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STANDARD**

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365**

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**Installation of electric lift — Safety  
requirements**

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Requests for permission to reproduce this document should be addressed to:

Rwanda Standards Board

P.O Box 7099 Kigali-Rwanda

KK 15 Rd, 49

Tel. +250 788303492

Toll Free: 3250

E-mail: [info@rsb.gov.rw](mailto:info@rsb.gov.rw)

Website: [www.rsb.gov.rw](http://www.rsb.gov.rw)

ePortal: [www.portal.rsb.gov.rw](http://www.portal.rsb.gov.rw)

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## Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by technical committees are ratified by members of RSB Board of Directors for publication and gazettelement as Rwanda Standards.

RS 365 was prepared by joint Technical Committee RSB/TC 10 & RSB/TC 23, Electrical Engineering and Mechanical Engineering & Metallurgy

In the preparation of this standard, reference was made to the following standard:

EN 81-20 / EN 81-50 series, Safety rules for construction and installation of lifts — Electric lifts

The assistance derived from the above source is hereby acknowledged with thanks.

This second/third/... edition cancels and replaces the first/second/... edition (RS nnn-n: yyyy), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

(The first/second/third/... edition (RS nnn-n: yyyy) has been reaffirmed by the Board on dd-mm-yyyy.)

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# Installation of electric lift — Safety requirements

## 1 Scope

This Rwanda standard specifies the safety requirements for the installation of permanently new electric lifts with a car designed for the transportation of persons and/or goods, suspended by ropes or chains and moving between guide rails inclined not more than 15° to the vertical.

## 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 8100-30:2019, *Lift (Elevator) installation — Part 1: Class I, II, III and VI lifts*

RS ISO 4190-2, *Lift (US: Elevator) installation — Part 2: Class IV lifts*

RS ISO 4190-3, *Passenger lift installations - Part 3: Service lifts class V*

ISO 4190-5:2006, *Lift (Elevator) installation — Part 5: Control devices, signals and additional Fittings*

ISO 8100-32:2020, *Lifts and service lifts (USA: elevators and dumbwaiters) — Part 6: Passenger lifts to be installed in residential buildings — Planning and selection*

RS ISO 13857: 2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

RS IEC 60947-4-1, *Low-voltage switchgear and controlgear — Part 4: Contactors and motor-starters —Section 1: Electromechanical contactors and motor-starters.*

RS IEC 60947-5-1, *Low-voltage switchgear and controlgear — Part 5: Control circuit devices and switching elements —Section 1: Electromechanical control circuit devices.*

IEC 61000-4, *Electromagnetic compatibility (EMC) —Part 4: Testing and measurement techniques*

RS IEC 60227-6 *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 6: Lift cables and cables for flexible connections*

RS 186-2, *Code of practice for fire safety of building — Part 2: Details of construction*

## 3 Terms and definitions

For the purposes of this standard, the terms and definitions given in RS ISO 4190 series apply.

## 4 Requirements

### 4.1 Lift well

The counterweight or the balancing weight of a lift shall be in the same well as the car.

#### **4.1.1 Well enclosure**

**4.1.1.1** A lift shall be separated from the surroundings by walls, floor and ceiling, or sufficient space.

**4.1.1.2** In sections of the building where the well is required to contribute against the spread of fire, the well shall be totally enclosed by imperforate walls, floor and ceiling.

**4.1.1.3** The only permissible openings are:

- a) openings for landing doors;
- b) openings for inspection and emergency doors to the well and inspection traps;
- c) vent openings for escape of gases and smoke in the event of fire;
- d) ventilation openings;
- e) necessary openings for the functioning of the lift between the well and the machine or pulley rooms;
- f) openings in partition between lifts.

**4.1.1.4** Where the well is not required to contribute against the spread of fire, the well does not need to be totally enclosed, provided:

- a) the height of the enclosure at places normally accessible to persons shall be sufficient to prevent such persons:
  - 1) being endangered by moving parts of the lift, and
  - 2) interfering with the safe operation of the lift by reaching lift equipment within the well either directly or with hand-held objects
- b) the enclosure shall be imperforate;
- c) provisions shall be taken to prevent the interference with the operation of the lift by other equipment;
- d) special precautions shall be taken for lifts exposed to weather.

#### **4.1.2 Inspection and emergency doors**

**4.1.2.1** Inspection and emergency doors, and inspection traps to the well, shall not be used except on grounds of safety to users or the requirements of maintenance.

**4.1.2.2** The size of the doors shall comply with the requirements given in relevant part of RS ISO 4190 based on type of lift

**4.1.2.3** Inspection and emergency doors and inspection traps shall not open towards the interior of the well.

**4.1.2.4** The doors and traps shall be provided with a key-operated lock, capable of being reclosed and relocked without a key

**4.1.2.5** Inspection and emergency doors shall be capable of being opened from inside the well without a key even when locked

**4.1.2.6** Operation of the lift shall depend on maintaining these doors and traps in the closed position

**4.1.2.7** Inspection, emergency doors and inspection traps shall be imperforate, satisfy the same requirements for mechanical strength according to relevant part of RS ISO 4190 as the landing doors, and comply with the regulations relevant to the fire protection for the building concerned.

