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## Installation of electric lift — Safety requirements

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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.

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In other circumstances, particularly when there is an urgent need for such documents, Rwanda Standards Board may decide to publish technical specifications to respond to either market or regulatory needs. A technical specification represents an agreement of majority of the members of a Technical Committee and the document is subjected to review for improvement.

DRS 365: 2017 was prepared by Joint Technical Committee RSB/TC 010& RSB/TC 23, *Electrical Engineering and Electronics & Mechanical Engineering and Metallurgy*.

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

EN 81-1: 1998, *Electric rules for construction and installation of lifts — Electric lifts*

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

## Committee membership

The following organizations were represented on the Joint Technical Committee on Electrical Engineering and Electronics and Mechanical Engineering and Metallurgy (RSB/TC 010&RSB/TC 023) in the preparation of this standard.

Association des Consommateurs au Rwanda (ADECOR)

Rwanda Standards Board (RSB) – Secretariat

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## Installation of electric lift — Safety requirements

### 1 Scope

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

### 2 Normative references

The following referenced documents are indispensable for the application 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.

RS ISO 4190-1 *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*

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

RS ISO 4190-6 *Lifts and service lifts (USA: elevators and dumbwaiters) - Part 6: Passenger lifts to be installed in residential buildings - Planning and selection*

RS ISO 13857 *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*

### 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.

- 91 **4.1.1.3** The only permissible openings are:
- 92 a) openings for landing doors ;
- 93 b) openings for inspection and emergency doors to the well and inspection traps ;
- 94 c) vent openings for escape of gases and smoke in the event of fire ;
- 95 d) ventilation openings ;
- 96 e) necessary openings for the functioning of the lift between the well and the machine or pulley rooms ;
- 97 f) openings in partition between lifts.
- 98 **4.1.1.4** Where the well is not required to contribute against the spread of fire, the well does not need to
- 99 be totally enclosed, provided:
- 100 a) the height of the enclosure at places normally accessible to persons shall be sufficient to prevent such
- 101 persons :
- 102 1) being endangered by moving parts of the lift, and
- 103 2) interfering with the safe operation of the lift by reaching lift equipment within the well either directly or
- 104 with hand-held objects.
- 105 b) the enclosure shall be imperforate ;
- 106 c) provisions shall be taken to prevent the interference with the operation of the lift by other equipment;
- 107 d) special precautions shall be taken for lifts exposed to weather.
- 108 **4.1.2 Inspection and emergency doors - Inspection traps**
- 109 **4.1.2.1** Inspection and emergency doors, and inspection traps to the well, shall not be used except on
- 110 grounds of safety to users or the requirements of maintenance.
- 111 **4.1.2.2** The size of the doors shall comply with the requirements given in relevant part of RS ISO 4190
- 112 **4.1.2.3** Inspection and emergency doors and inspection traps shall not open towards the interior of the
- 113 well.
- 114 **4.1.2.4** The doors and traps shall be provided with a key-operated lock, capable of being reclosed and
- 115 relocked without a key.
- 116 **4.1.2.5** Inspection and emergency doors shall be capable of being opened from inside the well without a
- 117 key even when locked.
- 118 **4.1.2.6** Operation of the lift shall depend on maintaining these doors and traps in the closed position.
- 119 **4.1.2.7** Inspection and emergency doors and inspection traps shall be imperforate, satisfy the same
- 120 requirements for mechanical strength according to relevant part of ISO 4190 as the landing doors, and comply
- 121 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 to National Building Regulations and 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 National Building Regulations and 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.

153 **4.1.7.6** The partition shall extend through the full height of the well if the horizontal distance between the  
154 edge of the car roof and a moving part (car, counterweight or balancing weight) of an adjacent lift is less than  
155 0,50 m.

156 **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  
157 to be guarded, plus 0,10 m on each side.

#### 158 **4.1.8 Exclusive use of the lift well**

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

#### 163 **4.1.9 Lighting of the well**

164 **4.1.9.1** The well shall be provided with permanently installed electric lighting, giving an intensity of  
165 illumination of at least 50 lux, 1 m above the car roof and the pit floor, even when all doors are closed.

