IEC 60670-24

Edition 2.0 2011-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Boxes and enclosures for electrical accessories for household and similar fixed electrical installations – Part 24: Particular requirements for enclosures for housing protective devices and other power dissipating electrical equipment

Boîtes et enveloppes pour appareillage électrique pour installations électriques fixes pour usages domestiques et analogues – Partie 24: Exigences particulières pour enveloppes pour appareillages de protection et autres appareillages électriques ayant une puissance dissipée

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 24: Particular requirements for enclosures for housing protective devices and other power dissipating electrical equipment

FOREWORD

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International Standard IEC 60670-24 has been prepared by subcommittee 23B: Plugs, socket-outlets and switches, of IEC technical committee 23: Electrical accessories.

This second edition cancels and replaces the first edition published in 2005 and constitutes a technical revision.

The following major changes from the first edition are introduced:

- new definition for basic, general purpose enclosures (GP enclosure) and enclosures for pre-determined equipment (PD enclosure);
- new classification and marking for general purpose enclosure (GP enclosure) and enclosure for pre-determined equipment (PD enclosure);
- required data for instruction sheet and/or documentation according to the type of enclosure;

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- adequate space to allow mounting and connection of the accessories (fully equipped) as declared by the manufacturer;
- requirements for general purpose enclosure (GP enclosure) as in Clause 101;
- requirements for enclosure for pre-determined equipment (PD enclosure) as in Clause 102;
- instructions to be given by the manufacturer of the GP enclosure to the installer how to integrate accessories and example of calculation given in Annex AA;
- instructions to be given by the manufacturer of the PD enclosure to the installer how to integrate accessories given in Annex BB.

The text of this standard is based on the following documents:

FDIS	Report on voting
23B/982/FDIS	23B/992/RVD

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

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

This standard shall be used in conjunction with IEC 60670-1. It lists the changes necessary to convert that standard into a specific standard for housing protective devices and other power dissipating electrical equipment.

Where this Part 24 states "addition“, "modification“ or "replacement“, the relevant requirement, test specifications or explanatory matter in Part 1 shall be adapted accordingly.

Clauses and subclauses, notes, figures or tables which are additional to those in Part 1 are numbered starting from 101.

Additional annexes to Part 1 are numbered AA, BB, etc.

In this publication the following print types are used:

- requirements proper: in roman type.
- *test specifications: in italic type.*
- notes: in smaller roman type.

A list of all the parts in the IEC 60670 series, under the general title *Boxes and enclosures for electrical accessories for household and similar fixed electrical installations*, can be found on the IEC website.

The committee has decided that the contents of this publication 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.

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BOXES AND ENCLOSURES FOR ELECTRICAL ACCESSORIES FOR HOUSEHOLD AND SIMILAR FIXED ELECTRICAL INSTALLATIONS –

Part 24: Particular requirements for enclosures for housing protective devices and other power dissipating electrical equipment

1 Scope

Replacement:

This part of IEC 60670 applies to enclosures and parts of them for housing protective devices and other power dissipating electrical equipment intended to be used with a rated voltage not exceeding 400 V and a total incoming load current not exceeding 125 A for household and similar fixed electrical installations.

These enclosures are intended to be installed where unskilled persons have access. They are intended to be integrated with electrical equipment on site by skilled persons (installers).

They are intended to be installed where the prospective short circuit current does not exceed 10 kA unless they are protected by current limiting protective devices with a cut-off current not exceeding 17 kA.

Enclosures complying with this standard are suitable for use, after installation, at ambient temperature not normally exceeding 25 °C, but occasionally reaching 35 °C over 24 h, max. 40 °C and min. –5 °C.

An enclosure which is an integral part of an electrical accessory and provides protection against external influences (e.g. mechanical impacts, ingress of solid objects or of water), is covered by the relevant standard for such an accessory.

This standard does not apply to a low-voltage switchgear and controlgear assembly (ASSEMBLY) as defined in the IEC 60439 or IEC 61439 series of standards nor to a main entrance panel which may or may not be part of the distribution board.

