

## Bibliographie

CEI 61032, *Protection des personnes et des matériels par les enveloppes – Calibres d'essai pour la vérification*

CEI 61140, *Protection contre les chocs électriques – Aspects communs pour les installations et les matériels*



# FINAL VERSION

## VERSION FINALE



---

**Degrees of protection provided by enclosures (IP Code)**

**Degrés de protection procurés par les enveloppes (Code IP)**

This is a preview. [Click here to purchase the full publication.](#)

## CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
INTRODUCTION TO AMENDMENT 2 .....	8
1 Scope and object.....	9
2 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 .....	22
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 .....	23
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 IEC 60529 bears the edition number 2.2. It consists of 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]. The technical content is identical to the base edition and its amendments.**

**This Final version does not show where the technical content is modified by amendments 1 and 2. A separate Redline version with all changes highlighted is available in this publication.**

**This publication has been prepared for user convenience.**

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.

**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.**



## 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.

## 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.