



BSI Standards Publication

Lifts for the transport of persons and goods

Part 2: Design rules, calculations, examinations and tests of lift components

National foreword

This British Standard is the UK implementation of [ISO 8100-2:2019](#).

The UK participation in its preparation was entrusted to Technical Committee MHE/4, Lifts, hoists and escalators.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2019
Published by BSI Standards Limited 2019

ISBN 978 0 580 97616 2

ICS 91.140.90

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2019.

Amendments/corrigenda issued since publication

Date	Text affected
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INTERNATIONAL STANDARD

ISO
8100-2

First edition
2019-03-12

Lifts for the transport of persons and goods —

Part 2: Design rules, calculations, examinations and tests of lift components

Elévateurs pour le transport de personnes et d'objets —

*Partie 2: Règles de conception, calculs, examens et essais des
composants pour élévateurs*



Reference number
ISO 8100-2:2019(E)
Documents
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Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 List of significant hazards	2
5 Design rules, calculations, examinations and tests	3
5.1 General provisions for type examinations of safety components	3
5.1.1 Object and extent of the tests	3
5.1.2 General provisions	3
5.2 Type examination of landing and car door locking devices	4
5.2.1 General provisions	4
5.2.2 Examination and tests	4
5.2.3 Test particular to certain types of locking devices	7
5.2.4 Type examination certificate	7
5.3 Type examination of safety gear	7
5.3.1 General provisions	7
5.3.2 Instantaneous safety gear	8
5.3.3 Progressive safety gear	10
5.3.4 Comments	13
5.3.5 Type examination certificate	13
5.4 Type examination of overspeed governors	14
5.4.1 General provisions	14
5.4.2 Check on the characteristics of the overspeed governor	14
5.4.3 Type examination certificate	15
5.5 Type examination of buffers	15
5.5.1 General provisions	15
5.5.2 Samples to be submitted	16
5.5.3 Test	16
5.5.4 Type examination certificate	19
5.6 Type examination of safety circuits containing electronic components and/or programmable electronic systems (PESSRAL)	20
5.6.1 General provisions	20
5.6.2 Test samples	20
5.6.3 Tests	21
5.6.4 Type examination certificate	22
5.7 Type examination of ascending car overspeed protection means	22
5.7.1 General provisions	22
5.7.2 Statement and test sample	23
5.7.3 Test	23
5.7.4 Possible modification to the adjustments	25
5.7.5 Test report	25
5.7.6 Type examination certificate	25
5.8 Type examination of unintended car movement protection means	25
5.8.1 General provisions	25
5.8.2 Statement and test sample	26
5.8.3 Test	26
5.8.4 Possible modification to the adjustments	28
5.8.5 Test report	28
5.8.6 Type examination certificate	29
5.9 Type examination of rupture valve/one-way restrictor	29
5.9.1 General provisions	29

5.10	Guide rails calculation	34
5.10.1	Range of calculation	34
5.10.2	Bending	34
5.10.3	Buckling	36
5.10.4	Combination of bending and compression/tension or buckling stresses	37
5.10.5	Flange bending	37
5.10.6	Deflections	38
5.11	Evaluation of traction	38
5.11.1	General	38
5.11.2	Traction calculation	39
5.11.3	Formulae for a general case (see Figure 9)	42
5.12	Evaluation of safety factor on suspension ropes for electric lifts	46
5.12.1	General	46
5.12.2	Equivalent number, N_{equiv} , of pulleys	47
5.12.3	Safety factor	48
5.13	Calculations of rams, cylinders, rigid pipes and fittings	49
5.13.1	Calculation against over pressure	49
5.13.2	Calculations of the jacks against buckling	53
5.14	Pendulum shock tests	59
5.14.1	General	59
5.14.2	Test rig	59
5.14.3	Tests	60
5.14.4	Interpretation of the results	61
5.14.5	Test report	61
5.15	Electronic components — Failure exclusion	64
5.16	Design rules for programmable electronic systems (PESSRAL)	73
6	Use of ISO/TS 8100-3	73
	Annex A (normative) Model form of type examination certificate	74
	Annex B (normative) Programmable electronic systems in safety related applications for lifts (PESSRAL)	75
	Annex C (informative) Example for calculation of guide rails	85
	Annex D (informative) Calculation of traction — Example	93
	Annex E (informative) Equivalent number of pulleys, N_{equiv} — Examples	95
	Annex F (informative) Relationship between ISO 22559-1 and ISO 8100-2	97
	Bibliography	98

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 178, *Lifts, escalators, passenger conveyors*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

A list of all parts in the ISO 8100 series can be found on the ISO website.

Introduction

The content of this document was already published in [EN 81-50:2014](#). This document contains only editorial changes and update of references.

The object of this document is to define safety rules related to lifts with a view to safeguarding persons and objects against the risk of accidents associated with the use, maintenance and emergency operations of lifts.

Reference is made to the respective introductions of the standards (e.g. [ISO 8100-1:2019](#)) calling for the use of this document with regard to persons and objects to be safeguarded, assumptions, principles, etc.

Lifts for the transport of persons and goods —

Part 2:

Design rules, calculations, examinations and tests of lift components

1 Scope

This document specifies the design rules, calculations, examinations and tests of lift components which are referred to by other standards used for the design of passenger lifts, goods passenger lifts, goods only lifts, and other similar types of lifting appliances.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4344, *Steel wire ropes for lifts — Minimum requirements*

[ISO 8100-1:2019](#), *Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Passenger and goods passenger lifts*

[ISO/TS 8100-3](#), *Requirements from Other Standards (ASME A17.1/CSA B44 and JIS A 4307-1/ JIS A 4307-2) not included in ISO 8100-1 or ISO 8100-2*

[IEC 60068-2-6](#), *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)*

[IEC 60068-2-27](#), *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

[IEC 60112](#), *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

[IEC 60664-1](#), *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*

[IEC 60947-4-1](#), *Low-voltage switchgear and control gear — Part 4-1: Contactors and motor-starters — Electromechanical contactors and motor-starters*

[IEC 60947-5-1](#), *Low-voltage switchgear and control gear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

EN 10025 (all parts), *Hot rolled products of non-alloy structural steels — Technical delivery conditions*

[EN 12385-5](#), *Steel wire ropes — Safety — Part 5: Stranded ropes for lifts*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <http://www.electropedia.org/>

3.1

approved body

organization or manufacturer, operating an approved full quality assurance system to undertake testing of *safety components* (3.2)

3.2

safety component

component provided to fulfil a safety function when in use

3.3

type examination certificate

document issued by an *approved body* (3.1) carrying out a type-examination in which it certifies that the product example under consideration complies with the provisions applicable to it

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this document, identified by risk assessment as significant for this type of machinery, and they require action to eliminate or reduce the risk (see [Table 1](#)).