NOTE 1 A main entrance panel is a set composed by a panel or an enclosure equipped with a meter and/or the main incoming device. Main entrance panels comply with their appropriate standards or the requirements of the local supplier if any.

NOTE 2 In the following country this standard cannot be used in installations with a 230 V single-phase supply rated up to 100 A that is under the control of ordinary persons. Integration of mechanical and electrical devices into an enclosure must be verified by compliance with IEC 60439-3 [British standard EN 60439-3]: UK.

NOTE 3 In the following country this standard can only be used for GP enclosures with the instructions according to Annex A. For the other types of enclosures the integration of mechanical and electrical devices into an enclosure is verified by compliance with DS EN 60439-3: DK.

2 Normative references

Addition:

IEC 60417, *Graphical Symbols for Use on Equipment*

IEC 60898-1, *Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation*

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IEC 61008-2-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCB's) - Part 2-1: Applicability of the general rules to RCCB's functionally independent of line voltage*

IEC 61009-2-1, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBO's) - Part 2-1: Applicability of the general rules to RCBO's functionally independent of line voltage*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

3 Definitions

Addition:

3.101
basic enclosure
BE
enclosure containing only mounting means

3.102
general purpose enclosure
GP enclosure
empty enclosure or basic enclosure where integration of mechanical and electrical devices has been verified by tests carried out by the manufacturer according to the present standard and where the installer has to verify the installed equipment by information given in Annex AA

3.103
enclosure for pre-determined equipment
PD enclosure
empty enclosure or basic enclosure where the capability to integrate pre-determined mechanical and electrical equipment has been verified according to design rules and tests according to the present standard carried out by the manufacturer where the installer has to verify the installed equipment following the design instruction declared by the manufacturer according to Annex BB

3.104
manufacturer's design instructions
instructions in accordance to Annexes AA and BB leading to a configuration of the enclosure ensuring the necessary heat dissipation. Standards can be part of those manufacturer design instructions.

3.105
maximum capability to dissipate power
P_{de}
maximum capability of the enclosure to dissipate in normal use the power losses of the installed devices, as declared by the manufacturer

NOTE P_{de} is expressed in watts (W).

3.106
rated current
I_n
current assigned by the manufacturer of the enclosure corresponding to the highest rated current of the incoming device(s) to be installed in the enclosure

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3.107
rated voltage
U_n
voltage assigned by the manufacturer of the enclosure

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

Replacement:

Void.

7 Classification

This clause of Part 1 is applicable with the following modifications:

Table 1 – Classification of boxes and enclosures

Classification criteria 7.7.2 and 7.7.3.1 do not apply.

Addition:

7.101 Empty enclosure	7.101.1 GP enclosure	
	7.101.2 PD enclosure	
7.102 Basic enclosure	7.102.1 GP enclosure	
	7.102.2 PD enclosure	
NOTE 101 In the following countries only enclosures classified according to 7.101.2 and 7.102.2 can be used: BE, DE, FR and GR. NOTE 102 In the following country only enclosures according to 7.101.1 and 7.102.1 can be used: DK.		

8 Marking

This clause of Part 1 is applicable with the following modifications:

Replacement:

8.1 Enclosures shall be marked with

a) the name, trade mark or identification mark of the manufacturer or the responsible vendor;

b) IP code against ingress of solid foreign objects and against access to hazardous parts if higher than IP3X and/or if IP code against harmful ingress of water is higher than IPX0.

The IP code, if applicable, shall be marked on the outside of the enclosure so as to be easily discernible when the enclosure is mounted and wired as for normal use. The

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visibility of the marking is also allowed after opening the door or the lid if a minimum degree of IP20 is maintained after opening;

c) the symbol for total insulation, if applicable (IEC 60417-5172 (2003-02)) ⧈;

d) type designation, reference number or catalogue number;

e) letter N for terminals intended exclusively for the neutral conductor, if any;

f) symbol ⏚ according to IEC 60417-5019 (2006-08) for earthing terminals for the connection of the protective conductor, if any.

