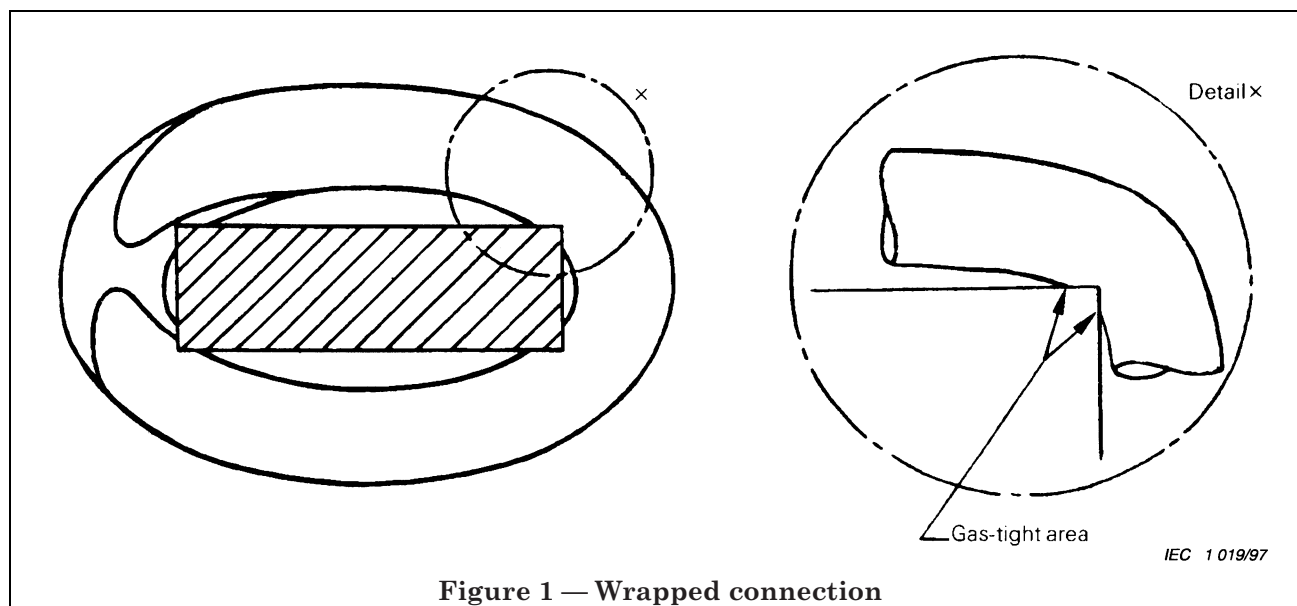


Figure 1 — Wrapped connection

3.3

conventional wrapped connection

a solderless connection achieved by wrapping a solid conductor around a wrap post without any contact of the wire insulation to the post (see Figure 2a) [IEV 581-03-45]

3.4

modified wrapped connection

a solderless connection achieved by wrapping a solid conductor around a wrap post with the wire insulation wrapped around at least three corners of the post (see Figure 2b) [IEV 581-03-44]

