

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Solderless connections –
Part 4: Non-accessible insulation displacement (ID) connections –
General requirements, test methods and practical guidance

Connexions sans soudure –
Partie 4: Connexions autodénudantes (CAD) non accessibles –
Règles générales, méthodes d'essai et guide pratique



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22,000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67,000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Solderless connections –
Part 4: Non-accessible insulation displacement (ID) connections –
General requirements, test methods and practical guidance**

IEC 60352-4:2020

**Connexions sans soudure –
Partie 4: Connexions autodénudantes (CAD) non accessibles –
Règles générales, méthodes d'essai et guide pratique**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.20

ISBN 978-2-8322-8413-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	10
4 Workmanship.....	14
5 Prerequisites for basic test schedule	14
5.1 General.....	14
5.2 Prerequisites for ID terminations	14
5.2.1 Non-accessible ID terminations materials	14
5.2.2 Non-accessible ID terminations dimensions	14
5.2.3 Non-accessible ID terminations surface finishes	14
5.2.4 Non-accessible ID terminations design features.....	15
5.3 Prerequisites for wires and conductors.....	15
5.3.1 Wire and conductors.....	15
5.3.2 Conductor materials.....	15
5.3.3 Wire and conductor dimensions	15
5.3.4 Conductor surface finishes	15
5.3.5 Wire insulation.....	15
5.4 Non-accessible insulation displacement connections (ID connections)	16
6 Testing.....	16
6.1 Overview.....	16
6.2 General.....	16
6.3 Standard conditions for testing.....	16
6.4 Preconditioning.....	16
6.5 Recovery	17
6.6 Specimen.....	17
7 Tests	17
7.1 General examination	17
7.2 Mechanical tests	17
7.2.1 General	17
7.2.2 Bending of the cable/wire	17
7.2.3 Vibration	18
7.2.4 Repeated connection and disconnection, reusable non-accessible ID terminations	19
7.2.5 Microsection	20
7.3 Electrical tests	21
7.3.1 General	21
7.3.2 Contact resistance.....	21
7.3.3 Electrical load and temperature	22
7.4 Climatic tests	22
7.4.1 General	22
7.4.2 Rapid change of temperature.....	22
7.4.3 Climatic sequence	23
7.4.4 Flowing mixed gas, corrosion test.....	23
7.4.5 Damp heat, cyclic	23

8	Test schedules	23
8.1	General.....	23
8.1.1	Overview	23
8.1.2	ID connections with terminations suitable for a range of wire diameters	24
8.1.3	Multipole connectors.....	24
8.2	Basic test schedule	24
8.2.1	General	24
8.2.2	Initial examination.....	25
8.2.3	Testing of non-accessible ID connections	25
8.3	Full test schedule.....	26
8.3.1	General	26
8.3.2	Initial examination.....	27
8.3.3	Testing of non-accessible ID connections	27
8.4	Flow charts	30
Annex A	(informative) Practical guidance.....	33
A.1	General information on non-accessible ID connections	33
A.1.1	General	33
A.1.2	Advantages of non-accessible ID connections	33
A.2	Current-carrying capacity considerations	34
A.3	Tool information.....	34
A.3.1	Wire insertion tool.....	34
A.3.2	Wire extraction tool.....	34
A.3.3	Combination tool.....	34
A.4	Termination information.....	35
A.4.1	General.....	35
A.4.2	Design features	35
A.4.3	Materials	35
A.4.4	Surface finishes	35
A.5	Wire information.....	35
A.5.1	Type	35
A.5.2	Dimensions.....	35
A.5.3	Surface finishes.....	35
A.5.4	Insulation.....	35
A.5.5	Ribbon cable	36
A.6	Connection information.....	36
A.6.1	General	36
A.6.2	ID connections made with more than one wire in one connection slot	37
Annex B	(informative) Application examples	38
B.1	ID connections	38
B.1.1	ID connections which can be examined by destructive inspection only.....	38
B.1.2	ID connections which can be examined by non-destructive inspection	39
B.2	General additional information about ID connections as part of a multi-pole connector.....	40
B.2.1	Mounting and bending of wire bundles/cables with contacts having ID connections	40
B.2.2	Mating and unmating of multipole connectors with ID contacts.....	41
B.3	Examples for good transversal microsection or negative results (see Figure B.6).....	41
B.4	Final remarks.....	42