Markings of neutral terminals and earthing terminals shall not be placed on screws, or any other easily removable parts.

The following information shall be marked on the boxes and enclosures or provided by the manufacturer on the smallest package unit or in the instructions of the manufacturer:

g) rated voltage;

h) rated current as declared by the manufacturer for enclosures classified according to 7.101.2 and 7.102.2;

i) reference number of this standard i.e. IEC 60670-24;

j) maximum temperature during the building process if 90 °C;

k) for enclosures classified according to 7.3.7 (without inlets), the necessary information concerning the openings that can be made during installation;

l) for enclosures classified according to 7.101.1 and 7.102.1, the maximum capability to dissipate power (P_{de});

NOTE 1 In case of an enclosure designed with ventilation openings, the maximum capability to dissipate power (P_{de}) should be declared by the manufacturer, for both closed and open openings.

m) for enclosures classified according to 7.7 the usability for hollow wall installation;

n) the corresponding dimension sheet, if any;

p) for enclosures classified according to

- 7.101.1 and 7.102.1 the marking "GP";
- 7.101.2 and 7.102.2 the marking "PD"

NOTE 2 Easily removable parts are those parts which can be removed during the normal installation of the enclosure.

Addition:

8.101 Required data for instruction sheet and/or documentation

The manufacturer shall

- provide appropriate instructions regarding the means (for instance glands, grommets, barriers…) to be used to obtain the intended degree of protection;
- give information to the installer concerning the verification of the electrical continuity of the protective circuit (see Clause 11);
- give to the installer the necessary instructions:
  - for enclosures classified according to 7.101.1 and 7.102.1 the manufacturer shall include in the documentation accompanying the enclosure the necessary instructions for installation and how to integrate accessories as given in Annex AA;
  - for enclosures classified according to 7.101.2 and 7.102.2 the manufacturer shall include in the documentation accompanying the enclosure the necessary instructions

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for installation according to the appropriate mounting environment as given in Annex BB.

9 Dimensions

This clause of Part 1 is applicable.

10 Protection against electric shock

This clause of Part 1 is applicable with the following modifications:

Deletion of the 2nd paragraph.

Addition:

10.101 Enclosures are tested completed with the necessary means (such as grommets…) indicated in the manufacturer's instruction and the window opening(s), if any, completely filled up with blank inserts delivered by the manufacturer and/or samples of products as declared by the manufacturer.

Enclosures shall have a degree of protection of at least IPXXC, when mounted and installed as for normal use, according to the manufacturer's instruction.

When mounted and installed as for normal use, enclosures with total insulation shall

a) completely enclose the installed equipment in insulating material, and

b) at no point be pierced by conducting parts in such a manner that there is a possibility of a fault voltage being brought out of the enclosure, and

c) not have conductive parts, such as plates, cover-plates or frames connected to the protective circuit.

If doors or covers of the enclosure can be opened without the use of a key or tool, they shall be left open during the test.

Compliance is checked by inspection and in case of doubt by the following test.

Enclosures shall be tested with test probe C according to IEC 61032 applied for 1 min with a force of 3 N, and the test probe shall not enter that part of the enclosure where live parts are to be installed according to the manufacturer's instructions.

Tests shall be carried out on parts which are accessible after installation.

In addition, all enclosures according to 7.1.1 and 7.1.3 with parts of thermoplastic or elastomeric material shall be subjected for 1 min to a force applied through the tip of test probe C of IEC 61032 but at an ambient temperature of (35 ± 2) °C, the enclosure being at this temperature.

The probe is applied to

– *all places except membranes or the like, where yielding of insulating material could impair the safety, with a force of 3 N;*

– *knock-outs with a force of 3 N.*

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11 Provisions for earthing

This clause of Part 1 is applicable with the following addition:

Addition:

11.101 The electrical continuity of the protective circuit, if any, shall be checked.

Except for enclosures intended to be used for total insulation, all exposed conductive parts of the enclosure shall be connected separately or in groups to the protective circuit terminals.