Table 1 — List of significant hazards

No.	Hazards as listed in ISO 12100:2010 , Annex B	Relevant clauses
1	Mechanical hazards due to:	
	Acceleration, deceleration (kinetic energy)	5.3 ; 5.4 ; 5.5 ; 5.7 ; 5.8 ; 5.9
	Approach of a moving element to a fixed part	5.2
	Elastic elements	5.10 ; 5.11 ; 5.12 ; 5.13
	Falling objects	5.3 ; 5.4 ; 5.5 ; 5.9
	Gravity (stored energy)	5.3 ; 5.4 ; 5.5 ; 5.9
	Height from the ground	5.3 ; 5.4 ; 5.5 ; 5.9
	High pressure	5.13
	Moving elements	5.2 ; 5.3 ; 5.4 ; 5.5 ; 5.6 ; 5.7 ; 5.8 ; 5.9 ; 5.10 ; 5.11 ; 5.12 ; 5.13 ; 5.14 ; 5.15 ; 5.16
	Rotating elements	5.4 ; 5.11 ; 5.12
	Stability	5.10 ; 5.11 ; 5.12 ; 5.13 ; 5.14
	Strength	5.10 ; 5.11 ; 5.12 ; 5.13 ; 5.14
2	Electrical hazards	
	Arc	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Electrostatic phenomena	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Live parts	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Not enough distance to live parts under high voltage	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Overload	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Parts which have become live under faulty conditions	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
	Short-circuit	5.2 ; 5.4 ; 5.6 ; 5.7 ; 5.8 ; 5.15 ; 5.16
6	Hazards generated by radiation	
	Low frequency electromagnetic radiation	5.6 ; 5.15 ; 5.16
	Radio frequency electromagnetic radiation	5.6 ; 5.15 ; 5.16

No.	Hazards as listed in ISO 12100:2010 , Annex B	Relevant clauses
9	Hazards associated with the environment in which the machine is used	5.2 ; 5.3 ; 5.4 ; 5.5 ; 5.6 ; 5.7 ; 5.8 ; 5.9 ; 5.10 ; 5.11 ; 5.12 ; 5.13 ; 5.14 ; 5.15 ; 5.16

5 Design rules, calculations, examinations and tests

5.1 General provisions for type examinations of safety components

5.1.1 Object and extent of the tests

The safety component/device is submitted to a test procedure to verify that insofar as construction and operation are concerned, it conforms to the requirements imposed by this document. It shall be checked, in particular, that the mechanical, electrical and electronic components of the device are properly rated and that, in the course of time, the device does not lose its effectiveness, particularly through wear or aging. If the safety component is needed to satisfy particular requirements (waterproof, dust proof or explosion proof construction), supplementary examinations and/or tests under appropriate criteria shall be made.

5.1.2 General provisions

5.1.2.1 For the purposes of this document, it is assumed that the laboratory undertakes both the testing and the certification as an approved body. An approved body may be that of a manufacturer operating an approved full quality assurance system. In certain cases, the test laboratory and the body approved for the issue of type examination certificates may be separate. In these cases, the administrative procedures can differ from those described in this document.

5.1.2.2 The application for type examination shall be made by the manufacturer of the component, or their authorized representative, and shall be addressed to an approved test laboratory.

5.1.2.3 The dispatch of samples for examination shall be made by agreement between the laboratory and the applicant.

5.1.2.4 The applicant may attend the tests.

5.1.2.5 If the laboratory entrusted with the complete examination of one of the components requiring the supply of a type examination certificate has no appropriate means available for certain tests or examinations, it may, under its responsibility, have these made by other laboratories with the agreement of the applicant.

5.1.2.6 Unless specified otherwise, the precision of the instruments shall allow measurements to be made within the following accuracy:

- a) ± 1 % for masses, forces, distances, speeds;
- b) ± 2 % for accelerations, retardations;
- c) ± 5 % for voltages, currents;
- d) ± 5 °C for temperatures;
- e) recording equipment shall be capable of detecting signals, which vary in time of 0,01 s;
- f) $\pm 2,5$ % for flow rate;
- g) ± 1 % for pressure, P , below 200 kPa;

h) $\pm 5\%$ for pressure, P , above 200 kPa.

5.2 Type examination of landing and car door locking devices

5.2.1 General provisions

5.2.1.1 Field of application

These procedures are applicable to locking devices for landing and car doors. It is understood that each component taking part in the locking of doors and in the checking of the locking forms part of the locking device.

5.2.1.2 Documents to be submitted

5.2.1.2.1 Schematic arrangement drawing with description of operation

This drawing shall clearly show all the details relating to the operation and the safety of the locking device, including:

- a) the operation of the device in normal service, showing the effective engagement of the locking elements and the point at which the electrical safety device operates;
- b) the operation of the device for mechanical checking of the locking position if this device exists;
- c) the control and operation of the emergency unlocking device;
- d) the type (A.C. and/or D.C.), rated voltage and rated current.

5.2.1.2.2 Assembly drawing with key

This drawing shall show all parts important to the operation of the locking device, in particular those required to conform to the requirements of this document. A key shall indicate the list of the principal parts, the type of materials used, and the characteristics of the fixing elements.

5.2.1.3 Test samples

One door-locking device shall be submitted to the laboratory.

If the test is carried out on a prototype, it shall be repeated later on a production model.

If the test of the locking device is only possible when the device is mounted in the corresponding door, the device shall be mounted on a complete door in working order. However, the door dimensions may be reduced by comparison with a production model, on the condition that it does not falsify the test results.

5.2.2 Examination and tests

5.2.2.1 Examination of operation

This examination aims to verify that:

- the mechanical and electrical components of the locking device are operating correctly with respect to safety, and in conformity with:
 - the requirements of this document;
 - the standard calling for this locking device; and
- the device is in conformity with the particulars provided in the application.

In particular, it shall be verified that:

- a) there is at least 7 mm engagement of the locking elements before the electric safety device operates;
- b) it is not possible to operate the lift from positions normally accessible to persons with a door open or unlocked, after one single action not forming part of the normal operation.

5.2.2.2 Mechanical tests

5.2.2.2.1 General

These tests have the purpose of verifying the strength of the mechanical locking components and the electrical components.

The sample of the locking device in its normal operating position is controlled by the devices normally used to operate it.

The sample shall be lubricated in accordance with the requirements of the manufacturer of the locking device.

When there are several possible means of control and positions of operation, the endurance test shall be made in the arrangement which is regarded as the most unfavourable from the point of view of the forces on the components.

The number of complete cycles of operation and the travel of the locking components shall be registered by mechanical or electrical counters.

