BS EN 60445:2017



BSI Standards Publication

Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors (IEC 60445:2017 + COR1:2017)

bsi.

National foreword

This British Standard is the UK implementation of EN 60445:2017. It is identical to IEC 60445:2017. It supersedes BS EN 60445:2010, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/3, Documentation and graphical symbols.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2017
Published by BSI Standards Limited 2017

ISBN 978 0 580 89632 3

ICS 29.020; 01.070; 13.110; 01.080.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2017.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60445

November 2017

ICS 01.080.20; 13.110; 29.020

Supersedes EN 60445:2010

English Version

Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors (IEC 60445:2017 + COR1:2017)

Principes fondamentaux et de sécurité pour les interfaces homme-machine, le marquage et l'identification - Identification des bornes de matériels, des extrémités de conducteurs et des conducteurs (IEC 60445:2017 + COR1:2017)

Grund- und Sicherheitsregeln für die Mensch-Maschine-Schnittstelle - Kennzeichnung von Anschlüssen elektrischer Betriebsmittel, angeschlossenen Leiterenden und Leitern (IEC 60445:2017 + COR1:2017)

This European Standard was approved by CENELEC on 2017-09-08. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

© 2017 CENELEC All rights of exploitation in any form and by any means reserved worldwide for CENELEC Members.

Ref. No. EN 60445:2017 E

European foreword

The text of document 3/1313/FDIS, future edition 6 of IEC 60445, prepared by IEC/TC 3 "Information structures and elements, identification and marking principles, documentation and graphical symbols" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60445:2017.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-06-08
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2020-09-08

This document supersedes EN 60445:2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60445:2017+COR1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60079-11:2006	NOTE	Harmonized as EN 60079-11:2007 [1] (not modified).
IEC 60601 Series	NOTE	Harmonized as EN 60601 Series.
IEC 61140:2016	NOTE	Harmonized as EN 61140:2016 (not modified).
IEC 61666:2010	NOTE	Harmonized as EN 61666:2010 (not modified).
IEC 62491:2008	NOTE	Harmonized as EN 62491:2008 (not modified).

[1] Superseded by EN 60079-11:2012 (IEC 60079-11:2011).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60417-DB	-	Graphical symbols for use on equipment	-	-
IEC 60617-DB	-	Graphical symbols for diagrams	-	-
IEC Guide 104	-	The preparation of safety publications and the use of basic safety publications and group safety publications	-	-
ISO/IEC Guide 51	-	Safety aspects - Guidelines for their inclusion in standards	-	-

This page deliberately left blank

CONTENTS

FOREWORD 4
1 Scope 6
2 Normative references 6
3 Terms and definitions 6
4 Methods of identification 9
5 Application of identification means 10
6 Identification by colours 10
6.1 General 10
6.2 Use of single colours 11
6.2.1 Permitted colours 11
6.2.2 Neutral or mid-point conductor 11
6.2.3 Line conductor in AC system 11
6.2.4 Line conductor in DC system 11
6.2.5 Functional earthing conductor 11
6.3 Use of bi-colour combinations 11
6.3.1 Permitted colours 11
6.3.2 Protective conductor 11
6.3.3 PEN conductor 12
6.3.4 PEL conductor 12
6.3.5 PEM conductor 13
6.3.6 Protective bonding conductor 13
7 Identification by alphanumeric notation 13
7.1 General 13
7.2 Equipment terminal identification – Marking principles 14
7.3 Identification of certain designated conductors 16
7.3.1 General 16
7.3.2 Neutral conductor 16
7.3.3 Protective conductor 16
7.3.4 PEN conductor 17
7.3.5 PEL conductor 17
7.3.6 PEM conductor 17
7.3.7 Protective bonding conductor 17
7.3.8 Protective bonding conductor earthed 17
7.3.9 Protective bonding conductor unearthed 17
7.3.10 Functional earthing conductor 17
7.3.11 Functional bonding conductor 17
7.3.12 Mid-point conductor 17
7.3.13 Line conductor 17
Annex A (informative) Colours, alphanumeric notations and graphical symbols used for identification of conductors and terminals 18
Annex B (informative) List of notes concerning certain countries 20
Bibliography 26

Figure 1 – Single element with two terminals 14

Figure 2 – Single element with four terminals: Two endpoints and two intermediate points 14
Figure 3 – Three-phase equipment with six terminals 15
Figure 4 – Three-element equipment with twelve terminals: Six endpoints and six intermediate points 15
Figure 5 – Equipment with groups of elements 16
Figure 6 – Interconnection of equipment terminals and certain designated conductors 16

Table A.1 – Colours, alphanumeric notations and graphical symbols used for identification of conductors and terminals 18

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

BASIC AND SAFETY PRINCIPLES FOR MAN-MACHINE INTERFACE, MARKING AND IDENTIFICATION – IDENTIFICATION OF EQUIPMENT TERMINALS, CONDUCTOR TERMINATIONS AND CONDUCTORS

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.

This document has been prepared by IEC technical committee 3: Information structures and elements, identification and marking principles, documentation and graphical symbols.

It has the status of a basic safety publication in accordance with IEC Guide 104.

This sixth edition cancels and replaces the fifth edition of IEC 60445, published in 2010.

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

a) the text of the introduction has been moved into the scope in accordance with IEC Guide 104;
b) colour codes for the identification of line conductors of DC systems;
c) colour code for the identification of functional earthing conductor;
d) update of Table A.1 with colour codes for DC line conductors;

e) conversion of notes containing non-mandatory requirements to normative text;

f) the terminology is aligned with IEC 60050-195.

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

FDIS	Report on voting
3/1313/FDIS	3/1326/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.

The reader's attention is drawn to the fact that Annex B lists all of the “in-some-country” clauses on differing practices of a less permanent nature relating to the subject of this standard.

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.

The contents of the corrigendum of November 2017 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

BASIC AND SAFETY PRINCIPLES FOR MAN-MACHINE INTERFACE, MARKING AND IDENTIFICATION – IDENTIFICATION OF EQUIPMENT TERMINALS, CONDUCTOR TERMINATIONS AND CONDUCTORS

1 Scope

This document applies to the identification and marking of terminals of electrical equipment such as resistors, fuses, relays, contactors, transformers, rotating machines and, wherever applicable, to combinations of such equipment (e.g. assemblies), and also applies to the identification of terminations of certain designated conductors. It also provides general rules for the use of certain colours or alphanumeric notations to identify conductors with the aim of avoiding ambiguity and ensuring safe operation. These conductor colours or alphanumeric notations are intended to be applied in cables or cores, busbars, electrical equipment and installations.

This basic safety publication is primarily intended for use by technical committees in the preparation of standards in accordance with the principles laid down in IEC Guide 104 and ISO/IEC Guide 51.

It is not intended for use by manufacturers or certification bodies. One of the responsibilities of a technical committee is, wherever applicable, to make use of basic safety publications in the preparation of its publications. The requirements of this basic safety publication will not apply unless specifically referred to or included in the relevant publications.

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 60417, *Graphical symbols for use on equipment*

IEC 60617, *Graphical symbols for diagrams*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

ISO/IEC Guide 51, *Safety aspects – Guidelines for their inclusion in standards*

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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

NOTE The terms are sorted in alphabetical order in the English language.