166 **4.1.9.2** This lighting shall comprise one lamp at most 0,50 m from the highest and lowest points in the  
167 well with intermediate lamp(s)

#### 168 **4.2 Machinery and pulley spaces**

169 Machinery and pulleys shall be located in machinery and pulley spaces. These spaces and the associated  
170 working areas shall be accessible. Provisions shall be made to allow access to the spaces only to authorized  
171 persons (maintenance, inspection and rescue). The spaces and the associated working areas shall be  
172 suitably protected against environmental influences to be taken into consideration and provisions made for  
173 suitable areas for maintenance/inspection work and emergency operation.

#### 174 **4.2.1 Access**

175 **4.2.1.1** Access to the interior of the machine and pulley rooms shall:

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

178 **4.2.1.2** A safe access for persons to machine and pulley rooms shall be provided.

#### 179 **4.2.2 Machinery in machine room**

180 **4.2.2.1** When lift machines and their associated equipment are located in a machine room, it shall  
181 comprise solid walls, ceiling, floor and door and / or trap.

182 **4.2.2.2** Machine rooms shall not be used for purposes other than lifts. They shall not contain ducts,  
183 cables or devices other than for the lift. These rooms may, however, contain:

- 184 a) machines for service lifts or escalators;

- 185 b) equipment for air-conditioning or heating of these rooms, excluding steam heating and high pressure  
186 water heating;
- 187 c) fire detectors or extinguishers, with a high operating temperature, appropriate for the electrical equipment,  
188 stable over a period of time, and suitably protected against accidental impact.
- 189 **4.2.2.3** The traction sheave may be installed in the well, provided that:
- 190 a) examinations and the tests and the maintenance operations may be carried out from the machine room;  
191 b) openings between the machine room and the well are as small as possible.
- 192 **4.2.2.4** The dimensions of machine rooms working areas inside the well, shall comply with the  
193 requirements of the relevant part of RS ISO 4190
- 194 **4.2.2.5** Machine rooms shall be so constructed to withstand the loads and forces to which they are intended  
195 to be subjected. They shall be of non-slip material and in durable material not favouring the creation of dust.
- 196 **4.2.2.6** The dimensions of doors and trap doors shall comply with the requirements of the relevant part of  
197 RS ISO 4190
- 198 **4.2.2.7** Trap doors shall not open downwards, unless they are linked to retractable ladders. Hinges, if  
199 any, shall be of a type which cannot be unhooked.
- 200 **4.2.2.8** When a trap door is in the open position, precautions shall be taken to prevent the fall of persons  
201 (e.g. a guard rail).
- 202 **4.2.2.9** The doors or trap doors shall be fitted with locks having keys, which can be opened without a key  
203 from inside the room.
- 204 **4.2.2.10** Trap doors used only for access of material may be locked from the inside only.
- 205 **4.2.2.11** The machine rooms and machinery spaces inside the well shall be ventilated. Stale air from other  
206 parts of the building shall not be extracted directly into the machine room and the electric equipment of the  
207 machinery shall be protected from dust, harmful fumes and humidity.
- 208 **4.2.2.12** The machine room shall be provided with permanently installed electric lighting on the basis of at  
209 least 200 lux at floor level.
- 210 **4.2.2.13** A switch placed inside close to the access point(s), at an appropriate height, shall control lighting  
211 of the room.
- 212 **4.2.2.14** One or more metal supports or hooks with the indication of the safe working load shall be provided in  
213 the machine room ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment.
- 214 **4.2.2.15** A switch accessible only to authorized persons and placed close to the access point(s) to working  
215 area(s), at an appropriate height, shall control the lighting of the areas and spaces.
- 216 **4.2.2.16** At least one socket outlet shall be provided at an appropriate place for machine room and each  
217 working area.

218 **4.2.3 Machinery outside of the well**

219 4.2.3.1 Machinery spaces outside of the well and not located in a separate machine room shall be so  
220 constructed to withstand the loads and forces to which they are intended to be subjected.

