IEC 60335-2-95

Edition 3.2 2017-10
CONSOLIDATED VERSION

INTERNATIONAL STANDARD

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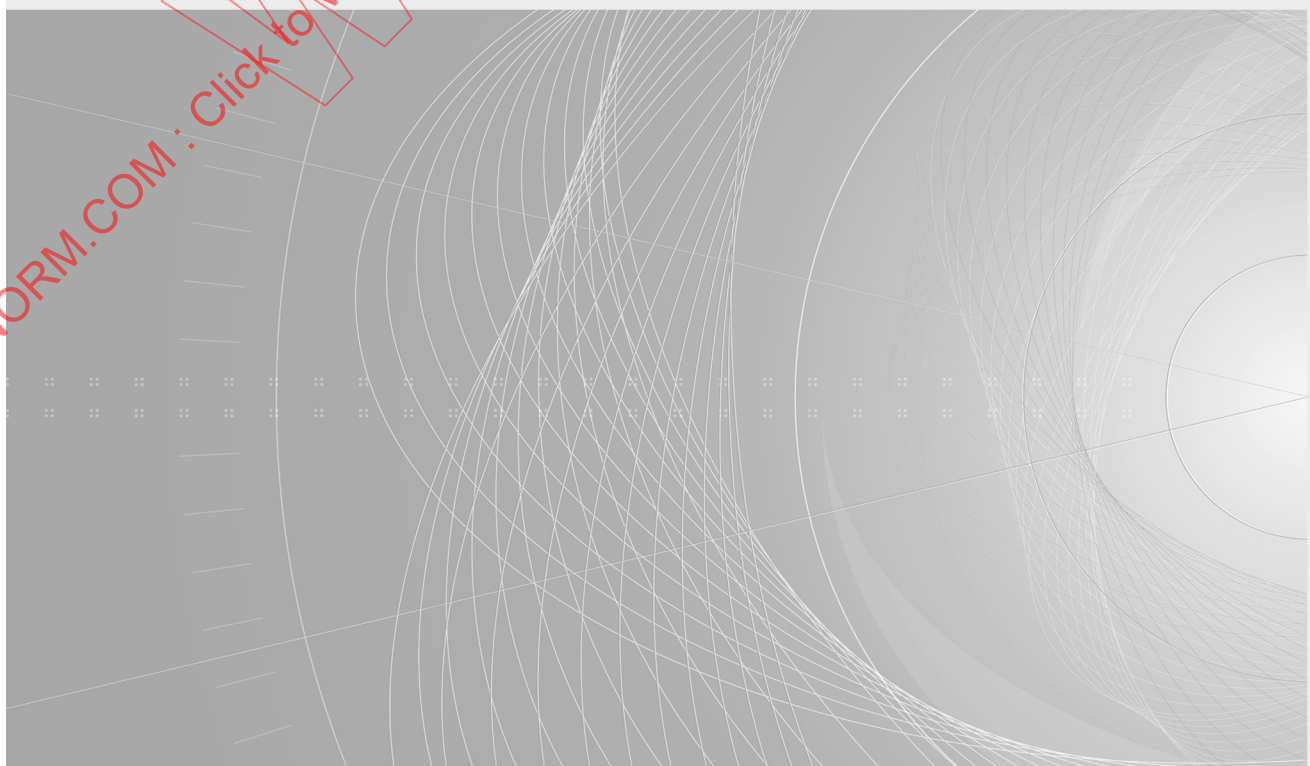
Household and similar electrical appliances – Safety –
Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use



IEC 60335-2-95:2011-09+AMD1:2015-09+AMD2:2017-10 CSV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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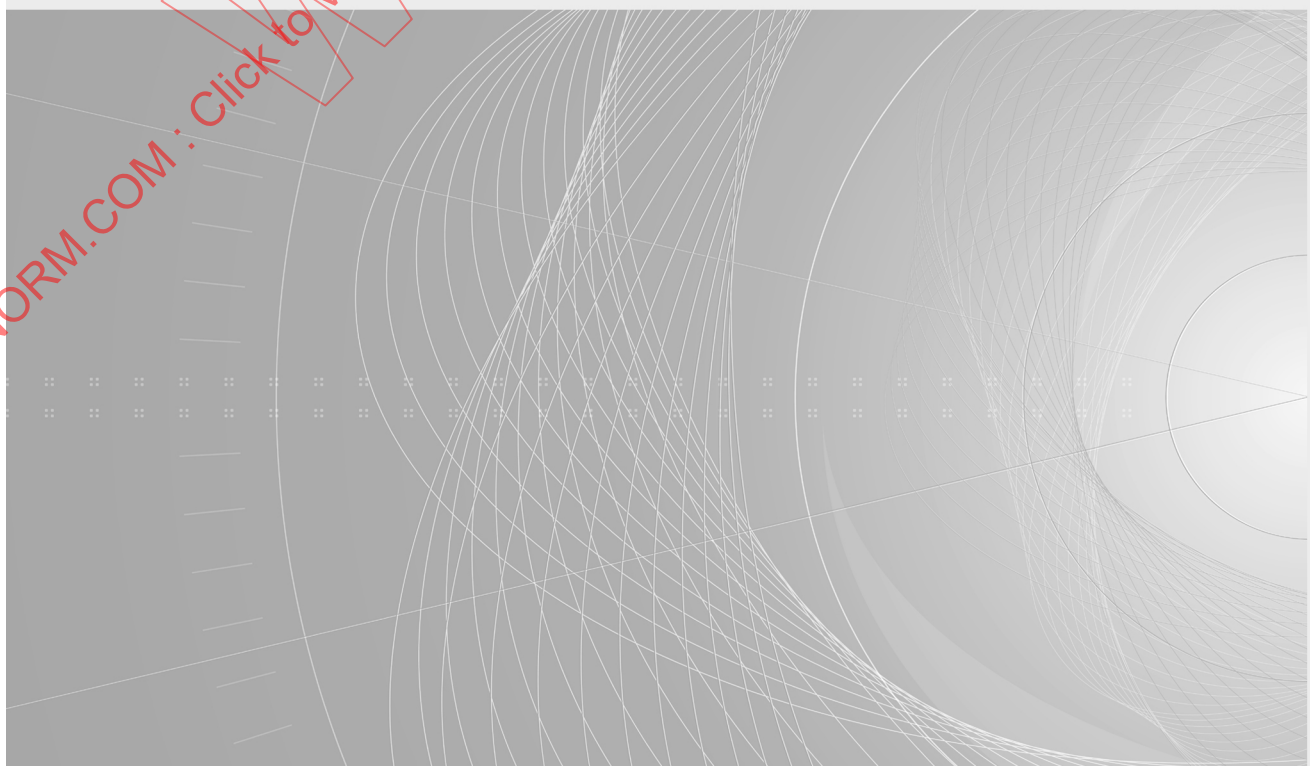

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use

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

IEC 60335-2-95 edition 3.2 contains the third edition (2011-09) [documents 61/4103/CDV and 61/4201/RVC], its amendment 1 (2015-01) [documents 61/4827/FDIS and 61/4871/RVD] and its amendment 2 (2017-10) [documents 61/5294/CDV and 61/5380A/RVC].