5.2.2.2.2 Endurance test

The locking device shall be submitted to 1 000 000 (± 1 %) complete cycles; one cycle comprises one forward and return movement over the full travel possible in both directions.

The driving of the device shall be smooth, without shocks, and at a rate of 60 (± 10 %) cycles per minute.

During the endurance test, the electrical contact of the lock shall close a resistive circuit under the rated voltage and at a current value double that of the rated current.

If the locking device is provided with a mechanical checking device for the locking pin or the position of the locking element, this device shall be submitted to an endurance test of 100 000 (± 1 %) cycles.

The driving of the device shall be smooth, without shocks, and at a rate of 60 (± 10 %) cycles per minute.

5.2.2.2.3 Static test

For locking devices intended for hinged doors, a test shall be made consisting of the application over a total period of 300 s of a static force, increasing progressively to a value of 3 000 N.

This force shall be applied in the opening direction of the door and in a position corresponding as far as possible to that which can be applied when a user attempts to open the door. The force applied shall be 1 000 N in the case of a locking device intended for sliding doors.

5.2.2.2.4 Dynamic test

The locking device, in the locked position, shall be submitted to a shock test in the opening direction of the door.

The shock shall correspond to the impact of a rigid mass of 4 kg falling in free fall from a height of 0,50 m.

5.2.2.3 Criteria for the mechanical tests

After the endurance test ([5.2.2.2.2](#)), the static test ([5.2.2.2.3](#)) and the dynamic test ([5.2.2.2.4](#)), there shall not be any wear, deformation or breakage, which could adversely affect safety.

5.2.2.4 Electrical test

5.2.2.4.1 Endurance test of contacts

This test is included in the endurance test laid down in [5.2.2.2.2](#).

5.2.2.4.2 Test of ability to break circuit

5.2.2.4.2.1 General

This test shall be carried out after the endurance test. It shall check that the ability to break a live circuit is sufficient. This test shall be made in accordance with the procedure in [IEC 60947-4-1](#) and [IEC 60947-5-1](#). The values of current and rated voltage serving as a basis for the tests shall be those indicated by the manufacturer of the device.

If nothing is specified, the rated values shall be as follows:

- a) alternating current: 230 V, 2 A;
- b) direct current: 200 V, 2 A.

Unless indicated otherwise, the capacity to break circuit shall be examined for both A.C. and D.C. conditions.

The tests shall be carried out with the locking device in the working position. If several positions are possible, the test shall be made in the most unfavourable position.

The sample tested shall be provided with covers and electric wiring as used in normal service.

5.2.2.4.2.2 A.C. locking devices shall open and close an electric circuit under a voltage equal to 110 % of the rated voltage 50 times, at normal speed and at intervals of 5 s to 10 s. The contact shall remain closed for at least 0,5 s.

The circuit shall comprise a choke and a resistance in series. Its power factor shall be $0,7 \pm 0,05$ and the test current shall be 11 times the rated current indicated by the manufacturer of the device.

5.2.2.4.2.3 D.C. locking devices shall open and close an electric circuit under a voltage equal to 110 % of the rated voltage 20 times, at normal speed and at intervals of 5 s to 10 s. The contact shall remain closed for at least 0,5 s.

The circuit shall comprise a choke and a resistance in series having values such that the current reaches 95 % of the steady-state value of the test current in 300 ms.

The test current shall be 110 % of the rated current indicated by the manufacturer of the device.

5.2.2.4.2.4 The tests are considered satisfactory if no tracking or arcing is produced and if no deterioration occurs which can adversely affect safety.

5.2.2.4.3 Test for resistance to leakage currents

This test shall be made in accordance with the procedure in [IEC 60112](#). The electrodes shall be connected to a source providing an A.C. voltage which is sinusoidal at 175 V, 50 Hz.

5.2.2.4.4 Examination of clearances and creepage distances

The clearances in air and creepage distances shall be in accordance with the requirements laid down in the standards calling for the use of this document (e.g. [ISO 8100-1:2019](#), 5.11.2.2.4).

5.2.2.4.5 Examination of the requirements appropriate to safety contacts and their accessibility

This examination shall be made taking account of the mounting position and the layout of the locking device, as appropriate.

5.2.3 Test particular to certain types of locking devices

5.2.3.1 Locking device for horizontally or vertically sliding doors with several panels

According to the requirements laid down in the standards calling for the use of this document, the devices providing direct mechanical linkage between panels (e.g. [ISO 8100-1:2019](#), 5.3.14.1) or indirect mechanical linkage (e.g. [ISO 8100-1:2019](#), 5.3.14.2) are considered forming part of the locking device.

These devices shall be submitted to the tests mentioned in [5.2.2](#). The number of cycles per minute in such endurance tests shall be suited to the dimensions of the construction.

5.2.3.2 Flap type locking device for hinged door

If this device is provided with an electric safety device required to check the possible deformation of the flap, and if, after the static test envisaged in [5.2.2.2.3](#), there are any doubts on the strength of the device, the load shall be increased progressively until the safety device begins to open. No component of the locking device or of the door shall be damaged or permanently deformed by the load applied.

If, after the static test, the dimensions and construction leave no doubt as to its strength, it is not necessary to proceed to the endurance test on the flap.

5.2.4 Type examination certificate

The certificate shall indicate the following:

- a) information according to [Annex A](#);
- b) type and application of locking device;
- c) type (A.C. and/or D.C.) and values of the rated voltage and rated current;
- d) in the case of flap type door locking devices: the necessary force to actuate the electric safety device for checking the elastic deformation of the flap.

5.3 Type examination of safety gear

5.3.1 General provisions

The applicant shall state the range of use provided, i.e.:

- minimum and maximum masses;
- maximum rated speed and maximum tripping speed.

Detailed information shall be provided on the materials used, the type of guide rails and their surface condition (drawn, milled, ground).

The following documents shall be attached to the application:

- a) detailed and assembly drawings showing the construction, operation, materials used, dimensions and tolerances of the construction components;
- b) in the case of progressive safety gear, also a load diagram relating to elastic parts.

5.3.2 Instantaneous safety gear

5.3.2.1 Test samples

Two gripping assemblies with wedges or clamps and two lengths of guide rail shall be submitted to the laboratory.

The arrangement and the fixing details for the samples shall be determined by the laboratory in accordance with the equipment that it uses.

If the same gripping assemblies can be used with different types of guide rails, a new test shall not be required if the thickness of the guide rails, the width of the grip needed for the safety gear, and the surface state (drawn, milled, ground) are the same.

5.3.2.2 Test

5.3.2.2.1 Method of test

The test shall be made using a press or similar device, which moves without abrupt speed change. Measurements shall be made of:

- a) the distance travelled as a function of the force;
- b) the deformation of the safety gear block as a function of the force or as a function of the distance travelled.

