



BSI Standards Publication

Safety rules for the construction and installation of lifts – Lifts for the transport of persons and goods

Part 21: New passenger and goods passenger lifts in existing building

National foreword

This British Standard is the UK implementation of EN 81-21:2018. It supersedes BS EN 81-21:2009+A1:2012, which is withdrawn.

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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English Version

**Safety rules for the construction and installation of lifts -
Lifts for the transport of persons and goods - Part 21: New
passenger and goods passenger lifts in existing building**

Règles de sécurité pour la construction et l'installation
des élévateurs - Elévateur pour le transport de
personnes et d'objets - Partie 21 : Ascenseurs et
ascenseurs de charge neufs dans les bâtiments
existants

Sicherheitsregeln für die Konstruktion und den Einbau
von Aufzügen - Aufzüge für den Personen- und
Gütertransport - Teil 21: Neue Personen- und
Lastenaufzüge in bestehenden Gebäuden

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 81-21:2018) has been prepared by Technical Committee CEN/TC 10 “Lifts, escalators and moving walks”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2018 and conflicting national standards shall be withdrawn at the latest by September 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 81-21:2009+A1:2012.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The main changes with respect to the previous edition (EN 81-21:2009+A1:2012) are as follows:

- updating of references and their associated requirements with regard to EN 81-20:2014;
- removal of duplicated text in reference to the requirements for refuge spaces expressed in EN 81-20:2014;
- replacement of Annex ZA with regard to the commission mandate M/549/C(2016) 5844 Final and Directive 2014/33/EU.

This standard is part of the EN 81 series of standards “*Safety rules for the construction and installation of lifts*”. This is the second edition.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document is a type C standard as stated in EN ISO 12100.

When provisions of this type C standard are different from those stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

Where one or several requirements in EN 81-20:2014 cannot be fulfilled, due to reasons such as the constraints of the structure of the existing building, the corresponding requirements in this European Standard apply. According to section 2.2 of Annex I to the Lifts Directive, the application of alternative measures to prevent the risk of crushing above and underneath the lift car is restricted to installations where the requirement for free space or refuge is impossible to fulfil and may be subject to prior approval by national authorities.

The main concern dealt with in this standard is the reduction of top and pit clearances that may be required due to site conditions. The adopted principle of safety is based on two levels of achievement: first by means of an electrical stopping of the lift car, then by means of a mechanical stopping of the lift car.

When drafting this standard, it has been considered for reduced overhead and pit the following:

- a) Risk reduction measures that rely solely on operations in compliance with procedures are considered as not acceptable, except in a few situations in which mistake-proof solutions are not available (e.g. some activities in repair and installation in which safety devices cannot be operational);
- b) The risk reduction measures are automatically (without any intervention) activated, or may be manually activated if mistake-proof-by-design, or a combination of both is used.

1 Scope

This European Standard specifies the safety rules related to new passenger and goods/passenger lifts permanently installed in existing buildings where in some circumstances due to limitations enforced by building constraints, some requirements of EN 81-20:2014 cannot be met.

This European Standard addresses a number of these constraints and gives requirements for alternative solutions. It will be read and applied in conjunction with the European Standard EN 81-20:2014.

This European Standard covers:

- either the construction and installation of one or more complete new lift(s) including new well and machinery spaces in an existing building; or
- the replacement of one or more existing lift(s) by new ones in existing well(s) and machinery spaces.

This European Standard does not cover:

- replacement or modifications of some parts to a lift already installed;
- other applications outside of the scope of EN 81-20:2014.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 81-20:2014 *Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods - Part 20: Passenger and goods passenger lifts*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13857:2008, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

ISO 3864-1:2011, *Graphical symbols - Safety colours and safety signs - Part 1: Design principles for safety signs and safety markings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 81-20:2014 and the following apply.

3.1 existing building

building, which is used or was already used before the order for the lift was placed

Note 1 to entry: A building whose internal structure is completely renewed is considered as a new building.

3.2

movable stop

mechanical device that under normal operation allows the free movement of the lift between normal terminal stops

Note 1 to entry: Where a person enters on the car roof or in the pit, the device limits the travel of the car to ensure sufficient refuge space in the headroom or in the pit.

3.3

triggering device

device for operating a stopping gear by a mechanical linkage when the lift car passes a predetermined position in the well

Note 1 to entry: This device is activated when an access to the lift well is opened by means of a key.

3.4

stopping gear

mechanical device for stopping, and maintaining stationary the lift car in the case of movement of the lift car above and/or below a predetermined position in the well to protect person(s) on the car roof and/or in the pit

3.5

pre-triggered stopping system

system including the triggering device, the stopping gear and a mechanical linkage in between

Note 1 to entry: Under normal operation of the lift, the system allows the free movement of the lift between normal terminal stops. Where a person enters on the car roof or in the pit the system ensures refuge spaces in the headroom or in the pit.

4 List of significant hazards

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

Table 1 — List of significant hazards

No	Hazards as listed in Annex B of EN ISO 12100:2010	Relevant clauses in this standard
1	Mechanical hazards due to: - Machine parts or work pieces, e.g.: - Accumulation of energy inside the machinery, e.g.:	
	Crushing hazard	5.5, 5.7
	Shearing hazard	5.2 a), 5.4.2
	Drawing-in or trapping hazard	5.5.3, 5.7.3
	Impact hazard	5.3, 5.4.3, 5.9, 5.10, 5.11, 5.12.
	Slip, trip and fall of persons (related to machinery)	5.2 b), 5.4.2, 5.8
	- Uncontrolled amplitude of movements	5.4.1, 5.4.3
	- From insufficient mechanical strength of parts	5.5.2.3.2 d), 5.6.1.2 a), 5.7.2.3.2 d), 5.8.1
	- Falling of person from person carrier	5.6, 5.8.1
8	Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:	
	Access	5.4.2 d), 5.9, 5.10, 5.11, 5.12
	Inadequate local lighting	5.4.2 h), 5.4.2 i)
	Unhealthy postures	5.5.1
	Human error, human behaviour	5.5.4, 5.7.4, 7.2
	From abnormal conditions of assembly / testing / use / maintenance	5.4, 5.5, 5.6, 5.7, 5.8
9	Hazards associated with the environment in which the machine is used	
	Failure of the power supply	5.5.2.5.1.1, 5.5.3.1, 5.5.3.2, 5.7.2.5.1.1, 5.7.3.1, 5.7.3.2
	Failure of the control circuit	5.5, 5.7
	Unexpected start-up, unexpected overrun / overspeed (or any similar malfunction) from;	
	- Restoration of energy supply after an interruption	5.5.4, 5.7.4

5 Safety requirements and/or protective measures

5.1 General

Lifts within the scope of this standard shall comply with the relevant safety requirements and/or protective measures of the following clauses where one or several requirements in EN 81-20:2014 cannot be fulfilled. In addition, the lift shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this standard.