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

This part of International Standard IEC 60335 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition constitutes a technical revision.

The principal changes in this edition as compared with the second edition of IEC 60335-2-95 are as follows (minor changes are not listed).

– Some notes have been converted to normative text (11.7, 20.2, 20.101).
– A requirement to fit an entrapment protection device has been added (22.109).

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fifth edition (2010) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for drives for vertically moving garage doors for residential use.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;
– *test specifications: in italic type;*
– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

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.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

– 6.1: Class 0I appliances are allowed (Japan).
– 7.1: Additional markings are required (USA).
– 7.12.1: Additional warnings and instructions are required (USA).
– 11.7: The test conditions are different (USA).
– 19.9: A running overload test is carried out (USA).
– 20.101: The test is not carried out (USA).

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

A bilingual version of this publication may be issued at a later date.

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.

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **drives** for garage doors for residential use that open and close in a vertical direction, the **rated voltage** of the **drives** being not more than 250 V for single-phase appliances and 480 V for other appliances. It also covers the hazards associated with the movement of these electrically driven garage doors.

NOTE 101 Examples of garage doors are shown in Figure 101.

NOTE 102 The **drive** may be supplied with a garage door.

NOTE 103 This standard also applies to **entrapment protection devices** for use with **drives**. It does not cover hazards related to the mechanisms of the door itself.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account playing with the appliance by young children, but recognizes that children may be in the vicinity of the garage door.

NOTE 104 Attention is drawn to the fact that in many countries additional requirements are specified by the national authorities responsible for the protection of labour and similar authorities.

NOTE 105 This standard does not apply to **drives**

– for rolling shutters, awnings, blinds and similar equipment (IEC 60335-2-97);

– for garage doors for use by more than one household (IEC 60335-2-103);

– for commercial and industrial purposes;

– intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation
operation of the **drive** under the following conditions

Drives supplied without a door are operated with their **rated load**.

Drives supplied with a door are operated with the door installed in accordance with the instructions.

3.101
drive
motor and other components that control the movement of the door

NOTE Examples of components are gears, controls, brakes and **entrapment protection systems**.

3.102
entrapment protection system
part of the **drive** that protects against trapping which could result in the human body being squeezed or crushed by the door

NOTE 1 Trapping in the garage is covered by the manual release of 20.109.

NOTE 2 An **entrapment protection system** may be incorporated in the motor assembly or may be installed separately. It may consist of one or more devices, such as pressure sensitive edges, passive infrared, active light sensing devices or a **biased-off switch**.

3.103
automatic drive
drive that operates the door in at least one direction without intentional activation by the user

3.104
biased-off switch
switch that automatically returns to the **off position** when its actuating member is released

3.105
rated load
force or torque assigned to the **drive** by the manufacturer

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

*When a test has to be carried out with a door, the door specified for installation with the **drive** that gives the most unfavourable conditions for the test is used. An artificial load may be used to simulate the door for some of the tests. The **drive** is adjusted in accordance with the instructions.*

5.5 *Addition:*

Wicket doors are kept closed during the tests.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Drives shall be **class I, class II** or **class III**.

6.2 *Addition:*

Drives intended to be exposed to outdoor conditions shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Modification:*

Drives shall be marked with the **rated power input**.

Addition:

Drives supplied without a door shall be marked with the **rated load** in N or in Nm.

7.12 *Addition:*

The instructions shall state the substance of the following:

WARNING: Important safety instructions. It is important for the safety of persons to follow all instructions. Save these instructions.

The instructions shall include the substance of the following:

– do not allow children to play with door controls. Keep remote controls away from children;
– watch the moving door and keep people away until the door is completely opened or closed (not necessary for **automatic drives**);
– take care when operating the manual release since an open door may fall rapidly due to weak or broken springs, or being out of balance;
– frequently examine the installation, in particular check cables, springs and mountings for signs of wear, damage or imbalance. Do not use if repair or adjustment is needed since a fault in the installation or an incorrectly balanced door may cause injury;
– each month check that the drive reverses when the door contacts a 40 mm high object placed on the floor. Adjust if necessary and recheck since an incorrect adjustment may present a hazard;
– details on how to use the manual release;
– information concerning the adjustment of the door and drive (when applicable);
– disconnect the supply when cleaning or carrying out other maintenance.

Instructions for **automatic drives** shall state the substance of the following:

WARNING: Automatic door – The door may operate unexpectedly, therefore do not allow anything to stay in the path of the door.

7.12.1 *Addition:*

The installation instructions shall state the substance of the following:

WARNING: Important safety instructions. Follow all instructions since incorrect installation can lead to severe injury.

The installation instructions shall include details for the installation of the **drive** and its associated components.

For **drives** supplied without a door, the installation instructions shall indicate the type, size and mass of doors for which the **drive** is intended to be used.

The installation instructions shall include the substance of the following:

– before installing the drive, remove all unnecessary ropes or chains and disable any equipment, such as locks, not needed for powered operation;
– before installing the drive, check that the door is in good mechanical condition, correctly balanced and opens and closes properly;
– install the actuating member for the manual release at a height less than 1,8 m;
– install any fixed control at a height of at least 1,5 m and within sight of the door but away from moving parts;

NOTE 101 It is not required to specify a minimum height for key-operated switches.

– permanently fix the labels warning against entrapment in a prominent place or near any fixed controls;
– permanently fix the label concerning the manual release adjacent to its actuating member;
– after installation, ensure that the mechanism is properly adjusted and that the drive reverses when the door contacts a 40 mm high object placed on the floor;
– necessary information for the safe handling of a drive weighing more than 20 kg. This information shall describe how to use the handling means, such as hooks and ropes;
– the drive must not be used with a door incorporating a wicket door (unless the **drive** cannot be operated with the wicket door open);
– after installation, ensure that parts of the door do not extend over public footpaths or roads.

7.101 Drives shall be supplied with a label suitable for permanent fixing. For **automatic drives**, the label shall state the substance of the following:

WARNING: Automatic drive – Keep away from the area of the door since it may operate unexpectedly.

For other **drives**, the label shall include a warning sign having a height of at least 60 mm. The label shall also include the substance of the following:

WARNING: Keep children away when the door is moving.

NOTE An example of a suitable warning sign is shown in Figure 102.

Compliance is checked by inspection and measurement.