Compliance is checked by inspection and, if necessary, by a continuity test of the protective circuit.

A measurement shall be carried out to verify that the resistance between the terminal of the incoming protective conductor and the exposed conductive parts shall be less than 0,05 Ω with a current of 10 A a.c. or d.c..

12 Construction

This clause of Part 1 is applicable with the following modifications:

12.1 Lids, covers or cover-plates or parts of them

Replacement:

Lids, covers, cover plates or parts of them, which are intended to ensure protection against electric shock, shall be held in place effectively. They shall be removable only by the use of a tool and/or a key.

12.11 Enclosures classified according to 7.7.1

Replacement:

Enclosures for hollow walls classified according to 7.7.1 shall provide suitable means for fixing the enclosure to hollow walls.

Compliance is checked by inspection.

Addition:

12.101 Enclosures for hollow walls shall have provisions for retention means for cables or means to use a separate retention device or devices.

NOTE In the following country, cables are retained using fixing means applied during installation by the installer: UK.

Compliance is checked by inspection.

12.102 Enclosures shall have enough space to allow mounting and connection of the accessories (fully equipped) as declared by the manufacturer, in safe way.

Compliance is checked by inspection and in case of doubt by manual test using samples of products as declared by the manufacturer and complying with the relevant standard, if any.

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Any generally available conductors having the largest nominal cross-sectional area as declared by the manufacturer shall be used.

13 Resistance to ageing, protection against ingress of solid foreign objects and against harmful ingress of water

This clause of Part 1 is applicable with the following modification:

13.2 Protection against the ingress of solid foreign objects

Replacement of the first paragraph:

Enclosures shall provide a degree of protection of at least IP3X against the ingress of solid foreign objects in accordance with their declared IP code with the lid closed, if any.

In the case of an enclosure with a door or a lid which can be opened without the use of a tool during normal use, a minimum degree of IP20 shall be maintained after opening the door or the lid.

NOTE In the following countries in the case of an enclosure with a door or a lid which can be opened without the use of a tool during normal use, a minimum degree of IP30 shall be maintained after opening the door or the lid: DE, DK.

14 Insulation resistance and electric strength

This clause of Part 1 is applicable.

15 Mechanical strength

This clause of Part 1 is applicable.

Addition:

15.101 PD enclosure shall provide a degree of protection against external mechanical impact in accordance with their declared IK code.

Compliance is checked by the relevant test of IEC 62262.

16 Resistance to heat

This clause of Part 1 is applicable.

17 Creepage distances, clearances and distances through sealing compound

Replacement:

Creepage distances, clearances and distances through sealing compound shall not be less than the value shown in Table 101.

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Table 101 – Creepage distances, clearances and distances through sealing compound

Rated voltage V	Creepage distance, clearance and distance through sealing compound mm
130	1,5
>130 and ≤250	3,0
>250 and ≤400	4,0

Compliance is checked by measurement between the following parts:

Creepage distances and clearances:

- *between live parts of different polarity;*
- *between live parts and*
  - *metal covers and enclosures without insulating lining;*
  - *the surface on which the enclosure is mounted.*

Distances through sealing compound:

– *between live parts covered with sealing compound and the surface on which the enclosure is mounted.*

For multi-way terminal devices and terminals without fixing means but with protection, distances are measured between live parts and any opening which represents the closest point liable to touch any other part when the terminal is fitted with conductors having the largest cross-sectional area.

In cases where various terminals or connecting devices may be mounted in the enclosure, the most unfavourable combinations shall be tested.

18 Resistance of insulating material to abnormal heat and to fire

This clause of Part 1 is applicable with the following modifications:

Replacement of the table by the following:

By the test made at 650 °C	By the test made at 850 °C	By the test made at 960 °C
- for parts of insulating material not necessary to retain current-carrying parts in position (even though they are in contact with them), and - for parts of insulating material retaining earthing terminal in position.	- for parts of insulating material, necessary to retain parts of the earthing circuit in position (with the exception of parts of insulating material needed to retain the earth terminal in position in an enclosure), and - for parts of insulating material of enclosures classified according to 7.7.	- for parts of insulating material necessary to retain current-carrying parts in position.

