

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Degrees of protection provided by enclosures (IP Code)

Degrés de protection procurés par les enveloppes (Code IP)

Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2013 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 It also gives information on projects, replaced and withdrawn publications.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 online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

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.

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 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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.

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 online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

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.

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.

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.



IEC 60529

Edition 2.2 2013-08
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Degrees of protection provided by enclosures (IP Code)

Degrés de protection procurés par les enveloppes (Code IP)

Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 13.260; 29.020

ISBN 978-2-8322-1086-4

**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.**

REDLINE VERSION

VERSION REDLINE



Degrees of protection provided by enclosures (IP Code)

Degrés de protection procurés par les enveloppes (Code IP)

Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
INTRODUCTION TO AMENDMENT 2	8
1 Scope and object.....	9
2 Object Normative references	10
3 Definitions	10
4 Designations	12
4.1 Arrangement of the IP Code	12
4.2 Elements of the IP Code and their meanings	12
4.3 Examples for the use of letters in the IP Code	13
5 Degrees of protection against access to hazardous parts and against solid foreign objects indicated by the first characteristic numeral	14
5.1 Protection against access to hazardous parts.....	14
5.2 Protection against solid foreign objects	15
6 Degrees of protection against ingress of water indicated by the second characteristic numeral	16
7 Degrees of protection against access to hazardous parts indicated by the additional letter	18
8 Supplementary letters.....	19
9 Examples of designations with the IP Code	20
9.1 IP Code not using optional letters:.....	20
9.2 IP Code using optional letters:.....	20
10 Marking	21
11 General requirements for tests	21
11.1 Atmospheric conditions for water or dust tests.....	21
11.2 Test samples.....	21
11.3 Application of test requirements and interpretation of test results	21
11.4 Combination of test conditions for the first characteristic numeral.....	22
11.5 Empty enclosures.....	22
12 Tests for protection against access to hazardous parts indicated by the first characteristic numeral	22
12.1 Access probes.....	22
12.2 Test conditions.....	22
12.3 Acceptance conditions.....	24
12.3.1 For low-voltage equipment (rated voltages not exceeding 1 000 V a.c. and 1 500 V d.c.)	24
12.3.2 For high-voltage equipment (rated voltages exceeding 1 000 V a.c. and 1 500 V d.c.)	24
12.3.3 For equipment with hazardous mechanical parts.....	25
13 Tests for protection against solid foreign objects indicated by the first characteristic numeral	25
13.1 Test means	25
13.2 Test conditions for first characteristic numerals 1, 2, 3, 4	25

13.3	Acceptance conditions for first characteristic numerals 1, 2, 3, 4	25
13.4	Dust test for first characteristic numerals 5 and 6	25
13.5	Special conditions for first characteristic numeral 5	27
13.5.1	Test conditions for first characteristic numeral 5	27
13.5.2	Acceptance conditions for first characteristic numeral 5	27
13.6	Special conditions for first characteristic numeral 6	27
13.6.1	Test conditions for first characteristic numeral 6	27
13.6.2	Acceptance conditions for first characteristic numeral 6	27
14	Tests for protection against water indicated by the second characteristic numeral	27
14.1	Test means	27
14.2	Test conditions	28
14.2.1	Test for second characteristic numeral 1 with the drip box	29
14.2.2	Test for second characteristic numeral 2 with the drip box	29
14.2.3	Test for second characteristic numeral 3 with oscillating tube or spray nozzle	30
14.2.4	Test for second characteristic numeral 4 with oscillating tube or spray nozzle	30
14.2.5	Test for second characteristic numeral 5 with the 6,3 mm nozzle	31
14.2.6	Test for second characteristic numeral 6 with the 12,5 mm nozzle	31
14.2.7	Test for second characteristic numeral 7: temporary immersion between 0,15 m and 1 m	31
14.2.8	Test for second characteristic numeral 8: continuous immersion subject to agreement	32
14.2.9	Test for second characteristic numeral 9 with a spray nozzle	32
14.3	Acceptance conditions	32
15	Tests for protection against access to hazardous parts indicated by the additional letter	33
15.1	Access probes	33
15.2	Test conditions	33
15.3	Acceptance conditions	33

