

# EN 81-20

Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Part 20: Passenger and goods passenger lifts

## Changes from EN 81-1 / 2



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**EN 81-20**

**General, building interface and lift car**



# General and Principals



- General
  - The list of risks considered is removed as it is now found in Clause 4.
  - Clarification of the persons to be safeguarded and the surrounding environment of the lift, including the provision of lifts to suit seismic conditions where necessary.
- Principals
  - Clarification of the required negotiations between the manufacturer and the user with regard to ensuring the lift is fit for purpose.
  - Clarification of the “standard” weight of a person considered in floor area/load calculations.

# Assumptions



- Clarification that the safe design must include any allowed overload (up to 10%)
- Clarification that even components declared as “sealed for life” must still be available for inspection.
- The responsibility to ventilate the well, with information provided by the lift installer, becomes the responsibility of the building designer/architect.

This is due to the wide coverage of the subject in National Building regulations which would otherwise conflict with the requirements of the new standards.

- Assumption that the hydraulic fluid used is to ISO 6743-4

# Revision of EN 81-1 & EN 81-2 Scope



- New Exclusions

- All hydraulic product where the setting of the relief valve is greater than 50 Mpa.  
This should ensure that there is no conflict with other European legislation regarding pressure vessels.
- Lifts installed into existing building where there may be restricted refuge spaces.  
In this case EN 81-21 should be followed.

# Revision of EN 81-1 & EN 81-2

## Normative References



# Normative References and Bibliography



- The normative references have been reviewed and updated according to the requirements of the standard.
  - Where a standard is referenced with a date, then only that version of the standard is valid as a requirement in EN 81-20.
  - Where a standard is referenced without a date, then the latest version of that standard is valid as a requirement in EN 81-20.
- Standards references in the introduction or in notes are not requirements of EN 81-20 and so these are now included into the Bibliography at the end of EN 81-20.

# Revision of EN 81-1 & EN 81-2

## Terms and Definitions



New definitions are given for:

- Authorized persons
- Competent persons
- Installer
- Maintenance
- Preliminary Operations
- Rescue Operations
- Safety Circuit
- Safety Component
- Special Tools
- Type Examination Certificate

- **Revised definitions are given for:**
  - Machine room
  - Machinery space
- **Deleted:**
  - Pulley space
  - Instantaneous Safety Gear with buffered effect
  - Minimum breaking load of a rope
  - System reaction time

# Revision of EN 81-1 & EN 81-2

## List of Significant Hazards



# EN414 Requirements



- A new table is given for significant hazards accounted for in the standard using the list found in EN 14121-1, in accordance with the new EN 414 layout of the standard.

| No | Hazards as listed in Annex B of EN ISO 12100 | Relevant clauses   |
|----|--|--|
| 1  | <b>Mechanical hazards</b> due to:            |  |
|    | Acceleration, deceleration (kinetic energy)  | 5.2.5; 5.3.6, 5.5.3; 5.6.2; 5.6.3; 5.6.6; 5.6.7; 5.8.2; 5.9.2; 5.9.3 |
|    | Angular parts                                | Not Relevant   |
|    | Approach of a moving element to a fixed part | 5.2.5; 5.2.6; 5.5.8  |

- Due to this standard, all the clauses previously numbered from 5 to 16 will now be covered in a new Clause 5.  
This will mean nearly all clauses are renumbered from those that exist today.

# Revision of EN 81-1 & EN 81-2

## The Well

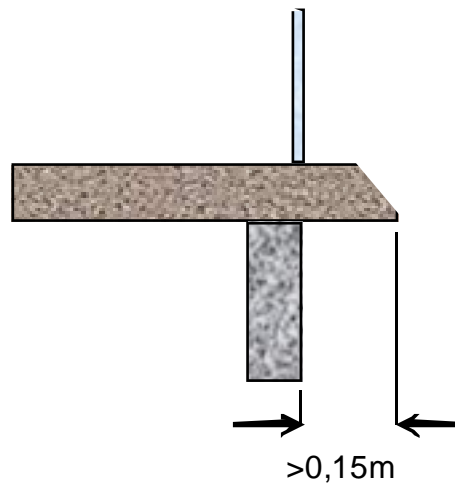


- Where there is more than 11m between consecutive floors there is an option to have :
  - Intermediate emergency doors.
  - Adjacent lift cars with emergency doors
  - ~~– Electrical emergency operation.~~

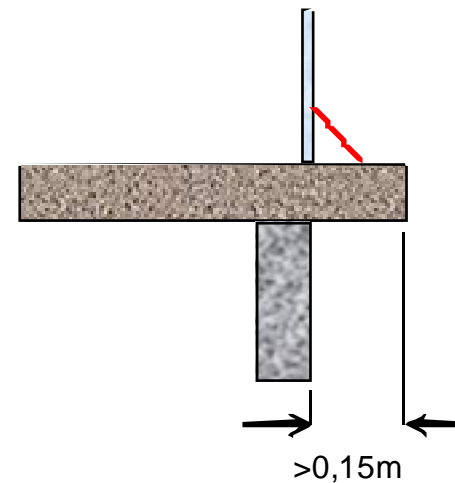
***Changed back to EN81-1.***
- Where there are accessible spaces under the pit a safety gear must be provide on the counterweight.
  - ***No longer permissible to use a “solid pier”.***
- Ventilation of well to be the responsibility of the building designer, as stated in the introduction.

## Protection of ledges in the well

Where there is no car roof balustrade and ledges exist in the well greater than 0,15m protection must be provided to prevent persons from standing in these areas.

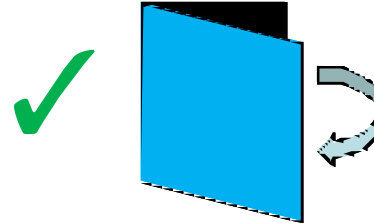
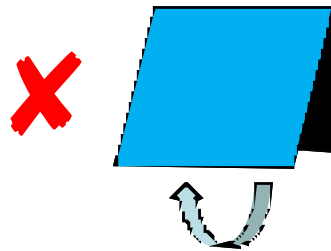


OR



## Doors for access, inspection and rescue

- Inspection “traps” deleted and replaced with access or inspection doors.



### – Door sizes

- Access doors to well = 2m high x 0,6m wide
- Emergency doors in well = 1,8m high x 0,5m wide
- Inspection doors in well = 0,5m high x 0,5m wide

## Strength

- All glass used in the well must be laminated.
- New requirements for strength of walls, doors and pit floor.

|   | Force | Area        | Deflection                        |
|---|-------|-------------|-----------------------------------|
| Well walls (other than glass)                   | 1000N | 0,3m x 0,3m | ≤ 1mm permanent<br>≤ 15mm elastic |
| Glass well walls                                | 1000N | 0,3m x 0,3m | No permanent deformation          |
| Access , inspection and emergency doors in well | 1000N | 0,3m x 0,3m | ≤ 15mm elastic                    |

- Pit floor
  - Should withstand loads from guides, equipment mounted on the guides and “push through” forces.
  - Forces on buffers should be distributed amongst the number of buffers

## Protection in the well

### All screens

- Should meet EN 13857
- Strength 300N over 5cm<sup>2</sup> without contacting moving parts.

### Counterweight Screen

- Height from 0,3m to 2m from pit floor
- If more than 0,3m from the well wall, must be guarded to prevent access.
- Slots allowed for compensation ropes and for inspection

**Shaft Division Screen** - now been changed from 500mm from the side of the car to the nearest moving part, to 500mm from the inside of the car roof balustrade to the nearest moving part.

## Headroom and Pit Refuge Spaces

- Re-written to increase understanding of requirements.
- New Table to show the extreme position of the car, from which the clearances are then measured.

| Position   | Traction drives  | Positive drives                      | Hydraulic drives   |
|--|--|--------------------------------------|--|
| Highest position of car                            | Counterweight on fully compressed buffer + $0,035 v^2 a$ | Car on fully compressed upper buffer | Ram in its ultimate position achieved through the means of ram stroke limitation + $0,035 v_m^2$ |
| Lowest position of car                             | Car on fully compressed buffer                           | Car on fully compressed lower buffer | Car on fully compressed buffer   |
| Highest position of counterweight/balancing weight | Car on fully compressed buffer + $0,035 v^2$             | Car on fully compressed lower buffer | Car on fully compressed buffer + $0,035 v_d^2$   |
| Lowest position of counterweight/balancing weight  | Counterweight on fully compressed buffer                 | Car on fully compressed upper buffer | Ram in its ultimate position achieved through the means of ram stroke limitation + $0,035 v_m^2$ |

# The Well (continued)



## Headroom

- One refuge space for each person on the car roof.
- All refuge spaces must be of the same type.
- Reduction allowed to the base of type two along one edge of 100mm x 300mm
- Sign on car roof stating how many refuge spaces and what type
- Sign on CWT giving dimension to buffer under normal operation.

| Type   | Posture   | Pictogram | Horizontal dimensions of the refuge space<br>(m x m) | Height of the refuge space<br>(m) |
|--|-----------|-----------|--|-----------------------------------|
| 1  | Standing  |           | 0,40 x 0,50  | 2,00                              |
| 2  | Crouching |           | 0,50 x 0,70  | 1,00                              |
| Key for pictograms<br>①: Black colour<br>②: Yellow colour<br>③: Black colour |           |           |  |                                   |