NOTE Accessories complying with other standards, e.g. connecting devices incorporated but not integrated into the enclosure, are not considered as part of the enclosures.

19 Resistance to tracking

This clause of Part 1 is applicable.

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20 Resistance to corrosion

This clause of Part 1 is applicable.

21 Electromagnetic compatibility

This clause of Part 1 is applicable.

Addition:

101 Verification of the maximum capability to dissipate power (P_{de})

Enclosures according to 7.101.1 and 7.102.1 shall fulfil the following requirements and tests.

These enclosures shall have the capability to dissipate the declared power (P_{de}) according to 8.1 l).

Compliance is checked by the following test.

The maximum capability to dissipate power is determined using heating resistors.

NOTE 101 The test simulates the power dissipated by devices when mounted and wired in the intended circuit as for normal use.

The test is carried out on specimens equipped with the heating resistor fitted in the most unfavourable position.

NOTE 102 For example, the different positions of a rail, etc.

The cross-sectional area of the conductors for the connection of the heating resistors shall be 1,5 mm^2 and the opening for this cable is sealed, if needed.

Other openings for cables, if any, and for devices are closed as in normal use.

For enclosures according to 7.2.1 the test is carried out with the specimen mounted as declared by the manufacturer.

For enclosures according to 7.2.2 the specimen is mounted on a minimum 19 mm thick plywood painted black.

For enclosures according to 7.2.3.1 the test is carried out with the specimen cast in a concrete wall of thickness not less than 100 mm on each surface; it is allowed to cast the specimen in walls of different material, with equivalent thermal conductivity.

The test in concrete represents the conventional mounting condition.

For declared mounting conditions other than in concrete the manufacturer shall declare the appropriate P_{de} value in the documentation according to the declared mounting condition.

At least 200 mm are provided between each surface of the specimen and the relevant edge of the test surface (Figure 101).

A heating resistor (Figure 102) with uniformly distributed winding on an insulating support (such as mica) is placed into the specimen under test.

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The winding and the insulating support shall provide a uniform thermal flow.

For enclosures intended to be fitted with rail mounting accessories and electrical equipment, the heating resistor is located at half the distance between the rail and the window, as shown in Figure 103.

If there is more than one row of rail mounting accessories and electrical equipment, the test is carried out by equalising the power loss on all rows using equal heating resistors on each row.

The heating resistor(s) length is (are) equal to the length of the window(s) with a tolerance of $^{0}_{-10}$ *mm. The window or windows are closed with their own blank covers provided by the manufacturer.*

For enclosures other than those intended to be fitted with modular devices, the heating resistor is located at half the distance between the door or lid and the inner bottom surface of the specimen (or the mounting surface for the device intended by the manufacturer) as shown in Figure 104. The distance of the heating resistor(s) ends from the lateral and from the upper and lower edges of the mounting surface shall be equal to (50 ± 5) mm.

If the dimensions of the specimen allow the mounting of several devices in different positions, the test is carried out by equalising the power loss using equal heating resistors mounted as shown in Figures 104 and 105, and the distance between the heating resistors being of (90 ± 5) mm.

In this case the distance of the heating resistor(s) from the upper and lower edge of the mounting surface of the specimen shall not be less than 50 mm (Figure 105).

The temperature rise of the accessible parts of the enclosure or of parts that can become accessible during normal use, including the blank covers, if any, is measured. This test shall be performed with the door or lid, if any, closed.

The current passing through the heating resistor is such that the temperature at the hottest point of the heating resistor(s) is not greater than 200 °C, and the temperature rise measured in a steady state condition (variation less than 1 K/h) on the hottest accessible part shall not be greater than 30 K. The power dissipated by the heating resistor(s) is then measured.

The value rounded to the next lower integer number shall not be less than the declared value of the maximum capability of the dissipated power (P_{de})*.*

NOTE 103 Basis for the temperature rise value of 30 K is an ambient temperature of 25 °C.