5.2 Perforate wall of the lift well

The requirements for the well enclosure of EN 81-20:2014, 5.2.5.2 are complemented by the following:

Any existing well enclosure may be perforate provided that

- a) EN ISO 13857:2008, 4.2.4.2 is fulfilled; and
- b) a protective imperforate screen shall be provided around the landing door locking devices in order to prevent any manipulation of the locking devices by means of a rigid rod 0,30 m long.

NOTE National regulations for the preservation of historical buildings may require the retention of an existing perforate enclosure.

5.3 Distance between car, counterweight or balancing weight

The requirements of EN 81-20:2014, 5.2.5.5.1 h) for this distance may be replaced by the following:

The car and its associated components shall be at a distance of at least 25 mm from the counterweight or balancing weight (if there is one) and its associated components.

To avoid any impact between the car (and its associated components) and the counterweight or balancing weight (and its associated components), in case of failure of normal guidance, emergency guidance on the car and counterweight shall be provided to maintain the car and the counterweight in their horizontal position.

5.4 Counterweight or balancing weight in a separate well

5.4.1 General

The counterweight or the balancing weight may be installed in a separate well from the car, provided that the configuration on site does not permit the installation of a lift having an available car area sufficient to fulfil the transport needs.

NOTE The standard covers only the installation of one counterweight (or balancing weight) in its own well.

The following requirements shall be met.

5.4.2 Counterweight or balancing weight well provisions

The requirements of EN 81-20:2014, 5.2.5.1.2 are complemented as follows:

In case of a separate well for the counterweight/balancing weight the following requirements apply:

- a) all requirements related to the totally enclosed well (EN 81-20:2014, 5.2.1.8 and 5.2.5.2) shall be fulfilled for the well of the counterweight/balancing weight;
- b) inspection doors shall be provided at both ends of the separate well and where necessary between them to allow safe maintenance and examinations of the well equipment; they shall comply with EN 81-20:2014, 5.2.3;

- c) the distance between inspection doors and equipment requiring maintenance or inspection shall not exceed 0,7 m;
- d) where a safety gear is installed at the counterweight/balancing weight, inspection doors shall provide access to be able to inspect and maintain the full travel of the counterweight/balancing weight;
- e) stopping device(s) accessible on opening the inspection doors at both ends of the separate well shall be provided, in conformity with the requirements of EN 81-20:2014, 5.12.1.11;
- f) electric socket outlets accessible on opening the inspection doors at both ends of the well shall be provided as defined in EN 81-20:2014, 5.10.7.2;
- g) the separate well shall be exclusively used for the lift in compliance with EN 81-20:2014, 5.2.1.2;
- h) the separate well shall be provided with permanently installed electric lighting, giving an intensity of at least 50 lux on the equipment requiring maintenance/inspection;
- i) means to switch the separate well lighting shall be provided on opening the inspection door at the lower end of the well.

5.4.3 Guiding of the counterweight or balancing weight

The requirements of EN 81-20:2014, 5.7.1 are supplemented as follows:

When travelling in a separate well, the counterweight or the balancing weight may be guided by ropes or by the shape of the counterweight or the balancing weight and its well enclosure.

If the counterweight or balancing weight is resting on its buffers it shall be kept in a substantially upright position by the use of a small distance to the well enclosure or an emergency guiding.

Provisions shall be made so as to avoid the counterweight or the balancing weight to rotate, e.g. by using equal number of left and right twisted suspension ropes.

Where its shape guides the counterweight or balancing weight, the enclosure of the well shall be continuous and flush without any protrusion from which the counterweight or the balancing weight can be blocked. The well enclosure shall be covered by durable material.

In case of ropes as guiding elements a minimum number of 4 ropes shall be used. Springs or weights shall tighten the ropes. The horizontal free distance between the counterweight or the balancing weight and the well enclosure shall be at least 50 mm if the enclosure of the well is continuous and flush otherwise it shall be increased by 2 mm for each meter of distance between the fixations of the ropes.

5.5 Reduced clearances in the headroom

5.5.1 General

The requirements of EN 81-20:2014, 5.2.5.7 may be replaced by the following:

5.5.2 Devices providing refuge spaces in the headroom

5.5.2.1 General

The devices shall be:

- a) either movable stops; or
- b) a pre-triggered stopping system.

5.5.2.2 Movable stops

5.5.2.2.1 General

Automatically operated movable stops shall be designed to prevent damage due to any collision when they are moved between the fully retracted and extended position.

5.5.2.2.2 Arrangement

5.5.2.2.2.1 In the case of traction drive lifts, the movable stops shall be installed in such a way as to act on a downwards travelling counterweight to mechanically stop the car.

5.5.2.2.2.2 In the case of positive drive lifts, the movable stops shall be installed in such a way as to act on an upwards travelling car to mechanically stop the car.

5.5.2.2.2.3 In the case of hydraulic lifts, the movable stops shall consist of one or more devices external to the jack situated outside of the car projection, the resultant force of which is exerted on the centre line of the jack.

5.5.2.2.3 Buffering of movable stops

5.5.2.2.3.1 In the case of traction and positive drive lifts the movable stops shall incorporate buffers or act on buffers complying with EN 81-20:2014, 5.8.1 and 5.8.2.

5.5.2.2.3.2 In the case of hydraulic lifts the design of the movable stops shall be such that the average retardation of the car does not exceed $1g_n$ and that in case of an indirect acting lift the retardation does not result in slack rope or chain.

5.5.2.3 Pre-triggered stopping system

5.5.2.3.1 General

The pre-triggered stopping system shall include a triggering device with its actuation means for tripping a mechanical stopping gear by a linkage when the car reaches a fixed tripping point in the up direction.

5.5.2.3.2 The triggering device shall be easily accessible so that examinations and maintenance operations can be carried out in complete safety from the pit, or from the car roof or from outside of the well.

