



SLOVENSKI STANDARD
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Rotating electrical machines - Part 5: Classification of degrees of protection provided by enclosures for rotating machinery (IEC 60034-5:1981 (Modified))

Rotating electrical machines -- Part 5: Classification of degrees of protection provided by enclosures for rotating machinery

Drehende elektrische Maschinen -- Teil 5: Einteilung der Schutzarten durch Gehäuse für umlaufende Maschinen

Machines électriques tournantes -- Partie 5: Classification des degrés de protection procurés par les enveloppes des machines tournantes

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ROTATING ELECTRICAL MACHINES
PART 5: CLASSIFICATION OF DEGREES OF PROTECTION PROVIDED
BY ENCLOSURES FOR ROTATING MACHINERY
 (IEC 34-5 (1981 - 2nd edition, modified))

Machines électriques tournantes
Cinquième partie: Classification
des degrés de protection procurés
par les enveloppes des machines
tournantes
 (CEI 34-5 (1981- 2ème édition,
 modifiée))

Umlaufende elektrische Maschinen
Teil 5: Einteilung der Schutzarten
durch Gehäuse für umlaufende
Maschinen
 (IEC 34-5 (1981 - 2. Ausgabe,
 modifiziert))

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C E N E L E C

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General Secretariat: rue Bréderode, 2, B - 1000 Brussels

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BRIEF HISTORY

This European Standard has been prepared by CENELEC TC 2. It supersedes HD 53.5 which harmonized the first edition of the Reference Document.

TECHNICAL TEXT

The text of the International Standard IEC 34-5 (second edition, 1981) together with agreed common modifications, prepared by CENELEC Technical Committee TC 2, was approved by CENELEC on 7 March 1985 as a European Standard. For the sake of clarity, these CENELEC common modifications have been incorporated at the appropriate places in the text of IEC 34-5 (1981); they are marked by a vertical line at the left-hand margin.

NOTE: The foreword of the IEC Publication 34-5 does not form part of this European Standard.

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ROTATING ELECTRICAL MACHINES

Part 5: Classification of degrees of protection provided by enclosures for rotating machines

INTRODUCTION

After an enquiry to all National Committees, Sub-Committee 2H implemented the decision to redraft this Publication 34-5 revised on the basis of IEC Publication 529: Classification of Degrees of Protection Provided by Enclosures, with additions and modifications with particular reference to rotating machines.

Apart from some editorial alterations, the main discrepancies are the following:

- precisions concerning the use of letters S and M (Sub-clause 3.2.1);
- addition of requirements concerning external fans (Sub-clause 4.3) and drain holes (Sub-clause 4.4);
- addition, in Table I, of the principle of a protection against "approach to live or moving parts", necessary for rotating machines;
- deletion of first characteristic numeral 6, not used for rotating machines;
- addition, in Table III of the classification of enclosures under category 1;
- introduction of first characteristic numeral 3 (this is a discrepancy with Publication 34-5, edition 1968);
- introduction of a clause concerning weather-protected machines (Clause 10).

1. Scope

This standard applies to the classification of degrees of protection provided by enclosures for rotating machines.

2. Object

The object of this standard is to describe:

- a) definitions for standard degrees of protection provided by enclosures applicable to electrical rotating machines as regards:
 - 1) protection of persons against contact with or approach to live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure and protection of the machine against ingress of solid foreign objects;
 - 2) protection of machines against the harmful effects due to the ingress of water;
- b) designations for these protective degrees;
- c) tests to be performed to check that the machines meet the requirements of this standard.

This standard defines the requirements with which protective enclosures shall comply.

This standard deals only with enclosures that are in all other respects suitable for their intended use and which from the point of view of materials and workmanship ensure that the properties dealt with in this standard are maintained under the normal conditions of use.

This standard does not specify degrees of protection against mechanical damage of the machine, or conditions such as moisture (produced for example by condensation) corrosive vapours, fungus or vermin. This standard does not specify types of protection of machines for the use in an explosive atmosphere.

Fences external to the enclosure which have to be provided solely for the safety of personnel are not considered part of the enclosure and are not dealt with.

3. Designation

The designation used for the degree of protection consists of the letters IP followed by two characteristic numerals signifying conformity with the conditions indicated in the tables of Clauses 4 and 5 respectively.

3.1 Single characteristic numeral

When it is required to indicate a degree of protection by only one characteristic numeral, the omitted numeral shall be replaced by the letter X. For example IPX5 or IP2X.

3.2 Supplementary letters

Additional information may be indicated by a supplementary letter.