221 **4.2.3.2** The machinery of a lift shall be located inside a cabinet which shall not be used for purposes  
222 other than the lift. It shall not contain ducts, cables or devices other than for the lift.

223 **4.2.3.3** The openings when accessible to non-authorised persons shall comply with the following  
224 requirements:

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

227 **4.2.3.4** The door(s) shall meet the following:

- 228 a) have sufficient dimensions to carry out the required work through the door;  
229 b) not open towards the inside of the cabinet;  
230 c) be provided with a key-operated lock, capable of being reclosed and relocked without a key.

231 **4.2.3.5** The machinery cabinet shall be ventilated. It shall be such that the machinery is protected from  
232 dust, harmful fumes and humidity.

233 **4.2.3.6** The inside of the machinery cabinet shall be provided with permanently installed electric lighting  
234 with an intensity of at least 200 lux at floor level.

235 **4.2.3.7** A switch placed inside close to the door(s), at an appropriate height, shall control lighting of the  
236 cabinet. At least one socket outlet shall be provided.

237 **4.2.4 Construction and equipment of pulley spaces**

238 **4.2.4.1** Pulleys outside of the well shall be located in a pulley room.

239 **4.2.4.2** The pulley rooms shall be so constructed to withstand the loads and forces to which they will  
240 normally be subjected. They shall be in durable material, not favouring the creation of dust.

241 **4.2.4.3** The floors of the pulley rooms shall be of non-slip material.

242 **4.2.4.4** Pulley room dimensions shall be sufficient to provide easy and safe access for maintenance  
243 personnel to all the equipment.

244 **4.2.4.5** A stopping device shall be installed in the pulley room, close to the point(s) of access.

245 **4.2.4.6** If the pulley rooms also contain electrical equipment, the ambient temperature shall be similar to  
246 that of the machine room.

247 **4.2.4.7** The pulley room shall be provided with permanently installed electric lighting with an intensity of  
248 at least 100 lux at the pulley(s).

249 **4.2.4.8** A switch, placed inside, close to the access point, at an appropriate height, shall control the  
250 lighting of the room.

251 **4.2.4.9** At least one socket outlet shall be provided.

252 **4.2.4.10** Diverter pulleys may be installed in the headroom of the well provided that they are located  
253 outside the projection of the car roof and that examinations and tests and maintenance operations can be  
254 carried out in complete safety from the car roof, from inside the car, from a platform or from outside of the well.

255 **4.2.4.11** Diverter pulley, with single or double wrap, may be installed above the car roof for diverting  
256 towards the counterweight, provided that its shaft can be reached in complete safety from the car roof or from  
257 a platform.

## 258 **4.3 Landing doors**

### 259 **4.3.1 Strength of doors and their frames**

260 **4.3.1.1** Doors and their frames shall be constructed in such a way that they will not become deformed in  
261 the course of time and shall be made of metal or tempered glass.

262 **4.3.1.2** Landing doors shall comply with the regulations relevant to the fire protection for the building  
263 concerned.

264 **4.3.1.3** Door panels made of glass shall be fixed in such a way that forces demanded by this standard  
265 which may be applied are transferred without damaging the fixing of the glass.

266 **4.3.1.4** The fixing of the glass in doors shall ensure that the glass cannot slip out of the fixings, even  
267 when sinking.

### 268 **4.3.2 Height and width of entrances**

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

### 270 **4.3.3 Sills, guides, door suspension**

271 **4.3.3.1** Every landing entrance shall incorporate a sill of sufficient strength to withstand the passage of  
272 loads being introduced into the car.

273 **4.3.3.2** Landing doors shall be designed to prevent, during normal operation, derailment, mechanical  
274 jamming, or displacement at the extremities of their travel.

275 **4.3.3.3** Where the guides may become ineffective due to wear, corrosion or fire, emergency guidance  
276 shall be provided to maintain the landing doors in their position.