5.3.2.2.2 Test procedure

The guide rail shall be moved through the safety gear.

Reference marks shall be traced onto the blocks in order to be able to measure their deformation.

The distance travelled shall be recorded as a function of the force.

After the test:

- a) the hardness of the block and the gripping element shall be compared with the original values quoted by the applicant. Other analyses may be carried out in special cases;
- b) if there is no fracture, deformations and other changes shall be examined (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbed surfaces);
- c) if necessary, photographs shall be taken of the block, the gripping elements and the guide rail for evidence of deformations or fractures.

5.3.2.2.3 Documents

5.3.2.2.3.1 Two charts shall be drawn up as follows:

- a) the first one shall show the distance travelled as a function of the force;
- b) the other shall show the deformation of the block. It shall be done in such a way that it can be related to the first chart.

5.3.2.2.3.2 The capacity of the safety gears shall be established by integration of the area of the distance-force chart.

The area of the chart to be taken into consideration shall be:

- a) the total area, if there is no permanent deformation;
- b) if permanent deformation or rupture has occurred, either:
 - 1) the area up to the value at which the elastic limit has been reached; or
 - 2) the area up to the value corresponding to the maximum force.

5.3.2.3 Determination of the permissible mass

5.3.2.3.1 Energy absorbed by the safety gear

A distance of free fall, calculated with reference to the maximum tripping speed of the overspeed governor fixed in the requirements laid down in the standards calling for the use of this document (e.g. [ISO 8100-1:2019](#), 5.6.2.2.1.2), shall be adopted.

The distance of free fall in metres, h , shall be taken as [Formula \(1\)](#):

$$h = \frac{v_1^2}{2 \cdot g_n} + 0,1 + 0,03 \quad (1)$$

where

- g_n is the standard acceleration of free fall in metres per square second;
- v_1 is the tripping speed of overspeed governor in metres per second;
- 0,1 corresponds to the distance travelled during the response time, in metres;
- 0,03 corresponds to the travel during take-up of clearance between the gripping elements and the guide rails, in metres.

The total energy the safety gear is capable of absorbing is calculated with [Formulae \(2\) and \(3\)](#):

$$2 \cdot K = (P + Q)_1 \cdot g_n \cdot h \quad (2)$$

$$\text{from which: } (P + Q)_1 = \frac{K}{g_n \cdot h} \quad (3)$$

where

- K is the energy absorbed by one safety gear block, in joules (calculated in accordance with the chart);
- P are the masses of the empty car and components supported by the car, i.e. part of the travelling cable, compensating ropes/chains (if any), etc., in kilograms;
- Q is the rated load, in kilograms;
- $(P + Q)_1$ is the permissible mass, in kilograms.

5.3.2.3.2 Permissible mass

- a) If the elastic limit has not been exceeded, the permissible mass in kilograms, $(P + Q)_1$, is calculated with [Formula \(4\)](#):

$$(P + Q)_1 = \frac{2 \cdot K}{2 \cdot g_n \cdot h} \quad (4)$$

where

K is calculated by the integration of the area defined in [5.3.2.2.3.2 a\)](#);

2 is taken as the dividing safety coefficient.

- b) If the elastic limit has been exceeded, [Formulae \(5\)](#) and [\(6\)](#) shall be used and the higher permissible mass may be selected.

$$(P + Q)_1 = \frac{K_1}{g_n \cdot h} \quad (5)$$

where

K_1 is calculated by the integration of the area defined in [5.3.2.2.3.2 b\) 1\)](#);

2 is taken as the dividing safety coefficient.

$$(P + Q)_1 = \frac{2 \cdot K_2}{3,5 \cdot g_n \cdot h} \quad (6)$$

where

K_2 is calculated by the integration of the area defined in [5.3.2.2.3.2 b\) 2\)](#);

3,5 is taken as the dividing safety coefficient.

5.3.3 Progressive safety gear

5.3.3.1 Statement and test sample

The applicant shall state for what mass in kilograms, and tripping speed in metres per second, of the overspeed governor the test will be carried out. If the safety gear needs to be certified for various masses, the applicant shall specify them and indicate, in addition, whether the adjustment is by stages or continuous.

The applicant should choose the suspended mass in kilograms by dividing the anticipated braking force in newtons by 16, to aim at an average retardation of 0,6 g_n .

A complete safety gear assembly, as agreed with the laboratory, together with the number of brake shoes necessary for all the tests, shall be placed at the disposal of the laboratory. The number of sets of brake shoes necessary for all the tests shall be attached. For the type of guide rail used, the length specified by the laboratory shall also be supplied.

5.3.3.2 Test

5.3.3.2.1 Method of test

5.3.3.2.1.1 The test shall be carried out in free fall. Direct or indirect measurements shall be made of:

- a) the total height of the fall;

- b) the braking distance on the guide rails;
- c) the sliding distance of the overspeed governor rope, or that of the device used in its place;
- d) the total travel of the elements forming the spring.

Measurements a) and b) shall be recorded as a function of the time.

5.3.3.2.1.2 The following shall be determined:

- a) the average braking force;
- b) the greatest instantaneous braking force;
- c) the smallest instantaneous braking force.

5.3.3.2.2 Test procedure

5.3.3.2.2.1 Safety gear certified for a single mass

The laboratory shall carry out four tests with the mass $(P + Q)_1$. Between each test, the friction parts shall be allowed to return to their normal temperature.

During the tests, several identical sets of friction parts may be used.

However, one set of parts shall be capable of:

- a) three tests, if the rated speed does not exceed 4 m/s;
- b) two tests, if the rated speed exceeds 4 m/s.

The height of free fall shall be calculated to correspond to the maximum tripping speed of the overspeed governor for which the safety gear can be used.

The engagements of the safety gear shall be achieved by a means allowing the tripping speed to be fixed precisely.

For example, a rope may be used, the slack of which should be carefully calculated, fixed to a sleeve which can slide with friction over a fixed smooth rope. The friction effort should be the same as the effort applied to the operating rope by the governor attached to this safety gear.

5.3.3.2.2.2 Safety gear certified for different masses

Adjustment in stages or continuous adjustment.

Two series of tests shall be carried out for the maximum, and the minimum values applied for.

The applicant shall supply a formula, or a chart, showing the variation of the braking force as a function of a given parameter.

The laboratory shall verify by suitable means (in the absence of anything better, by a third series of tests for intermediary points) the validity of the supplied formula.

5.3.3.2.3 Determination of the braking force of the safety gear

5.3.3.2.3.1 Safety gear certified for a single mass

The braking force that the safety gear is capable of for the given adjustment and the type of guide rail, is taken as equal to the average of the average braking forces determined during the tests. Each test shall be made on an unused section of guide rail.