#### **4.1.3 Ventilation of the well**

The well shall be ventilated. It shall not be used to provide ventilation of rooms other than those belonging to the lift.

#### **4.1.4 Walls, floor and ceiling of the well**

**4.1.4.1** The structure of the well shall conform and shall be able to support at least the loads which may be applied by the machine, by the guide rails at the moment of safety gear operation, in the case of eccentric load in the car, by the action of the buffers, by those which may be applied by the anti-rebound device, by loading and unloading the car.

**4.1.4.2** The strength of the walls, floor and ceiling of the well shall be in compliance with relevant standards.

#### **4.1.5 Construction of the walls of lift wells and landing doors facing a car entrance**

**4.1.5.1** The requirements relating to landing doors and walls, or parts of walls, facing a car entrance shall apply over the full height of the well.

**4.1.5.2** The assembly comprising the landing doors and any wall or part of a wall facing the car entrance shall form an imperforate surface over the full entrance width of the car, excluding the operational clearances of doors.

#### **4.1.6 Protection of any spaces located below the car, the counterweight or the balancing weight**

If accessible spaces do exist below the car, the counterweight or the balancing weight, the base of the pit shall be designed for an imposed load of at least 5 000 N/m<sup>2</sup>, and either there shall be installed below the counterweight buffer or under the travelling area of the balancing weight, a solid pier extending down to solid ground, or the counterweight or the balancing weight shall be equipped with safety gear.

#### **4.1.7 Protection in the well**

**4.1.7.1** The travelling area of the counterweight or the balancing weight shall be guarded by means of a rigid screen extending from a position of not more than 0, 30 m above the lift pit floor to a position at least 2, 50 m.

**4.1.7.2** The width shall be at least equal to that of the counterweight plus 0, 10 m on each side.

**4.1.7.3** Where the well contains several lifts there shall be a partition between the moving parts of different lifts.

**4.1.7.4** The partition shall extend at least from the lowest point of travel of the car, the counterweight or the balancing weight to a height of 2, 50 m above the floor of the lowest landing.

**4.1.7.5** The width shall be as to prevent access from one pit to another.

**4.1.7.6** The partition shall extend through the full height of the well if the horizontal distance between the edge of the car roof and a moving part (car, counterweight or balancing weight) of an adjacent lift is less than 0, 50m.

**4.1.7.7** The width of the partition shall be at least equal to that of the moving part, or part of this, which is to be guarded, plus 0, 10 m on each side.

#### **4.1.8 Exclusive use of the lift well**

The well shall be exclusively used for the lift. It shall not contain cables or devices other than for the lift. The well may, however, contain heating equipment for the lift well excluding steam heating and high-pressure water heating. However, any control and adjustment devices of the heating apparatus shall be located outside the well.

#### **4.1.9 Lighting of the well**

**4.1.9.1** The well shall be provided with permanently installed electric lighting, giving an intensity of illumination of at least 50 lux, 1 m above the car roof and the pit floor, even when all doors are closed.

**4.1.9.2** This lighting shall comprise one lamp at most 0, 50 m from the highest and lowest points in the well with intermediate lamp(s)

### **4.2 Machinery and pulley spaces**

#### **4.2.1 General**

**4.2.1.1** Machinery and pulleys shall be located in machinery and pulley spaces. These spaces and the associated working areas shall be accessible.

**4.2.1.2** Provisions shall be made to allow access to the spaces only to authorized persons (maintenance, inspection and rescue).

**4.2.1.3** The spaces and the associated working areas shall be suitably protected against environmental influences to be taken into consideration and provisions made for suitable areas for maintenance/inspection work and emergency operation.

**4.2.1.4** The machinery and pulley spaces shall be protected by an automatic fire suppression system

#### **4.2.2 Access**

**4.2.2.1** Access to the interior of the machine and pulley rooms shall:

- a) be capable of being properly lit by a permanent electric light fixture(s);
- b) be easy to use in complete safety in all circumstances without necessitating entry into private premises.

**4.2.2.2** A safe access for persons to machine and pulley rooms shall be provided.

#### **4.2.3 Machinery in machine room**

**4.2.3.1** When lift machines and their associated equipment are located in a machine room, it shall comprise solid walls, ceiling, floor and door and / or trap.

**4.2.3.2** Machine rooms shall not be used for purposes other than lifts. They shall not contain ducts, cables or devices other than for the lift. These rooms may, however, contain:

- a) machines for service lifts or escalators;
- b) equipment for air-conditioning or heating of these rooms, excluding steam heating and high pressure water heating;
- c) fire detectors or extinguishers, with a high operating temperature, appropriate for the electrical equipment, stable over a period of time, and suitably protected against accidental impact.

**4.2.3.3** The traction sheave may be installed in the well, provided that:

- a) examinations and the tests and the maintenance operations may be carried out from the machine room;
- b) openings between the machine room and the well are as small as possible.

**4.2.3.4** The dimensions of machine rooms working areas inside the well, shall comply with the requirements of the relevant part of RS ISO 4190

**4.2.3.5** Machine rooms shall be so constructed to withstand the loads and forces to which they are intended to be subjected. They shall be of non-slip material and in durable material not favouring the creation of dust.