3.5

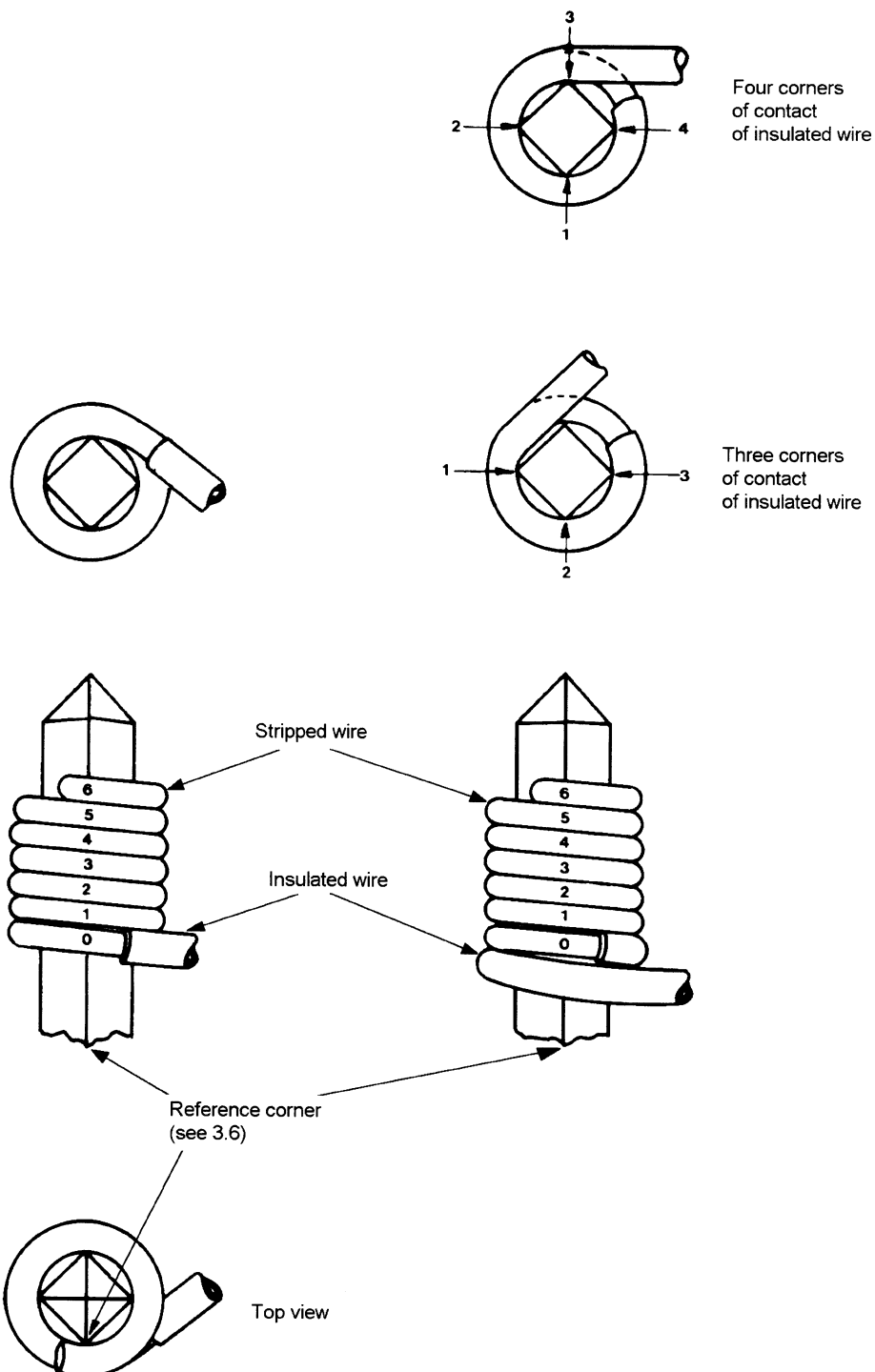
turn of wire

a single helical ring of wire wrapped 360° around a wrap post [IEV 581-03-65]

3.6

reference corner

that corner of the wrap post at which the stripped wire makes its first indentation and from which the number of wrapped turns is counted (see Figure 2) [IEV 581-03-38]



IEC 1 020/97

Figure 2a — Conventional wrapped connection

IEC 1 021/97

Figure 2b — Modified wrapped connection

Figure 2 — Reference corner

3.7**end tail**

the final portion of the last turn of wire in a wrapped connection which extends beyond the last corner of contact (see Figure 3) [IEV 581-03-54]