Bibliography.....	43
Figure 1 – Example of accessible and non-accessible insulation displacement connection	7
Figure 2 – Insulation displacement connection	11
Figure 3 – Slot	12
Figure 4 – Beam	13
Figure 5 – Guiding block	13
Figure 6 – Test arrangement, bending of the cable/wire	18
Figure 7 – Test arrangement, vibration	19
Figure 8 – Non-accessible ID connection made with a stranded conductor.....	20
Figure 9 – Non-accessible ID connection made with a solid round conductor	20
Figure 10 – Test arrangement, contact resistance	21
Figure 11 – Basic test schedule (see 8.2)	31
Figure 12 – Full test schedule (see 8.3)	32
Figure A.1 – Example of a non-accessible ID connection with two conductors with different cross-sections in one connection slot; wires with stranded conductors	37
Figure B.1 – Examples of correct ID connections with closed housing design, opened or visible by microsectioning	38
Figure B.2 – Parts of connector housings to ensure correct ID connections (examples)	40
Figure B.3 – Mounting of wire bundles/cables with contacts having ID connections.....	40
Figure B.4 – Bending of wire bundles of connectors.....	41
Figure B.5 – Mating and unmating of multipole connectors.....	41
Figure B.6 – IDC: transversal microsection.....	41
Table 1 – Vibration, preferred test severities.....	19
Table 2 – Contact resistance of non-accessible ID connections, maximum permitted values.....	22
Table 3 – Number of specimens required	24
Table 4 – Qualification test schedule – Test group 1	25
Table 5 – Qualification test schedule – Test group 2	26
Table 6 – Qualification test schedule – Test group 3	26
Table 7 – Qualification test schedule – Test group 4	26
Table 8 – Qualification test schedule – Test group A.....	27
Table 9 – Qualification test schedule – Test group B.....	28
Table 10 – Qualification test schedule – Test group C	28
Table 11 – Qualification test schedule – Test group D	29
Table 12 – Qualification test schedule – Test group E.....	30

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOLDERLESS CONNECTIONS –**Part 4: Non-accessible insulation displacement (ID) connections –
General requirements, test methods and practical guidance**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60352-4 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This second edition cancels and replaces the first edition, published in 1994, and its Amendment 1 (2000). This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Transferred Clauses 9 to 13 into Annex A (informative).
- b) The figures were re-drawn for clarity.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
48B/2804/FDIS	48B/2820/RVD

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

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

A list of all parts in the IEC 60352 series, published under the general title *Solderless connections*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60352-4:2020](#)

<https://standards.iteh.ai/catalog/standards/sist/ecf23d4d-ae28-4e93-b351-19f707351115/iec-60352-4-2020>

INTRODUCTION

The two following parts of IEC 60352 are available on solderless insulation displacement connections:

- Part 3: Accessible insulation displacement (ID) connections – General requirements, test methods and practical guidance;
- Part 4: Non-accessible insulation displacement (ID) connections – General requirements, test methods and practical guidance.

NOTE In this document the term "insulation displacement" is abbreviated to "ID", for example "ID connection", "ID termination".

Figure 1 illustrates examples of accessible and non-accessible insulation displacement connections that clarify the difference among them.

Part 4 includes requirements and relevant tests (normative) as well as a practical guidance in Annex A (informative) for non-accessible ID connections.

Two test schedules are provided:

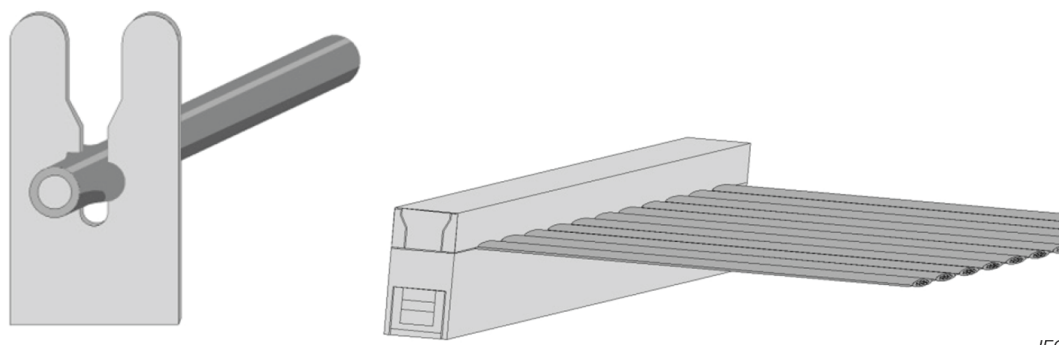
- the basic test schedule which applies to insulation displacement connections which conform to all prerequisites of Clause 5. It is derived from experience with successful applications of such connections;
- the full test schedule which applies to insulation displacement connections which do not fully conform to all prerequisites of Clause 5, for example which are manufactured using materials or finishes not included in Clause 5.