5.5.2.3.3 The pre-triggered stopping system shall comply with the following:

- a) the stopping gear shall be fixed on the car and act on the guide rails of the car;
- b) the stopping gear shall be tripped by a mechanical triggering device using a mechanical linkage for the tripping operation;
- c) the stopping gear shall be kept tripped by the triggering device and the linkage when the car is at any position above the tripping point;

in case of a release of the stopping gear due to dynamic effects or rescue operations it shall be re-engaged when the car moves again in up direction above the tripping point keeping the required refuge space;

- d) the stopping gear shall be operated positively;
 - 1) where springs are used they shall act by compression and be guided;
 - 2) where a rope is used the minimum breaking load of the rope shall be related by a safety factor of at least 8 to the tensile force created during operation of the stopping gear;
- e) the force required to activate the stopping gear shall be at least the greater of the following two values:
 - 1) twice the engagement force of the stopping gear taking into consideration the tolerances due to friction;
 - 2) 300 N.
- f) the stopping gear shall operate an electric safety device in conformity with EN 81-20:2014, 5.11.2, if it is engaged;
- g) when the stopping gear has been tripped, the return to normal operation shall require the intervention of a person competent in maintenance procedures;
- h) after the release, the stopping gear shall be in a condition to operate;
- i) The triggering device shall be protected against the accidental insertion of objects and from dirt and corrosion such that its operation is not affected;
- j) the pre-triggered stopping system shall be able to stop the car and keep it stopped from any speed between zero and the tripping speed of the ascending car overspeed protections means;
- k) the maximum retardation by the stopping gear shall not exceed $1 g_n$ in the worst condition as validated according to Annex C;
- l) when the stopping gear operates, the floor of the car with or without the load uniformly distributed shall not incline more than 5 % from its normal position;
- m) the pre-triggered stopping system shall be designed and verified according to the requirements in Annex C.

5.5.2.4 Clearances

When the buffers according to 5.5.2.2.3.1 are fully compressed or when the car is stopped by the pre-triggered stopping system the refuge spaces on car roof and clearances in the headroom shall comply with EN 81-20:2014, 5.2.5.7.

5.5.2.5 Operation

5.5.2.5.1 General

The movable stops or the triggering device shall be operated:

- a) automatically at the latest when the safety system (5.5.3) has been activated; or
- b) manually.

5.5.2.5.2 In the case of power failure to devices providing clearances:

- a) the automatic movable stops or the automatic triggering device shall be activated and maintained in the active position at least up to power restoration;
- b) for manually operated movable stops or for manually operated triggering devices, a mechanical safety device shall maintain the car stationary. This device shall be activated and maintained in the active position at least up to power restoration.

5.5.2.5.3 For traction drive lifts, in the case of manual operation of moveable stops or manual operation of triggering devices, the mechanical safety device according to 5.5.2.5.2 b) shall be operated by the safety system (5.5.3), in order to prevent any movement of the car in the up direction if the movable stops or the triggering device is not in the active position.

5.5.2.6 Electrical monitoring

The movable stops or the triggering device shall be provided with electric safety devices according to EN 81-20:2014, 5.11.2 that monitor:

- a) the fully extended (active) position; and
- b) the fully retracted (inactive) position.

5.5.3 Safety system

5.5.3.1 An electric safety device according to EN 81-20:2014, 5.11.2 shall:

- a) activate a safety system that neutralizes normal operation;
- b) be operated when any access to the car roof is opened by means of a key;
- c) be bi-stable;
- d) be reset together with the resetting of the safety system (See 5.5.3.2).

For landing doors not mechanically coupled to the car door an additional electric device according to EN 81-20:2014, 5.11.2 shall prevent any movement of the car if this landing door gives access to the car roof and is open. This device shall not be accessible without using a tool.

5.5.3.2 The resetting of the safety system and the return of the lift to normal operation shall only be made by operation of an electrical reset device.

The resetting shall be effective only when:

- a) the lift is not in inspection operation;
- b) the stopping devices in the pit and on the car roof according EN 81-20:2014, 5.12.1.11.1 a), c) and d) are not in the STOP position;
- c) any access to the car roof is closed and locked;
- d) the devices providing the refuge spaces are in the inactive position (see 5.5.2);

A power failure shall not reset the safety system.

5.5.3.3 The electrical reset device shall be:

- a) lockable with the use of a padlock or equivalent, to ensure no inadvertent operation; and
- b) placed outside of the well and accessible to authorized persons only (maintenance, inspection and rescue); and
- c) monitored by an electric safety device according to EN 81-20:2014, 5.11.2, which prevents normal operation when the reset device remains activated.

5.5.3.4 An additional electric safety device in conformity with EN 81-20:2014, 5.11.2 shall interrupt movements of the car under inspection operation in up direction before the buffering parts of the movable stops are hit or before the triggering device is tripping the stopping gear. The car shall be stopped before the stopping gear is tripped.

This electrical safety device shall allow the movement of the car only in the down direction.

In the position in which the car has stopped, examinations and test and maintenance operations for all components, which are located in the headroom shall be able to be carried out in complete safety from the car roof or from outside of the well.

5.5.3.5 Normal operation of the lift shall only be possible if the movable stops or the triggering device are in the inactive position and the safety system is not activated.

5.5.3.6 When the safety system has been activated, inspection operation shall only be possible if the movable stops or the triggering device are in the active position.

5.5.3.7 When the safety system has been activated and the movable stops or the triggering device are not in the active position, emergency electrical operation shall only be possible in down direction.

5.5.4 Visible and/or audible information

On opening by means of a key of any access to the car roof (see 5.5.3.1), a signal visible and/or audible from the landing shall inform about the positions (active and not active) of:

- a) the movable stops; or
- b) the triggering device.

If both ends of the travel are protected by the movable stop(s) and/or by pre-triggered stopping system(s), this information shall allow noticing whether it is from top or bottom end of the well.

The audible signal may be switched off after 60 s provided that the movable stops or the triggering device are in the active position. The audible signal shall be re-activated when the movable stops or the triggering device is removed from the active position.

See also 7.2.2.

5.5.5 Protection for group of lifts

Where the horizontal distance from the edge of the car roof of a lift having reduced top clearances to the car roof of an adjacent lift(s) is less than 2,0 m a partition according to EN 81-20:2014, 5.2.5.5.2 shall prevent access to the lift(s) having reduced top clearances.

The partition shall extend through the full height and depth of the well.

5.6 Car roof balustrade

5.6.1 The requirements of EN 81-20:2014, 5.4.7.2 are supplemented as follows:

5.6.2 Where a balustrade is necessary on the car roof according to EN 81-20:2014, an easily and safely extendable balustrade shall be permanently installed.