## Headroom

**A:** Distance  $\geq 0,50$

**B:** Distance  $\geq 0,50$

**C:** Distance  $\geq 0,50$

**D:** Distance  $\geq 0,30$

**E:** Distance  $\leq 0,40$  m

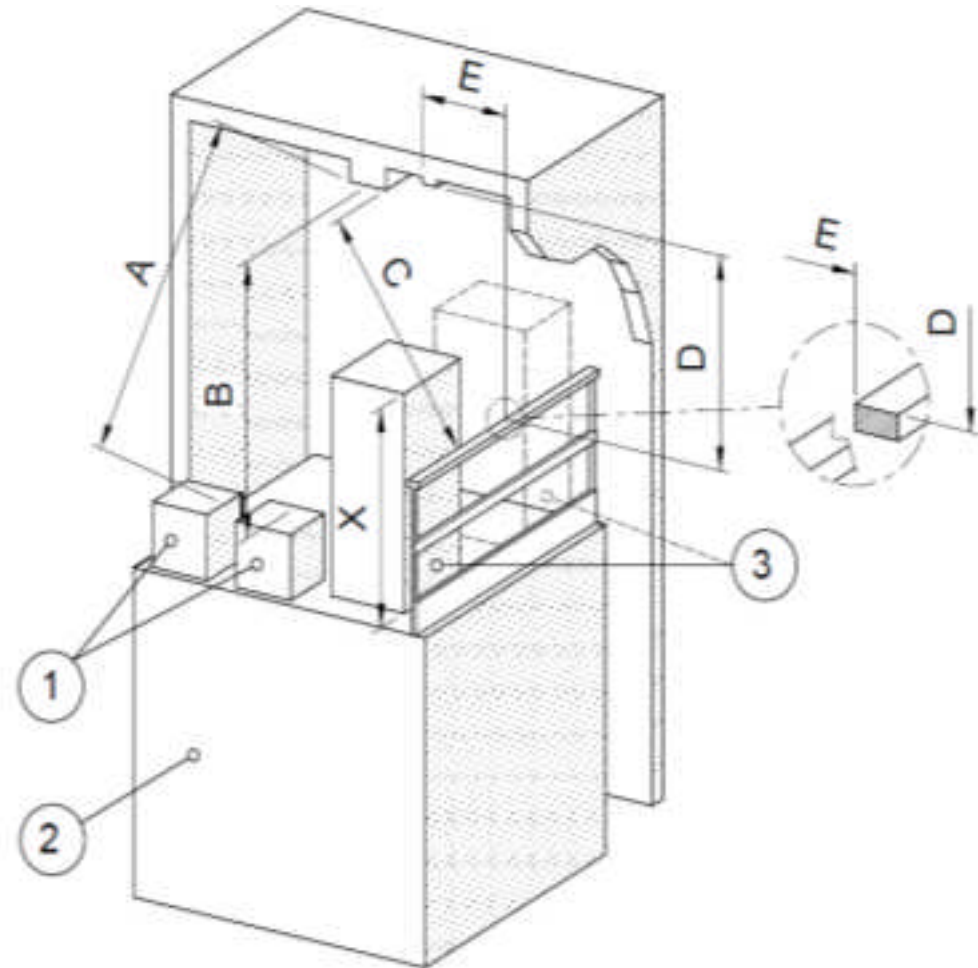
**X:** Height of refuge spaces

① : Highest parts on the car roof

② : Car

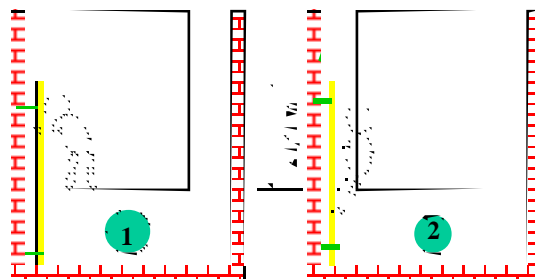
③ : Refuge space(s)

- Height above any area considered as a standing area ( $0,12\text{m}^2$  must be the same as the refuge space height).

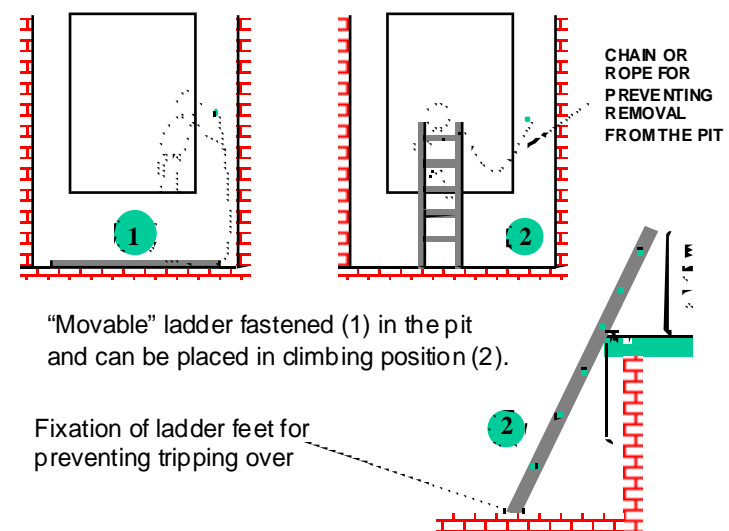


# The Well (continued)

- Access to pits > 2.5m deep must be by stairs
- New requirements for pit access ladders and to provide them with a safety contact where necessary.
- Normative text in clause 5, combined with a new normative annex giving the possible ladder types.



Ladder fixed in the pit (1) and always placed in the climbing position (2).



"Movable" ladder fastened (1) in the pit and can be placed in climbing position (2).




Fixation of ladder feet for preventing tripping over

# The Well (continued)



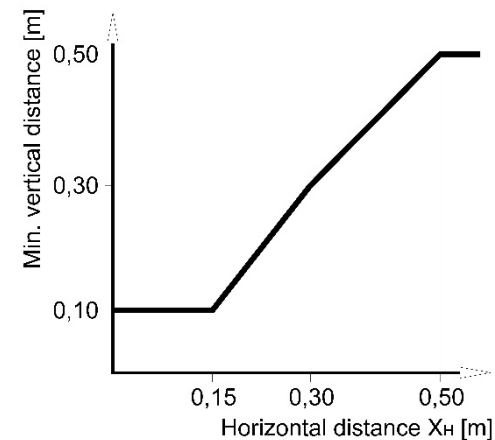
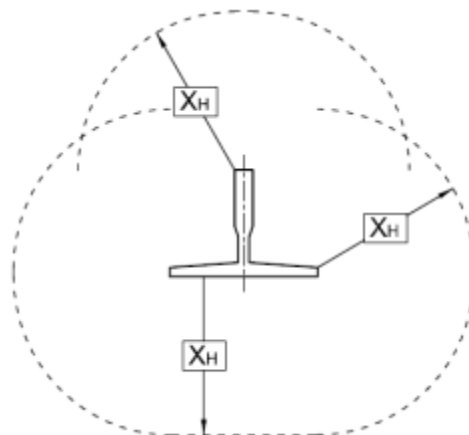
## Pit

- One refuge space for each person in the pit.
- All refuge spaces must be of the same type.
- Sign in pit stating how many refuge spaces and what type

| Type   | Posture   | <u>Pictogram</u>  | Horizontal dimensions of the refuge space<br>(m x m) | Height of the refuge space<br>(m) |
|--|-----------|---|--|-----------------------------------|
| 1  | Standing  |    | 0,40 x 0,50  | 2,00                              |
| 2  | Crouching |    | 0,50 x 0,70  | 1,00                              |
| 3  | Laying    |  | 0,7 x 1,0  | 0,5                               |
| Key for pictograms<br>①: Black colour<br>②: Yellow colour<br>③: Black colour |           |   |  |                                   |

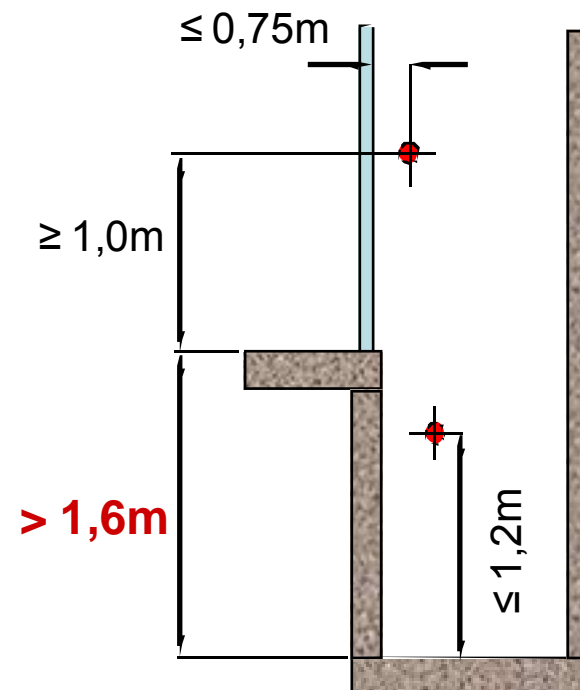
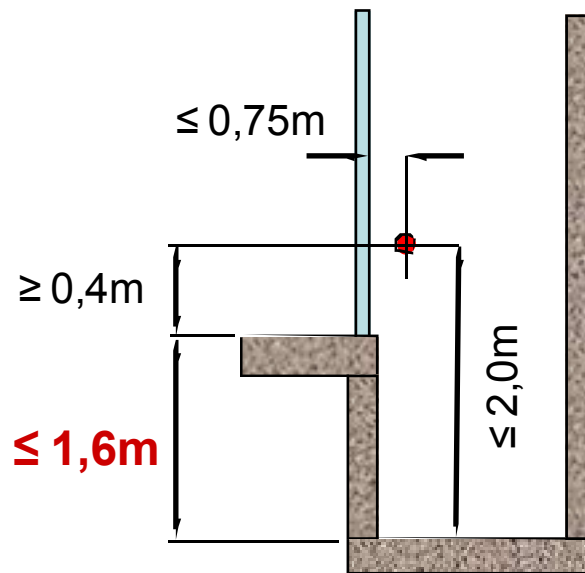
## Pit Clearances