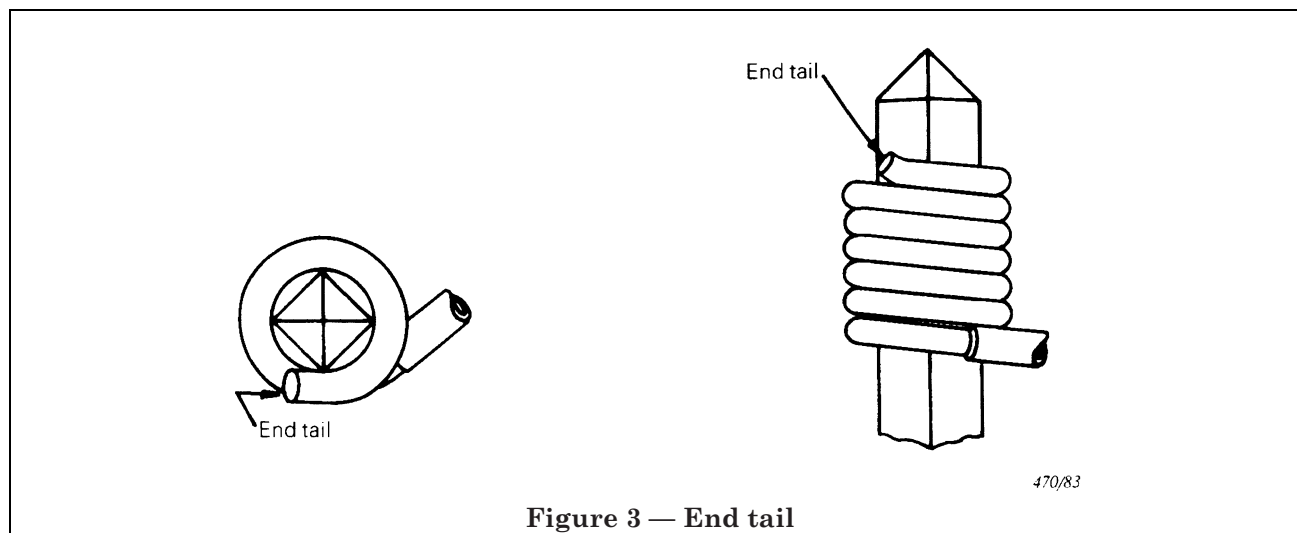


Figure 3 — End tail

3.8**gas-tight area**

the part of the contact area that is not affected by gases under specified conditions (see Figure 1) [IEV 581-03-64]

3.9**stripping force**

the force applied to the wrapped connection along the major axis of the post which breaks the gas-tight areas [IEV 581-03-55]

NOTE The gas-tight areas are broken by the initial movement of the connection along the post.

3.10**effective wrapping length**

that portion of a wrap post suitable and available for the application of the wrapped connection for which all requirements are fixed [IEV 581-03-60]

3.11**total post length**

the length of a post from the mounting plane to the tip [IEV 581-03-61]

3.12**hoop stress**

the tension in the wire induced by the wrapping operation and maintained by the wire being locked on the corners of the post [IEV 581-03-50]

4 Requirements

4.1 Workmanship

The connections shall be processed in a careful and workmanlike manner, in accordance with good current practice.

4.2 Tools

Tools shall be used and inspected according to the instructions given by the manufacturer.

4.2.1 *Wrapping tools*

The wrapping tool shall be capable of making uniformly reliable connections during its lifetime. It shall also make a neat closure of the last turn, without causing undue mutilation of the wrapping wire or post. The hole in the bit shall have a depth sufficient to accommodate the total length of the post (see **6.2.1** and **6.3.5.3**).

Tools are evaluated by testing wrapped connections made with the tools to be evaluated.

4.2.2 *Unwrapping tools*

Unwrapping tools shall not damage the post and shall completely remove the unwrapped wire from the post (see **6.2.2**).

4.3 Posts

4.3.1 *Materials*

Copper alloys with Vickers hardness of 95 HV 5 to 220 HV 5 when tested in accordance with ISO 6507-1 shall be used. Suitable alloys are brass, phosphor bronze, nickel-silver. When the hardness of the post is to be measured and Vickers hardness cannot be used due to the size of the indent, another suitable method such as diamond pyramid hardness or Knoop hardness may be used.

NOTE The hardness range 95 HV 5 to 120 HV 5 is mainly used for busbars incorporating wrap posts.

4.3.2 Cross-section

Table 1 lists 11 groups of post sizes and the relevant wire sizes for each.