Annex A (informative)	Examples of IP coding for the verification of protection of low-voltage equipment against access to hazardous parts	43
-----------------------	--	----

Annex B (informative)	Summary of responsibilities of relevant technical committees	49
-----------------------	--	----

Bibliography	51
---------------------------	-----------

Figure 1 – Jointed test finger	34
Figure 2 – Test device to verify protection against dust (dust chamber)	35
Figure 3 – Test device to verify protection against vertically falling water drops (drip box)	36
Figure 4 – Test device to verify protection against spraying and splashing water; second characteristic numerals 3 and 4 (oscillating tube)	37
Figure 5 – Hand-held device to verify protection against spraying and splashing water; second characteristic numerals 3 and 4 (spray nozzle)	38
Figure 6 – Test device to verify protection against water jets (hose nozzle)	38
Figure 7 – Fan jet nozzle dimensions	39

Figure 8 – Fan jet nozzle resulting dimensions of spraying hole for checking purpose 39

Figure 9 – Fan jet nozzle examples..... 40

Figure 10 – Set-up for measuring the impact force of the water jet for determining the protection against high-pressure and temperature water jet, degree of protection against ingress of water IP X9..... 41

Figure 11 – Impact force distribution 41

Figure 12 – Test device to verify protection against high pressure and temperature water jet for small enclosures 42

Table 1 – Degrees of protection against access to hazardous parts indicated by the first characteristic numeral..... 15

Table 2 – Degrees of protection against solid foreign objects indicated by the first characteristic numeral..... 16

Table 3 – Degrees of protection against water indicated by the second characteristic numeral..... 18

Table 4 – Degrees of protection against access to hazardous parts indicated by the additional letter 19

Table 5 – Test conditions for degrees of protection indicated by the first characteristic numeral..... 22

Table 6 – Access probes for the tests for protection of persons against access to hazardous parts..... 23

Table 7 – Test means for the tests for protection against solid foreign objects 25

Table 8 – Test means and main test conditions for the tests for protection against water 28

Table 9 – Total water flow rate q_v under IPX3 and IPX4 test conditions – Mean flow rate per hole $q_{vI} = 0,07$ l/min..... 31

IP Codes of examples in annex A 48

INTERNATIONAL ELECTROTECHNICAL COMMISSION

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP Code)

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 consolidated version of the official IEC Standard and its amendments has been prepared for user convenience.

IEC 60529 edition 2.2 contains the second edition (1989) [documents 70(CO)13 + 70(CO)15 and 70(CO)16 + 70(CO)17], its corrigendum 1 (2003), its corrigendum 2 (2007), its corrigendum 3 (2009), its amendment 1 (1999) [documents 70/91/FDIS and 70/92/RVD] and its amendment 2 [documents 70/122/FDIS and 70/123/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendments 1 and 2. Additions and deletions are displayed in red, with deletions being struck through. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 60529 has been prepared by technical committee 70: Degrees of protection by enclosures.

Annexes A and B are for information only.

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

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the stability 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.

The contents of the corrigenda of October 2013, May 2015 and January 2019 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 publication using a colour printer.

(<https://standards.iteh.ai>)
Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>

INTRODUCTION

This standard describes a system for classifying the degrees of protection provided by the enclosures of electrical equipment. Whilst this system is suitable for use with most types of electrical equipment, it should not be assumed that all the listed degrees of protection are applicable to a particular type of equipment. The manufacturer of the equipment should be consulted to determine the degrees of protection available and the parts of equipment to which the stated degree of protection applies.

The adoption of this classification system, wherever possible, will promote uniformity in methods of describing the protection provided by the enclosure and in the tests to prove the various degrees of protection. It should also reduce the number of types of test devices necessary to test a wide range of products.