- Distance between the bottom of the pit and the lowest parts of the car  $\geq 0,50$  m.
- This distance may be reduced:
  - for any part of the apron or parts of the vertically sliding car door(s) to a minimum of 0,10 m within a horizontal distance of 0,15 m to the adjacent wall(s);
  - for car frame parts, safety gears, guide shoes, pawl devices, within a maximum horizontal distance from the guide rails according to **Figures 6 and 7**;
- Distance between the highest parts fixed in the pit, and the lowest parts of the car  $\geq 0,30$  m



## Controls in the pit

- New requirement for pit control station similar to that on the car roof.
- New requirement for the position of stop switches



- **Services in the well**
  - Fire Extinguisher (sprinkler) is now allowed in the well under certain conditions
    - Lift must go to exit floor and park with doors open before sprinkler discharges.
- **Well Alarms**
  - Alarms to comply with EN 81-28.
  - Where this standard has not been published in some countries TR 81-12 will advise on compliance.

# The Well (continued)



## Lighting Requirements for Well, Machinery Spaces, Pulley rooms and Car

| Lighting Area                             | Requirement from EN81-1/2   | Requirement from Interpretation                                      | Requirement from EN81-20  |
|---|---|--|---|
| <b>Well</b>                               | <ul style="list-style-type: none"> <li>50 lux @ 1m from car roof</li> <li>50 lux @ 1m from pit floor</li> <li>Intermediate lamps</li> <li>Lamps at 0.5m from highest and lowest points</li> </ul> | ---<br>---<br>20 lux throughout the well<br>---                      | <ul style="list-style-type: none"> <li>50 lux @ 1m from car roof</li> <li>50 lux @ 1m from pit floor</li> <li>20 lux @ all other areas excluding shadows</li> </ul> |
| <b>Access to Well or Machinery Spaces</b> | Permanently lit   | ---  | 50 lux  |
| <b>Machine Room</b>                       | 200 lux @ floor level   | @ places where persons can stand, work or move between working areas | <ul style="list-style-type: none"> <li>200 lux @ places where persons can work</li> <li>50 lux @ places where persons move between working areas</li> </ul>         |
| <b>Machinery Space</b>                    | 200 lux @ floor level   | ---  | <ul style="list-style-type: none"> <li>200 lux @ places where persons can work</li> <li>50 lux @ places where persons move between working areas</li> </ul>         |
| <b>Machinery Cabinet</b>                  | 200 lux @ floor level   | ---  | 200 lux @ places where persons can work   |
| <b>Emergency and Test panel</b>           | 50 lux @ device   | 200 lux @ floor level  | 200 lux @ device  |
| <b>Pulley Room</b>                        | 100 lux @ pulleys   | ---  | <ul style="list-style-type: none"> <li>200 lux @ places where persons can work</li> <li>50 lux @ places where persons move between working areas</li> </ul>         |
| <b>Landings</b>                           | 50 lux @ floor  | ---  | 50 lux @ floor  |
| <b>Car</b>                                | 50 lux @ floor and controls   | @ floor (> than 100mm from walls and at controls)                    | 100 lux @ controls and 1m above floor > 100mm from wall   |
| <b>Car Emergency</b>                      | 1 w for 1 hour  | 1 lux for 1 hour @ alarm button and any instructions                 | 5 lux for 1 hour @ alarm button and 1m from floor in centre of car  |
| <b>Car Roof Emergency</b>                 | ---   | ---  | 5 lux for 1 hour @ alarm button and 1m from floor in centre of car roof   |

# Revision of EN 81-1 & EN 81-2 Machinery Spaces and Pulley Rooms



# Machinery Spaces



- **Access and Working**

- Access is now permitted through private premises where National Regulations allow. This must be subject to negotiation with the owner for rescue and maintenance.
- Access ladders greater than 3m in height should be fitted with a means of fall protection (hoops)
- The clear height for working is now 2.1m
- New rules for the safe exit of persons from work areas in the pit and on the car roof.
- New rules for guarding of pulleys in the well and the ability to access them in safety for maintenance.
- Requirements for environmental protection in case of hydraulic lifts.

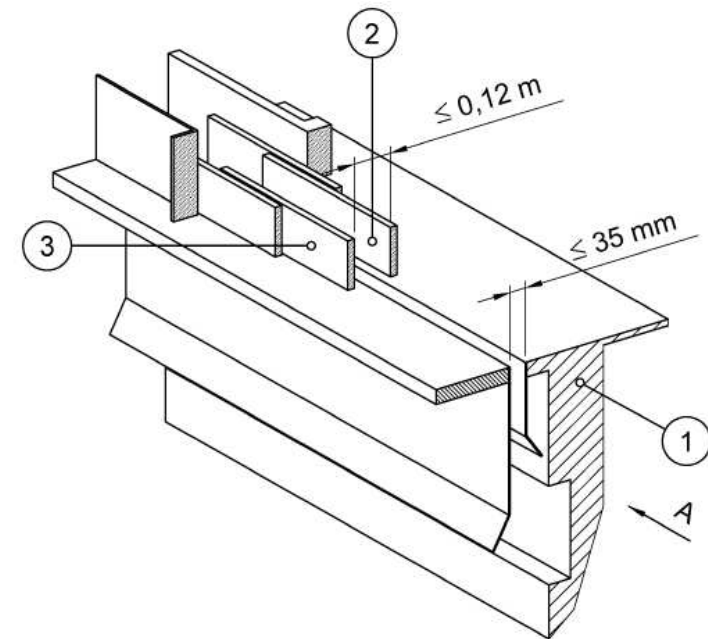
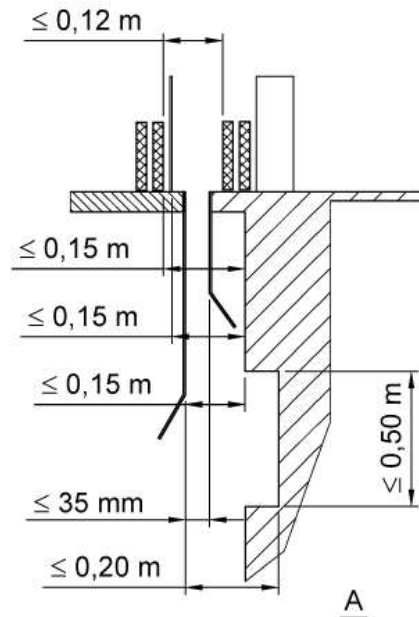
# Revision of EN 81-1 & EN 81-2 Landing Doors and Car Doors



- The clauses for landing and car doors have been combined
- All fire test certification of lift landing doors shall be to EN 81-58. TR 81-12 gives information for compliance where this standard has not been adopted.
- Unlocking mechanisms
  - Horizontal Plane = 2,0m maximum height
  - Vertical Plane = 2.7m maximum height with extended length unlocking key.

## Car Door to Well Dimensions

- Not more than one gap of 0,5m x 0,2m allowed between consecutive landing doors.



### Key

- ① Lift well wall
- ② Landing door leading panel
- ③ Car door leading panel

# Landing / Car Doors (continued)



- All doors in future, including their frame, will be subject to pendulum impact testing at their weakest points.
- The criteria for acceptance of the pendulum test is given in EN 81-20.

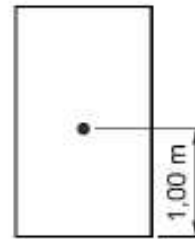


Figure 11.a - Door panel without glass panel

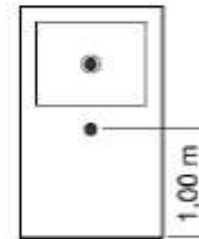


Figure 11.b - Door panel with glass panel

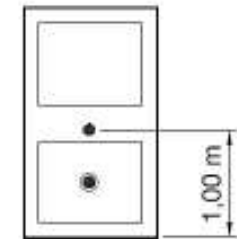


Figure 11.c - Door panel with more than one glass panel

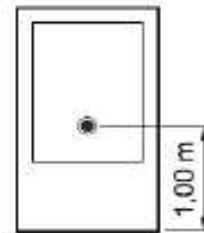


Figure 11.d - Door panel with glass panel or full glass

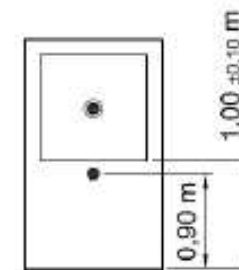


Figure 11.e - Door panel with glass panel above 1,0 m

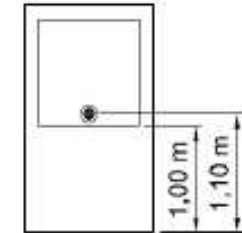


Figure 11.f - Door panel with glass panel above 1,0 m

**Key**

- Striking point for soft pendulum shock test
  - Striking point for hard pendulum shock test
- For hitting points defined by 1 m, the tolerance is  $\pm 0,10$  m.