See also 7.2.3.

5.6.3 The extendable balustrade shall meet the following requirements:

- a) the balustrade shall be as EN 81-20:2014, 5.4.7.4, and shall be such as its fixings ensure it remains in its extended position when a force of 1000 N is applied vertically at right angles to any point at the top of the balustrade.
- b) the balustrade shall be designed in such a way that it can be totally unfolded/folded or extended/retracted while standing on a safe area;
- c) if the safe standing area is on the car roof, it shall be:
 - 1) according to EN 81-20:2014, 5.2.5.7.3;
 - 2) clearly indicated and visible from the landing;
 - 3) placed at a distance from the edge of the car roof not less than 0,50 m, where the risk of falling exists.
- d) electric safety devices in conformity with EN 81-20:2014, 5.11.2 shall prevent the movement of the car if:
 - 1) in normal operation, the balustrade is not fully retracted;
 - 2) in inspection operation from the car roof if the balustrade is not fully extended.
- e) For emergency electrical operation and in inspection operation a direction dependant electric safety device (EN 81-20:2014, 5.11.2) shall prevent upward movements in the zone where the balustrade, if not folded or retracted, can collide with the ceiling of the well.

NOTE This direction dependant electric safety device for the balustrade can be realized with the electric safety device according to 5.5.3.4.

5.7 Reduced clearances in the pit

5.7.1 General

The requirements of EN 81-20:2014, 5.2.5.8.1 and 5.2.5.8.2 may be replaced by the following.

5.7.2 Devices providing refuge spaces in the pit

5.7.2.1 General

The devices shall be:

- a) either movable stops; or
- b) a pre-triggered stopping system.

5.7.2.2 Movable stops

Movable stops shall comply with the following:

- a) the movable stops shall be installed in the pit to mechanically stop the car;
- b) the movable stops shall incorporate buffers or act on buffers complying with EN 81-20:2014, 5.8.1 and 5.8.2;
- c) automatically operated movable stops shall be designed to prevent damage due to any collision when they are moved between the fully retracted and extended position.

5.7.2.3 Pre-triggered stopping system

5.7.2.3.1 General

The pre-triggered stopping system shall include a triggering device with its actuation means for tripping the mechanical stopping gear by a linkage when the car reaches a fixed tripping point in the down direction.

5.7.2.3.2 The triggering device shall be easily accessible so that examinations and maintenance operations can be carried out in complete safety from the pit, or from the car roof or from outside of the well.

5.7.2.3.3 The pre-triggered stopping system shall comply with the following:

- a) the stopping gear shall be fixed on the car and act on the guide rails of the car;
- b) the stopping gear shall be tripped by a mechanical triggering device using a mechanical linkage for the tripping operation;
- c) the stopping gear shall be kept tripped by the triggering device and the linkage when the car is at any position below the tripping point.

In case of a release of the stopping gear due to dynamic effects or rescue operations it shall be re-engaged when the car moves again in down direction below the tripping point keeping the required refuge space;

- d) the stopping gear shall be operated positively:
 - 1) where springs are used they shall act by compression and be guided;
 - 2) where a rope is used the minimum breaking load of the rope shall be related by a safety factor of at least 8 to the tensile force created during operation of the stopping gear;
- e) the force required to activate the stopping gear shall be at least the greater of the following two values:
 - 1) twice the engagement force of the stopping gear taking into consideration the tolerances due to friction;
 - 2) 300 N;
- f) the stopping gear shall operate an electric safety device in conformity with EN 81-20:2014, 5.11.2, if it is engaged;

- g) when the stopping gear has been tripped, return to normal operation shall require the intervention of a competent maintenance person;
- h) after the release, the stopping gear shall be in a condition to operate;
- i) the triggering device shall be protected against the accidental insertion of objects and from dirt and corrosion, such that its operation is not affected;
- j) the pre-triggered stopping system shall be able to stop the car and keep it stopped from any speed between zero and the tripping speed of the safety gear;
- k) the maximum retardation by the stopping gear shall not create a retardation higher than the one created by the safety gear;
- l) when the stopping gear operates, the floor of the car with or without the load uniformly distributed shall not incline more than 5 % from its normal position;
- m) the pre-triggered stopping system shall be designed and verified according to the requirements in Annex C.

5.7.2.4 Clearances

When the car rests on the fully compressed buffers according to 5.7.2.2 b) or when the car is stopped by the pre-triggered stopping system the refuge spaces and clearances in the pit shall comply with EN 81-20:2014, 5.2.5.8.

5.7.2.5 Operation

5.7.2.5.1 General

The movable stops or the triggering device shall be operated:

- a) automatically at the latest when the safety system (5.7.3) has been activated; or
- b) manually.

5.7.2.5.2 In the case of power failure to devices providing clearances:

- a) the automatic movable stops or the automatic triggering device shall be activated and maintained in the active position at least up to power restoration;
- b) for manually operated movable stops or for manually operated triggering devices, a mechanical safety device shall maintain the car stationary. This device shall be activated and maintained in the active position at least up to power restoration.

5.7.2.5.3 In the case of manual operation of moveable stops or manual operation of triggering devices, the mechanical safety device according to 5.7.2.5.2 b) shall be operated by the safety system (5.7.3), in order to prevent any movement of the car in the down direction if the movable stops or the triggering device is not in the active position.

5.7.2.6 Electrical monitoring

The movable stops or the triggering device shall be provided with electric safety devices according to EN 81-20:2014, 5.11.2 that monitor:

- a) the fully extended (active) position; and
- b) the fully retracted (inactive) position.

5.7.3 Safety system

5.7.3.1 An electric safety device according to EN 81-20:2014, 5.11.2 shall:

- a) activate a safety system that neutralizes normal operation;
- b) be operated when any access to the pit is opened by means of a key;
- c) be bi-stable;
- d) be reset together with the resetting of the safety system (see 5.7.3.2).

For landing doors not mechanically coupled to the car door an additional electric safety device according to EN 81-20:2014, 5.11.2 shall prevent any movement of the car if this landing door gives access to the pit and is open. This device shall not be accessible without using a tool.

Any door/trap door whose sill having a distance less than 2,5 m from the pit floor is considered as access door to the pit.

5.7.3.2 The resetting of the safety system and the return of the lift to normal operation shall only be made by operation of an electrical reset device.