After the test, the enclosure shall show no damage or deformation which would impair its further use.

102 Verification of temperature rise

Enclosures according to 7.101.2 and 7.102.2 shall fulfil the following requirements and tests.

These enclosures shall have an acceptable temperature rise when equipped with the most onerous configuration of electrical equipment declared by the manufacturer.

Compliance is checked by the following tests.

The temperature rise test is performed with an enclosure arranged as follows.

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The enclosure shall be equipped, wired and mounted as in normal use, including electrical devices, lids, covers, doors, connections, terminals, etc., according to the manufacturer's instructions and the corresponding manufacturer design instructions.

The thermometers or thermocouples for the measure of the internal and ambient temperatures shall be installed at appropriate locations and protected against air currents and heat radiation.

For enclosures according to 7.2.1 the test is carried out with the specimen mounted as declared by the manufacturer.

For enclosures according to 7.2.3.1 the test is carried out with the specimen cast in a concrete wall of thickness not less than 100 mm on each surface; it is allowed to cast the specimen in walls of different material, with equivalent thermal conductivity.

For enclosures according to 7.2.2 the specimen is mounted on a minimum 19 mm thick plywood painted black.

The test in concrete represents the conventional mounting condition.

For declared mounting conditions other than in concrete the manufacturer shall declare a correction factor in the documentation according to the declared mounting condition.

At least 200 mm are provided between each surface of the specimen and the relevant edge of the test surface (Figure 101).

The test shall be made for a time sufficient for the temperature rise to reach a constant value. In practice, this condition is reached when the variation does not exceed 1 K/h.

The specimen is loaded with its rated current (I_n). This current shall be distributed amongst the smallest possible number of outgoing circuits so that each of these circuits is loaded with its rated current multiplied by the rated diversity factor, as stated in Table 102. In the case where the exact total load cannot be obtained by a number of devices loaded to this current, only the last loaded circuit shall be loaded to a lower value to give the correct total.

Table 102 – Diversity factor

Number of main circuits	Diversity factor K
2 and 3	0,8
4 and 5	0,7
6 to 9	0,6
10 and more	0,5

After the test, the enclosure shall show no damage which would impair its further use.

The temperature rise measured on the terminals of the devices shall not exceed the values defined in the relevant standard in a steady-state condition (variation less than 1 K/h).

The temperature of the accessible surfaces of the enclosure shall not exceed the values as given in Table 103.