This second edition of IEC 60529 takes account of experiences with the first edition, and clarifies the requirements. It provides for an optional extension of the IP Code by an additional letter A, B, C, or D if the actual protection of persons against access to hazardous parts is higher than that indicated by the first characteristic numeral.

In general, enclosures with an IP coding to the first edition would be eligible for the same code according to this edition.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>

INTRODUCTION TO AMENDMENT 2

This Amendment 2 introduces a new degree of protection IP X9 whereas no modifications of the existing degrees of protection are made.

Thus neither additional tests nor modifications of the existing certificates should be requested in case of enclosures providing a different IP code.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 60529:1989](#)

<https://standards.iteh.ai/catalog/standards/iec/a8ba3678-063c-47f3-9234-86991fa0a4bc/iec-60529-1989>

DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP Code)

1 Scope and object

This standard applies to the classification of degrees of protection provided by enclosures for electrical equipment with a rated voltage not exceeding 72,5 kV.

2—Object

The object of this standard is to give:

- a) *Definitions* for degrees of protection provided by enclosures of electrical equipment as regards:
 - 1) protection of persons against access to hazardous parts inside the enclosure;
 - 2) protection of the equipment inside the enclosure against ingress of solid foreign objects;
 - 3) protection of the equipment inside the enclosure against harmful effects due to the ingress of water.
- b) *Designations* for these degrees of protection.
- c) *Requirements* for each designation.
- d) *Tests* to be performed to verify that the enclosure meets the requirements of this standard.

It will remain the responsibility of individual technical committees to decide on the extent and manner in which, the classification is used in their standards and to define “enclosure” as it applies to their equipment. However, it is recommended that for a given classification the tests do not differ from those specified in this standard. If necessary, complementary requirements may be included in the relevant product standard. A guide for the details to be specified in relevant product standards is given in annex B.

For a particular type of equipment, a technical committee may specify different requirements provided that at least the same level of safety is ensured.

This standard deals only with enclosures that are in all other respects suitable for their intended use as specified in the relevant product standard and which from the point of view of materials and workmanship ensure that the claimed degrees of protection are maintained under the normal conditions of use.

This standard is also applicable to empty enclosures provided that the general test requirements are met and that the selected degree of protection is suitable for the type of equipment to be protected.

Measures to protect both the enclosure and the equipment inside the enclosure against external influences or conditions such as

- mechanical impacts
- corrosion
- corrosive solvents (for example, cutting liquids)
- fungus
- vermin
- solar radiation
- icing
- moisture (for example, produced by condensation)
- explosive atmospheres

and the protection against contact with hazardous moving parts external to the enclosure (such as fans), are matters for the relevant product standard **to be protected**.

Barriers external to the enclosure and not attached to it and obstacles which have been provided solely for the safety of personnel are not considered as a part of the enclosure and are not dealt with in this standard.

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 60050-195:1998, *International Electrotechnical Vocabulary (IEV) – Part 195: Earthing and protection against electric shock*

IEC 60050(826):1982, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations of buildings*

IEC 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-68:1994, *Environmental testing – Part 2: Tests – Test L: Dust and sand*

IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*

3 Definitions

For the purpose of this standard, the following definitions apply:

3.1

enclosure

a part providing protection of equipment against certain external influences and, in any direction, protection against direct contact [IEV 826-03-12]*.

NOTE This definition taken from the existing International Electrotechnical Vocabulary (IEV) needs the following explanations under the scope of this standard:

- 1) Enclosures provide protection of persons or livestock against access to hazardous parts.
- 2) Barriers, shapes of openings or any other means – whether attached to the enclosure or formed by the enclosed equipment – suitable to prevent or limit the penetration of the specified test probes are considered as a part of the enclosure, except when they can be removed without the use of a key or tool.

3.2

direct contact

contact of persons or livestock with live parts [IEV 826-03-05]

NOTE This IEC definition is given for information. In this standard “direct contact” is replaced by “access to hazardous parts”.

3.3

degree of protection

the extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods

* IEC 60050(826).