7.102 Drives that use contact sensing as an **entrapment protection system** shall be supplied with a label that states the substance of the following:

WARNING: Risk of entrapment – Regularly check and, if necessary, adjust to ensure that, when the door contacts a 40 mm high object placed on the floor, the door reverses or the object can be freed.

Compliance is checked by inspection.

7.103 Drives shall be supplied with a label suitable for permanent fixing that describes how to use the manual release.

Compliance is checked by inspection.

7.104 If the **drive** is intended to be installed by the user, the packaging shall indicate the type of door, including its size and mass, that the **drive** is intended to operate and, if applicable, that the **drive**

– is intended to be installed at least 2,5 m above the floor or other access level;

– can be used with doors having openings greater than 50 mm in diameter;

– is intended for automatic operation.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.2 *Modification:*

Basic insulation and parts separated from **live parts** by **basic insulation** may be touched during adjustment, if a **tool** is needed to gain access to the adjustment means.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Modification:*

Instead of determining the mean value, the maximum value of power input is determined, the effect of inrush currents being ignored.

10.2 *Modification*:

Instead of determining the mean value, the maximum value of the current is determined, inrush currents being ignored.

11 Heating

This clause of Part 1 is applicable except as follows.

11.7 *Replacement:*

***Drives** for continuous operation are operated for consecutive cycles until steady conditions are established.*

***Automatic drives** are operated without rest periods for 3 cycles based on the maximum size of door the **drive** is intended to operate or 4 min, whichever is longer.*

*Other **drives** are operated as follows:*

– ***drives** supplied without a door are operated without rest periods for a minimum of 2 min unless the rated operating time is longer;*

– ***drives** supplied with a door are operated without rest periods for 3 cycles.*

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 *Addition:*

*Parts of **drives** intended to be exposed to outdoor conditions are subjected to the tests specified for IPX4 appliances.*

15.1.2 *Addition*:

*IPX4 tubular **drives** are installed in a tube that is open at both ends and has the largest diameter specified in the instructions. The tube has a length twice that of the motor and is mounted on a support as in normal use. The support is rotated at a speed of 1 r/min.*

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

***Drives** are also subjected to the test of 19.101.*

19.9 Not applicable.

19.10 *Addition:*

*For **drives** having a manual release, the test is repeated with the **drive** released.*

The test is carried out for one cycle of operation if this is longer than 1 min.

19.13 *Addition:*

For each fault condition in 19.11.2, if the appliance is still operating, it shall comply with 20.102 to 20.106.

19.101 ***Drives**, other than those for continuous operation, are supplied at **rated voltage** and operated continuously under **normal operation**.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition*:

Moving parts of **drives** intended to be installed at a height of at least 2,5 m above the ground are considered to be positioned so that adequate protection is provided.

Addition:

Chains moving at less than 0,2 m/s are not considered to be dangerous moving parts.

20.101 **Drives** shall prevent doors from closing unexpectedly during normal use.

Compliance is checked by the following test.

*The **drive** is supplied at **rated voltage** but is not operated. It is loaded with 1,2 times the **rated load** applied for 30 min. If the **drive** is supplied with a door, the load is applied to the door and is equal to the highest force exerted by it. The highest force is determined with the door in the most unfavourable position, the **drive** not being energized. Automatic operation of **automatic drives** is rendered inoperative.*

There shall be no movement except for removal of any play in the system.

*The test is repeated with the **drive** supplied at 0,85 times **rated voltage** and with the supply disconnected.*

20.102 **Drives** controlled by a **biased-off switch** shall stop when the actuating member of the switch is released.

Compliance is checked by the following test.

*The **drive** is installed with a door and supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**. It is operated to close the door. When the actuating member of the switch is released,*

- *if the closing force exerted by the door does not exceeds 150 N, as measured in 20.104.1, the bottom edge of the door shall stop;*
- *if the closing force exerted by the door exceeds 150 N, as measured in 20.104.1, the bottom edge of the door shall stop before it has travelled more than 50 mm vertically;*

The test is repeated during the opening movement of the door.

20.103 **Drives** incorporating an **entrapment protection system** with sensing devices which prevent the door coming into contact with an obstacle shall not cause injury resulting from a moving door.

Compliance is checked by the following test.

*The **drive** is installed with a door, the force exerted by the **drive** is set at the maximum value according to the instructions and the **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**.*

*An obstacle having dimensions of approximately 80 mm x 300 mm and a height of 100 mm is placed on the ground and centrally along its 300 mm length across the door opening. The **drive** is operated to close the door from heights of 100 mm, 1 000 mm and the fully open position of the door. The door shall not move or only move in the opening direction.*

NOTE The obstacle is normally made of rough wood and painted white but other materials and colours may be used to simulate the most unfavourable conditions.

*The obstacle is positioned centrally in the door opening and is then raised in increments up to 300 mm from the height of the door, but not higher than 2,5 m. At each increment, the **drive** is operated to close the door. The door shall stop within 50 mm or reverse its movement without contacting the obstacle.*

A cylindrical obstacle, having a diameter of 50 mm and a length of 850 mm, is suspended centrally in the door opening. It is suspended vertically with the upper end at a height of 900 mm above the ground.

*The **drive** is operated to close the door and the cylinder is swung across the door opening from an angle of 45°. The **entrapment protection system** shall cause the door to reverse its movement.*

The test is repeated from the fully open position with the obstacle positioned at 100 mm from each end of the door opening in turn.

*During the tests, any **biased-off switch** is held closed.*

20.104 **Drives** incorporating an **entrapment protection system** with sensing devices which rely on the door contacting an obstacle shall not cause injury resulting from a moving door.

*Compliance is checked by the test of 20.104.1. If the **drive** is an **automatic drive**, or a **drive** that operates the driven part in at least one direction by a command that can be initiated via a telecommunication or communication network, and for ~~**automatic drives** and~~ **drives** with a closing force exceeding 400 N, compliance is also checked by the test of 20.104.2 for a closing movement.*

*The **drive** is installed with a door, the force exerted by the **drive** is set at the maximum value according to the instructions and the **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**.*

*During the tests, any **biased-off switch** is held closed.*

20.104.1 *Any non-contact **entrapment protection system** is rendered inoperative.*

*The **drive** is operated to close the door from the fully open position and the **entrapment protection system** shall limit the vertical component of the average closing force to*

– *150 N during the first 5 s after the force has exceeded 25 N and*
– *25 N thereafter;*

or

– *400 N during the first 0,75 s after the force has exceeded 150 N,*

– *150 N during a further period of 4,25 s and*

– *25 N thereafter;*

or

– *800 N during the first 2 s after the force has exceeded 150 N for doors that do not swing outward,*

– *600 N during the first 2 s after the force has exceeded 150 N for doors that swing outward,*

– *150 N during a further period of 3 s and*

– *25 N thereafter.*

The force is measured by means of an instrument that incorporates a rigid plate having a diameter of 80 mm and a spring having a ratio of 500 N/mm ± 50 N/mm. The spring acts on a sensing element that is connected to an amplifier having a rise and fall time not exceeding 5 ms. The measuring instrument shall be accurate to within 5 %.