- 277 **4.3.3.4** Horizontally sliding landing doors shall be guided top and bottom.
- 278 **4.3.3.5** Vertically sliding landing doors shall be guided at both sides.
- 279 **4.3.3.6** Panels of vertically sliding landing doors shall be fixed to two independent suspension elements.
- 280 **4.3.3.7** Suspension ropes, chains, belts shall be designed with a safety factor of at least 8
- 281 **4.3.3.8** The pitch diameter of suspension rope pulleys shall be at least 25 times the rope diameter.
- 282 **4.3.3.9** Suspension ropes and chains shall be guarded against leaving the pulley grooves or sprockets.
- 283 **4.3.4 Protection in relation to door operation**
- 284 **4.3.4.1** The doors and their surrounds shall be designed in such a way as to minimize risk of damage or  
285 injury due to jamming of a part of the person, clothing or other object.
- 286 **4.3.4.2** To avoid the risk of shearing during operation, the exterior face of automatic power operated  
287 sliding doors shall not have recesses or projections exceeding 3 mm. Edges of these shall be chamfered in  
288 the opening direction of movement.
- 289 **4.3.4.3** Power operated doors shall be designed to reduce to a minimum the harmful consequences of a  
290 person being struck by a door panel.
- 291 **4.3.4.1 Horizontal sliding automatic power operated doors**
- 292 **4.3.4.1.1** The effort needed to prevent the door closing shall not exceed 150 N. This measurement shall not  
293 be made in the first third of the travel of the door.
- 294 **4.3.4.1.2** The kinetic energy of the landing door and the mechanical elements which are rigidly connected  
295 to it, calculated or measured at the average closing speed shall not exceed 10 J.
- 296 **4.3.4.1.3** The average closing speed of a sliding door is calculated over its whole travel, less :
- 297 a) 25 mm at each end of the travel in the case of centrally closing doors ;
- 298 b) 50 mm at each end of the travel in the case of side closing doors.
- 299 **4.3.4.1.4** A protective device shall automatically initiate re-opening of the door in the event of a person  
300 being struck, or about to be struck, by the door in crossing the entrance during the closing movement. .
- 301 **4.3.4.1.5** The effort needed to prevent a folding door from opening shall not exceed 150 N.

#### 4.3.4.2 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.

#### 4.3.4.3 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.

#### 4.3.5 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.

#### 4.3.6 Locking and closed landing door check

**4.3.6.1** 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.

**4.3.6.2** 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.

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

##### 4.3.6.1 Locking

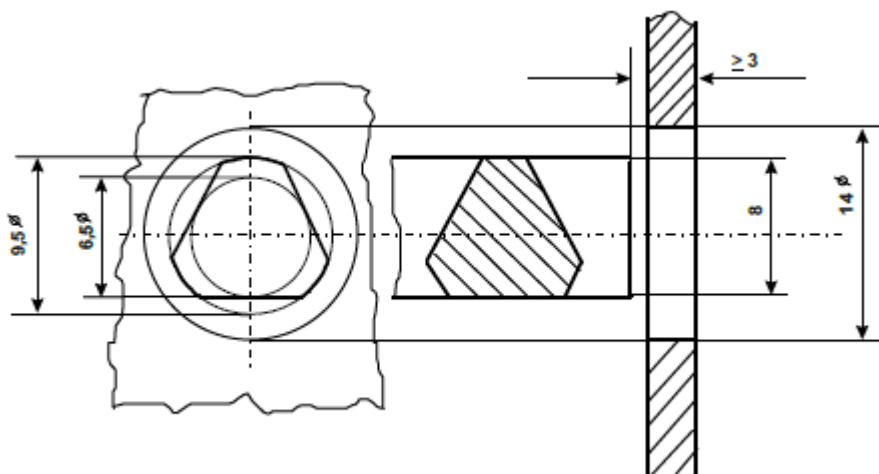
**4.3.6.1.1** The effective locking of the landing door in the closed position shall precede the movement of the car. The locking must be proved by an electric safety device