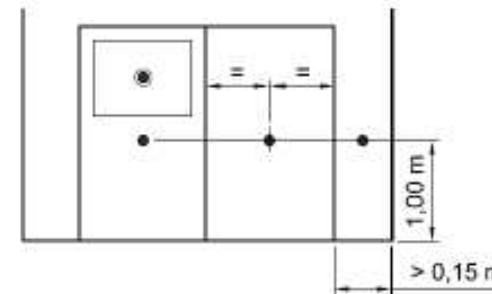


Figure 11 — Complete landing door with door panels (example according to figure 12.a and figure 12.b)

# Landing / Car Doors (continued)



## Forces and tests on doors

|   | Force to be applied           | Acceptance criteria                              |
|---|-------------------------------|--|
| Landing and car doors                   | 300N over 5cm <sup>2</sup>    | ≤ 1mm permanent<br>≤ 15mm elastic                |
| Landing and car doors                   | 1000N over 100cm <sup>2</sup> | No significant damage affecting safety integrity |
| Landing and car doors with glass panels | Soft pendulum @ 800mm         | No permanent deformation > 120mm                 |
|   | Hard pendulum @ 500mm         | No cracks, no chips > 2mm                        |
| Side frames wider than 150mm            | Soft pendulum @ 800mm         | No permanent deformation > 120mm                 |
|   | Hard pendulum @ 500mm         | No cracks, no chips > 2mm                        |
| All doors with their retainers          | Soft pendulum @ 800mm         | No permanent deformation > 120mm                 |

## Door Protection

- Kinetic energy of the landing and/or car door at the average closing speed shall not exceed 10 J.
- A protective device shall automatically initiate re-opening of the door(s) in the event of a person crossing the entrance during the closing movement. The protective device may be rendered inoperative in the last 20 mm of door closing or gap;
  - In case of failure, or deactivation of the protective device, the kinetic energy of the doors shall be limited to 4J, if the lift is kept in operation, and an acoustic signal shall operate at any time the door(s) is (are) closing.
- The effort needed to prevent the door closing shall not exceed 150 N excluding the first third of the travel of the door;
- If the door closing is obstructed a re-opening of the door shall be initiated

## Door Protection

- Doors made from glass shall be provided with means to limit the opening force to 150 N and to stop the door in the event of an obstruction.
- The thickness of the front edge of the leading glass panel(s) shall not be less than 20 mm.
- To avoid dragging of children hands on doors made of glass means shall be provided to minimise the risk, by:
  - Making the glass opaque on the side exposed to the user to a height of minimum 1,10 m, or
  - Sensing the presence of fingers at least up to 1,6 m above sill and stopping the door movement in opening direction, or
  - Limiting the gap between door panels and frame to maximum 4 mm at least up to a minimum of 1,6 m above sill.

## Opening the car door

- In the unlocking zone it shall be possible with a force  $\leq 300$  N, to open the car and landing door by hand from:
  - The landing after the landing door has been unlocked with the triangular unlocking key or being unlocked by the car door;
  - Within the car.
- In order to restrict the opening of the car door by persons inside the car a means shall be provided such that:
  - When the car is moving it shall not be possible to open the car door when applying a force of 50 N, and
  - When the car is outside of the zone defined in **5.3.8.1**, it shall not be possible to open the car door more than 50 mm with a force of 1000 N, at the restrictor mechanism.
- It shall be possible within the UCM zone, once the corresponding landing door has been opened, to open the car door from the landing without tools, other than the triangular unlocking key or tools being permanently available on site. This also applies to car doors locking devices.
- For lifts fitted with car door locks the opening of the car door from inside the car shall be possible only when the car is in the unlocking zone.

# Revision of EN 81-1 & EN 81-2

## Counterweight and Balancing Weight



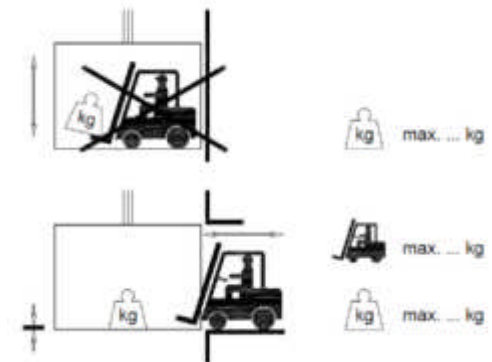
## Load / Floor Area

- Car area measured from wall to wall car body inner dimensions excluding finishes, at a height 1 m from the floor.
- Recesses and extensions in the car walls are only permitted if their area is taken into account in the calculation of maximum available car area.
- Recesses or extensions above the car floor level, which cannot accommodate a person due to equipment placed in them need not be taken into account (e.g. niches for tip-up seats, recesses for intercoms).
- Where there is an available area between the entrance frame uprights when the doors are closed the following applies:
  - Where the area is less or equal than 100 mm deep up to any door panel (including fast and slow doors in the case of multi-panel doors), then it shall be excluded from the floor area;
  - Where the area is greater than 100 mm deep, the total available area shall be included in the floor area.

## Goods Lifts / Handling Devices

Either:

- The weight of handling devices are included in the rated load; or
- The weight of handling devices shall be considered separately from the rated load:
  - Handling devices are not transported with the load;
  - The car sling, the car safety gear, the guide rails, the machine brake, traction, hydraulic ram, the UCM protection means, etc, shall be based on the total load of rated load plus weight of handling devices
  - If due to loading and un-loading the maximum levelling accuracy is exceeded a mechanical device shall limit downward movement of the car to 20mm



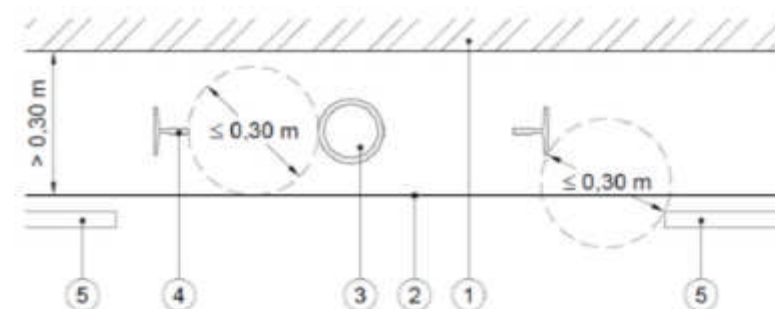
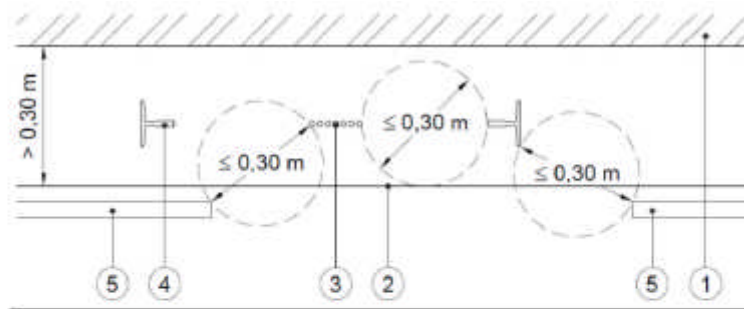
## Car Design

- Car internal finishes to be of limited combustibility to EN 13501-1.
- Car lighting
  - 100 lux normal lighting
  - 5 lux emergency lighting inside car
  - 5 lux emergency lighting on car roof
- Mirrors used inside the car to be of safety glass to EN 12600
- New requirements for the strength of the car walls and car apron.

# Lift Car (continued)



- **New requirements for the balustrade.**
  - All lift cars regardless of well clearances to have a “toe board” around the car roof edge.
  - Use of 1100mm high balustrades when distance to well wall exceeds 500mm.
  - Must withstand horizontal force of 300N
  - Components can be used to form “equivalent” protection