The resetting shall be effective only when:

- a) the lift is not in inspection operation;
- b) the stopping devices in the pit and on the car roof according to EN 81-20:2014, 5.12.1.11.1 a), c) and d) are not in the STOP position;
- c) any door/trap door giving access to the pit are closed and locked;
- d) the devices providing the refuge spaces are in the inactive position (see 5.7.2).

The resetting device described in EN 81-20:2014, 5.12.1.5.2.2 may be combined with that above.

A power failure shall not reset the safety system.

5.7.3.3 The electrical reset device shall be:

- a) lockable with the use of a padlock or equivalent, to ensure no inadvertent operation; and
- b) placed outside of the well and accessible to authorized persons only (maintenance, inspection and rescue); and
- c) monitored by an electric safety device according to EN 81-20:2014, 5.11.2, which prevents normal operation when the reset device remains activated.

5.7.3.4 An electric safety device in conformity with EN 81-20:2014, 5.11.2 shall interrupt movements of the car under inspection operation in down direction before the buffering parts of the movable stops are hit or before the triggering device is tripping the stopping gear. The car shall be stopped before the stopping gear is tripped.

This electric safety device shall allow the movement of the car only in the up direction.

In the position in which the car has stopped, examinations and tests and maintenance operations for all components which are located in the lower part of the car shall be able to be carried out in complete safety from the pit or from outside of the well.

5.7.3.5 Normal operation of the lift shall only be possible if the movable stops or the triggering device are in the inactive position and the safety system is not activated.

5.7.3.6 When the safety system has been activated, inspection operation shall only be possible if the movable stops of the triggering device are in the active position.

5.7.3.7 When the safety system has been activated and the movable stops or the triggering device are not in the active position, emergency electrical operation shall only be possible in upwards direction.

5.7.4 Visible and/or audible information

On opening by means of a key of any access to the pit (see 5.7.3.1), a signal visible and/or audible from the landing shall inform about the positions (active and not active) of:

- a) the movable stops; or
- b) the triggering device.

If both ends of the travel are protected by movable stop(s) and/or by pre-triggered stopping system(s), this information shall allow noticing whether it is from top or bottom end of the well.

The audible signal may be switched off after 60 s provided that the movable stops or the triggering device are in the active position. The audible signal shall be re-activated when the movable stops or the triggering device is removed from the active position.

See also 7.2.4.

5.7.5 Partition in the pit

When the well contains several lifts, a partition shall be provided according to EN 81-20:2014, 5.2.5.5.2.1 extending at least from the pit floor level to a height of 4,0 m.

5.7.6 Safe pit access

The requirements of EN 81-20:2014, 5.2.2.4 is modified as follows:

The following paragraph is added:

For pit depth not exceeding 0,50 m a pit ladder is not required. In this case, where there are two landing doors at the same level giving access to the pit, then both shall be determined as the pit access door.

5.8 Apron

5.8.1 General

The requirements of EN 81-20:2014, 5.4.5.1 and 5.4.5.2 may be replaced by the following.

If a fixed apron is not possible, each car sill shall be fitted with an extendable apron, which in its extended position shall fulfil the requirements of EN 81-20:2014, 5.4.5 and the height of the fixed vertical part shall be at least equal to the unlocking zone extending above the landing sill level;

See also 7.2.5.

5.8.2 Specific requirements

One of the following means shall be provided:

- a) an apron retracted under normal operation, manually extendable when needed and fulfilling the following conditions:
 - 1) if the apron is not in the retracted position, normal operation of the lift shall be neutralized by means of an electric safety device in conformity with EN 81-20:2014, 5.11.2;
 - 2) the car door shall be equipped with a locking device in conformity with EN 81-20:2014, 5.3.9.2;
 - 3) the apron shall be unlocked by means of the emergency unlocking key (EN 81-20:2014, 5.3.9.3.1, Figure 13) operated at the apron;
 - 4) putting back the car apron into the retracted position shall be possible manually only from the lowest landing, the pit floor or the car roof, by appropriate means;
 - 5) a direction dependant electric safety device (EN 81-20:2014, 5.11.2) shall prevent downwards inspection and emergency operations in the zone where the car apron, if not retracted, can collide with the pit floor;

This direction dependant electric safety device for the apron can be realized with the electric safety device according to 5.7.3.4.
- 6) the stopping distance as required by EN 81-20:2014, 5.6.7.5 applies to the retracted position of the apron.
- b) or an apron retracted under normal operation, automatically extended on opening any landing door with the emergency unlocking key, and fulfilling the following conditions:
 - 1) if the apron is not in the retracted position, normal operation of the lift shall be neutralized by means of an electric safety device in conformity with EN 81-20:2014, 5.11.2;
 - 2) the car door shall be equipped with a locking device in conformity with EN 81-20:2014, 5.3.9.2;
 - 3) in the case of loss of power supply (interruption or switching off), the car apron shall move automatically into the extended position;
 - 4) putting back the car apron in to the retracted position shall be possible:
 - i) either automatically provided the landing doors are closed and locked; or
 - ii) manually only from the lowest landing, the pit floor or the car roof, by appropriate means;
 - 5) a direction dependant electric safety device (EN 81-20:2014, 5.11.2) shall prevent downwards inspection and emergency operations in the zone where the car apron, if not retracted, can collide with the pit floor;

This direction dependant electric safety device for the apron can be realized with the additional electric safety device according to 5.7.3.4;

- 6) the stopping distance as required by EN 81-20:2014, 5.6.7.5 applies to the retracted position of the apron where the apron is not automatically extended by the operation of the uncontrolled movement protection system;
- c) or an apron extended under normal operation, retracted when the car is reaching its lowest position, and fulfilling the following condition:

Normal operation shall be neutralized by electric safety devices in conformity with EN 81-20:2014, 5.11.2 if the apron is not in the extended position when the car is not in a zone, which extends from the position of the car resting on its fully compressed buffers to a position of not more than 1 m above the lowest landing sill.

5.9 Height of machine room

The requirements of EN 81-20:2014, 5.2.6.3.2.1 for the height of the machine room may be replaced by the following:

When the clear height at working areas is less than 2,1 m, warnings e.g. using yellow and black stripes according to ISO 3864-1:2011, Figure 17 and/or an adequate warning sign shall be appropriately placed and soft materials shall be provided under the ceiling above those areas.

The clear height of the machine room, measured up to the lower surface of soft materials on the ceiling, shall not be less than 1,80 m for working areas.

NOTE This may be subject to National Building laws.