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

The suitability of the non-accessible ID connection implies that the specified requirements and tests apply to all factors involved in producing a suitable ID connection, namely:

- the ID termination, which may be part of a single-pole or multipole connector;
- the wire (or range of wires) for which the termination is suitable;
- the tools (if any) required to produce that type of solderless connection.

The practical guidance provided in Annex A (informative) serves as a guideline for the required workmanship. Attention is drawn to the fact that some industries (e.g. automotive, aerospace, nuclear, military) may have specific workmanship standards and/or quality requirements, which are outside the scope of this document.



IEC

Figure 1 – Example of accessible and non-accessible insulation displacement connection

IEC Guide 109 advocates the need to minimise the impact of a product on the natural environment throughout the product life cycle.

It is understood that some of the materials permitted in this document can have a negative environmental impact.

As technological advances lead to acceptable alternatives for these materials, they will be eliminated from the document.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 60352-4:2020](https://standards.iteh.ai/catalog/standards/sist/ecf23d4d-ae28-4e93-b351-19f707351115/iec-60352-4-2020)

<https://standards.iteh.ai/catalog/standards/sist/ecf23d4d-ae28-4e93-b351-19f707351115/iec-60352-4-2020>

SOLDERLESS CONNECTIONS –

Part 4: Non-accessible insulation displacement (ID) connections – General requirements, test methods and practical guidance

1 Scope

This part of IEC 60352 is applicable to non-accessible ID connections for which the tests and measurements according to Clauses 6 through 8 are suitable and which are made with:

- appropriately designed ID terminations;
- wires having solid round conductors of 0,25 mm to 3,6 mm nominal diameter;
- wires having stranded conductors of 0,05 mm² to 10 mm² cross-sectional area;

for use in electrical and electronic equipment and components.

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

There are different designs and materials for ID terminations in use. For this reason, only fundamental parameters of the termination are specified, while the performance requirements of the wire and the complete connection are specified in full detail.

The purpose of this document is: [IEC 60352-4:2020
https://standards.iteh.ai/catalog/standards/sist/ecf23d4d-ae28-4e93-b351-19f707351115/iec-60352-4-2020](https://standards.iteh.ai/catalog/standards/sist/ecf23d4d-ae28-4e93-b351-19f707351115/iec-60352-4-2020)

- to determine the suitability of non-accessible ID connections under specified mechanical, electrical and atmospheric conditions;
- to provide a means of comparing test results when the tools used to make the connections, if any, are of different designs or manufacture.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-581, *International Electrotechnical Vocabulary – Part 581: Electromechanical components for electronic equipment*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60228, *Conductors of insulated cables*

IEC 60512-1, *Connectors for electrical and electronic equipment – Tests and measurements – Part 1: Generic specification*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-2-2, *Connectors for electronic equipment – Tests and measurements – Part 2-2: Electrical continuity and contact resistance tests – Test 2b: Contact resistance – Specified test current method*

IEC 60512-2-5, *Connectors for electronic equipment – Tests and measurements – Part 2-5: Electrical continuity and contact resistance tests – Test 2e: Contact disturbance*

IEC 60512-6-4, *Connectors for electronic equipment – Tests and measurements – Part 6-4: Dynamic stress tests – Test 6d: Vibration (sinusoidal)*

IEC 60512-9-2, *Connectors for electronic equipment – Tests and measurements – Part 9-2: Endurance tests – Test 9b: Electrical load and temperature*

IEC 60512-11-1, *Connectors for electrical and electronic equipment – Tests and measurements – Part 11-1: Climatic tests – Test 11a – Climatic sequence*