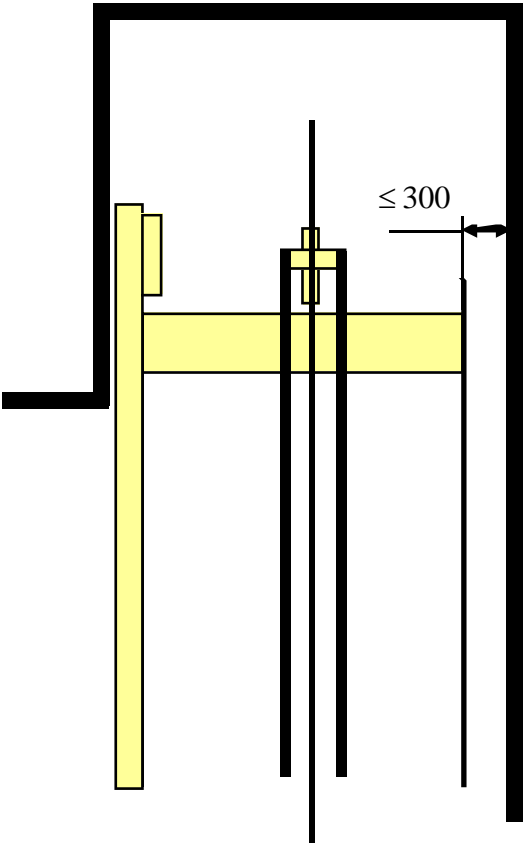
**Key:**

①: Lift well wall  
②: Lift car roof edge  
③: Ropes, belts

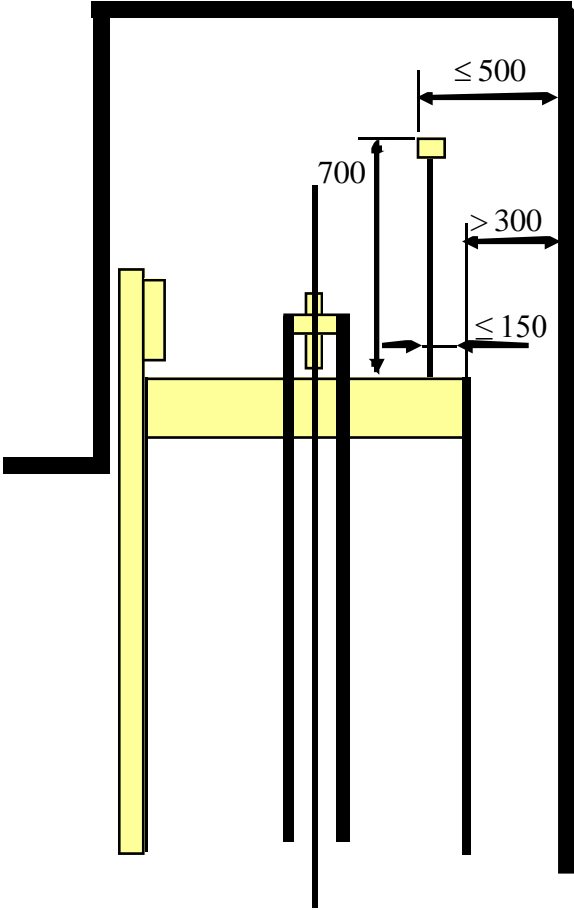
④: Guide rails  
⑤: Balustrade

④: Guide rails  
⑤: Balustrade

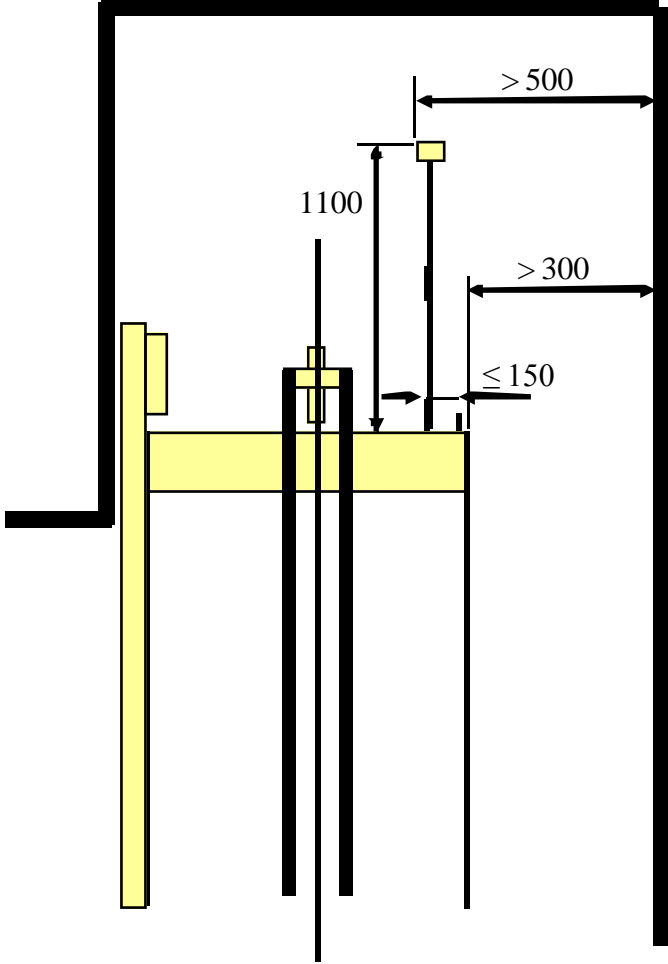
# Lift Car (continued)



No balustrade required but needs toe board 100mm



Required balustrade Height  $\geq 700$  mm



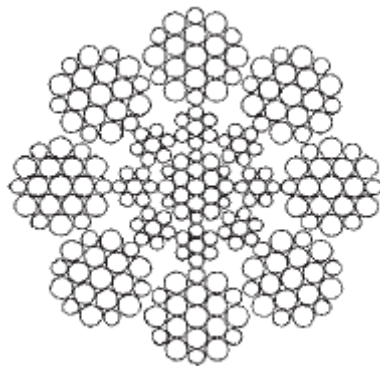
Required balustrade Height  $\geq 1100$  mm

# EN 81-20 - Suspension



Strength and characteristics have to comply with EN 12385-5

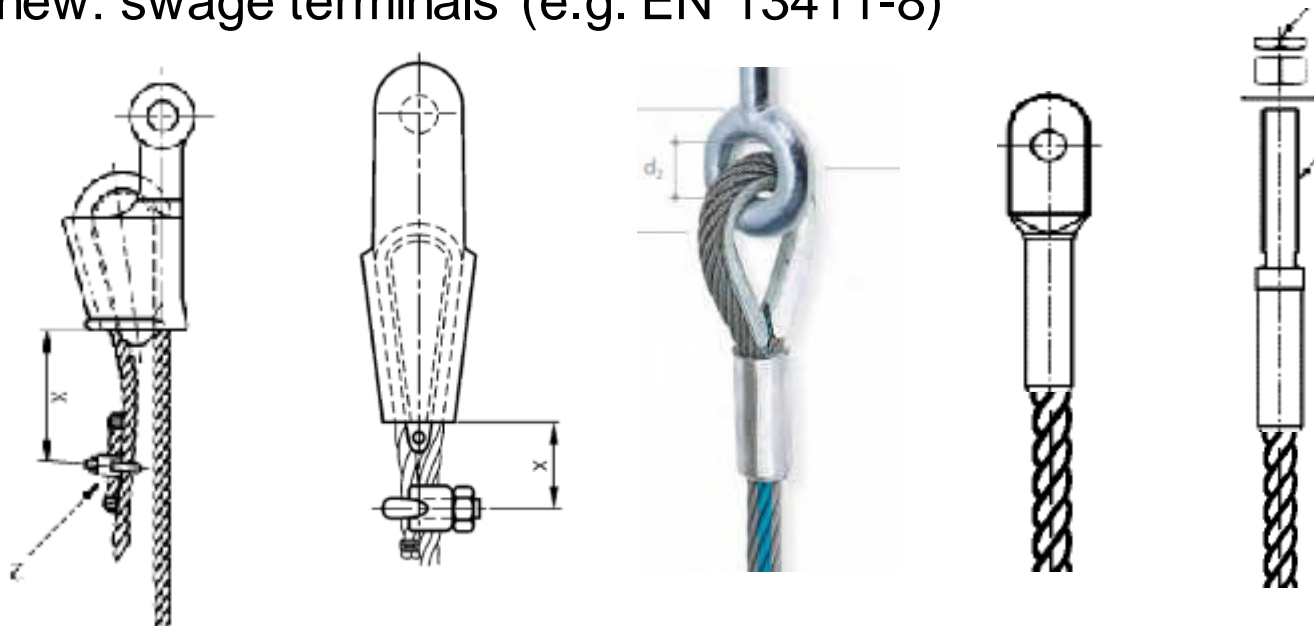
- harmonised under Lifts Directive
- similar requirements as in ISO 4344
- similar as previous requirements



# Suspension Means (continued)



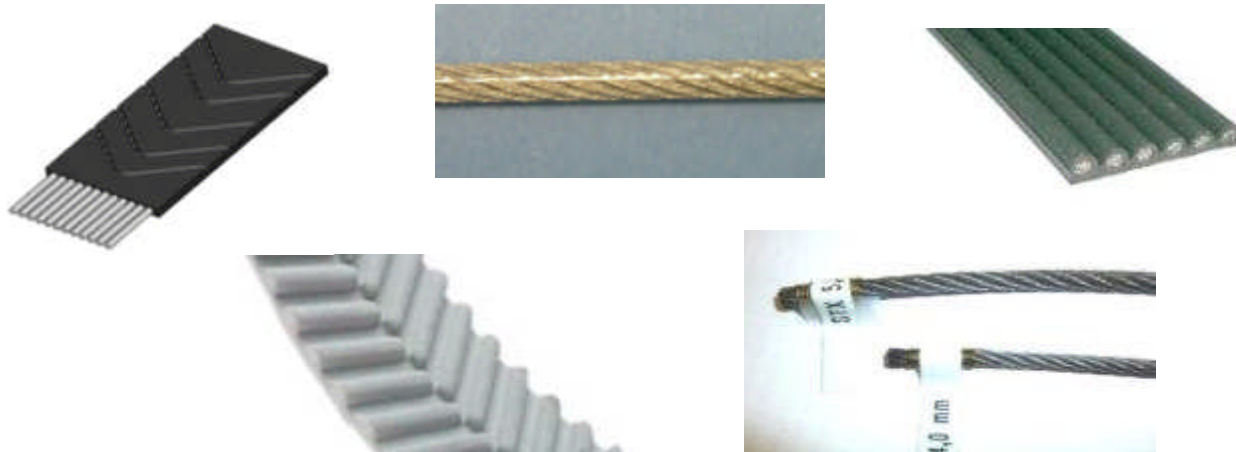
- Rope terminations
  - deleted: resin filled sockets, rope grips, splices eyes and other equivalent systems
  - self-tightened wedge type sockets (e.g. EN 13411-6, 7)
  - ferrule secured eyes (e.g. EN 13411-3)
  - new: swage terminals (e.g. EN 13411-8)