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

**4.3.6.1.3** 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.

- 332 **4.3.6.1.4** For hinged doors, locking shall be effected as near as possible to the vertical closing edge(s) of  
333 the doors, and maintained even in the case of panels sagging.
- 334 **4.3.6.1.5** The locking elements and their fixings shall be resistant to shock, and be made or reinforced with  
335 metal.
- 336 **4.3.6.1.6** The engagement of the locking elements shall be achieved in such a way that a force of 300 N in  
337 the opening direction of the door does not diminish the effectiveness of locking.
- 338 **4.3.6.1.7** The lock shall resist, without permanent deformation during the test, a minimum force at the level  
339 of the lock and in the direction of opening of the door of:
- 340 a) 1000 N in the case of sliding doors ;  
341 b) 3000 N on the locking pin, in the case of hinged doors.
- 342 **4.3.6.1.8** The locking action shall be effected and maintained by the action of gravity, permanent magnets,  
343 or springs. The springs shall act by compression, be guided and of such dimensions that, at the moment of  
344 unlocking, the coils are not compressed solid.
- 345 **4.3.6.1.9** In the event of the permanent magnet (or spring) no longer fulfilling its function, gravity shall not  
346 cause unlocking.
- 347 **4.3.6.1.10** If the locking element is maintained in position by the action of a permanent magnet, it shall not  
348 be possible to neutralize its effect by simple means.
- 349 **4.3.6.1.11** The locking device shall be protected against the risk of an accumulation of dust, which could  
350 hinder its proper functioning.
- 351 **4.3.6.1.12** In the case where the lock contacts are in a box, the fixing screws for the cover shall be of the  
352 captive type, so that they remain in the holes in the cover or box when opening the cover.
- 353 **4.3.6.2 Emergency unlocking**
- 354 **4.3.6.2.1** Each of the landing doors shall be capable of being unlocked from the outside with the aid of a  
355 key, which will fit the unlocking triangle as defined in Figure 1.





**Figure 1-Unlocking triangle**

**4.3.6.2.2** 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.

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

**4.3.6.2.4** 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.

#### **4.3.6.3 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

378 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.

379 c) the other characteristics shall at least correspond to those specified in the relevant standards.

380 **4.4.1.3** The minimum number of ropes or chains shall be two. Ropes or chains shall be independent.

381 **4.4.2 Sheave, pulley, drum and rope diameter ratios, rope/chain terminations**

382 **4.4.2.1** The ratio between the pitch diameter of sheaves, pulleys or drums and the nominal diameter of  
383 the suspension ropes shall be at least 40, regardless of the number of strands.

384 **4.4.2.2** The safety factor of the suspension ropes shall be less than:

385 a) 12 in the case of traction drive with three ropes or more ;

386 b) 16 in the case of traction drive with two ropes ;

387 c) 12 in the case of drum drive.

388 **4.4.2.3** The junction between the rope and the rope termination shall be able to resist at least 80 % of the  
389 minimum breaking load of the rope.

390 **4.4.2.4** The ends of the ropes shall be fixed to the car, counterweight or balancing weight, or suspension  
391 points of the dead parts of reeved ropes by means of metal or resin filled sockets, self tightening wedge type  
392 sockets, heart shaped thimbles with at least three suitable rope grips, hand spliced eyes, ferrule secured  
393 eyes, or any other system with equivalent safety.

394 **4.4.2.5** The fixing of the ropes on the drums shall be carried out using a system of blocking with wedges,  
395 or using at least two clamps or any other system with equivalent safety.

396 **4.4.2.6** The safety factor of the suspension chains shall be at least 10

397 **4.4.2.7** The ends of each chain shall be fixed to the car, counterweight or balancing weight, or  
398 suspension points of the dead parts of reeved chains by suitable terminations.

399 **4.4.2.8** The junction between the chain and the chain termination shall be able to resist at least 80 % of  
400 the minimum breaking load of the chain.

401 **4.4.3 Distribution of load between the ropes or the chains**

402 **4.4.3.1** An automatic device shall be provided for equalizing the tension of suspension ropes or chains, at  
403 least at one of their ends.

404 **4.4.3.2** For chains engaging with sprockets, the ends fixed to the car as well as the ends fixed to the  
405 balancing weight shall be provided with such equalization devices.