3.2.1 Letters following numerals

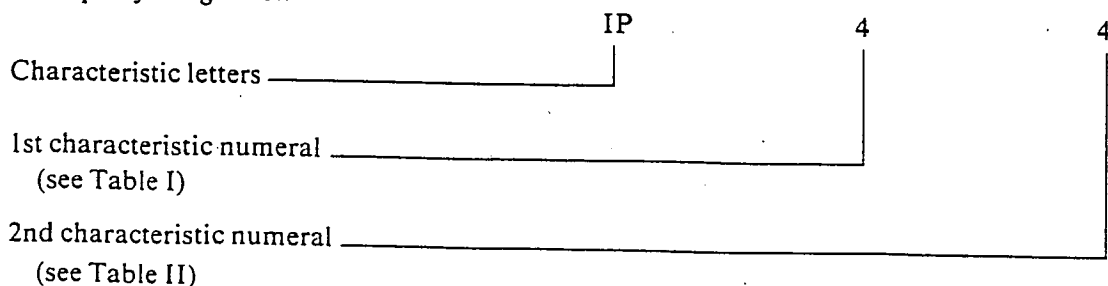
In special applications (such as machines with open circuit cooling for ship deck installation with air inlet and outlet openings closed during standstill) numerals may be followed by a letter indicating whether the protection against harmful effects due to ingress of water was verified or tested for the machine not running (letter S) or the machine running (letter M). In this case the degree of protection in either state of the machine shall be indicated, for example IP55S/IP20M.

The absence of the letters S and M shall imply that the intended degree of protection will be provided under all normal conditions of use.

3.2.2 Letters placed immediately after the letters IP

For machines suitable for use under specified weather conditions and provided with additional protective features or processes, the letter W (placed immediately after the letters IP) may be used.

3.3 Example of designation



3.4 The most frequently used degrees of protection for electrical machines are given in Appendix A.

4. Degrees of protection – First characteristic numeral

4.1 The first characteristic numeral indicates the degree of protection provided by the enclosure with respect to persons and also to the parts of the machine inside the enclosure.

Table I gives, in column 3, brief details of objects which will be “excluded” from the enclosure for each of the degrees of protection represented by the first characteristic numeral.

The term “excluded” implies that a part of the body, or a tool or a wire held by a person, either will not enter the machine or, if it enters, that adequate clearance will be maintained between it and the live parts or dangerous moving parts (smooth rotating shafts and the like are not considered dangerous).

Column 3 of Table I also indicates the minimum size of solid foreign objects which will be excluded.

4.2 Compliance of an enclosure with an indicated degree of protection implies that the enclosure will also comply with all lower degrees of protection in Table I. In consequence, the tests establishing these lower degrees of protection are not required, except in case of doubt.

4.3 External fans

The blades and spokes of fans external to the enclosure shall be protected against contact by means of guards complying with the following requirements:

Protection of machine	Test of fan
IP0X and IP1X IP2X to IP5X	50 mm sphere test Finger test

For the test, the rotor is slowly rotated by hand.

Smooth rotating shafts and similar parts are not considered dangerous.

Note. – In certain applications (such as agricultural or domestic appliances) more extensive precautions against accidental or deliberate contact may be required if specified.

4.4 Drain holes

If the enclosure is provided with drain holes, the following shall apply:

Drain holes intended normally to be opened on site shall be kept opened during testing.

Drain holes intended normally to be closed on site shall be kept closed during testing.

If the machines are intended to operate with open drain holes :

- drain holes of machines with protection IP3X or IP4X may have IP2X protection ;
- drain holes of machines with protection IP5X shall have IP4X protection.

TABLE I

Degrees of protection indicated by the first characteristic numeral

First characteristic numeral	Degree of protection		Test conditions
	Brief description (Note 1)	Definition	
0	Non-protected machine	No special protection	No test, but see Sub-clause 4.3
1 (Note 2)	Machine protected against solid objects greater than 50 mm	Accidental or inadvertent contact with or approach to live and moving parts inside the enclosure by a large surface of the human body, such as a hand (but no protection against deliberate access) Ingress of solid objects exceeding 50 mm in diameter	Table III
2 (Note 2)	Machine protected against solid objects greater than 12 mm	Contact by fingers or similar objects not exceeding 80 mm in length with or approach to live or moving parts inside the enclosure Ingress of solid objects exceeding 12 mm in diameter	
3 (Note 2)	Machine protected against solid objects greater than 2.5 mm	Contact with or approach to live or moving parts inside the enclosure by tools or wires exceeding 2.5 mm in diameter Ingress of solid objects exceeding 2.5 mm in diameter	
4 (Note 2)	Machine protected against solid objects greater than 1 mm	Contact with or approach to live or moving parts inside the enclosure by wires or strips of thickness greater than 1 mm in diameter Ingress of solid objects exceeding 1 mm in diameter	
5 (Note 3)	Dust-protected machine	Contact with or approach to live or moving parts inside the enclosure Ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with satisfactory operation of the machine	

Notes 1. - The brief description given in column 2 of this table should not be used to *specify* the form of protection.