# Suspension Means (continued)



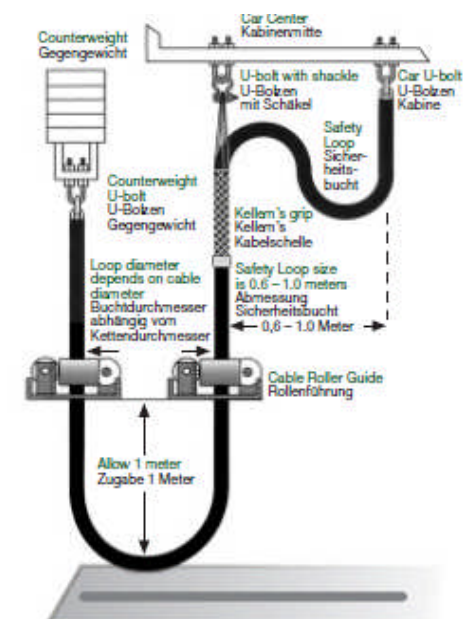
- New technologies (steel ropes < 8 mm, fibre ropes, belts) not incorporated at this time
  - concerns due to patents or copyright protection
  - may be incorporated at next amendment



# Compensation Means



- Compensation means
  - $\leq 3$  m/s other compensation means than ropes can be used
  - $> 3$  m/s only compensation ropes with tensioning device shall be used
  - $> 3,5$  m/s only additionally anti-rebound device has to be provided
- Other compensation means than ropes
  - min. safety factor 5
  - $> 1,75$  m/s guiding at vicinity of loop

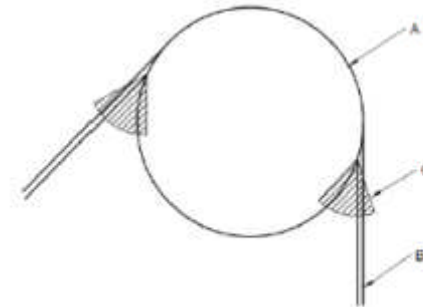


# Protection of sheaves, pulleys and sprockets



| Location of sheaves, pulleys and sprockets   |                                     | Risk according to 5.5.7.1 |                 |                 |                 |
|--|-------------------------------------|---------------------------|-----------------|-----------------|-----------------|
|  |                                     | a                         | b               | c               |                 |
| At the car   | on the roof                         | x                         | x               | x               |                 |
|  | under the floor                     |                           | x               | x               |                 |
| On the counterweight / balancing weight  |                                     |                           | x               | x               |                 |
| In machine and pulley rooms  |                                     | x <sup>2)</sup>           | x               | x <sup>1)</sup> |                 |
| In the well  | Headroom                            | above car                 | x               | x               |                 |
|  |                                     | beside car                | added → x       | x               |                 |
|  | between pit and headroom            |                           |                 | x               | x <sup>1)</sup> |
|  | Pit                                 |                           | x               | x               | x               |
| Jack   | Extending upwards                   |                           | x <sup>2)</sup> | x               |                 |
|  | Extending downwards                 |                           |                 | x               | x <sup>1)</sup> |
|  | With mechanical synchronizing means |                           | x               | x               | x               |
| <p>x Risk shall be taken into account.</p> <p>1) Required only if the ropes/chains are entering the traction sheave or the pulley/sprocket horizontally or at any angle above the horizontal up to a maximum of 90°.</p> <p>2) Protection shall be nip guards as a minimum preventing accidental access to areas where ropes/chains enter or leave the sheaves, pulleys or sprockets (See <b>Figure 18</b>).</p> |                                     |                           |                 |                 |                 |

- Example for nib guard



- Position and number of rope retainers
  - if wrap angle  $> 120^\circ$  and  $> 60^\circ$  are below horizontal axis

- 3 retainers
  - other cases
  - 2 retainers



# EN 81-20 - Safety gear, Overspeed and UCM



# Protection means for traction and positive drive lifts



| Hazardous situation   | Protection means                                   | Tripping means   |
|---|--|--|
| Free fall and excessive speed in down direction of car                | Safety gear (5.6.2.1)                              | Overspeed governor (5.6.2.2.1)   |
| Free fall of counterweight or balancing weight in the case of 5.2.5.4 | Safety gear (5.6.2.1)                              | Overspeed governor (5.6.2.2.1) or for rated speeds not exceeding 1 m/s<br><ul style="list-style-type: none"> <li>- tripping by breakage of suspension means(5.6.2.2.2), or</li> <li>- tripping by safety rope (5.6.2.2.3)</li> </ul> |
| Excessive speed in up direction (traction lifts only)                 | Ascending car overspeed protection means (5.6.6)   | Included in 5.6.6  |
| Unintended car movement with open doors                               | Protection against unintended car movement (5.6.7) | Included in 5.6.7  |

→ No change of solutions

# Protection means for hydraulic drive lifts



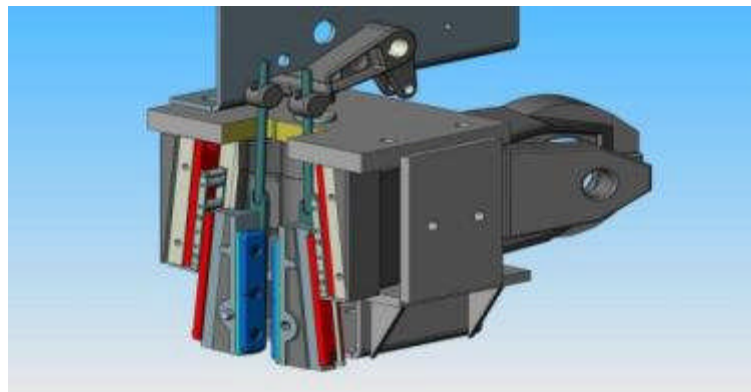
- Reference to releveling added
- Clamping device deleted

|   |                       | Precautions against creeping in addition to releveling (5.12.4)  |   |                     |  |
|---|-----------------------|--|---|---------------------|--|
|   | Type of lifts         | Alternative combinations to be selected  | Tripping of safety gear (5.6.2.1) by downward movement of the car (5.6.2.2.4) | Pawl device (5.6.5) | Electrical anti-creep system (5.12.1.10) |
| Precautions against free fall or descent with excessive speed   | Direct acting lifts   | Safety gear (5.6.2.1), tripped by overspeed governor (5.6.2.2.1)   | X   | X                   | X  |
|   |                       | Rupture valve (5.6.3)  |   | X                   | X  |
|   |                       | Restrictor (5.6.4)   |   | X                   |  |
|   | Indirect acting lifts | Safety gear (5.6.2.1), tripped by overspeed governor (5.6.2.2.1)   | X   | X                   | X  |
|   |                       | Rupture valve (5.6.3) plus safety gear (5.6.2.1) tripped by breakage of suspension means (5.6.2.2.2) or by safety rope (5.6.2.2.3) | X   | X                   | X  |
| Restrictor (5.6.4) plus safety gear (5.6.2.1) tripped by breakage of suspension means (5.6.2.2.2) or by safety rope (5.6.2.2.3) |                       | X  | X   |                     |  |

# Safety Gear

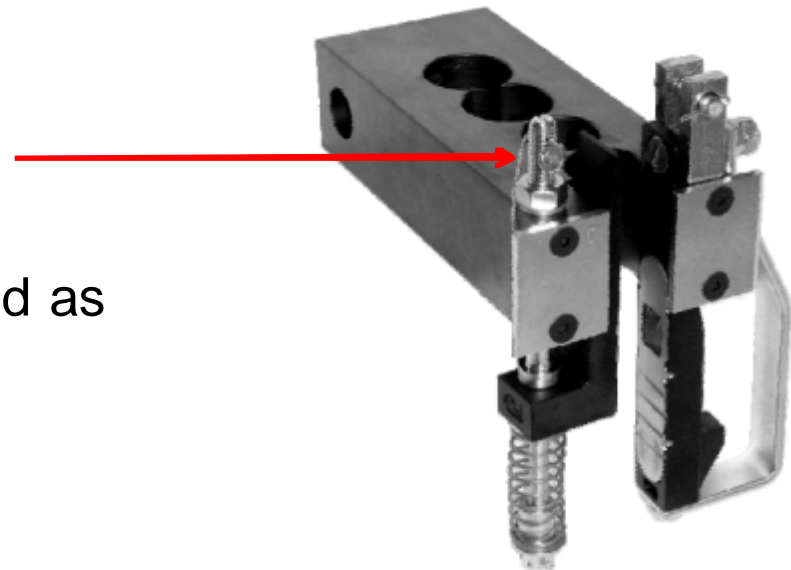


- Previous note deleted
  - ~~The safety gear operating devices shall be preferably be located at the lower part of the car~~
- Additional information on data plate
  - type of safety gear
  - if adjustable, load range or adjustment parameter if the relationship with the load range is specified in instruction manual
- Instantaneous safety gear with buffered effect deleted