**4.2.3.6** The dimensions of doors and trap doors shall comply with the requirements of the relevant part of RS ISO 4190

**4.2.3.7** Trap doors shall not open downwards, unless they are linked to retractable ladders. Hinges, if any, shall be of a type which cannot be unhooked.

**4.2.3.8** When a trap door is in the open position, precautions shall be taken to prevent the fall of persons (e.g., a guard rail).

**4.2.3.9** The doors or trap doors shall be fitted with locks having keys, which can be opened without a key from inside the room.

**4.2.3.10** Trap doors used only for access of material may be locked from the inside only.

**4.2.3.11** The machine rooms and machinery spaces inside the well shall be ventilated. Stale air from other parts of the building shall not be extracted directly into the machine room and the electric equipment of the machinery shall be protected from dust, harmful fumes and humidity.

**4.2.3.12** The machine room shall be provided with permanently installed electric lighting on the basis of at least 200 lux at floor level.

**4.2.3.13** A switch placed inside close to the access point(s), at an appropriate height, shall control lighting of the room.

**4.2.3.14** One or more metal supports or hooks with the indication of the safe working load shall be provided in the machine room ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment.

**4.2.3.15** A switch accessible only to authorised persons and placed close to the access point(s) to working area(s), at an appropriate height, shall control the lighting of the areas and spaces.

**4.2.3.16** At least one socket outlet shall be provided at an appropriate place for machine room and each working area.

#### **4.2.4 Machinery outside of the well**

**4.2.4.1** Machinery spaces outside of the well and not located in a separate machine room shall be so constructed to withstand the loads and forces to which they are intended to be subjected.

**4.2.4.2** The machinery of a lift shall be located inside a cabinet which shall not be used for purposes other than the lift. It shall not contain ducts, cables or devices other than for the lift.

**4.2.4.3** The openings when accessible to non-authorised persons shall comply with the following requirements:

- a) protection according to RS ISO 13857 against contact with danger zones, and
- b) degree of protection of at least IP 2XD against contact with electrical equipment.

**4.2.4.4** The door(s) shall meet the following:

- a) have sufficient dimensions to carry out the required work through the door;
-

- b) not open towards the inside of the cabinet;
- c) be provided with a key-operated lock, capable of being reclosed and relocked without a key.

**4.2.4.5** The machinery cabinet shall be ventilated. It shall be such that the machinery is protected from dust, harmful fumes and humidity.

**4.2.4.6** The inside of the machinery cabinet shall be provided with permanently installed electric lighting with an intensity of at least 200 lux at floor level.

**4.2.4.7** A switch placed inside close to the door(s), at an appropriate height, shall control lighting of the cabinet. At least one socket outlet shall be provided.

#### **4.2.5 Construction and equipment of pulley spaces**

**4.2.5.1** Pulleys outside of the well shall be located in a pulley room.

**4.2.5.2** The pulley rooms shall be so constructed to withstand the loads and forces to which they will normally be subjected. They shall be in durable material, not favouring the creation of dust.

**4.2.5.3** The floors of the pulley rooms shall be of non-slip material.

**4.2.5.4** Pulley room dimensions shall be sufficient to provide easy and safe access for maintenance personnel to all the equipment.

**4.2.5.5** A stopping device shall be installed in the pulley room, close to the point(s) of access.

**4.2.5.6** If the pulley rooms also contain electrical equipment, the ambient temperature shall be similar to that of the machine room.

**4.2.5.7** The pulley room shall be provided with permanently installed electric lighting with an illumination intensity of at least 100 lux at the pulley(s).

**4.2.5.8** A switch, placed inside, close to the access point, at an appropriate height, shall control the lighting of the room.

**4.2.5.9** At least one socket outlet shall be provided.

**4.2.5.10** Diverter pulleys may be installed in the headroom of the well provided that they are located outside the projection of the car roof and that examinations and tests and maintenance operations can be carried out in complete safety from the car roof, from inside the car, from a platform or from outside of the well.

**4.2.5.11** Diverter pulley, with single or double wrap, may be installed above the car roof for diverting towards the counterweight, provided that its shaft can be reached in complete safety from the car roof or from a platform.

## **4.3 Landing doors**

### **4.3.1 Strength of doors and their frames**

**4.3.1.1** Doors and their frames shall be constructed in such a way that they will not become deformed in the course of time and shall be made of metal or tempered glass.

**4.3.1.2** Door panels made of glass shall be fixed in such a way that forces demanded by this standard which may be applied are transferred without damaging the fixing of the glass.

**4.3.1.3** The fixing of the glass in doors shall ensure that the glass cannot slip out of the fixings, even when sinking.

### **4.3.2 Height and width of entrances**

The height and width dimensions shall comply with the requirements of relevant part of RS ISO 4190

### **4.3.3 Sills, guides, door suspension**

**4.3.3.1** Every landing entrance shall incorporate a sill of sufficient strength to withstand the passage of loads being introduced into the car.

**4.3.3.2** Landing doors shall be designed to prevent, during normal operation, derailment, mechanical jamming, or displacement at the extremities of their travel.

**4.3.3.3** Where the guides may become ineffective due to wear, corrosion or fire, emergency guidance shall be provided to maintain the landing doors in their position.