2. - Machines assigned a first characteristic numeral 1, 2, 3 or 4 will exclude both regularly or irregularly shaped solid objects provided that three normally perpendicular dimensions of the object exceed the appropriate figure in column "Definition".
3. - The degree of protection against dust defined by this standard is a general one. When the nature of the dust (dimensions of particles, their nature, for instance fibrous particles) is specified, test conditions should be determined by agreement between manufacturer and user.

5. Degrees of protection – Second characteristic numeral

5.1 The second characteristic numeral indicates the degree of protection provided by the enclosure with respect to harmful effects due to ingress of water.

Table II gives, in column 3, details of the type of protection provided by the enclosure for each of the degrees of protection represented by the second characteristic numeral.

A machine is *weather-protected* when its design reduces the ingress of rain, snow and air-borne particles, under specified conditions, to an amount consistent with correct operation.

This degree of protection is designated by the letter W (placed between IP and the numerals).

5.2 Compliance of an enclosure with an indicated degree of protection implies that the enclosure will also comply with all lower degrees of protection in Table II.

In consequence, the tests establishing these lower degrees of protection are not required, except in case of doubt.

-TABLE II

Degrees of protection indicated by the second characteristic numeral

Second characteristic numeral	Degree of protection		Test conditions
	Brief description	Definition	
0	Non-protected machine	No special protection	No test
1	Machine protected against dripping water	Dripping water (vertically falling drops) shall have no harmful effect	Table IV
2	Machine protected against dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the machine is tilted at any angle up to 15° from its normal position	
3	Machine protected against spraying water	Water falling as a spray at an angle up to 60° from the vertical shall have no harmful effect	
4	Machine protected against splashing water	Water splashing against the machine from any direction shall have no harmful effect	
5	Machine protected against water jets	Water projected by a nozzle against the machine from any direction shall have no harmful effect	
6	Machine protected against heavy seas	Water from heavy seas or water projected in powerful jets shall not enter the machine in harmful quantities	
7	Machine protected against the effects of immersion	Ingress of water in the machine in a harmful quantity shall not be possible when the machine is immersed in water under stated conditions of pressure and time	
8	Machine protected against continuous submersion	The machine is suitable for continuous submersion in water under conditions which shall be specified by the manufacturer <i>Note.</i> – Normally, this will mean that the machine is hermetically sealed. However with certain types of machines it can mean that water can enter but only in such a manner that it produces no harmful effect	

Note. – The brief description given in column 2 of this table should not be used to *specify* the form of protection.

6. Marking

It is recommended that the characteristic letters and numerals be marked on the machine preferably on the rating plate, or, if this is not practicable, on the enclosure.

When all parts of a machine have not the same degree of protection, the designation of the lowest degree shall be shown first, followed if applicable by the other designation with reference to the part to which it applies.

Where the mounting of the machine has an influence on the degree of protection, the intended mounting arrangement shall be indicated by the manufacturer on the rating plate or in his instructions for mounting or the like.

7. General requirements for tests

The tests specified in this standard are type tests.

"They shall be carried out on standard products or models of them. Where this is not possible, verification either by test or by examination of drawings should be the subject of an agreement between manufacturer and user".

Unless otherwise specified, the samples of machines for each test shall be in clean and new condition, with all the parts in place and mounted in the manner stated by the manufacturer.

In the case of first characteristic numerals 1 and 2 and second characteristic numerals 1, 2, 3 and 4, a visual inspection may, in certain obvious cases, show that the intended degree of protection is obtained. In such cases, no test need be made. However, in case of doubt, tests are to be made as prescribed in Clauses 8 and 9.

7.1 Adequate clearance

For the purpose of the following test clauses in this standard, the term "adequate clearance" has the following meaning:

7.1.1 Low-voltage machines (rated voltages not exceeding a.c.: 1 000 V and d.c.: 1 500 V)

The test device (sphere, finger, wire, etc.) does not touch the live parts or moving parts other than non-dangerous parts such as smooth rotating shafts.

7.1.2 High-voltage machines (rated voltages exceeding a.c.: 1 000 V and d.c.: 1 500 V)

When the test device is placed in the most unfavourable position(s), the machine shall be capable of withstanding the dielectric test applicable to the machine.

This dielectric test requirement may be replaced by a specified clearance dimension in air which would ensure that this test would be satisfactory under the most unfavourable electrical field configuration.