# Safety Gear (continued)

- Release of the safety gear shall be possible at all load conditions up to rated load
  - either by means defined for emergency operations
  - or in application of procedures available on site
- Intervention of a competent person to set lift to normal operation
  - after release of safety gear (before: release by competent person)
  - main switch operation not sufficient
- Seal has to prevent re-adjustment without breaking the seal
- Accidental tripping shall be prevented as far as possible



# Overspeed Governor

- Requirement for higher tripping speed of overspeed governor for counterweight or balancing weight deleted
- Special design for heavy rated load and low speed deleted
- Requirement for sufficiently short response time not permitting dangerous speeds replaced by requirement for maximum distance between tripping points of 250 mm
- Type examination (EN 81-50)
  - at least 2 tests with acceleration 0,9 – 1,0 gn to check strength of overspeed governor



# Overspeed Governor (continued)

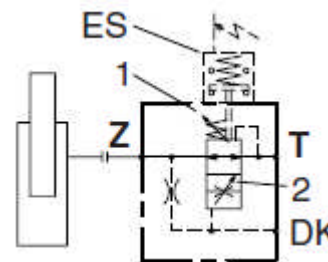
- Governor ropes have to comply with EN 12385-5
- Requirement for min. rope diameter 6 mm deleted
- Seal has to prevent re-adjustment without braking the seal
- Additional information on data plate
  - type of overspeed governor
- Requirements for testing of tripping means by breakage of suspension means
  - actuating the mechanism for tests without entering the well
  - max. force for actuating 400 N



# Rupture valve and restrictor



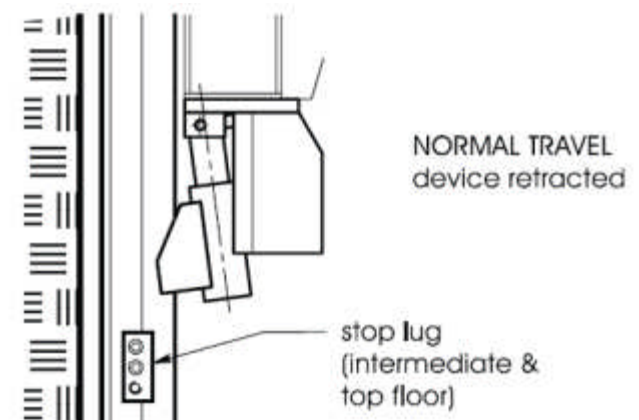
- Rupture valves and restrictors have to be accessible for adjustment and inspection directly from the car roof or the pit
- Means allowing to reach the tripping flow of the rupture valve or restrictor shall be accessible from outside the well



# Pawl Device

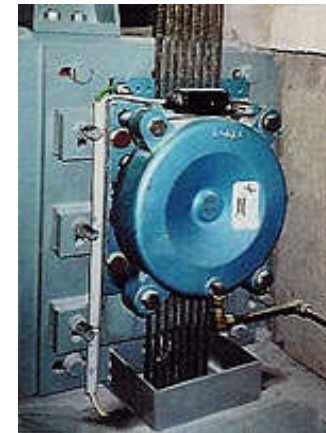


- Energy accumulation type buffers with buffered return movement deleted
- Checking of position of pawl device
  - if not in retracted position
    - electric safety device shall prevent normal movements
  - if not in extended position
    - electric (safety) device shall prevent opening of doors and normal movements
    - pawl device shall be fully retracted and car be sent to lowest level
    - doors shall be opened to allow persons to leave the car
    - intervention of competent person



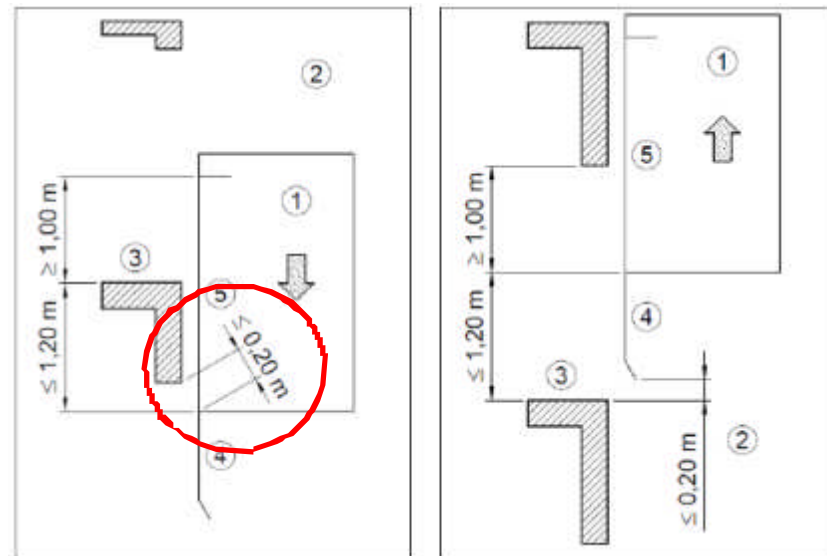
# Ascending car overspeed protection means

- ACOP shall be active in
  - normal operation
  - manual rescue operation, if no direct observation of the machine and no other means for limiting the speed
- If machine brake is used as ACOP
  - self-monitoring (subject to type test as for UCMP)
  - may be placed on same shaft as traction sheave if shaft has only 2 bearings
- Additional information on data plate
  - type of ACOP



# Unintended car movement protection means

- Specific case added for lifts without relevering and machine brake certified as UCM brake
  - no detection device needed
- If machine brake is used as UCM brake
  - may be placed on same shaft as traction sheave if shaft has only 2 bearings
- Additional requirement for max. 200 mm gap for partly enclosed wells on landing side



# EN 81-20 - Guide rails



# Guide Rails



- Guide rails for low speeds manufactured with other methods than cold drawn or machined deleted
- Guide rail fixings containing non-metallic elements
  - failure of non-metallic elements has to be considered for permissible deflections
- Safe operation has to be ensure by taking into account combination of
  - deflections of guide rails
  - deflection of brackets and structure
  - play in guide shoes
  - straightness of guide rail



# Guide Rails (continued)



- Calculation has to consider in addition
  - weight of guide rails
  - push through forces in rail clips
  - forces and torques due to auxiliary equipment including impact factors
- Push through forces of rail clips may be ignored for travel height  $\leq 40$  m
  - for standing or hanging guide rails
  - for freely hanging guide rails (no fixing point)



# Guide Rails (continued)



- Vertical sill load
  - factor 0,85 for goods passenger lifts only in case of handling devices not included in rated load
  - if guide shoes are close to brackets ( $\leq 10\%$  bracket distance) sill load may be ignored
- Table for combination of load cases revised

| Load cases              | Loads and forces    | $P$ | $Q$ | $M_{cwr}/M_{bwr}$ | $F_s$ | $F_p$ | $M_g$ | $M_{aux}$ | $WL$ |
|-------------------------|---------------------|-----|-----|-------------------|-------|-------|-------|-----------|------|
| Normal operation        | Running             | x   | x   | x                 |       | $x^a$ | x     | x         | x    |
|                         | Loading + unloading | x   |     |                   | x     | $x^a$ | x     | x         | x    |
| Safety device operation |                     | x   | x   | x                 |       | $x^a$ | x     | x         |      |

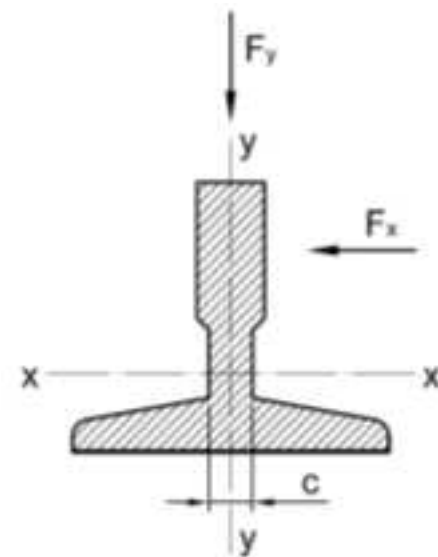
<sup>a</sup> See 5.7.2.3.5

NOTE Load and forces may not act simultaneously.