The force is measured on the bottom edge of the door at the following heights above the ground:

– *50 mm;*

– *300 mm;*

– *500 mm;*

– *2 500 mm, or 300 mm below the maximum opening height of the door if this is less than 2 800 mm.*

At each height, the force is measured at the following locations:

– *in the centre of the bottom edge of the door;*

– *200 mm from each end of the bottom edge of the door.*

The test is carried out three times and the arithmetic average closing force is calculated for each location.

NOTE The door may reverse its movement after contacting the obstacle.

20.104.2 *An obstacle having dimensions of approximately 80 mm × 300 mm and a height of 100 mm is placed on the ground and centrally along its 300 mm length across the door opening. The* ***drive*** *is operated to close the door from heights of 100 mm, 1 000 mm and the fully open position of the door. The door shall not move or only move in the opening direction.*

The test is repeated from the fully open position with the obstacle positioned at 100 mm from each end of the door opening in turn.

A cylindrical obstacle, having a diameter of 50 mm and a length of 850 mm, is suspended centrally in the door opening. It is suspended vertically with the upper end at a height of 900 mm above the ground.

The ***drive*** *is operated to close the door and the cylinder is swung across the door opening from an angle of 45°. The* ***entrapment protection system*** *shall cause the door to reverse its movement.*

20.105 **Drives** shall prevent entrapment in the opening direction.

Compliance is checked by the following test.

*The force exerted by the **drive** is set at the maximum value according to the instructions. A test piece having dimensions of approximately 200 mm x 300 mm, a height of 700 mm and a mass of 20 kg ± 0,5 kg is fixed centrally to the outside of the door, with the 300 mm edge adjacent to the bottom edge of the door.*

*The **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage** and operated to open the door. The movement of the door shall stop before the test piece comes into contact with the lintel.*

20.106 Entrapment protection systems shall provide an adequate level of protection in the event of a failure within the system installation wiring.

*Compliance is checked by the following test, unless the **entrapment protection system** is a **biased-off switch**.*

*The **drive** is installed with a door and supplied at **rated voltage**. The **drive** is operated to close the door. During the movement, a short circuit or open circuit is simulated in the system installation wiring.*

*Unless the **entrapment protection system** continues to operate normally, the door shall stop moving or reverse and stop at the fully open position. After completing its movement, the door may be controlled by a supplementary **biased-off switch**.*

*If the **entrapment protection system** continues to operate normally, the test is repeated with one additional fault simulated.*

The test is repeated during the opening movement of the door.

20.107 A mechanical fault in the **drive** shall not result in a hazardous condition.

Compliance is checked by inspection and if necessary by test.

*The inspection shall evaluate which parts can affect the safety of operation and whether they are likely to break or become loose. These parts may be within the **drive** or used for connecting the **drive** to the door.*

NOTE Examples of parts which are evaluated are screws, pins, shafts, wheels, chains and supporting parts.

*If the inspection cannot determine whether the **drive** will continue to operate normally or stop its movement when the part has failed, the following test is carried out.*

*The **drive** is installed with a door, the force exerted by the **drive** is set at the maximum value according to the instructions and the **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**.*

*The faults are introduced one at a time and the **drive** is operated as in normal use.*

*Unless the **drive** and the door continue to operate normally,*

– *the **drive** shall stop operating by the end of the cycle, and*
– *further operation shall not be possible, and*
– *the speed of the door shall not increase by more than 20 %.*

20.108 During the movement of the **drive** in either direction, the actuation of a manual control shall stop the movement if there is no separate button for the stop function.

If the control has a single button for controlling the movement, further actuation shall reverse the direction of movement.

If the control has three buttons for controlling the movement, one button shall be a stop button.

Compliance is checked by a manual test.

NOTE The test may be carried out without a door.

20.109 The appliance shall incorporate a manual release so that the door can be operated manually. Operation of the manual release shall not give rise to a hazard, such as kickback or unexpected operation of the **drive**.

Compliance is checked by operating the manual release with the door blocked by an obstacle placed at different heights during closing. The release shall be operable with a force not exceeding 220 N or a torque not exceeding 1,6 Nm.

*The test is carried out with the entrapment protection devices rendered inoperative and then without the **drive** being energized.*

20.110 **Drives** shall not restart automatically after the movement has stopped unintentionally.

NOTE 1 Unintentional stopping may be caused by interruption of the power supply or by operation of a **thermal cut-out**.

Compliance is checked by the following test.

*The appliance is supplied at **rated voltage** and operated under **normal operation**. The supply is then interrupted for at least 2 s. After the supply is restored, the **drive** shall not restart. However, **automatic drives** may restart, provided they function as in normal use.*

*The appliance is operated again and operation of a **thermal cut-out** is simulated. After the fault condition has been removed, the **drive** shall not restart. However, **automatic drives** may restart, provided they function as in normal use.*

NOTE 2 The test may be carried out without a door.

21 Mechanical strength

This clause of Part 1 is applicable.

22 Construction

This clause of Part 1 is applicable except as follows.

22.40 Not applicable.

22.46 *Addition:*

If compliance with the requirements in Clause 20 relies on the operation of a programmable electronic circuit, the software shall contain measures to control the fault/error conditions specified in Table R.1.

22.101 It shall not be possible to adjust the **drive** without the use of a **tool**.

Compliance is checked by inspection.

22.102 **Drives** shall be supplied with all associated components necessary for compliance with this standard.

Compliance is checked by inspection.

22.103 If the **entrapment protection system** is a **biased-off switch**, it shall only be possible to activate the **drive** when operating the switch within sight of the door.

Compliance is checked by inspection and test.

22.104 **Drives** shall not be provided with a control that renders the **entrapment protection system** inoperative. A malfunctioning **entrapment protection system** shall only be overridden by a **biased-off switch** in sight of the door but not on its first activation.

NOTE 1 The **biased-off switch** can be the control used to operate the **drive** as in normal use.

Compliance is checked by inspection and the following test.

*Each **entrapment protection system** is tested for proper operation and that it is not overridden when the **entrapment protection system** is fully functional. For each test, a fault is introduced in the **entrapment protection system**. The **biased-off switch** shall not override the malfunctioning **entrapment protection system** on its first activation.*

*Portable remote controls shall be checked to ensure that they do not override a malfunctioning **entrapment protection system** unless they can only activate the **drive** in sight of the door.*

NOTE 2 Releasing the **biased-off switch** is the same as introducing an obstruction.