5.10 Height of machine room doors

The requirements of EN 81-20:2014, 5.2.3.2 a) may be replaced by the following:

Access doors shall have a minimum width of 0,60 m and a minimum height of 1,70 m. When the height is less than 2,0 m, suitable warnings using yellow and black stripes according to ISO 3864-1:2011, Figure 17 and/or an adequate warning sign shall be appropriately placed on both sides of the door.

NOTE This may be subject to National Building laws.

5.11 Dimensions of trap doors for machine room and pulley room

The requirements of EN 81-20:2014 5.2.3.2 c) for the dimensions of access trap doors may be replaced by the following:

Access trap doors for persons shall give a clear passage of at least 0,60 m × 0,80 m, and shall be counterbalanced.

When one of the dimensions is less than 0,80 m, warnings using yellow and black stripes according to ISO 3864-1:2011, Figure 17 and/or an adequate warning sign shall be appropriately placed on both sides of the trap door.

5.12 Height of landing doors

The requirements of EN 81-20:2014, 5.3.2.1 may be replaced by the following:

The clear height of the entrance of a landing door shall be the maximum allowed by the building constraints, however not less than 1,80 m.

When the height is less than 2,0 m, suitable warnings, using yellow and black stripes according to ISO 3864-1:2011, Figure 17 and/or an adequate warning sign shall be appropriately placed in the car and at the landing and

- a) the edges of the door lintel shall be provided with an inclined surface of not more than 30° inclination to the horizontal up to the height of 2,0 m; or
- b) the edges shall be covered with soft material.

The door mechanism shall be covered up to the height of the car door.

5.13 Electrical safety devices

EN 81-20:2014, Annex A is supplemented by Annex A of this standard.

6 Verification of safety requirements and/or protective measures

6.1 Verification table

Safety requirements and/or protective measures of Clauses 5 and 7 shall be verified according to the Table 2 below.

The methods of verification listed in the following table should be adapted to the circumstances in which the verification is carried out on the lift (certification, putting into service, etc.).

Table 2 — Methods to be used to verify conformity to the requirements

Sub clause	Requirements	Visual presence inspection ^a	Design document check ^b	Functional test ^c	Measurement ^d
5.2	Perforate wall of the lift well	X			X
5.3	Distance between car, counterweight or balancing weight	X			X
5.4.2	Counterweight or balancing weight well provisions	X			X
5.4.3	Guiding of the counterweight or balancing weight	X			X
5.5	Reduced clearances in the headroom	X	X	X	X
5.5.2.2	Movable stops	X	X	X	
5.5.2.3	Pre-triggered stopping system	X	X	X	
5.5.2.4	Clearances	X			X
5.5.2.5	Operation	X		X	
5.5.2.6	Electrical monitoring	X		X	
5.5.3	Safety system	X		X	
5.5.4	Visible and/or audible information	X		X	
5.5.5	Protection for group of lifts	X			X
5.6	Car roof balustrade	X		X	X
5.7	Reduced clearances in the pit	X	X	X	X
5.7.2.2	Movable stops	X	X	X	

Sub clause	Requirements	Visual presence inspection ^a	Design document check ^b	Functional test ^c	Measurement ^d
5.7.2.3	Pre-triggered stopping system	X	X	X	
5.7.2.4	Clearances	X			X
5.7.2.5	Operation	X		X	
5.7.2.6	Electrical monitoring	X		X	
5.7.3	Safety system	X		X	
5.7.4	Visible and/or audible information	X		X	
5.7.5	Partition in the pit	X			X
5.7.6	Safe pit access	X			X
5.8	Apron	X		X	X
5.9	Height of machine room	X			X
5.10	Height of machine room doors	X			X
5.11	Dimensions of trap doors for machine room and pulley room	X			X
5.12	Height of landing doors	X			X
7.1	Instructions	X			X
<p>^a Visual presence inspection will be used to verify the features necessary for the requirement by visual examination of the supplied components.</p> <p>^b Drawings/calculations will verify that the design characteristics of the provided components meet the requirements.</p> <p>^c A functional test will verify that the features provided perform their function in such a way that the requirement is met.</p> <p>^d Measurement will verify by the use of instruments that requirements are met, to specified limits. Appropriate measuring methods to be used together with applicable testing standards.</p>					

6.2 Tests before putting the lift into service

In addition to the tests listed in EN 81-20:2014, 6.3, the following tests shall be carried out:

a) For top clearances:

- Movable stops and pre-triggered stopping system shall be dynamically tested with the empty car and at rated speed.

For traction drive lifts, the brake shall be kept open.

For positive drive lifts, and for hydraulic drive lifts, the electric safety device according to 5.5.3.4 shall be shorted out.

After the test, it shall be ascertained that no deterioration that could adversely affect the normal use of the lift has occurred. Visual check is considered to be sufficient;

- verification of the stroke of the buffers of the movable stop(s), see 5.5.2.2.3.1;
- check of the braking distance in the case of pre-triggered stopping system.

b) For bottom clearances:

- movable stops and pre-triggered stopping system shall be dynamically tested with the car loaded with rated load and at rated speed.

For traction drive and positive drive lifts, the brake shall be kept open.

For hydraulic drive lifts, the electric safety device according to 5.7.3.4 shall be shorted out.

After the test, it shall be ascertained that no deterioration that could adversely affect the normal use of the lift has occurred. Visual check is considered to be sufficient;

- verification of the stroke of the buffers of the movable stop(s), see 5.7.2.2 b);
- check of the braking distance in the case of pre triggered stopping system.

6.3 Technical compliance documentation

EN 81-20:2014, Annex B is supplemented as follows:

- in case of reduced pit and/or headroom, information about protective measures taken.

7 Information for use

7.1 Instructions

In addition to EN 81-20:2014, 7.1, the instruction manual shall include explanations on the functioning, use and maintenance of the provisions of this standard (e.g. safety system, movable stops, pre-triggered stopping system, extendable balustrade, extendable apron, etc.).

For pre-triggered stopping system, the nominal, minimum and maximum braking distances shall be stated in the technical compliance documentation (6.3) and in the instruction manual of the lift. Information shall be given how to proceed if the braking distance of a site test is outside of this range.

7.2 Notices and warnings

7.2.1 Dimensions

The minimum height of the characters used for the notices shall be:

a) For machinery spaces, emergency operation devices and for resetting device location:

- 10 mm for capital letters and numbers;
- 7 mm for small letters;

b) For pit and car roof locations:

- 17 mm for capital letters and numbers;
- 12 mm for small letters.