406 **4.4.3.3** For chains in the case of multiple return sprockets on the same shaft, these sprockets shall be  
407 able to rotate independently.

408 **4.4.3.4** If springs are used to equalize the tension they shall work in compression.

409 **4.4.3.5** The devices for adjusting the length of ropes or chains shall be made in such a way that these  
410 devices cannot work themselves loose after adjustment.

#### 411 **4.4.4 Protection for traction sheaves, pulleys and sprockets**

412 **4.4.4.1** For traction sheaves, pulleys and sprockets, provisions shall be made in manner that avoid:

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

416 **4.4.4.2** The devices used shall be constructed so that the rotating parts are visible, and do not hinder  
417 examination and maintenance operation.

418 **4.4.4.3** The dismantling/overhauling shall be necessary only in the following cases:

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

#### 422 **4.4.5 Safety gear**

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

#### 426 **4.4.6 Protection against unintended car movement**

427 **4.4.6.1** Lifts shall be provided with a means to stop unintended car movement away from the landing with  
428 the landing door not in the locked position and the car door not in the closed position, as a result of failure in  
429 any single component of the lift machine or drive control system upon which the safe movement of the car  
430 depends, except failure of the suspension ropes or chains and the traction sheave or drum or sprockets of the  
431 machine.

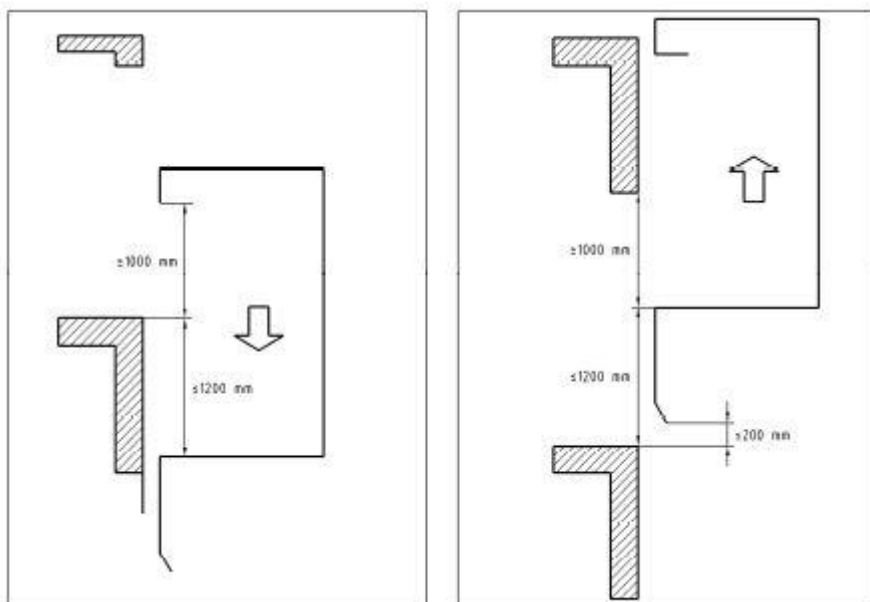
432 **4.4.6.2** The means shall detect unintended movement of the car, shall cause the car to stop, and keep it  
433 stopped.

434 **4.4.6.3** The means shall be capable of performing as required without assistance from any lift component  
435 that, during normal operation, controls the speed or retardation, stops the car or keeps it stopped, unless there  
436 is built-in redundancy and correct operation is self-monitored.

437 **4.4.6.4** The means shall stop the car in a distance:

- 438 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 Figure 4).



**Figure 4 — 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.

### **4.7.1 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.

4.7.2.1 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.

497 4.7.2.1 When the lift motors are supplied from D.C. generators driven by motors, the lift motors shall also  
498 be protected against overloads.

499 4.7.2.1 If the design temperature of electrical equipment provided with a temperature monitoring device is  
500 exceeded and the lift should not continue in operation, then the car shall stop at a landing such as the  
501 passengers can leave the car. An automatic return to normal operation of the lift shall only occur after  
502 sufficient cooling down.