NOTE 3 It is acceptable for the activation of a **biased-off switch** to override a malfunctioning **entrapment protection system** on the second activation but not on the first activation which will act as an obstruction.

22.105 The actuating member of the manual release shall be coloured red.

Compliance is checked by inspection.

22.106 All manual controls that operate the door shall have the same markings to indicate the functions.

Compliance is checked by inspection.

NOTE The control may be for remote operation or for wall mounting.

22.107 It shall only be possible to open and close the door by use of a manual control unless an **automatic drive** is provided.

Compliance is checked by inspection and test.

22.108 A **drive** for a door incorporating a wicket door shall be constructed so that the **drive** cannot be operated when the wicket door is open.

Compliance is checked by inspection and by the following test.

*The **drive** is installed with a door incorporating a wicket door and is supplied at **rated voltage**. The wicket door is opened and the **drive** is operated so as to open the door. The door shall not open.*

22.109 **Drives** shall incorporate

– a **biased-off switch**; or

– an **entrapment protection system** with sensing devices which prevent the door coming into contact with an obstacle; or

– an **entrapment protection system** with sensing devices which rely on the door contacting an obstacle.

Compliance is checked by inspection.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows.

24.1.3 *Addition*:

*If a switch is used to disconnect the **drive** when the manual release is operated, the switch is tested for 300 cycles of operation.*

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25.7 *Addition*:

The **supply cord** of **drives** for outdoor use shall be polychloroprene sheathed and not be lighter than ordinary polychloroprene sheathed cord (code designation 60245 IEC 57).

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.2 *Addition:*

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution during normal use of the appliance.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.2 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable except as follows.

Addition:

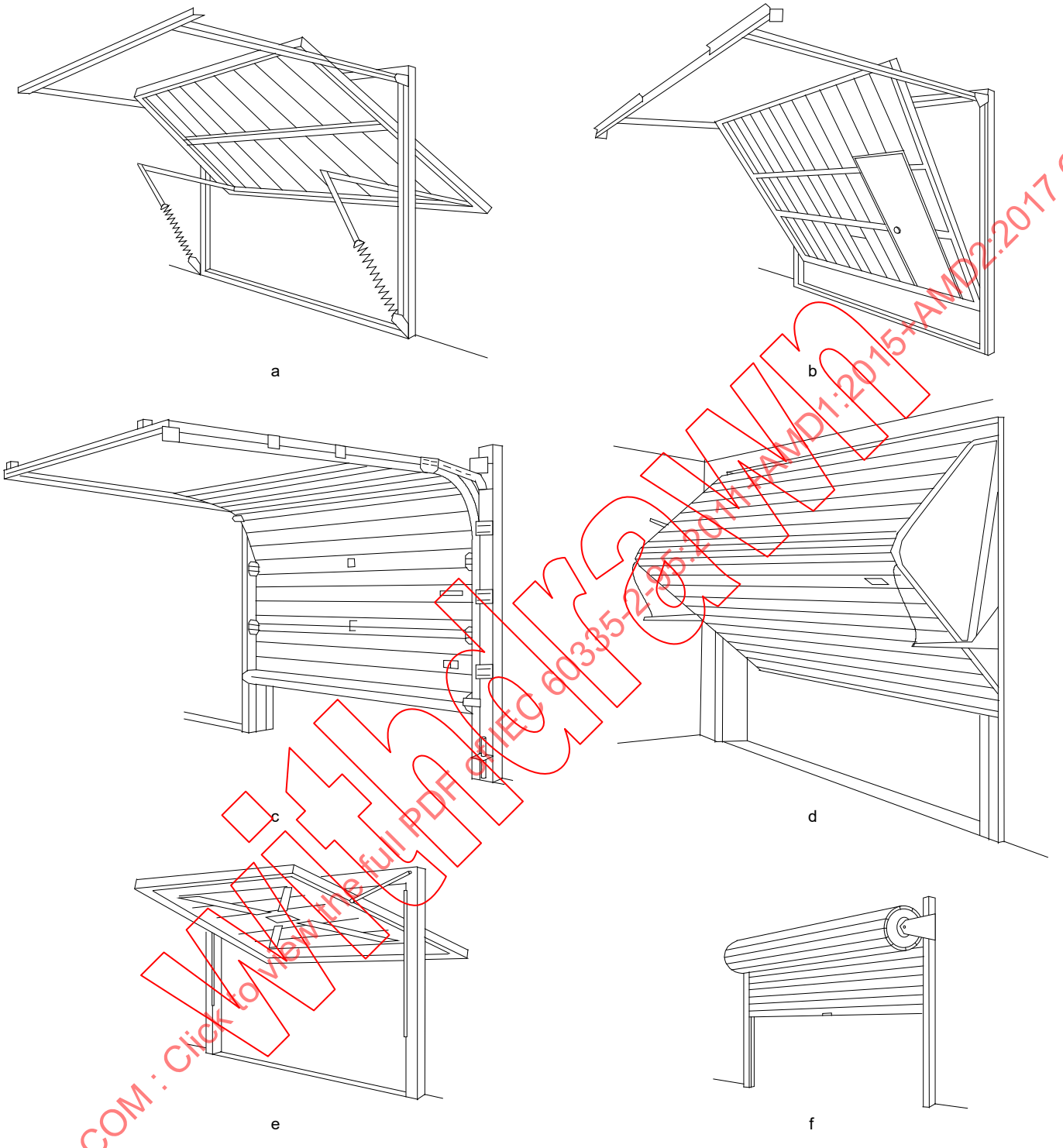
For parts intended to be installed outdoors, compliance is checked by the salt mist test of IEC 60068-2-52, severity 2 being applicable.

Before the test, coatings are scratched by means of a hardened steel pin, the end of which has the form of a cone with an angle of 40°. Its tip is rounded with a radius of 0,25 mm ± 0,02 mm. The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N. The scratches are made by drawing the pin along the surface of the coating at a speed of approximately 20 mm/s. Five scratches are made at least 5 mm apart and at least 5 mm from the edges.

After the test, the appliance shall not have deteriorated to such an extent that compliance with this standard, in particular with Clauses 8 and 27, is impaired. The coating shall not be broken and shall not have loosened from the metal surface.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.



Types

a One-piece door with horizontal track

b One-piece door, with vertical and horizontal tracks, containing a wicket door

c Sectional door with horizontal and vertical track

d Sectional door with horizontal folding

e Vertical tracked canopy door

f Rolling door

Figure 101 – Examples of types of garage doors

IEC 1497/04

NOTE Form and colours are in accordance with ISO 3864-1.