IEC 60512-11-4, *Connectors for electronic equipment – Tests and measurements – Part 11-4: Climatic tests – Test 11d: Rapid change of temperature*

IEC 60512-11-7, *Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*

IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-12, *Connectors for electronic equipment – Tests and measurements – Part 11-12: Climatic tests – Test 11m: Damp heat, cyclic*

3 Terms and definitions

For the purposes of this document, the terms and definition provided in IEC 60050-581 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

conductor

part of the cable or wire intended to carry electric current

Note 1 to entry: The conductor may be

- a) solid – made of a single strand of circular cross-section;
- b) stranded – made of several strands of circular cross-section assembled either by laying up concentrically or by bunching, and without insulation between them.

Note 2 to entry: The properties of the copper are in accordance with IEC 60228.

[SOURCE: IEC 60189-1:2018, 3.1, modified – Note 2 to entry has been added.]

3.2 wire

insulated conductor or assembly of several insulated conductors, laid up together and which may be provided with a screen

Note 1 to entry: The wire may be

- a) single – consists of a single insulated conductor;
- b) multiple – consists of several insulated conductors.

[SOURCE: IEC 60189-1:2018, 3.2, modified – deletion of "low frequency" in the title and the Note 2 to entry listing designations.]

3.3 insulation displacement connection ID connection

solderless electrical connection made by inserting a single wire into a precisely controlled slot in a termination such that the sides of the slot displace the insulation and deform the conductor of a solid wire or the strands of a stranded wire to produce a gas-tight connection

SEE: Figure 2.

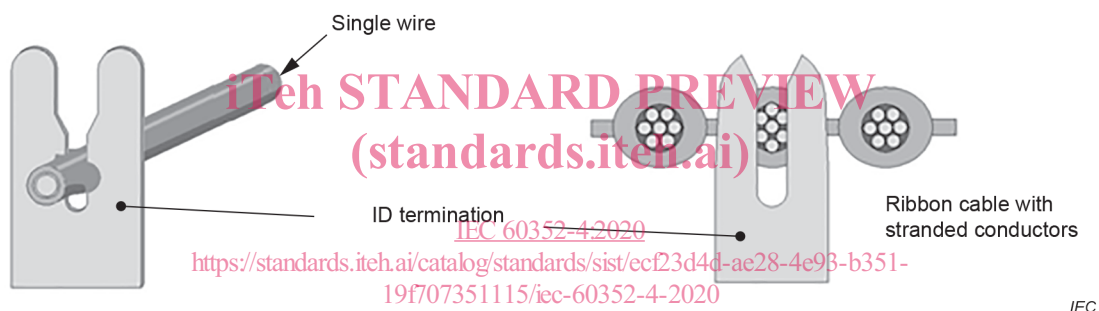


Figure 2 – Insulation displacement connection

3.3.1 accessible insulation displacement connection accessible ID connection

ID connection in which it is possible to access test points for carrying out mechanical tests (for example, transverse extraction force) and electrical measurements (for example, contact resistance) without deactivation of any design feature intended to establish and/or maintain the ID connection (see IEC 60352-3)

3.3.2 non-accessible insulation displacement connection non-accessible ID connection

ID connection in which it is not possible to access test points for carrying out mechanical tests such as transverse extraction force and some electrical measurements (for example, contact resistance) without deactivation of any design feature intended to establish and/or maintain the ID connection, mainly where the ID connection is enclosed in a component

3.4 insulation displacement termination ID termination

termination designed to accept a wire for the purpose of establishing an ID connection

3.4.1 reusable insulation displacement termination reusable ID termination
 ID termination that can be used more than once

3.4.2 non-reusable insulation displacement termination non-reusable ID termination
 ID termination that can be used only once

3.5 slot
 specially shaped opening in an ID termination suitable to provide either connection or strain relief

SEE: Figure 3.