### 503 4.7.3 Main switches

504 4.7.3.1 For each lift, a main switch capable of breaking the supply to the lift on all the live conductors  
505 shall be provided. The switch shall be capable of interrupting the highest current involved in normal conditions  
506 of use of the lift.

507 4.7.3.2 The switch shall not cut the circuits feeding:

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

514 4.7.3.3 The switch shall be located:

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

519 4.7.3.4 The main switches shall have stable open and closed positions, and shall be capable of being  
520 locked-off in the open position, with the use of a padlock or equivalent, to ensure no inadvertent operation.

521 4.7.3.5 The control mechanism for the main switch shall be easily and rapidly accessible from the  
522 entrance(s) to the machine room. If the machine room is common to several lifts, the control mechanism of the  
523 main switches shall allow the lift concerned to be identified easily.

524 4.7.3.6 If the machine room has several points of access, or if the same lift has several machine rooms  
525 each with its own point(s) of access, a circuit breaker contactor may be used, release of which shall be  
526 controlled by an electric safety device, inserted in the supply circuit to the coil of the circuit breaker contactor.

527 4.7.3.7 The re-engagement of the circuit breaker contactor shall not be carried out or made possible  
528 except by means of the device, which caused its release. The circuit-breaker contactor shall be used in  
529 conjunction with a manually controlled isolating switch.

530 4.7.3.8 Any capacitors to correct the power factor shall be connected before the main switch of the power  
531 circuit.

532 4.7.3.9 If there is a risk of over-voltage, when for example the motors are connected by very long cables,  
 533 the switch of the power circuit shall also interrupt the connection to the capacitors.

#### 534 **4.7.4 Electric wiring, lighting and socket outlets**

535 4.7.4.1 Electrical wiring shall be done according to Rwanda National Building Code and relevant national,  
 536 regional and/or international standards on electrical wiring.

537 4.7.4.2 Electrical cables shall comply with the requirements of RSIEC 60227-6 and shall be protected  
 538 mechanically

539 4.7.4.3 The electric lighting supplies to the car, the well and the machinery and pulley spaces, and  
 540 emergency and test panel(s), shall be independent of the supply to the machine

541 4.7.4.4 All socket outlets shall have earthing system

#### 542 **4.8 Protection against electric faults; controls; priorities**

543 4.8.1 During operation of one of the electric safety devices required in several clauses, movement of the  
 544 machine shall be prevented or it shall be caused to stop immediately

545 4.8.2 Apart from exceptions permitted in this standard, no electric equipment shall be connected in parallel  
 546 with an electric safety device.

547 4.8.3 The effects of internal or external induction or capacity shall not cause failure of electric safety  
 548 devices.

549 4.8.4 An output signal emanating from an electric safety device shall not be altered by an extraneous signal  
 550 emanating from another electric device placed further down the same circuit, which would cause a dangerous  
 551 condition to result.

552 4.8.5 In safety circuits comprising two or more parallel channels, all information other than that required for  
 553 parity checks shall be taken from one channel only.

554 4.8.6 Circuits which record or delay signals shall not, even in event of fault, prevent or appreciably delay the  
 555 stopping of the machine through the functioning of an electric safety device

556 4.8.9 The construction and arrangement of the internal power supply units shall be such as to prevent the  
 557 appearance of false signals at outputs of electric safety devices due to the effects of switching.

558 4.8.10 The operation of a safety contact shall be by positive separation of the circuit-breaking devices. The  
 559 separation shall occur even if the contacts have welded together.

560 4.8.11 The design of a safety contact shall be such as to minimize the risk of a short-circuit resulting from  
 561 component failure.

562 4.8.12 The safety contacts shall be provided for a rated insulation voltage of 250 V if the enclosure provides  
 563 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.

564 4.8.13 The safety contacts shall belong to the following categories as defined in RS IEC 60947-5-1:

565 a) AC-15 for safety contacts in A.C. circuits;

566 b) DC-13 for safety contacts in D.C. circuits.