Figure 102 – Example of pictogram warning against child entrapment

Annexes

The annexes of Part 1 are applicable except as follows:

Annex R
(normative)

Software evaluation

This annex of Part 1 is applicable except as follows:

R.2.2.5 *Addition:*

For other programmable electronic circuits with functions requiring software incorporating measures to control the fault/error conditions specified in Table R.1, detection of a fault/error shall occur within one cycle of operation if compliance with Clause 20 is impaired.

R.2.2.9 *Addition:*

For other programmable electronic circuits, the software and safety-related hardware under its control shall be initialized and shall terminate within one cycle of operation if compliance Clause 20 is impaired.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 60335-2-97, *Household and similar electrical appliances – Safety – Part 2-97: Particular requirements for drives for rolling shutters, awnings, blinds and similar equipment*

IEC 60335-2-103, *Household and similar electrical appliances – Safety – Part 2-103: Particular requirements for drives for gates, doors and windows*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

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IEC 60335-2-95

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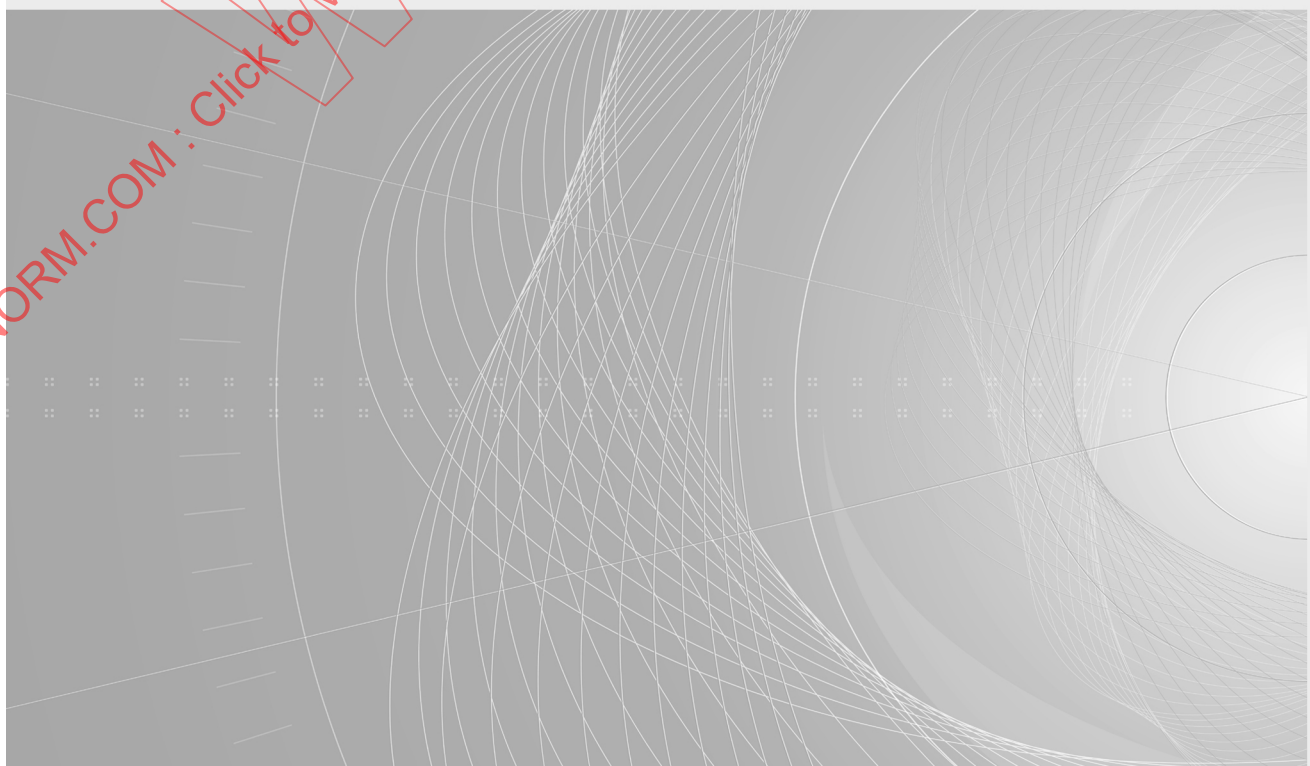
CONSOLIDATED VERSION

FINAL VERSION

colour inside

Household and similar electrical appliances – Safety – Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use



IEC 60335-2-95:2011-09+AMD1:2015-09+AMD2:2017-10 CSV(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use

FOREWORD

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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 60335-2-95 edition 3.2 contains the third edition (2011-09) [documents 61/4103/CDV and 61/4201/RVC], its amendment 1 (2015-01) [documents 61/4827/FDIS and 61/4871/RVD] and its amendment 2 (2017-10) [documents 61/5294/CDV and 61/5380A/RVC].

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 part of International Standard IEC 60335 has been prepared by IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition constitutes a technical revision.

The principal changes in this edition as compared with the second edition of IEC 60335-2-95 are as follows (minor changes are not listed).

– Some notes have been converted to normative text (11.7, 20.2, 20.101).
– A requirement to fit an entrapment protection device has been added (22.109).

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

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fifth edition (2010) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for drives for vertically moving garage doors for residential use.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states "addition", "modification" or "replacement", the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
– additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

– requirements: in roman type;
– *test specifications: in italic type;*
– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

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.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

The following differences exist in the countries indicated below.

– 6.1: Class 0I appliances are allowed (Japan).
– 7.1: Additional markings are required (USA).
– 7.12.1: Additional warnings and instructions are required (USA).
– 11.7: The test conditions are different (USA).
– 19.9: A running overload test is carried out (USA).
– 20.101: The test is not carried out (USA).

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety*, can be found on the IEC website.

A bilingual version of this publication may be issued at a later date.

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.

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

Part 2-95: Particular requirements for drives for vertically moving garage doors for residential use

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electric **drives** for garage doors for residential use that open and close in a vertical direction, the **rated voltage** of the **drives** being not more than 250 V for single-phase appliances and 480 V for other appliances. It also covers the hazards associated with the movement of these electrically driven garage doors.

NOTE 101 Examples of garage doors are shown in Figure 101.

NOTE 102 The **drive** may be supplied with a garage door.

NOTE 103 This standard also applies to **entrapment protection devices** for use with **drives**. It does not cover hazards related to the mechanisms of the door itself.

As far as is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account playing with the appliance by young children, but recognizes that children may be in the vicinity of the garage door.

NOTE 104 Attention is drawn to the fact that in many countries additional requirements are specified by the national authorities responsible for the protection of labour and similar authorities.

NOTE 105 This standard does not apply to **drives**

– for rolling shutters, awnings, blinds and similar equipment (IEC 60335-2-97);
– for garage doors for use by more than one household (IEC 60335-2-103);
– for commercial and industrial purposes;
– intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (dust, vapour or gas).