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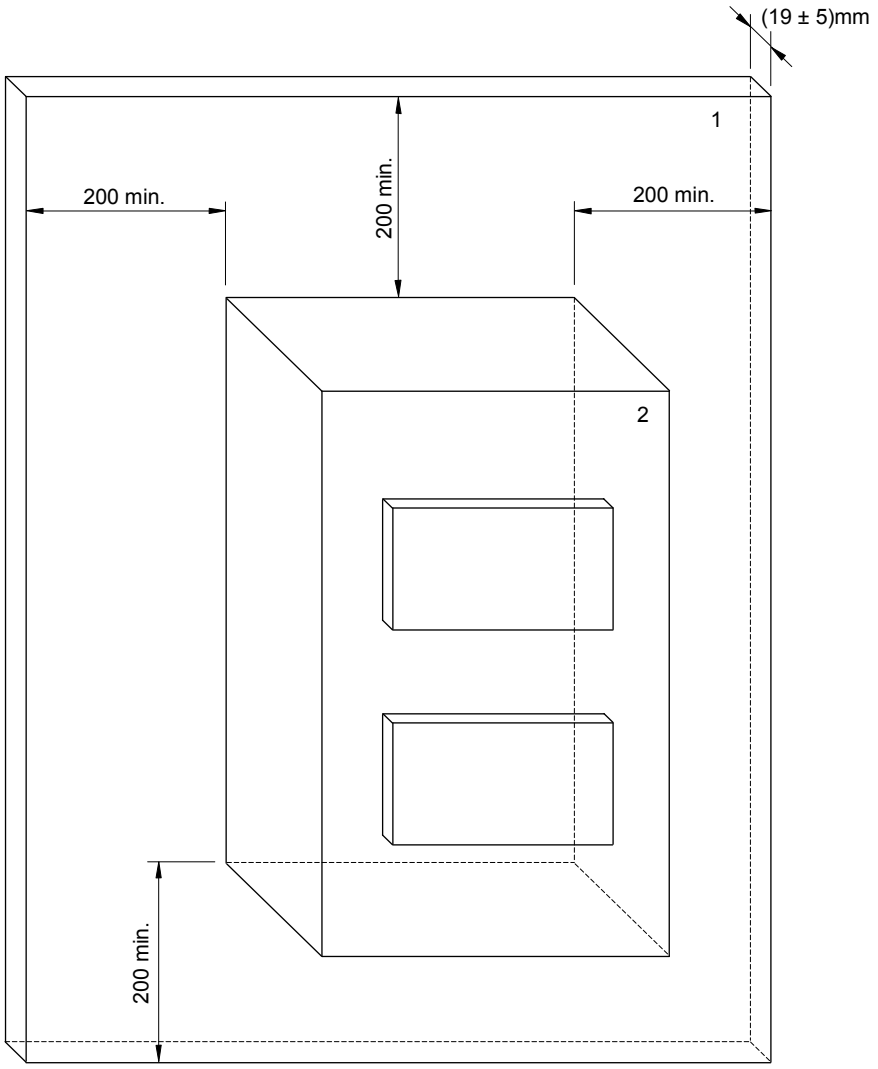
Table 103 – Temperatures of accessible surfaces

Accessible external enclosures and covers:	Temperature rise K
– metal surfaces	30
– insulating surfaces	40

Addition:

Dimensions in millimetres



Key

1 plywood

2 enclosure

Figure 101 – Arrangement for the verification of the maximum capability to dissipate power (P_{de}) and for verification of temperature rise of surface type enclosures

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Dimensions in millimetres

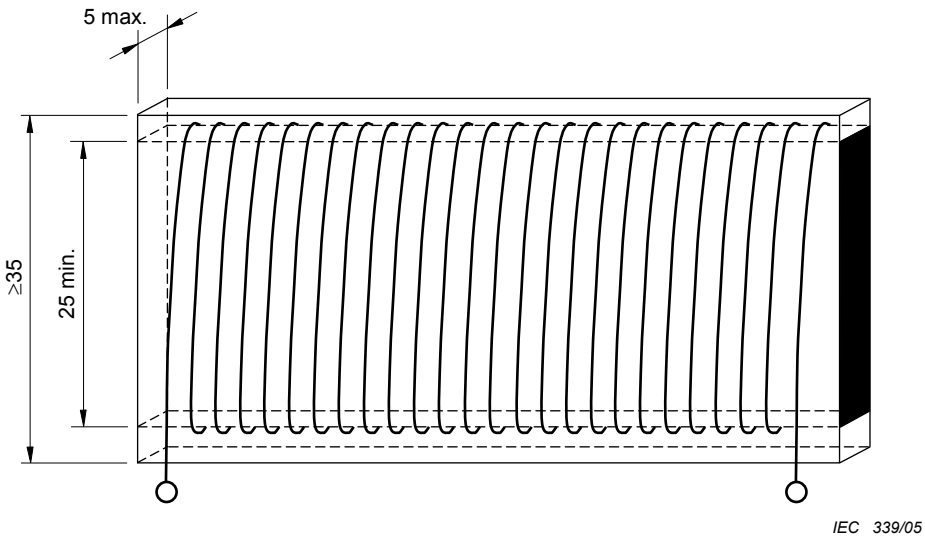

Figure 102 – Heating resistor for the verification of the maximum capability to dissipate power (P_{de})