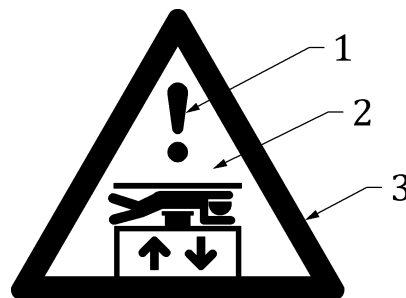
The minimum size of warning signs shall be according to the requirements of ISO 3864-1:2011.

7.2.2 Reduced top clearances

A notice bearing the following inscription: “**Danger – Reduced top clearances – Respect instructions**” shall be affixed:

- a) in machinery spaces at the emergency operation devices;
- b) on or at the device or key for resetting the lift;
- c) on the car roof.

This notice may be accompanied by the following symbol:



Key

- 1 = black
- 2 = yellow
- 3 = black

Figure 1

7.2.3 Extendable balustrade

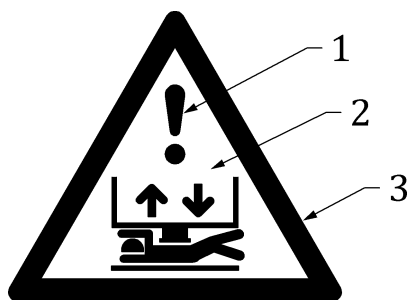
A warning shall be affixed on the car roof in order to inform about the need of extending the balustrade before any work is performed on the car roof.

7.2.4 Reduced bottom clearances

A notice bearing the following inscription: “**Danger – Reduced bottom clearances – Respect instructions**” shall be affixed:

- a) In machinery spaces at the emergency operation devices;
- b) On or at the device or key for resetting the lift;
- c) In the pit.

This notice may be accompanied by the following symbol:



Key

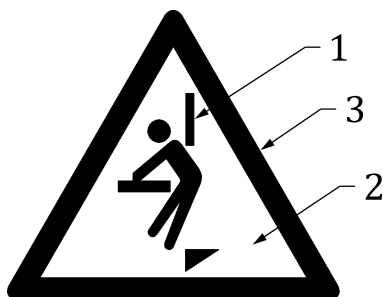
- 1 = black
- 2 = yellow
- 3 = black

Figure 2

7.2.5 Extendable car apron

A notice clearly visible from the landing when the doors are opened shall be affixed on or near the mechanical device required in **5.8.2 a) 3)** and **b) 3)** or on the fixed part of the apron, warning: **“Apron shall be fully extended before rescuing persons”**

This notice may be accompanied by the following symbol:



Key

- 1 = black
- 2 = yellow
- 3 = black

Figure 3

Annex A (normative)

List of the electric safety devices

EN 81-20:2014, Annex A is completed as follows:

Table A.1

Clause	Devices checked	Safety Integrity Level (SIL)
5.4.2 e)	Stopping device(s) in separate well of counterweight	3
5.5.2.3.3 f)	Check of the operation of the stopping gear	2
5.5.2.6 a)	Check of the fully extended position of movable stops or triggering devices	3
5.5.2.6 b)	Check of the fully retracted position of movable stops or triggering devices	3
5.5.3.1	Check of the opening to any door giving access to the car roof	3
5.5.3.3 c)	Monitoring of reset device	2
5.5.3.4	Preventing to hit the buffering parts of the movable stops or tripping of the stopping gear under inspection operation in up direction	2
5.6.3 d) 1)	Check of the fully retracted position of the balustrade	2
5.6.3 d) 2)	Check of the fully extended position of the balustrade	3
5.6.3 e)	Direction dependant electric safety device preventing collision with the ceiling of the lift well	2
5.7.2.3.3 f)	Check of the operation of the stopping gear	2
5.7.2.6 a)	Check of the fully extended position of movable stops or triggering devices	3
5.7.2.6 b)	Check of the fully retracted position of movable stops or triggering devices	3
5.7.3.1	Check of the opening to any door giving access to the pit	3
5.7.3.3 c)	Monitoring of reset device	2
5.7.3.4	Preventing to hit the buffering parts of the movable stops or tripping of the stopping gear under inspection operation in down direction	2
5.8.2 a) 1)	Check of the retracted position of apron	2
5.8.2 a) 5)	Direction dependant electric safety device preventing collision with pit floor	2
5.8.2 b) 1)	Check of the retracted position of apron	2
5.8.2 b) 5)	Direction dependant electric safety device preventing collision with pit floor	2
5.8.2 c)	Check of the extended position of apron	3

Annex B (informative)

Periodic examinations and tests, examinations and tests after an important modification or after an accident

B.1 Periodic examinations and tests

Tests on the movable stop(s) and pre-triggered stopping system, if made, shall be carried out with empty car and at a reduced speed.

B.2 Examinations and tests after an important modification or after an accident

EN 81-20:2014, C.2 is supplemented as follows:

change or replacement of:

- the movable stops;
- the pre-triggered stopping system;
- the extendable car roof balustrade;
- the extendable apron.

Annex C (normative)

Examination of pre-triggered stopping system

NOTE This annex defines test procedures for verification of conformity of pre-triggered stopping systems.

C.1 General provisions

The following information shall be provided:

- a) minimum and maximum tripping speed;
- b) minimum and maximum rated load;
- c) minimum and maximum masses of car, counterweight, ropes, travelling cables and compensating ropes or other compensating means;
- d) minimum and maximum inertia of rotating masses of the lift machine and other relevant rotating components;
- e) detailed information on the guide rails used: materials, type, surface condition (drawn, milled, ground, etc.), type and specifications of lubrication and any other relevant information which can influence the stopping behaviour;
- f) list of foreseeable failures, which can lead to uncontrolled movements and which have to be considered for calculation of braking distances;
- g) intended use including ranges of temperature, humidity, climatic conditions and any other special application which can influence the stopping behaviour;
- h) calculation formulas for calculation of braking distances under test conditions and worst-case conditions;
- i) detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components;
- j) if necessary, also a load diagram relating to elastic parts;
- k) instruction manual for pre-triggered stopping system including instructions for maintenance and periodical checking of functionality, braking distances, wear, aging, etc.

C.2 Statement and test samples

C.2.1 It shall be stated for which lift parameters and applications the device shall be certified. If the device has to be certified for a range of parameters, it shall be indicated in addition whether adjustment is by stages or continuous.

C.2.2 A number of sets of the pre-triggered stopping systems shall be supplied, which are needed to test the relevant conditions. The sets may include the car sling and other components, which are associated to the system. The guide rails on which the device acts shall also be supplied with the appropriate dimensions.