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60068-2-52, *Environmental testing – Part 2: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 *Replacement:*

normal operation
operation of the **drive** under the following conditions

Drives supplied without a door are operated with their **rated load**.

Drives supplied with a door are operated with the door installed in accordance with the instructions.

3.101
drive
motor and other components that control the movement of the door

NOTE Examples of components are gears, controls, brakes and **entrapment protection systems**.

3.102
entrapment protection system
part of the **drive** that protects against trapping which could result in the human body being squeezed or crushed by the door

NOTE 1 Trapping in the garage is covered by the manual release of 20.109.

NOTE 2 An **entrapment protection system** may be incorporated in the motor assembly or may be installed separately. It may consist of one or more devices, such as pressure sensitive edges, passive infrared, active light sensing devices or a **biased-off switch**.

3.103
automatic drive
drive that operates the door in at least one direction without intentional activation by the user

3.104
biased-off switch
switch that automatically returns to the **off position** when its actuating member is released

3.105
rated load
force or torque assigned to the **drive** by the manufacturer

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.2 *Addition:*

*When a test has to be carried out with a door, the door specified for installation with the **drive** that gives the most unfavourable conditions for the test is used. An artificial load may be used to simulate the door for some of the tests. The **drive** is adjusted in accordance with the instructions.*

5.5 *Addition:*

Wicket doors are kept closed during the tests.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Modification:*

Drives shall be **class I, class II** or **class III**.

6.2 *Addition:*

Drives intended to be exposed to outdoor conditions shall be at least IPX4.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7.1 *Modification:*

Drives shall be marked with the **rated power input**.

Addition:

Drives supplied without a door shall be marked with the **rated load** in N or in Nm.

7.12 *Addition:*

The instructions shall state the substance of the following:

WARNING: Important safety instructions. It is important for the safety of persons to follow all instructions. Save these instructions.

The instructions shall include the substance of the following:

– do not allow children to play with door controls. Keep remote controls away from children;
– watch the moving door and keep people away until the door is completely opened or closed (not necessary for **automatic drives**);
– take care when operating the manual release since an open door may fall rapidly due to weak or broken springs, or being out of balance;
– frequently examine the installation, in particular check cables, springs and mountings for signs of wear, damage or imbalance. Do not use if repair or adjustment is needed since a fault in the installation or an incorrectly balanced door may cause injury;
– each month check that the drive reverses when the door contacts a 40 mm high object placed on the floor. Adjust if necessary and recheck since an incorrect adjustment may present a hazard;
– details on how to use the manual release;
– information concerning the adjustment of the door and drive (when applicable);
– disconnect the supply when cleaning or carrying out other maintenance.

Instructions for **automatic drives** shall state the substance of the following:

WARNING: Automatic door – The door may operate unexpectedly, therefore do not allow anything to stay in the path of the door.

7.12.1 *Addition:*

The installation instructions shall state the substance of the following:

WARNING: Important safety instructions. Follow all instructions since incorrect installation can lead to severe injury.

The installation instructions shall include details for the installation of the **drive** and its associated components.

For **drives** supplied without a door, the installation instructions shall indicate the type, size and mass of doors for which the **drive** is intended to be used.

The installation instructions shall include the substance of the following:

– before installing the drive, remove all unnecessary ropes or chains and disable any equipment, such as locks, not needed for powered operation;
– before installing the drive, check that the door is in good mechanical condition, correctly balanced and opens and closes properly;
– install the actuating member for the manual release at a height less than 1,8 m;
– install any fixed control at a height of at least 1,5 m and within sight of the door but away from moving parts;

NOTE 101 It is not required to specify a minimum height for key-operated switches.

– permanently fix the labels warning against entrapment in a prominent place or near any fixed controls;
– permanently fix the label concerning the manual release adjacent to its actuating member;
– after installation, ensure that the mechanism is properly adjusted and that the drive reverses when the door contacts a 40 mm high object placed on the floor;
– necessary information for the safe handling of a drive weighing more than 20 kg. This information shall describe how to use the handling means, such as hooks and ropes;
– the drive must not be used with a door incorporating a wicket door (unless the **drive** cannot be operated with the wicket door open);
– after installation, ensure that parts of the door do not extend over public footpaths or roads.

7.101 Drives shall be supplied with a label suitable for permanent fixing. For **automatic drives**, the label shall state the substance of the following:

WARNING: Automatic drive – Keep away from the area of the door since it may operate unexpectedly.

For other **drives**, the label shall include a warning sign having a height of at least 60 mm. The label shall also include the substance of the following:

WARNING: Keep children away when the door is moving.

NOTE An example of a suitable warning sign is shown in Figure 102.

Compliance is checked by inspection and measurement.

7.102 Drives that use contact sensing as an **entrapment protection system** shall be supplied with a label that states the substance of the following:

WARNING: Risk of entrapment – Regularly check and, if necessary, adjust to ensure that, when the door contacts a 40 mm high object placed on the floor, the door reverses or the object can be freed.

Compliance is checked by inspection.

7.103 Drives shall be supplied with a label suitable for permanent fixing that describes how to use the manual release.

Compliance is checked by inspection.

7.104 If the **drive** is intended to be installed by the user, the packaging shall indicate the type of door, including its size and mass, that the **drive** is intended to operate and, if applicable, that the **drive**

– is intended to be installed at least 2,5 m above the floor or other access level;

– can be used with doors having openings greater than 50 mm in diameter;

– is intended for automatic operation.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.2 *Modification:*

Basic insulation and parts separated from **live parts** by **basic insulation** may be touched during adjustment, if a **tool** is needed to gain access to the adjustment means.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Modification:*

Instead of determining the mean value, the maximum value of power input is determined, the effect of inrush currents being ignored.

10.2 *Modification*:

Instead of determining the mean value, the maximum value of the current is determined, inrush currents being ignored.

11 Heating

This clause of Part 1 is applicable except as follows.

11.7 *Replacement:*

***Drives** for continuous operation are operated for consecutive cycles until steady conditions are established.*

***Automatic drives** are operated without rest periods for 3 cycles based on the maximum size of door the **drive** is intended to operate or 4 min, whichever is longer.*

*Other **drives** are operated as follows:*

– ***drives** supplied without a door are operated without rest periods for a minimum of 2 min unless the rated operating time is longer;*

– ***drives** supplied with a door are operated without rest periods for 3 cycles.*

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1.1 *Addition:*

*Parts of **drives** intended to be exposed to outdoor conditions are subjected to the tests specified for IPX4 appliances.*

15.1.2 *Addition*:

*IPX4 tubular **drives** are installed in a tube that is open at both ends and has the largest diameter specified in the instructions. The tube has a length twice that of the motor and is mounted on a support as in normal use. The support is rotated at a speed of 1 r/min.*

16 Leakage current and electric strength

This clause of Part 1 is applicable.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

18 Endurance

This clause of Part 1 is not applicable.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 *Addition:*

***Drives** are also subjected to the test of 19.101.*

19.9 Not applicable.

19.10 *Addition:*

*For **drives** having a manual release, the test is repeated with the **drive** released.*

The test is carried out for one cycle of operation if this is longer than 1 min.