567 4.8.14 Abrasion of conductive material shall not lead to short circuiting of contacts

568 4.8.15 The controls shall comply with the requirements of RS ISO 4190-5



569 4.8.16 To facilitate inspection and maintenance, a readily accessible inspection control station shall be  
570 provided on the car roof.

571 4.8.17 More than two inspection control stations shall not be installed.

572 4.8.18 A stopping device shall be provided for stopping, and maintaining the lift out of service,

573 4.8.19 The stopping devices shall consist of electric safety devices. They shall be bi-stable and such that a  
574 return to service cannot result from an involuntary action.

575 4.8.20 A stopping device in the car shall not be used except for cars with docking operation.

576 4.8.21 In order to call for outside assistance, passengers shall have available in the car an easily  
577 recognizable and accessible device for this purpose according to RS ISO 4190-5

578 4.8.22 The lift shall be fitted with a device to prevent normal starting, including re-levelling, in the event of  
579 overload in the car in accordance with RSISO 4190-5

580 4.8.23 The lift shall be installed with appropriate devices for soft landing and evacuation in case of  
581 emergency and/ or electrical cut off

## 582 **5 Notices, markings and operating instructions**

583 5.1 All labels, notices, markings and operating instructions shall be indelible, legible and readily  
584 understandable (if necessary aided by signs or symbols). They shall be untearable, of durable material,  
585 placed in a visible position, and written in at least two official languages where the lift is installed.

586 5.2 Notices marking and operating instructions shall comply to the requirements of RS ISO 4190-5

## 587 **6 Examinations - Tests - Register - Maintenance**

### 588 **6.1 Examinations and tests**

589 6.1.1 The technical dossier to be supplied if applying for preliminary authorization shall contain the  
590 necessary information to ascertain that the constituent parts are correctly designed and the proposed  
591 installation is in conformity with standard requirements

592 6.1.3 Before putting into service, lifts shall be subject to examinations and tests in accordance with  
593 requirements of the relevant standard.

### 594 **6.2 Register**

595 6.2.1 The basic characteristics of the lift shall be recorded in a register, or file, drawn up at the latest at the  
596 time the installation is put into service. This register or file shall comprise:

597 a) a technical section giving:

598 1) the date the lift was put into service;

599 2) the basic characteristics of the lift;

600 3) the characteristics of the ropes and/or chains;

601 4) the characteristics of those parts for which verification of conformity is required;

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- 602 5) the plans of installation in the building;
- 603 6) electric schematic diagrams; the circuit diagrams may be limited to the circuits for the overall  
604 understanding of the safety considerations.;
- 605 b) a section intended to keep duplicate dated copies of examination and inspection reports, with  
606 observations.
- 607 6.2.2 This register or file shall be kept up-to-date in case of:
- 608 a) important modifications to the lift;
- 609 b) replacement of ropes or important parts;
- 610 c) accidents.
- 611 6.2.3 This register or file should be available to those in charge of the maintenance, and to the person or  
612 organization responsible for the periodical examinations and tests.
- 613 **6.3 Installer information**
- 614 6.3.1 The manufacturer/installer shall provide an instruction manual for normal use and maintenance
- 615 6.3.2 The instruction manual shall give the necessary information about the normal use of the lift and  
616 rescue operation, especially relating to:
- 617 a) keeping the doors giving access to machinery and pulley spaces locked;
- 618 b) safe loading and unloading;
- 619 c) precaution to be taken in case of lifts with partially enclosed well;
- 620 d) events needing the intervention of a competent person;
- 621 e) keeping the documentation;
- 622 f) the use of the emergency unlocking key;
- 623 g) rescue operation.
- 624 h) necessary maintenance of the lift and its accessories in order to keep it in working order;
- 625 i) instruction for safe maintenance
- 626 6.3.3 The instruction manual shall inform about periodical examinations and examinations after important  
627 modifications or accidents.
- 628 6.3.4 Periodical examinations and tests on lifts shall be carried out after they are put into service to verify  
629 that they are in good condition.
- 630 6.3.5 Examinations and tests should be carried out after important modifications or after an accident to  
631 ascertain that lifts continue to conform to this standard.

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ICS 67.230