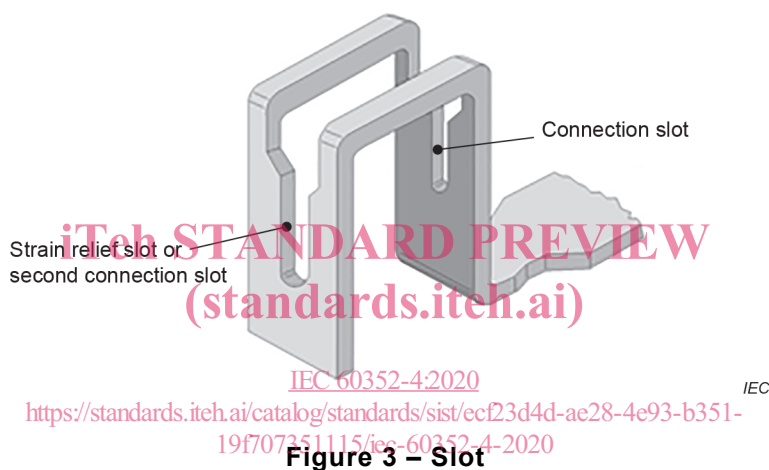


Figure 3 – Slot

3.5.1 connection slot
 specially shaped opening in an ID termination suitable to displace the insulation of a wire and to ensure a gas-tight connection between the termination and the conductor(s) of the wire

Note 1 to entry: In certain cases a second connection slot is used to provide for a double connection.

3.5.2 strain relief slot
 specially shaped opening in an ID termination suitable to provide for strain relief

3.6 beam
 specially shaped metallic part of an ID termination on each side of the slot

SEE: Figure 4.

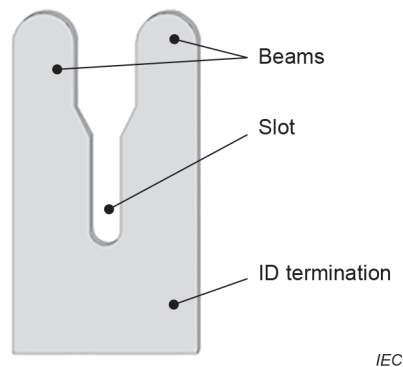


Figure 4 – Beam

3.7 apparent diameter

<of a stranded conductor> diameter of the circumscribing circle of the bundle of strands

3.8 guiding block

specially shaped part of a component, for example, a connector, which guides/inserts the wire(s) into the slot(s); additionally it may provide for other mechanical features, for example, fixing the wire(s) in correct position(s), strain relief of the ID connection(s), secondary loading on the ID termination(s) or beams

SEE: Figure 5.

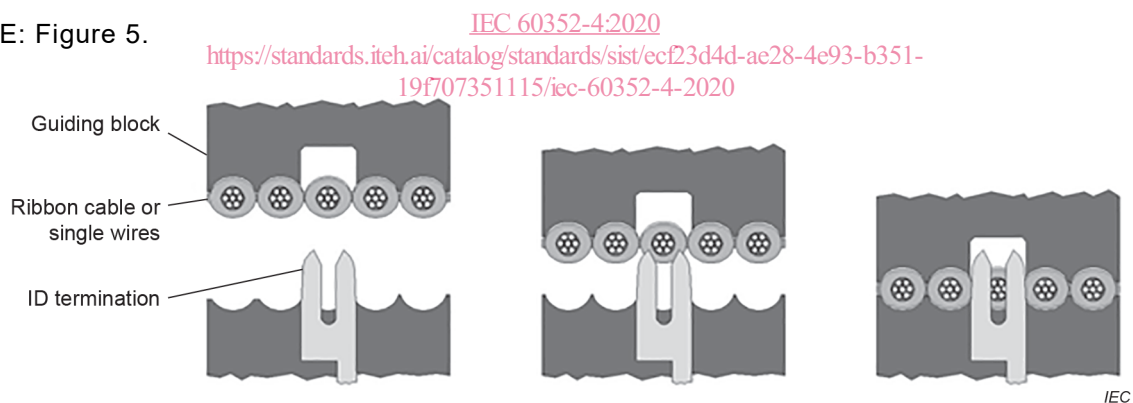


Figure 5 – Guiding block

3.9 wire insertion tool

hand or power operated tool for producing an insulation displacement connection by inserting the wire(s) in a controlled manner to a predetermined position into the slot(s)

[SOURCE: IEC 60050-581:2008, 581-24-27]

3.10 wire extraction tool

device for extracting the wire(s) from the insulation displacement termination

[SOURCE: IEC 60050-581:2008, 581-24-28]