**4.3.3.4** Horizontally sliding landing doors shall be guided top and bottom.

**4.3.3.5** Vertically sliding landing doors shall be guided at both sides.

**4.3.3.6** Panels of vertically sliding landing doors shall be fixed to two independent suspension elements.

**4.3.3.7** Suspension ropes, chains, belts shall be designed with a safety factor of at least 8

**4.3.3.8** The pitch diameter of suspension rope pulleys shall be at least 25 times the rope diameter.

**4.3.3.9** Suspension ropes and chains shall be guarded against leaving the pulley grooves or sprockets.

### **4.3.4 Protection in relation to door operation**

**4.3.4.1** The doors and their surrounds shall be designed in such a way as to minimize risk of damage or injury due to jamming of a part of the person, clothing or other object.

**4.3.4.2** To avoid the risk of shearing during operation, the exterior face of automatic power operated sliding doors shall not have recesses or projections exceeding 3 mm. Edges of these shall be chamfered in the opening direction of movement.

**4.3.4.3** Power operated doors shall be designed to reduce to a minimum the harmful consequences of a person being struck by a door panel.

#### **4.3.5 Horizontal sliding automatic power operated doors**

**4.3.5.1** The effort needed to prevent the door closing shall not exceed 150 N. This measurement shall not be made in the first third of the travel of the door.

**4.3.5.2** The kinetic energy of the landing door and the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed shall not exceed 10 J.

**4.3.5.3** The average closing speed of a sliding door is calculated over its whole travel, less:

- a) 25 mm at each end of the travel in the case of centrally closing doors;
- b) 50 mm at each end of the travel in the case of side closing doors.

**4.3.5.4** A protective device shall automatically initiate re-opening of the door in the event of a person being struck, or about to be struck, by the door in crossing the entrance during the closing movement.

**4.3.5.5** The effort needed to prevent a folding door from opening shall not exceed 150 N.

#### **4.3.6 Horizontal sliding non-automatic power operated doors**

When the closing of the door is carried out under the continuous control and supervision of the user, by continuous pressure on a button or similar (hold-to-run control), the average closing speed of the fastest panel shall be limited to 0,3 m/s, when the kinetic energy exceeds 10 J.

#### **4.3.7 Vertically sliding doors**

This type of sliding door shall only be used for goods passenger lifts and power closing shall only be used if the following conditions are fulfilled at the same time:

- a) the closing is carried out under the continuous control and supervision of the users;
- b) the average closing speed of the panels is limited to 0,3 m/s;
- c) the car door is at least two-thirds closed before the landing door begins to close.

#### **4.3.8 Local lighting**

The natural or artificial lighting of the landings in the vicinity of landing doors shall be at least 50 lux at floor level, such that a user can see ahead when he is opening the landing door to enter the lift, even if the car light has failed.

#### **4.3.9 Locking and closed landing door check**

**4.3.9.1** It shall not be possible in normal operation to open a landing door (or any of the panels in the case of a multi-panel door) unless the car has stopped, or is on the point of stopping, in the unlocking zone of that door.

**4.3.9.2** It shall not be possible in normal operation to start the lift nor keep it in motion if a landing door, or any of the panels in the case of a multi-panel door is open.

**4.3.9.3** Each landing door shall be provided with a locking device. This device shall be protected against deliberate misuse.

#### **4.3.10 Locking**

**4.3.10.1** The effective locking of the landing door in the closed position shall precede the movement of the car. The locking must be proved by an electric safety device

**4.3.10.2** The car shall not be able to start until the locking elements are engaged by at least 7 mm

**4.3.10.3** The element of the electric safety device proving the locked condition of the door panel(s) shall be positively operated without any intermediate mechanism by the locking element. It shall be foolproof but adjustable if necessary.

**4.3.10.4** For hinged doors, locking shall be affected as near as possible to the vertical closing edge(s) of the doors, and maintained even in the case of panels sagging.

**4.3.10.5** The locking elements and their fixings shall be resistant to shock, and be made or reinforced with metal.

**4.3.10.6** The engagement of the locking elements shall be achieved in such a way that a force of 300 N in the opening direction of the door does not diminish the effectiveness of locking.

**4.3.10.7** The lock shall resist, without permanent deformation during the test, a minimum force at the level of the lock and in the direction of opening of the door of:

- a) 1000 N in the case of sliding doors;
- b) 3000 N on the locking pin, in the case of hinged doors.

**4.3.10.8** The locking action shall be affected and maintained by the action of gravity, permanent magnets, or springs. The springs shall act by compression, be guided and of such dimensions that, at the moment of unlocking, the coils are not compressed solid.

**4.3.10.9** In the event of the permanent magnet (or spring) no longer fulfilling its function, gravity shall not cause unlocking.

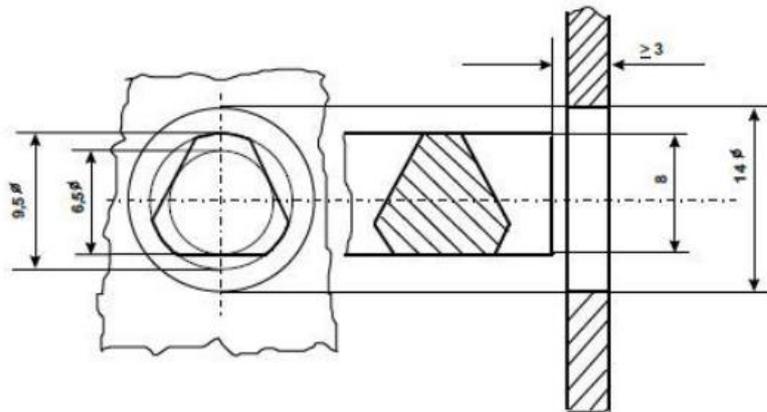
**4.3.10.10** If the locking element is maintained in position by the action of a permanent magnet, it shall not be possible to neutralize its effect by simple means.