A check shall be made that the average values determined during the tests lie within a range of $\pm 25\%$ in relation to the value of the braking force defined above.

NOTE Tests have shown that the coefficient of friction can be considerably reduced if several successive tests are carried out on the same area of a machined guide rail. This is attributed to a modification in the surface condition during successive safety gear operations.

It is accepted that, on an installation, an inadvertent operation of the safety gear would have every chance of occurring at an unused section of guide rail.

It is necessary to consider that if, by chance, this were not the case, the braking force would have a lower value until an unused portion of guide rail surface was reached. Hence, greater sliding than normal.

This is a further reason for not permitting any adjustment causing too small a retardation at the beginning.

5.3.3.2.3.2 Safety gear certified for different masses

Adjustment in stages or continuous adjustment.

The braking force that the safety gear is capable of, shall be calculated as laid down in [5.3.3.2.3.1](#) for the maximum and minimum values applied for.

5.3.3.2.4 Checking after the tests

After the tests, it shall be checked that:

- the hardness of the block and the gripping elements are compared with the original values submitted by the applicant;
- the deformations and modifications (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbing surfaces) are checked;
- if necessary, the safety gear assembly, the gripping elements and the guide rails are photographed in order to reveal deformations or fractures.

5.3.3.3 Calculation of the permissible mass

5.3.3.3.1 Safety gear certified for a single mass

The permissible mass shall be calculated using [Formula \(7\)](#):

$$(P+Q)_1 = \frac{F_B}{16} \quad (7)$$

where

F_B	is the braking force in newtons, determined in accordance with 5.3.3.2.3 ;
P	is the masses of the empty car and components supported by the car, i.e. part of the travelling cable, compensating ropes/chains (if any), etc., in kilograms;
Q	is the rated load, in kilograms;
$(P+Q)_1$	is the permissible mass, in kilograms.

If the calculated permissible mass is larger than the tested mass, the tested mass may be taken as permissible mass, provided that the average retardation of each test did not exceed $1 g_n$.

5.3.3.3.2 Safety gear certified for different masses

5.3.3.3.2.1 Adjustment in stages

The permissible mass shall be calculated for each adjustment as laid down in [5.3.3.3.1](#).

5.3.3.3.2.2 Continuous adjustment

The permissible mass shall be calculated as laid down in [5.3.3.3.1](#) for the maximum and minimum values applied for, and in accordance with the formula supplied for the intermediate adjustments.

5.3.3.4 Possible modification to the adjustments

If, during the tests, the values found differ by more than 20 % from those expected by the applicant, other tests may be made with their agreement, after modification of the adjustments, if necessary.

5.3.4 Comments

a) Applicable mass

The applicable mass used for a lift shall not exceed the permissible mass for instantaneous safety gear.

In the case of progressive safety gear, the mass stated may differ from the applicable mass stated in [5.3.3.3](#) by $\pm 7,5$ %. It is accepted, in these conditions, that the requirements laid down in the standards calling for the use of this document (e.g. [ISO 8100-1:2019](#), 5.6.2.1) are met on the installation, notwithstanding the usual tolerances on the thickness of the guide rails, the surface conditions, etc.

- b) To evaluate the validity of welded parts, reference shall be made to standards on this subject.
- c) A check shall be made that the possible travel of the gripping elements is sufficient under the most unfavourable conditions (accumulation of manufacturing tolerances).
- d) The friction parts shall be suitably retained so that it can be certain that they will be in place at the moment of operation.
- e) In the case of a progressive type safety gear, it shall be checked that the travel of the components forming the spring is sufficient.

5.3.5 Type examination certificate

The certificate shall indicate the following:

- a) the information according to [Annex A](#);
 - b) the type and application of safety gear;
 - c) the limits of the permissible masses [see [5.3.4](#) a)];
 - d) the tripping speed of the overspeed governor;
 - e) the type of guide rail;
 - f) the permissible thickness of the guide rail blade;
 - g) the minimum width of the gripping areas;
- and, for progressive safety gear only:
- h) the surface condition of the guide rails (drawn, milled, ground);

- i) the state of lubrication of the guide rails. If they are lubricated, the category and specification of the lubricant.

5.4 Type examination of overspeed governors

5.4.1 General provisions

The applicant shall indicate the following to the laboratory:

- a) the type (or the types) of safety gear which will be operated by the governor;
- b) the maximum and minimum rated speeds of lifts for which the governor may be used;
- c) the anticipated value of the tensile force produced in the rope by the overspeed governor when tripped.

Detailed and assembly drawings showing the construction, operation, materials used, dimensions and tolerances of the construction components shall be attached to the application.

5.4.2 Check on the characteristics of the overspeed governor

5.4.2.1 Test samples

The following shall be submitted to the laboratory:

- a) one overspeed governor;
- b) one rope of the type used for the overspeed governor, and the normal condition in which it should be installed. The length to be supplied is fixed by the laboratory;
- c) a tensioning pulley assembly of the type used for the overspeed governor.

5.4.2.2 Test

5.4.2.2.1 Method of test

The following shall be checked:

- a) the speed of tripping is within the range stated by the applicant;
- b) the operation of the electric safety device called for in the standards calling for the use of this document [e.g. [ISO 8100-1:2019](#), 5.6.2.2.1.6 a)] causing the machine to stop, if this device is mounted on the overspeed governor;
- c) the operation of the electric safety device called for in the standards calling for the use of this document e.g. [ISO 8100-1:2019](#), 5.6.2.2.1.6 b)] preventing all movement of the lift when the overspeed governor is tripped;
- d) the tensile force produced in the rope by the overspeed governor when tripped.

5.4.2.2.2 Test procedure

At least twenty tests shall be made in the speed range for tripping, corresponding to the range of rated speeds of the lift, indicated in [5.4.1 b\)](#).

The majority of tests should be made at the extreme values of the range.

The acceleration to reach the tripping speed of the overspeed governor should be as low as possible, in order to eliminate the effects of inertia.

In addition, a minimum of two tests shall be made with an acceleration between $0,9 g_n$ and $1 g_n$ in order to simulate a free fall situation and prove no deterioration of the governor has been caused.

5.4.2.2.3 Interpretation of the test results

In the course of twenty tests, the tripping speeds shall lie within the limits laid down for overspeed governors in the standards calling for the use of this document.

NOTE If the limits laid down are exceeded, an adjustment can be made by the manufacturer of the component and 20 new tests carried out.

In the course of the twenty tests, the operation of the devices for which the test is required in [5.4.2.2.1 b\)](#) and [c\)](#) shall occur within the limits laid down in the standards calling for the use of this document [e.g. [ISO 8100-1:2019](#), 5.6.2.2.1.6 a) and 5.6.2.2.1.6 b)].