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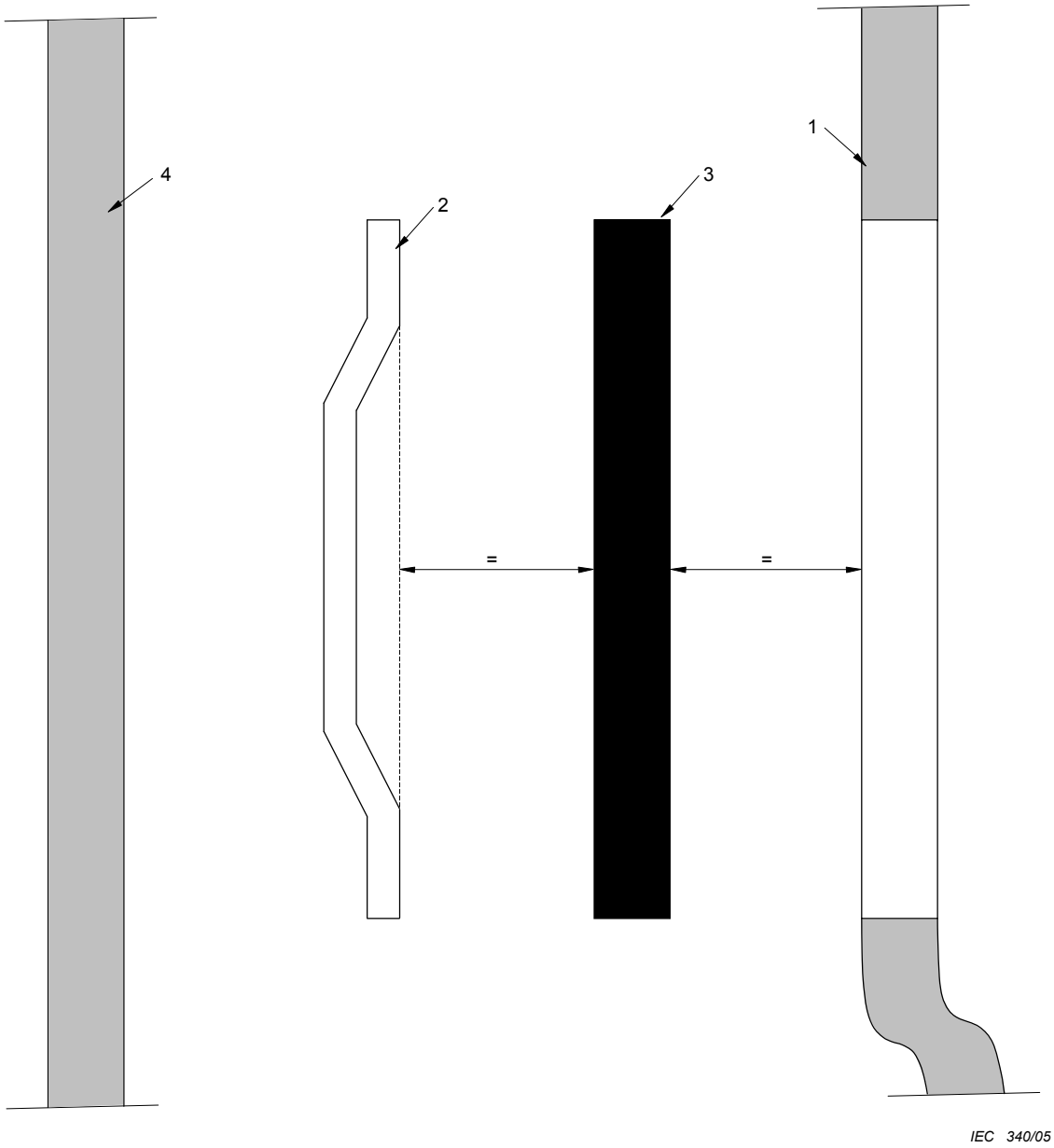

Key

1 door, lid or cover

2 rail for rail mounting accessories and electrical devices

3 resistor

4 rear surface of the enclosure

Figure 103 – Position of the resistor for enclosures designed or intended to be fitted with rail mounting modular accessories and electrical equipment

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