**4.3.10.11** The locking device shall be protected against the risk of an accumulation of dust, which could hinder its proper functioning.

**4.3.10.12** In the case where the lock contacts are in a box, the fixing screws for the cover shall be of the captive type, so that they remain in the holes in the cover or box when opening the cover.

#### 4.3.11 Emergency unlocking

**4.3.11.1** Each of the landing doors shall be capable of being unlocked from the outside with the aid of a key, which will fit the unlocking triangle as defined in Figure 1.



**Figure 1 — Unlocking triangle**

**4.3.11.2** Keys of this type shall be given only to a responsible person. They shall be accompanied by a written instruction detailing the essential precautions to be taken in order to avoid accidents which could result from an unlocking which was not followed by effective relocking.

**4.3.11.3** After an emergency unlocking, the locking device shall not be able to remain in the unlocked position with the landing door closed.

**4.3.11.4** In the case of landing doors driven by the car door, a device (either weight or springs) shall ensure the automatic closing of the landing door if this door becomes open, for whatever reason, when the car is outside the unlocking zone.

#### 4.3.12 Closing of automatically operated doors

In normal operation, automatically operated landing doors shall be closed after the necessary period of time, which may be defined according to the traffic using the lift, in the absence of a command for the movement of the car.

## **4.4 Suspension, compensation and overspeed protection**

### **4.4.1 Suspension**

**4.4.1.1** Cars, counterweights or balancing weights shall be suspended from steel wire ropes, or steel chains with parallel links (Galle type) or roller chains.

**4.4.1.2** The ropes shall correspond to the following requirements:

- a) the nominal diameter of the ropes shall be at least 8 mm;
- b) the tensile strength of the wires shall be:
  - 1) 1570 N/mm<sup>2</sup> or 1770 N/mm<sup>2</sup> for ropes of single tensile, or
  - 2) 1370 N/mm<sup>2</sup> for the outer wires and 1770 N/mm<sup>2</sup> for the inner wires of ropes of dual tensile.
- c) the other characteristics shall at least correspond to those specified in the relevant standards.

**4.4.1.3** The minimum number of ropes or chains shall be two. Ropes or chains shall be independent.

### **4.4.2 Sheave, pulley, drum and rope diameter ratios, rope/chain terminations**

**4.4.2.1** The ratio between the pitch diameter of sheaves, pulleys or drums and the nominal diameter of the suspension ropes shall be at least 40, regardless of the number of strands.

**4.4.2.2** The safety factor of the suspension ropes shall be less than:

- a) 12 in the case of traction drive with three ropes or more;
- b) 16 in the case of traction drive with two ropes;
- c) 12 in the case of drum drive.

**4.4.2.3** The junction between the rope and the rope termination shall be able to resist at least 80 % of the minimum breaking load of the rope.

**4.4.2.4** The ends of the ropes shall be fixed to the car, counterweight or balancing weight, or suspension points of the dead parts of reeved ropes by means of metal or resin filled sockets, self-tightening wedge type sockets, heart shaped thimbles with at least three suitable rope grips, hand spliced eyes, ferrule secured eyes, or any other system with equivalent safety.

**4.4.2.5** The fixing of the ropes on the drums shall be carried out using a system of blocking with wedges, or using at least two clamps or any other system with equivalent safety.

**4.4.2.6** The safety factor of the suspension chains shall be at least 10

**4.4.2.7** The ends of each chain shall be fixed to the car, counterweight or balancing weight, or suspension points of the dead parts of reeved chains by suitable terminations.

**4.4.2.8** The junction between the chain and the chain termination shall be able to resist at least 80 % of the minimum breaking load of the chain.

#### **4.4.3 Distribution of load between the ropes or the chains**

**4.4.3.1** An automatic device shall be provided for equalizing the tension of suspension ropes or chains, at least at one of their ends.

**4.4.3.2** For chains engaging with sprockets, the ends fixed to the car as well as the ends fixed to the balancing weight shall be provided with such equalization devices.

**4.4.3.3** For chains in the case of multiple return sprockets on the same shaft, these sprockets shall be able to rotate independently.

**4.4.3.4** If springs are used to equalize the tension they shall work in compression.

**4.4.3.5** The devices for adjusting the length of ropes or chains shall be made in such a way that these devices cannot work themselves loose after adjustment.

#### **4.4.4 Protection for traction sheaves, pulleys and sprockets**

**4.4.4.1** For traction sheaves, pulleys and sprockets, provisions shall be made in manner that avoid:

- a) bodily injury;
- b) the ropes/chains leaving the pulleys/sprockets, if slack;
- c) the introduction of objects between ropes/chains and pulleys/sprockets

**4.4.4.2** The devices used shall be constructed so that the rotating parts are visible, and do not hinder examination and maintenance operation.