The tensile force in the rope produced by the overspeed governor when tripped shall be at least 300 N or any higher value specified by the applicant.

Unless otherwise requested by the manufacturer of the device and specified in the test report, the arc of engagement should be 180° .

In the case of a device which operates by gripping the rope, it should be checked that there is no permanent deformation of the rope.

5.4.3 Type examination certificate

The certificate shall indicate the following:

- a) the information according to [Annex A](#);
- b) the type and application of overspeed governor;
- c) the maximum and minimum rated speeds of the lift for which the overspeed governor may be used;
- d) the diameter of the rope to be used and its construction;
- e) in the case of an overspeed governor with traction pulley, the minimum tensioning force;
- f) the tensile force in the rope which can be produced by the overspeed governor when tripped.

5.5 Type examination of buffers

5.5.1 General provisions

The applicant shall state the range of use provided, i.e. maximum impact speed, minimum and maximum masses. The following shall be attached to the application:

- a) detailed and assembly drawings showing the construction, operation, materials used, dimensions and tolerances of the construction components. In the case of hydraulic buffers, the graduation (openings for the passage of the liquid), in particular, shall be shown as a function of the stroke of the buffer;
- b) specifications for the liquid used;
- c) information regarding environmental conditions for use (temperature, humidity, pollution, etc.) and of life cycle (aging, rejection criteria).

5.5.2 Samples to be submitted

The following shall be submitted to the laboratory:

- a) one buffer;
- b) in the case of hydraulic buffers, the necessary liquid sent separately.

5.5.3 Test

5.5.3.1 Energy dissipation buffers

5.5.3.1.1 Test procedure

The buffer shall be tested with the aid of weights, corresponding to the minimum and maximum masses, falling in free fall to reach the maximum speed called for at the moment of impact.

The speed shall be recorded at least from the moment of impact of the weights. The acceleration and the retardation shall be determined as a function of time throughout the movement of the weights.

5.5.3.1.2 Equipment to be used

5.5.3.1.2.1 Weights falling in free fall

The weights shall correspond, with the tolerances of [5.1.2.6](#), to the maximum and minimum masses. They shall be guided vertically with the minimum friction possible.

5.5.3.1.2.2 Recording equipment

The recording equipment shall be able to detect signals with the tolerances of [5.1.2.6](#). The measuring chain, including the recording device for the recording of measured values as a function of time, shall be designed with a system frequency of at least 1 000 Hz.

5.5.3.1.2.3 Measurement of speed

The speed shall be recorded at least from the moment of impact of the weights on the buffer or throughout the travel of the weights, with the tolerances of [5.1.2.6](#).

5.5.3.1.2.4 Measurement of the retardation

If there is a device for measuring retardation (see [5.5.3.1.1](#)), it shall be placed as close as possible to the axis of the buffer, and shall be capable of measurement with the tolerances of [5.1.2.6](#).

5.5.3.1.2.5 Measurement of time

Time pulses of duration of 0,01 s shall be recorded and measured with the tolerances of [5.1.2.6](#).

5.5.3.1.3 Ambient temperature

The ambient temperature shall be between +15 °C and +25 °C.

The temperature of the liquid shall be measured with the tolerances of [5.1.2.6](#).

5.5.3.1.4 Mounting of the buffer

The buffer shall be placed and fixed in the same manner as in normal service.

5.5.3.1.5 Filling of the buffer

The buffer shall be filled up to the mark indicated, following the instructions of the component manufacturer.

5.5.3.1.6 Checks

5.5.3.1.6.1 Checking of retardation

The height of free fall of the weights shall be chosen in such a way that the speed at the moment of impact corresponds to the maximum impact speed stipulated in the application.

The retardation shall conform to the requirements of the standard calling for this device (e.g. [ISO 8100-1:2019](#), 5.8.2.2.3).

The creeping at the end of the buffer stroke for calculation of the average retardation shall be ignored where the retardation is below 0,5 m/s².

A first test shall be made with maximum mass, with a check on the retardation.

A second test shall be made with minimum mass, with a check on the retardation.

5.5.3.1.6.2 Checking of the return of the buffer to the normal position

After each test, the buffer shall be held in the completely compressed position for 5 min. The buffer shall then be freed to permit return to its normal extended position.

When the buffer is of a type with spring or gravity return, the position of complete return shall be reached in a maximum period of 120 s.

Before proceeding to another retardation test, there shall be a delay of 30 min to allow the liquid to return to the tank and for air bubbles to escape.

5.5.3.1.6.3 Checking of the liquid losses

The level of liquid shall be checked after having made the two retardation tests required in [5.5.3.1.6.1](#). After an interval of 30 min, the level of liquid shall again be sufficient to ensure normal operation of the buffer.

5.5.3.1.6.4 Checking of the condition of the buffer after tests

After the two retardation tests required in [5.5.3.1.6.1](#), no part of the buffer shall show any permanent deformation, or be damaged, so that its condition shall guarantee normal operation.

5.5.3.1.7 Procedure in the case of tests failing the requirements

When the test results are not satisfactory with the minimum and maximum masses appearing in the application, the laboratory may, in agreement with the applicant, establish the acceptable limits.

5.5.3.2 Energy accumulation buffers with non-linear characteristics

5.5.3.2.1 Test procedure

The buffer shall be tested with the aid of masses falling in free fall from a height to reach the maximum speed called for at the moment of impact, but not less than 0,8 m/s.

The falling distance, speed, acceleration and retardation shall be recorded from the moment of release of the weight to complete standstill.

The masses shall correspond to the maximum and minimum masses called for. They shall be guided vertically with a minimum of friction possible, so that at least $0,9 g_n$ is reached at the moment of impact.

5.5.3.2.2 Equipment to be used

The equipment shall correspond to [5.5.3.1.2](#).

5.5.3.2.3 Ambient temperature

The ambient temperature shall be between +15 °C and +25 °C.

5.5.3.2.4 Mounting of the buffer

The buffer shall be placed and fixed in the same manner as in normal service.

5.5.3.2.5 Number of tests

Three tests shall be made with the maximum mass and the minimum mass called for.

The time delay between two consecutive tests shall be between 5 min and 30 min.

In the three tests with maximum mass, the reference value of the buffer force at a stroke given by the applicant, equal to 50 % of the real height of the buffer, shall not vary by more than 5 %. In the tests with minimum mass, this shall be observed in analogy.