19.13 *Addition:*

For each fault condition in 19.11.2, if the appliance is still operating, it shall comply with 20.102 to 20.106.

19.101 ***Drives**, other than those for continuous operation, are supplied at **rated voltage** and operated continuously under **normal operation**.*

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.2 *Addition*:

Moving parts of **drives** intended to be installed at a height of at least 2,5 m above the ground are considered to be positioned so that adequate protection is provided.

Addition:

Chains moving at less than 0,2 m/s are not considered to be dangerous moving parts.

20.101 **Drives** shall prevent doors from closing unexpectedly during normal use.

Compliance is checked by the following test.

*The **drive** is supplied at **rated voltage** but is not operated. It is loaded with 1,2 times the **rated load** applied for 30 min. If the **drive** is supplied with a door, the load is applied to the door and is equal to the highest force exerted by it. The highest force is determined with the door in the most unfavourable position, the **drive** not being energized. Automatic operation of **automatic drives** is rendered inoperative.*

There shall be no movement except for removal of any play in the system.

*The test is repeated with the **drive** supplied at 0,85 times **rated voltage** and with the supply disconnected.*

20.102 **Drives** controlled by a **biased-off switch** shall stop when the actuating member of the switch is released.

Compliance is checked by the following test.

*The **drive** is installed with a door and supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**. It is operated to close the door. When the actuating member of the switch is released,*

- *if the closing force exerted by the door does not exceeds 150 N, as measured in 20.104.1, the bottom edge of the door shall stop;*
- *if the closing force exerted by the door exceeds 150 N, as measured in 20.104.1, the bottom edge of the door shall stop before it has travelled more than 50 mm vertically;*

The test is repeated during the opening movement of the door.

20.103 **Drives** incorporating an **entrapment protection system** with sensing devices which prevent the door coming into contact with an obstacle shall not cause injury resulting from a moving door.

Compliance is checked by the following test.

*The **drive** is installed with a door, the force exerted by the **drive** is set at the maximum value according to the instructions and the **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**.*

*An obstacle having dimensions of approximately 80 mm x 300 mm and a height of 100 mm is placed on the ground and centrally along its 300 mm length across the door opening. The **drive** is operated to close the door from heights of 100 mm, 1 000 mm and the fully open position of the door. The door shall not move or only move in the opening direction.*

NOTE The obstacle is normally made of rough wood and painted white but other materials and colours may be used to simulate the most unfavourable conditions.

*The obstacle is positioned centrally in the door opening and is then raised in increments up to 300 mm from the height of the door, but not higher than 2,5 m. At each increment, the **drive** is operated to close the door. The door shall stop within 50 mm or reverse its movement without contacting the obstacle.*

A cylindrical obstacle, having a diameter of 50 mm and a length of 850 mm, is suspended centrally in the door opening. It is suspended vertically with the upper end at a height of 900 mm above the ground.

*The **drive** is operated to close the door and the cylinder is swung across the door opening from an angle of 45°. The **entrapment protection system** shall cause the door to reverse its movement.*

The test is repeated from the fully open position with the obstacle positioned at 100 mm from each end of the door opening in turn.

*During the tests, any **biased-off switch** is held closed.*

20.104 **Drives** incorporating an **entrapment protection system** with sensing devices which rely on the door contacting an obstacle shall not cause injury resulting from a moving door.

*Compliance is checked by the test of 20.104.1. If the **drive** is an **automatic drive**, or a **drive** that operates the driven part in at least one direction by a command that can be initiated via a telecommunication or communication network, and for **drives** with a closing force exceeding 400 N, compliance is also checked by the test of 20.104.2 for a closing movement.*

*The **drive** is installed with a door, the force exerted by the **drive** is set at the maximum value according to the instructions and the **drive** is supplied at the most unfavourable voltage between 0,94 times and 1,06 times the **rated voltage**.*

*During the tests, any **biased-off switch** is held closed.*

20.104.1 *Any non-contact **entrapment protection system** is rendered inoperative.*

*The **drive** is operated to close the door from the fully open position and the **entrapment protection system** shall limit the vertical component of the average closing force to*

– *150 N during the first 5 s after the force has exceeded 25 N and*

– *25 N thereafter;*

or

– *400 N during the first 0,75 s after the force has exceeded 150 N,*

– *150 N during a further period of 4,25 s and*

– *25 N thereafter;*

or

– *800 N during the first 2 s after the force has exceeded 150 N for doors that do not swing outward,*

– *600 N during the first 2 s after the force has exceeded 150 N for doors that swing outward,*

– *150 N during a further period of 3 s and*

– *25 N thereafter.*

The force is measured by means of an instrument that incorporates a rigid plate having a diameter of 80 mm and a spring having a ratio of 500 N/mm ± 50 N/mm. The spring acts on a sensing element that is connected to an amplifier having a rise and fall time not exceeding 5 ms. The measuring instrument shall be accurate to within 5 %.

The force is measured on the bottom edge of the door at the following heights above the ground:

– *50 mm;*

– *300 mm;*

– *500 mm;*

– *2 500 mm, or 300 mm below the maximum opening height of the door if this is less than 2 800 mm.*

At each height, the force is measured at the following locations:

– *in the centre of the bottom edge of the door;*

– *200 mm from each end of the bottom edge of the door.*

The test is carried out three times and the arithmetic average closing force is calculated for each location.

NOTE The door may reverse its movement after contacting the obstacle.

20.104.2 *An obstacle having dimensions of approximately 80 mm × 300 mm and a height of 100 mm is placed on the ground and centrally along its 300 mm length across the door opening. The* ***drive*** *is operated to close the door from heights of 100 mm, 1 000 mm and the fully open position of the door. The door shall not move or only move in the opening direction.*

The test is repeated from the fully open position with the obstacle positioned at 100 mm from each end of the door opening in turn.

A cylindrical obstacle, having a diameter of 50 mm and a length of 850 mm, is suspended centrally in the door opening. It is suspended vertically with the upper end at a height of 900 mm above the ground.

The ***drive*** *is operated to close the door and the cylinder is swung across the door opening from an angle of 45°. The* ***entrapment protection system*** *shall cause the door to reverse its movement.*

20.105 **Drives** shall prevent entrapment in the opening direction.