**4.4.4.3** The dismantling/overhauling shall be necessary only in the following cases:

- a) replacement of a rope/chain;
- b) replacement of a pulley/sprocket; and
- c) re-cutting of the grooves.

#### 4.4.5 Safety gear

The car shall be provided with a safety gear capable of operating in the downward direction and capable of stopping a car carrying the rated load, at the tripping speed of the overspeed governor, even if the suspension devices break, by gripping the guide rails, and of holding the car there.

#### 4.4.6 Protection against unintended car movement

**4.4.6.1** Lifts shall be provided with a means to stop unintended car movement away from the landing with the landing door not in the locked position and the car door not in the closed position, as a result of failure in any single component of the lift machine or drive control system upon which the safe movement of the car depends, except failure of the suspension ropes or chains and the traction sheave or drum or sprockets of the machine.

**4.4.6.2** The means shall detect unintended movement of the car, shall cause the car to stop, and keep it stopped.

**4.4.6.3** The means shall be capable of performing as required without assistance from any lift component that, during normal operation, controls the speed or retardation, stops the car or keeps it stopped, unless there is built-in redundancy and correct operation is self-monitored.

**4.4.6.4** The means shall stop the car in a distance:

- a) not exceeding 1,20 m from the landing where the unintended car movement has been detected, and
- b) the vertical distance between the landing sill and the lowest part of the car apron shall not exceed 200 mm, and
- c) the free distance from car sill to landing door lintel, or from landing sill to car door lintel shall not be less than 1,00 m (see Figure2).

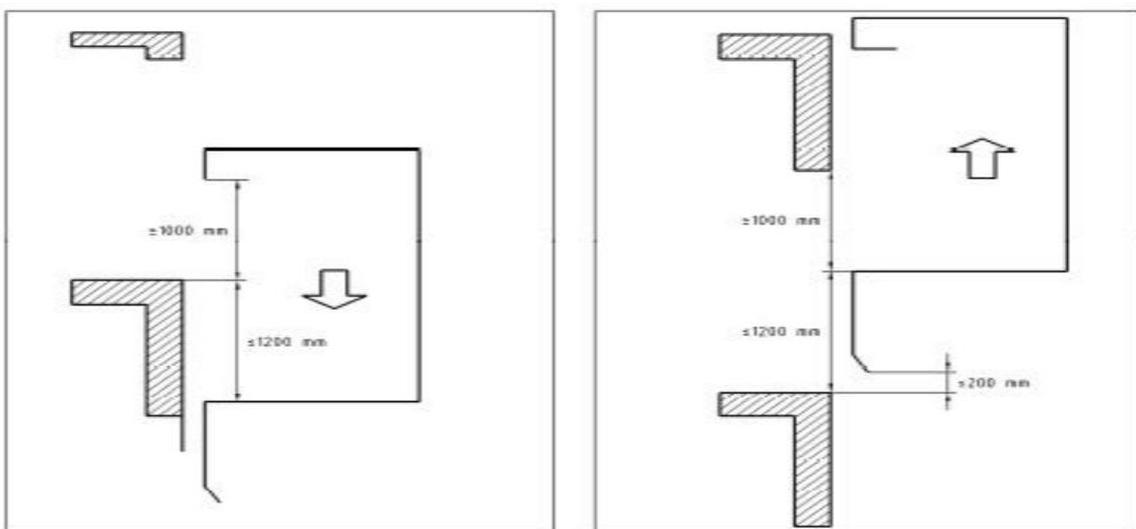


Figure 2 — Unintended car movement

#### 4.5 Guide rails, buffers and final limit switches

**4.5.1** The guide rails, their joints and attachments shall be sufficient to withstand the loads and forces imposed on them in order to ensure a safe operation of the lift.

**4.5.2** Lifts shall be provided with buffers at the bottom limit of travel of the car and counterweight.

**4.5.3** Final limit switches shall be provided and shall be set to function as close as possible to the terminal floors, without risk of accidental operation.

**4.5.4** Final limit switches shall operate before the car (or counterweight if there is one) comes into contact with the buffers. The action of the final limit switches shall be maintained whilst the buffers are compressed.

**4.5.5** Separate actuating devices shall be used for normal terminal stopping and final limit switches.

**4.5.6** After the operation of the final limit switches, the return to service of the lift shall not occur automatically.

#### 4.6 Lift machine

**4.6.1** The lift shall be provided with a braking system, which operates automatically:

- a) in the event of loss of the mains power supply;
- b) in the event of the loss of the supply to control circuits.

**4.6.2** The braking system shall have an electro-mechanical brake (friction type), but may, in addition, have other braking means (e.g., electric).

**4.6.3** The brake on its own shall be capable of stopping the machine when the car is travelling downward at rated speed and with the rated load plus 25 %. In these conditions the retardation of the car shall not exceed that resulting from operation of the safety gear or stopping on the buffer.

**4.6.4** All the mechanical components of the brake which take part in the application of the braking action on the drum or disk shall be installed in two sets. If one of the components is not working a sufficient braking effort to slow down the car, travelling downwards at rated speed and with rated load shall continue to be exercised.