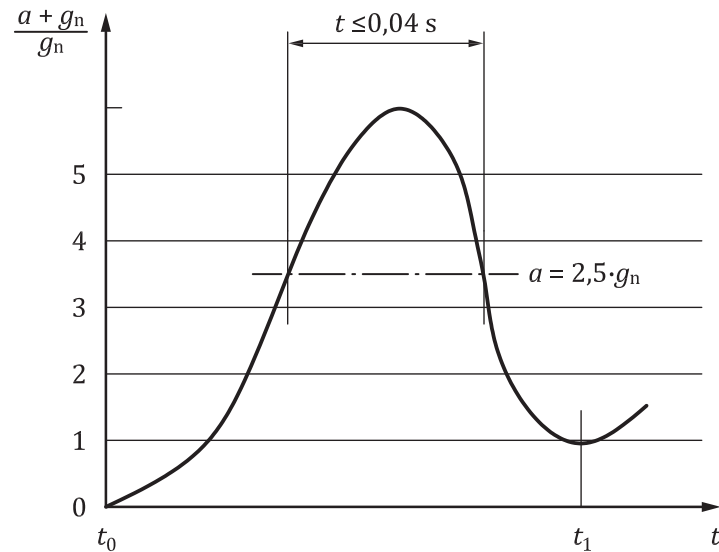
Within 30 min before the test, the buffer shall be once loaded, either statically or dynamically, in order to prevent further settlement and deviations during the test.

5.5.3.2.6 Checks

5.5.3.2.6.1 Checking of retardation

The retardation “a” (e.g. [ISO 8100-1:2019](#), 5.8.2.1.2.1), shall conform to the following requirements:

- a) The retardation will be evaluated taking into account the time between the first two absolute minima of the retardation (see [Figure 1](#)). The retardation shall not exceed the maximum as required by the standard calling for this device.
- b) Peaks of retardation above a value specified by the standard calling for this device shall not exceed the maximum duration of these peaks as required by the standard calling for this device [e.g. [ISO 8100-1:2019](#), 5.8.2.1.2.1 b)]
- c) The maximum peak retardation shall not exceed the maximum as required in the standard calling for this device [e.g. [ISO 8100-1](#), 5.8.2.1.2.1 e)].
- d) The return speed shall not exceed the maximum as required in the standard calling for this device.

**Key**

- a retardation in metres per square second
 g_n standard acceleration of free fall in metres per square second
 t time in seconds
 t_0 moment of hitting the buffer (first absolute minimum)
 t_1 second absolute minimum

Figure 1 — Retardation graph — Example using ISO 8100-1 requirements

5.5.3.2.6.2 Checking of the condition of the buffer after tests

After the tests with the maximum mass, no parts of the buffer shall show any permanent deformation or be damaged, so that its condition shall guarantee normal operation.

5.5.3.2.7 Procedure in the case of tests failing the requirements

When the test results are not satisfactory with the minimum and maximum masses appearing in the application, the laboratory may, in agreement with the applicant, establish the acceptable limits.

5.5.4 Type examination certificate

The certificate shall indicate the following:

- the information according to [Annex A](#);
- the type and application of buffer;
- the dimensions of the buffer;
- the maximum impact speed;
- the maximum mass;
- the minimum mass;
- the kind of fixation;
- the specification of the liquid in the case of hydraulic buffers;

- i) the environmental conditions for use according to instructions of the manufacturer (temperature, humidity, pollution, etc.).

5.6 Type examination of safety circuits containing electronic components and/or programmable electronic systems (PESSRAL)

5.6.1 General provisions

5.6.1.1 General

For safety circuits containing electronic components, laboratory tests are necessary because practical checks on site, by inspectors, are impossible.

In the following, mention is made to printed circuit board. If a safety circuit is not assembled in such a manner, then the equivalent assembly shall be assumed.

5.6.1.2 Safety circuits containing electronic components

The applicant shall indicate to the laboratory:

- a) identification on the board;
- b) environmental working conditions;
- c) list of components used;
- d) layout of the printed circuit board;
- e) layout of the hybrids and marks of the tracks used in safety circuits;
- f) function description;
- g) electrical wiring diagram, including input and output definitions of the board;
- h) method of failure analysis employed and documented results.

5.6.1.3 Safety circuits based on programmable electronic systems

In addition to [5.6.1.2](#), the following documentation shall be provided:

- a) documents and descriptions relating to the measures listed in [Annex B](#);
- b) general description of the software used (e.g. programming rules, language, compiler, modules);
- c) function description, including software architecture and hardware/software interaction;
- d) description of blocks, modules, data, variables and interfaces;
- e) software listings.

5.6.2 Test samples

The following shall be submitted to the laboratory:

- a) one printed circuit board;
- b) one bare printed circuit board (without components).

5.6.3 Tests

5.6.3.1 Mechanical tests

5.6.3.1.1 General

During the tests, the tested object (printed circuit) shall be kept under operation. During and after the tests, no unsafe operation and condition shall appear within the safety circuit.

5.6.3.1.2 Vibration

Transmitter elements of safety circuits shall withstand the requirements of:

- a) [IEC 60068-2-6:2007](#), Table C.2: 20 sweep cycles in each axis, at amplitude 0,35 mm, and in the frequency range 10 Hz–55 Hz; and
- b) [IEC 60068-2-27:2008](#), Table 1: the combination of:
 - peak acceleration 294 m/s² or 30 g_n ;
 - corresponding duration of pulse 11 ms; and
 - corresponding velocity change 2,1 m/s half sine.

NOTE Where shock absorbers for transmitter elements are fitted, they are considered as part of the transmitter elements.

After tests, clearances and creepage distances shall not become smaller than the minimum accepted.

5.6.3.1.3 Bumping (IEC 60068-2-27)

5.6.3.1.3.1 General

Bumping tests shall simulate the cases when printed circuits fall, introducing the risk of rupture of components and unsafe situations.

Tests are divided into partial shockings and continuous shockings.

The tests object shall satisfy the following minimum requirements:

5.6.3.1.3.2 Partial shocking

- a) Shocking shapes: half-sinus;
- b) Amplitude of acceleration: 15 g ;
- c) Duration of shock: 11 ms.

5.6.3.1.3.3 Continuous shocking

- a) Amplitude of acceleration: 10 g ;
- b) Duration of shock: 16 ms;
- c)
 - 1) Number of shocks: 1 000 $\pm$ 10;
 - 2) Shock frequency: 2/s.

5.6.3.2 Temperature tests (IEC 60068-2-14)

Operating ambient limits: 0 °C, +65 °C (the ambient temperature is of the safety device).

Test conditions:

- the printed circuit board shall be in operational position;
- the printed circuit board shall be supplied with rated operational voltage;
- the safety device shall operate during, and after the test. If the printed circuits board includes components other than safety circuits, they also shall operate during the test (their failure is not considered);
- tests shall be carried out for minimum and maximum temperature (0 °C, +65 °C). Tests shall last a minimum of four hours;
- if the printed circuit board is designed to operate within wider temperature limits, it shall be tested for these values.