Table 1 — Post and wire sizes

Post size			Wire size							
	Diagonal group ^b	Preferred (nominal) sizes	Nominal conductor diameter							
			mm							
			0,16	0,26	0,32	0,4	0,5	0,65	0,8	1,0
			Maximum insulation diameter ^a							
	mm	mm	mm							
			0,27	0,7	0,9	1,17	1,27	1,32	1,5	1,78
	0,41 – 0,431	0,3 × 0,3	Mod.	/	/	/	/		/	/
c	0,46 – 0,51	0,4 × 0,4	Mod.	Mod.	/	/	/	/	/	/
	0,5 – 0,565	0,4 × 0,4	Mod.	Mod.	/	/	/	/	/	/
	0,69 – 0,77	0,5 × 0,5	/	Mod.			/	/	/	/
	0,76 – 0,86	0,6 × 0,6	/	Mod.	Mod.	Mod. or Con.	/	/	/	/
c	0,77 – 0,825	0,635 × 0,635	/	Mod.	Mod.	Mod. or Con.	/	/	/	/
	0,84 – 0,91	0,635 × 0,635	/	Mod.	Mod.	Mod. or Con.	/	/	/	/
	0,95 – 1,20	0,8 × 0,8	/	Mod.	Mod.	Mod. or Con.		/	/	/
	1,35 – 1,78	1,0 × 1,0 0,8 × 1,4 0,8 × 1,6	/			Mod. or Con.	Mod. or Con.	Mod. or Con.	Mod. or Con.	/
	1,6 – 1,86	1,2 × 1,2 1,2 × 1,4	/			Mod. or Con.	Mod. or Con.	Mod. or Con.	Mod. or Con.	Mod. or Con.
	2,3 – 2,9	0,8 × 2,4	/	/	/	/		Mod. or Con.	Mod. or Con.	/
NOTE Mod. = modified wrapped connection. Con. = conventional wrapped connection. / = wrapped connection is not possible or not permitted. Blank = wrapped connection might be applied but the relevant combination of dimensions is neither recommended nor widely used.										
^a For the permitted maximum insulation diameter, see 6.3.6 .										
^b The relevant tool (bit) shall be chosen by the user.										
^c This diagonal group refers to chamfered posts, i.e. two corners of the post are chamfered, the other two are in accordance with 4.3.7 .										

4.3.3 Tolerance on post sizes

The dimensions of the post shall be such that the limits of the diagonals given in Table 1 are met. The diagonals include the effect of corner radii and burrs. The tolerance on post sizes shall comply with the relevant detail specification for the component.

NOTE Because posts are accommodated by round holes in the wrapping bits, it is necessary that their diagonals be within acceptable limits. Several cross-sections may fall into a diagonal range, but the tolerance on the diagonal is more important than the width and the thickness, or the tolerances thereon.

4.3.4 Length

The length of the post shall be as specified in the relevant detail specification.

NOTE It is considered desirable for the effective wrapping length of the post to be capable of accommodating up to three wrapped connections (see 6.3.5).

4.3.5 Parallelism

All posts shall have corners which are parallel within 0,05 mm per 10 mm over the entire effective wrapping length.

4.3.6 Straightness

The posts shall be free from bends and bows which might restrict the free entry of the post into the hole of the wrapping bit.

4.3.7 Corner radii

At any part of the post at least two of the corners shall meet the requirements of Table 2 after application of the surface finish.

Table 2 — Corner radii

Diagonals mm	Corner radii (max.) mm
< 0,6	0,025
0,6 – 1,3	0,05
> 1,3	0,08

4.3.7.1 Corner radius verification

The corner radii shall be verified by comparing a magnified shadowgraph of the post under test with an optical gauge as defined by Figure 4.

A cross-section shadowgraph of the post under test shall be prepared using a minimum magnification of 50 times.

A glass master as defined by Figure 4 shall be prepared as an optical gauge. The radius value r shall be chosen in accordance with the dimensions of Table 2.

NOTE For the glass master, the radius r of Table 2 is multiplied by the magnification factor of the shadowgraph.

The shadowgraph of the post under test shall be placed upon the optical gauge so that the flattest side of the shadowgraph is located on the datum line and the other side of the corner to be tested passes through the datum point.

Requirements:

- a) the side passing through the datum point shall be within the angular limits (2);
- b) the corner shall be within the area (1) defined by the optical gauge.

If the corner is located in area (3), the conditions of 4.3.8 shall be fulfilled additionally.

NOTE An example of a good radius is given in Figure 5.