**4.6.5** The component on which the brake operates shall be coupled to the traction sheave or drum or sprocket by direct and positive mechanical means.

**4.6.6** To hold off the brake, in normal operation, shall require a continuous flow of current.

**4.6.7** Braking shall become effective without supplementary delay after opening of the brake release circuit.

**4.6.8** The brake shoe or pad pressure shall be exerted by guided compression springs or weights.

**4.6.9** Band brakes shall not be used and brake linings shall be incombustible

**4.6.10** The speed of the lift car, half loaded, in downward motion, in mid-travel, excluding all acceleration and retardation periods, shall not exceed the rated speed by more than 5 %, when the supply is at its rated frequency, and the motor voltage is equal to the rated voltage of the equipment.

## **4.7 Electric installations and appliances**

**4.7.1** The lift shall be considered as a whole, in the same way as a machine with its built in electrical equipment.

**4.7.2** The electromagnetic compatibility shall comply with the requirements of relevant part of IEC 61000-4

**4.7.3** In the machinery and pulley spaces protection of the electrical equipment against direct contact shall be provided by means of casings providing a degree of protection of at least IP 2X.

**4.7.4** Proper earthing system shall be provided for protection of users and lifts

### **4.7.1 Contactors, relay-contactors, components of safety circuits**

**4.7.1.1** The main contactors shall belong to the following categories as defined in RS IEC 60947-4-1:

- a) AC-3 for contactors for A.C. motors;
- b) DC-3 for contactors for D.C. power.

**4.7.1.2** If, because of the power they carry, relay-contactors are used to operate the main contactors; those relay-contactors shall belong to the following categories as defined in RS IEC 60947-5-1:

- a) AC-15 for controlling A.C. electromagnets;
- b) DC-13 for controlling D.C. electromagnets.

### **4.7.2 Protection of motors and other electrical equipment**

**4.7.2.1** Motors directly connected to the mains shall be protected against short-circuiting.

**4.7.2.2** Except as Motors directly connected to the mains shall be protected against overloads by means of manual reset, automatic circuit-breakers which shall cut off the supply to the motor in all live conductors.

**4.7.2.3** When the lift motors are supplied from D.C. generators driven by motors, the lift motors shall also be protected against overloads.

**4.7.2.4** If the design temperature of electrical equipment provided with a temperature monitoring device is exceeded and the lift should not continue in operation, then the car shall stop at a landing such as the passengers can leave the car. An automatic return to normal operation of the lift shall only occur after sufficient cooling down.

### 4.7.3 Main switches

**4.7.3.1** For each lift, a main switch capable of breaking the supply to the lift on all the live conductors shall be provided. The switch shall be capable of interrupting the highest current involved in normal conditions of use of the lift.

**4.7.3.2** The switch shall not cut the circuits feeding:

- a) car lighting or ventilation, if any;
- b) socket outlet on the car roof;
- c) lighting of machinery and pulley spaces;
- d) socket outlet in the machinery and pulley spaces and in the pit;
- e) lighting of the lift well;
- f) alarm device

**4.7.3.3** The switch shall be located:

- a) in the machine room where it exists;
- b) where no machine room exists, in the control cabinet, except if this cabinet is mounted in the well, or
- c) at the emergency and tests panel(s) when the control cabinet is mounted in the well. If the emergency panel is separate from the test panel, the switch shall be at the emergency panel.

**4.7.3.4** The main switches shall have stable open and closed positions, and shall be capable of being locked-off in the open position, with the use of a padlock or equivalent, to ensure no inadvertent operation.

**4.7.3.5** The control mechanism for the main switch shall be easily and rapidly accessible from the entrance(s) to the machine room. If the machine room is common to several lifts, the control mechanism of the main switches shall allow the lift concerned to be identified easily.

**4.7.3.6** If the machine room has several points of access, or if the same lift has several machine rooms each with its own point(s) of access, a circuit breaker contactor may be used, release of which shall be controlled by an electric safety device, inserted in the supply circuit to the coil of the circuit breaker contactor.

**4.7.3.7** The re-engagement of the circuit breaker contactor shall not be carried out or made possible except by means of the device, which caused its release. The circuit-breaker contactor shall be used in conjunction with a manually controlled isolating switch.

**4.7.3.8** Any capacitors to correct the power factor shall be connected before the main switch of the power circuit.

**4.7.3.9** If there is a risk of over-voltage, when for example the motors are connected by very long cables, the switch of the power circuit shall also interrupt the connection to the capacitors.

#### **4.7.4 Electric wiring, lighting and socket outlets**

**4.7.4.1** Electrical wiring shall be done according to relevant national, regional and/or international standards on electrical wiring.

**4.7.4.2** Electrical cables shall comply with the requirements of RS IEC 60227-6 and shall be protected mechanically

**4.7.4.3** The electric lighting supplies to the car, the well and the machinery and pulley spaces, and emergency and test panel(s), shall be independent of the supply to the machine

**4.7.4.4** All socket outlets shall have earthing system

#### **4.8 Protection against electric faults; controls; priorities**

**4.8.1** During operation of one of the electric safety devices required in several clauses, movement of the machine shall be prevented or it shall be caused to stop immediately

**4.8.2** Apart from exceptions permitted in this standard, no electric equipment shall be connected in parallel with an electric safety device.