5.6.3.3 Failure analysis of electric safety circuits

The failure analysis document as required by the relevant standard calling for the use of this document shall be validated. (e.g. [ISO 8100-1:2019](#), 5.11.2.3).

5.6.3.4 Functional and safety test of PESSRAL

In addition to the verification of the measures defined in [Tables B.1](#) to [B.6](#), the following shall be validated:

- a) Software design and coding: Inspect all code statements using methods such as formal design reviews, FAGAN, test cases etc.;
- b) Software and hardware inspection: Verify all measures of [Tables B.1](#) and [B.2](#) and the measures chosen, for example, from [Table B.7](#) by using fault insertion testing (based on [IEC 61508-2](#) and [IEC 61508-7](#)).

5.6.4 Type examination certificate

The certificate shall indicate:

- a) the information according to [Annex A](#);
- b) the type and application of the circuitry;
- c) the design for pollution degree according to [IEC 60664-1](#);
- d) the operating voltages;
- e) the distances between the safety circuits and the rest of the control circuits on the board.

NOTE Other tests like humidity test, climatic shock test, etc., are not subject for tests because of the normal environmental situation where lifts are operating.

5.7 Type examination of ascending car overspeed protection means

5.7.1 General provisions

5.7.1.1 This specification applies to:

- ascending car overspeed protection means which are not using overspeed governors, or
- programmable electronic systems which are subject to verifications according to [5.4](#) and [5.6](#).

Test results of safety gears which have been verified according to [5.3](#) may be taken into account for verification of permissible application range.

5.7.1.2 The applicant shall state the range of use provided:

- a) minimum and maximum masses, or torque;
- b) minimum (if applicable) and maximum rated speed;
- c) use in installations with compensation means.

5.7.1.3 The following documents shall be attached to the applications:

- a) detailed and assembly drawings showing the construction, operation, materials used, dimensions and tolerances of the construction components;
- b) if necessary, also a load diagram relating to elastic parts;
- c) detailed information on the materials used, the type of part on which the ascending car overspeed protection means acts, and its surface condition (drawn, milled, ground, etc.).

5.7.2 Statement and test sample

5.7.2.1 The applicant shall state for what mass (in kilograms) and tripping speed (in meters per second) the test will be carried out. If the device needs to be certified for various masses, the applicant shall specify them and indicate, in addition, whether the adjustment is by stages or continuous.

5.7.2.2 As defined between the applicant and the laboratory, either:

- a complete assembly consisting of both elements, braking device and speed monitoring device; or
- only that device which was not subject to verifications according to [5.3](#), [5.4](#) and [5.6](#);

shall be provided by the applicant.

The number of sets of gripping elements necessary for all the tests shall be attached. The type of part on which the device acts, shall also be supplied with the dimensions agreed with the laboratory.

5.7.3 Test

5.7.3.1 Test method

The test method shall be defined between the applicant and the test laboratory, depending on the device and its function to achieve a realistic function of the system. Measurements shall be made of:

- a) the acceleration and speed;
- b) the braking distance;
- c) the retardation.

Measurements shall be recorded as a function of the time.

5.7.3.2 Test procedure

5.7.3.2.1 General

At least twenty tests shall be made with the speed monitoring element in the speed range for tripping, corresponding to the range of rated speeds of the lift indicated in [5.7.1.2](#).

The acceleration of the mass to reach the tripping speed should be as low as possible, in order to eliminate the effects of inertia.

5.7.3.2.2 Device certified for a single mass

The laboratory shall carry out four tests with the system mass representing an empty car.

Between each test, the friction parts shall be allowed to return to their normal temperature.

During the tests, several identical sets of friction parts may be used.

However, one set of parts shall be capable of:

- a) three tests, if the rated speed does not exceed 4 m/s;
- b) two tests, if the rated speed exceeds 4 m/s.

The test shall be made at the maximum tripping speed for which the device may be used.

5.7.3.2.3 Device certified for different masses

Adjustment in stages or continuous adjustment.

A series of tests shall be carried out for the maximum value applied, and a series for the minimum value. The applicant shall supply a formula, or a chart, showing the variation of the braking force as a function of a given parameter.

The laboratory shall verify by suitable means (in the absence of anything better, by a third series of tests for intermediary points) the validity of the supplied formula.

5.7.3.2.4 Overspeed monitoring device

5.7.3.2.4.1 Test procedure

At least twenty tests shall be made in the speed range for tripping without applying the braking device.

The majority of tests shall be made at the extreme values of the range.

5.7.3.2.4.2 Interpretation of the test results

In the course of twenty tests, the tripping speeds shall lie within the limits called for in the standards calling for the use of this document (e.g. [ISO 8100-1:2019](#), 5.6.6.1).

5.7.3.3 Checking after the tests

After the test:

- a) the hardness of the gripping element shall be compared with the original values quoted by the applicant;
- b) if there is no fracture, deformations and other changes shall be examined (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbing surfaces);
- c) if necessary, photographs shall be taken of the gripping elements and the parts on which the device acts for evidence of deformations or fractures;
- d) it shall be checked that the retardation with the minimum mass has not exceeded $1 g_n$.

5.7.4 Possible modification to the adjustments

If, during the tests, the values found differ by more than 20 % from those expected by the applicant, other tests may be made with his agreement, after modification of the adjustments if necessary.

5.7.5 Test report

In order to achieve reproducibility, the type examination shall be recorded in all details, such as:

- the method of test defined between applicant and laboratory;
- the description of the testing arrangement;
- the location of the device to be tested in the testing arrangement;
- the number of tests carried out;
- the record of measured values;
- the report of observations during the test;
- the evaluation of the test results to show compliance with the requirements.

5.7.6 Type examination certificate

The certificate shall indicate:

- a) the information according to [Annex A](#);
- b) the type and application of overspeed protection means;
- c) the limits of the permissible masses;
- d) the tripping speed range of the overspeed monitoring device;
- e) the type of parts on which the braking elements act.

5.8 Type examination of unintended car movement protection means

5.8.1 General provisions

The unintended car movement protection means shall be type tested as a complete system. Alternatively, the subsystems for detection, activation and stopping may be submitted to an individual type examination. The type examination of subsystems shall define interface conditions and the relevant parameters of each subsystem if integrated in a complete system.

The applicant shall state the key parameters for use of the system or subsystem that form part of the type examination:

- minimum and maximum masses;
- minimum and maximum force or torque or fluid pressure, if applicable;
- individual response times of detector, control circuit and stopping element(s);
- highest speed anticipated before deceleration occurs (see Note 1);
- distance from the floor at which the detector device will be installed;
- test speed(s) (see Note 2);