C.3 Laboratory tests

C.3.1 Method of test

The method of test shall be defined in order to achieve a realistic function of the system. The real situation on a lift shall be simulated as far as possible, e.g. with a test stand in form of a lift system with flexible masses on both sides of a traction sheave and detachable inertia masses. The test shall include the triggering device, the linkages and the stopping gear.

Measurements shall be made of:

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

Measurements shall be recorded as a function of the time.

C.3.2 Determination of the nominal braking force of the stopping gear

At least six tripping tests shall be made with the maximum tripping speed for the maximum adjustment and for the minimum adjustment of the stopping gear. These tests shall demonstrate the tolerances in the braking force and the wear after these tests.

The tests shall be made on the same part of the guide rail for which criteria shall be specified when it has to be replaced.

For each test the retardation shall be averaged over time. No peak value shall increase the average retardation by more than 2. From the average retardation the average braking force shall be calculated.

For none of six consecutive tests with one adjustment and the same brake jaws the average braking force shall differ more than $\pm 25\%$ from the nominal braking force specified for this adjustment.

The nominal braking force shall be approximately twice ($\pm 20\%$) the maximum static imbalance of the forces on the traction sheave in the test stand.

Additional tests, performed on a different part of the guide rail, shall demonstrate the stopping behaviour with expected influences under normal operation, e.g. with low or excessive lubrication, tolerances of the safety gear, etc.

Further tests, performed on a different part of the guide rail with reduced tripping speeds (50 %, 10 % and 0 % of maximum tripping speed) shall demonstrate that the lift will be stopped and be kept stopped for the intended load conditions

C.3.3 Checking after the tests

After the tests:

- a) the hardness of the gripping element shall be compared with the values originally quoted. Other analyses may be carried out in special cases;
- b) the test samples shall be checked, if there are no fractures, deformations and other changes (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbing surfaces);
- c) if necessary, photographs shall be taken of the elements for evidence of deformations or fractures.

C.4 Calculation

C.4.1 Calculation method

The calculation method shall allow the calculation of braking distances and retardation on basis of the nominal braking forces for the site test case and the foreseeable worst cases.

C.4.2 Site test case

The calculation shall demonstrate the nominal, the minimum and the maximum braking distances under these site test conditions according to 6.2 taking into consideration influences due tolerances, friction, wear and others which can be expected under normal operating conditions.

Tables C.1 and C.2 show examples how the influences can be combined for minimum and maximum conditions. The tolerances in braking force shall be validated in the tests according to C.3.

C.4.3 Worst cases

The calculation shall demonstrate the minimum and maximum braking distances under the foreseeable worst cases which shall take into consideration loading conditions, tripping speed, failures on the lift machine (e.g. broken shaft, brake failure) and tolerances, friction, wear and other influences. Tables C.1 and C.2 show examples how the influences can be combined for minimum and maximum worst cases.

The maximum worst case braking distance shall be the relevant value for location of the triggering device. The minimum worst-case braking distance shall be the relevant value for calculation of the maximum retardation.

Table C.1 — Influences and combinations for site test case and worst case conditions in up direction - Examples

	Conditions				
Parameters	Maximum site test case	Minimum site test case	Maximum worst case	Minimum worst case	
Load in or on car	0	0	750 N ^a	100 % ^b	2000 N ^c
Brake engaged	No	No	No	Yes	No
Inertia masses of geared machine attached	Yes	Yes	Yes	Yes	No
Tolerances of components	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces	
Tolerances of friction	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces	
Wear	Maximum expected reducing braking forces	0	Maximum foreseeable reducing braking forces	0	
Others	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces	
^a 750 N reflects one person in the car or on the car roof.					
^b 100 % reflects the rated load condition.					
^c 2000 N reflects the condition of two persons standing on the car roof.					

Table C.2 — Influences and combinations for site test case and worst case conditions in down direction - Examples

Parameters	Conditions			
	Maximum site test case	Minimum site test case	Maximum worst case	Minimum worst case
Load in or on car	100 % ^a	100 %	100 %	750 N ^b
Brake engaged	No	No	No	Yes
Inertia masses of geared machine attached	Yes	Yes	Yes	Yes
Tolerances of components	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces
Tolerances of friction	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces
Wear	Maximum expected reducing braking forces	0	Maximum foreseeable reducing braking forces	0
Others	Maximum expected reducing braking forces	Maximum expected increasing braking forces	Maximum foreseeable reducing braking forces	Maximum foreseeable increasing braking forces
^a 100 % reflects the rated load condition.				
^b 750 N reflects one person in the car or on the car roof.				

C.5 Test report

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

- type and application of pre-triggered stopping system;
- limits of the permissible masses and other lift parameters;
- maximum tripping speed;
- type of parts on which the braking elements act;
- defined method of test ;
- description of the testing arrangement;
- location of the device to be tested in the testing arrangement;
- number of tests carried out;
- record of measured values;
- report of observations during the test;
- evaluation of the test results to show compliance with the requirements.

Annex ZA (informative)

Relationship between this European Standard and the essential requirements of Directive 2014/33/EU aimed to be covered

This European Standard has been prepared under a Commission's standardization request "M/549 C(2016) 5884 final" to provide one voluntary means of conforming to essential requirements of Directive 2014/33/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to lifts and safety components for lifts (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in Table ZA.1 and Table ZA.2 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Annex I of Directive 2014/33/EU

Essential health and safety requirements of Annex I to Directive 2014/33/EU	Clause(s)/subclause(s) of this EN	Remarks/Notes
1.1	See below Table ZA.2	
2.1	5.2 Perforate wall of the lift well	
2.2	5.5 Reduced clearances in the headroom 5.7 Reduced clearances in the pit	
4.3	5.3 Distance between car, counterweight or balancing weight 5.4 Counterweight or balancing weight in a separate well	
4.4	5.8 Apron	
6.2 a)	7 Information for use	

Table ZA.2 — Correspondence between this European Standard and Annex I of Directive 2006/42/EC

Essential health and safety requirements of Annex I to Directive, 2006/42/EC	Clause(s)/sub-clause(s) of this EN	Remarks/Notes
1.1.6	5.9 Height of machine room 5.10 Height of machine room doors 5.11 Dimensions of trap doors for machine room and pulley room 5.12 Height of landing doors	
1.2.1	5.13 Electric safety devices	
1.5.15	5.6 Car roof balustrade	
1.7.2	7 Information for use	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European Standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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