**4.8.3** The effects of internal or external induction or capacity shall not cause failure of electric safety devices.

**4.8.4** An output signal emanating from an electric safety device shall not be altered by an extraneous signal emanating from another electric device placed further down the same circuit, which would cause a dangerous condition to result.

**4.8.5** In safety circuits comprising two or more parallel channels, all information other than that required for parity checks shall be taken from one channel only.

**4.8.6** Circuits which record or delay signals shall not, even in event of fault, prevent or appreciably delay the stopping of the machine through the functioning of an electric safety device

**4.8.9** The construction and arrangement of the internal power supply units shall be such as to prevent the appearance of false signals at outputs of electric safety devices due to the effects of switching.

**4.8.10** The operation of a safety contact shall be by positive separation of the circuit-breaking devices. The separation shall occur even if the contacts have welded together.

**4.8.11** The design of a safety contact shall be such as to minimize the risk of a short-circuit resulting from component failure.

**4.8.12** The safety contacts shall be provided for a rated insulation voltage of 250 V if the enclosure provides a degree of protection of at least IP 4X, or 500 V if the degree of protection of the enclosure is less than IP 4X.

**4.8.13** The safety contacts shall belong to the following categories as defined in RS IEC 60947-5-1:

- a) AC-15 for safety contacts in A.C. circuits;
- b) DC-13 for safety contacts in D.C. circuits.

**4.8.14** Abrasion of conductive material shall not lead to short circuiting of contacts

**4.8.15** The controls shall comply with the requirements of RS ISO 4190-5

**4.8.16** To facilitate inspection and maintenance, a readily accessible inspection control station shall be provided on the car roof.

**4.8.17** More than two inspection control stations shall not be installed.

**4.8.18** A stopping device shall be provided for stopping, and maintaining the lift out of service,

**4.8.19** The stopping devices shall consist of electric safety devices. They shall be bi-stable and such that a return to service cannot result from an involuntary action.

**4.8.20** A stopping device in the car shall not be used except for cars with docking operation.

**4.8.21** In order to call for outside assistance, passengers shall have available in the car an easily recognizable and accessible device for this purpose according to RS ISO 4190-5

**4.8.22** The lift shall be fitted with a device to prevent normal starting, including re-leveling, in the event of overload in the car in accordance with RS ISO 4190-5

**4.8.23** The lift shall be installed with appropriate devices for soft landing and evacuation in case of emergency and/ or electrical cut off

## **5 Fire protection**

All materials and installations of electric lift installed in any building shall comply with RS 186-2.

## **6 Notices, markings and operating instructions**

**6.1** All labels, notices, markings and operating instructions shall be indelible, legible and readily understandable (if necessary aided by signs or symbols). They shall be untearable, of durable material, placed in a visible position, and written in at least two official languages where the lift is installed.

**6.2** Notices marking and operating instructions shall comply to the requirements of RS ISO 4190-5

## 7 Inspections - Tests - Register - Maintenance

### 7.1 Inspections and tests

**7.1.1** The technical dossier to be supplied if applying for preliminary authorization shall contain the necessary information to ascertain that the constituent parts are correctly designed and the proposed installation is in conformity with standard requirements

**7.1.2** Before putting into service, lifts shall be subject to examinations and tests in accordance with requirements of the relevant standard.

### 7.2 Register

**7.2.1** The basic characteristics of the lift shall be recorded in a register, or file, drawn up at the latest at the time the installation is put into service. This register or file shall comprise:

- a) a technical section giving:
  - 1) the date the lift was put into service;
  - 2) the basic characteristics of the lift;
  - 3) the characteristics of the ropes and/or chains;
  - 4) the characteristics of those parts for which verification of conformity is required;
  - 5) the plans of installation in the building;
  - 6) electric schematic diagrams; the circuit diagrams may be limited to the circuits for the overall understanding of the safety considerations.;
- b) a section intended to keep duplicate dated copies of examination and inspection reports, with observations.

**7.2.2** This register or file shall be kept up-to-date in case of:

- a) important modifications to the lift;
- b) replacement of ropes or important parts;
- c) accidents.

**7.2.3** This register or file should be available to those in charge of the maintenance, and to the person or organization responsible for the periodical examinations and tests.

### 7.3 Installer and maintenance information

**7.3.1** The manufacturer/installer shall provide an instruction manual for normal use and maintenance

**7.3.2** The instruction manual shall give the necessary information about the normal use of the lift and rescue operation, especially relating to:

- a) keeping the doors giving access to machinery and pulley spaces locked;
- b) safe loading and unloading;
- c) precaution to be taken in case of lifts with partially enclosed well;
- d) events needing the intervention of a competent person;
- e) keeping the documentation;
- f) the use of the emergency unlocking key;
- g) rescue operation;
- h) necessary maintenance of the lift and its accessories in order to keep it in working order; and
- i) instruction for safe maintenance

**7.3.3** The instruction manual shall inform about periodical examinations and examinations after important modifications or accidents.

**7.3.4** Periodical examinations and tests on lifts shall be carried out after they are put into service to verify that they are in good condition.

**7.3.5** Examinations and tests should be carried out after important modifications or after an accident to ascertain that lifts continue to conform to this standard.



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