# Guide Rails (continued)



- Vertical sill load
  - factor 0,85 for goods passenger lifts only in case of handling devices not included in rated load
  - if guide shoes are close to brackets ( $\leq 10\%$  bracket distance) sill load may be ignored
- Table for combination of load cases revised



# EN 81-20 - Buffers



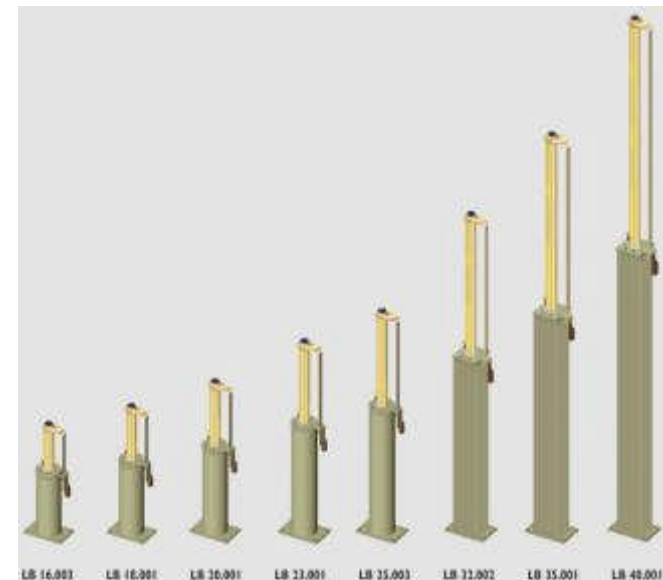
- Deleted
  - Max. stroke for hydraulic lifts at lowest landing when car is resting on buffers (max. 0,12 m vertical sill distance)
  - energy accumulation type buffers with buffered return movement
  - Annex L with diagram for buffer strokes
- Buffers fixed to the car or counterweight
  - shall hit an obstacle (pedestal) with min. 300 mm height
  - exception for buffers fixed to counterweight with a screen extending from max. 50 mm above pit floor



# Buffers (continued)



- Additional information on data plate
  - type of buffer
  - specification of liquid in case of hydraulic buffers
- Max. peak retardation  $6 g_n$  for energy accumulation type buffers with non-linear characteristic (PU buffers)
- Fixing elements shall not be considered for the fully compressed situation (90 %) buffers with non-linear characteristic
- Reduced buffer stroke
  - for rated speeds above 2,5 m/s
  - min. buffer stroke 420 mm



# EN 81-20 - Machines



# Machine Break



- Brake function test from outside of well
- Brake release by manual or powered means for emergency use
- Failure of release means not affecting normal operation of the brake
- Instructions for brake release located near release means

# Emergency Operation



- Effort to move car manually with brake released now 150N for nominally balanced car and 400N for fully loaded upwards.
- By gravity or by mechanical or electrical means independent from the mains supply
- Electrical means, power supply must be able to move the car with any load to an adjacent landing within 1 hour after a breakdown

# Emergency Operation



- Mechanical emergency operation means
  - max. effort  $\leq 150$  N to move the car to a landing
  - in case of removable means (e.g. handwheels)
    - to be located in an easily accessible place to be suitably marked in case of risk of confusion
    - electric safety device shall check when the means is about to be coupled
- Electrical emergency operation means
  - power shall be able to move the car to an adjacent landing within 1 hour after breakdown
  - max. speed 0,3 m/s



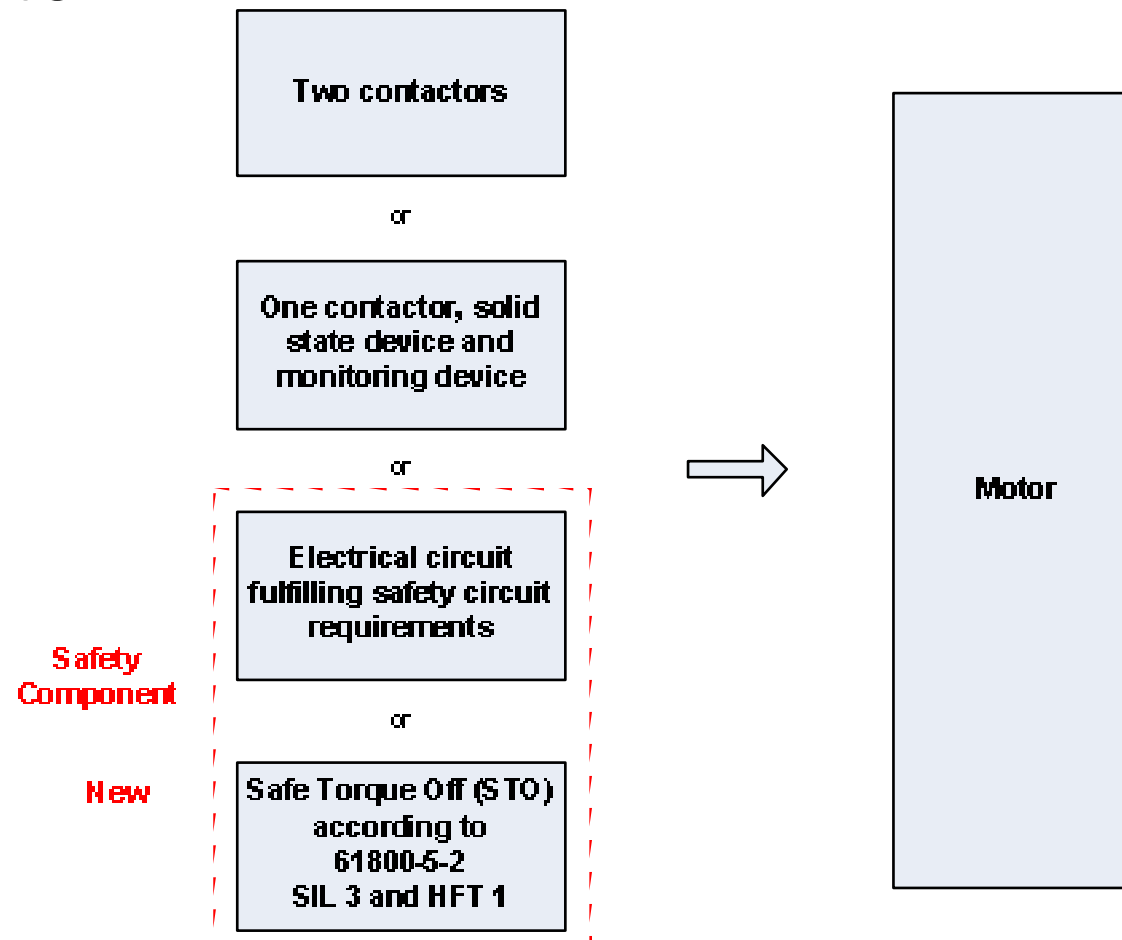
# EN 81-20 – Stopping the Machine



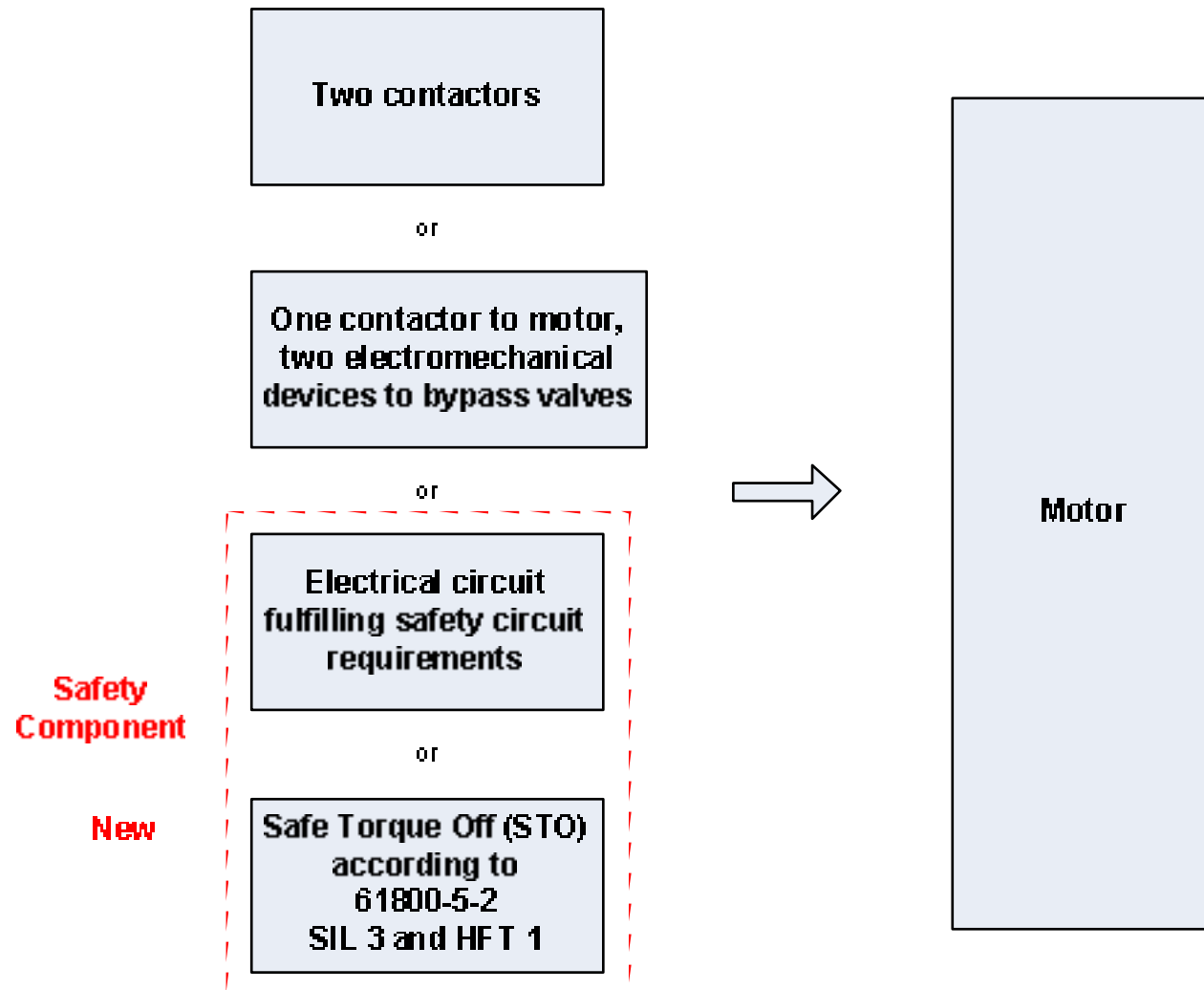
# Traction and Positive Drive



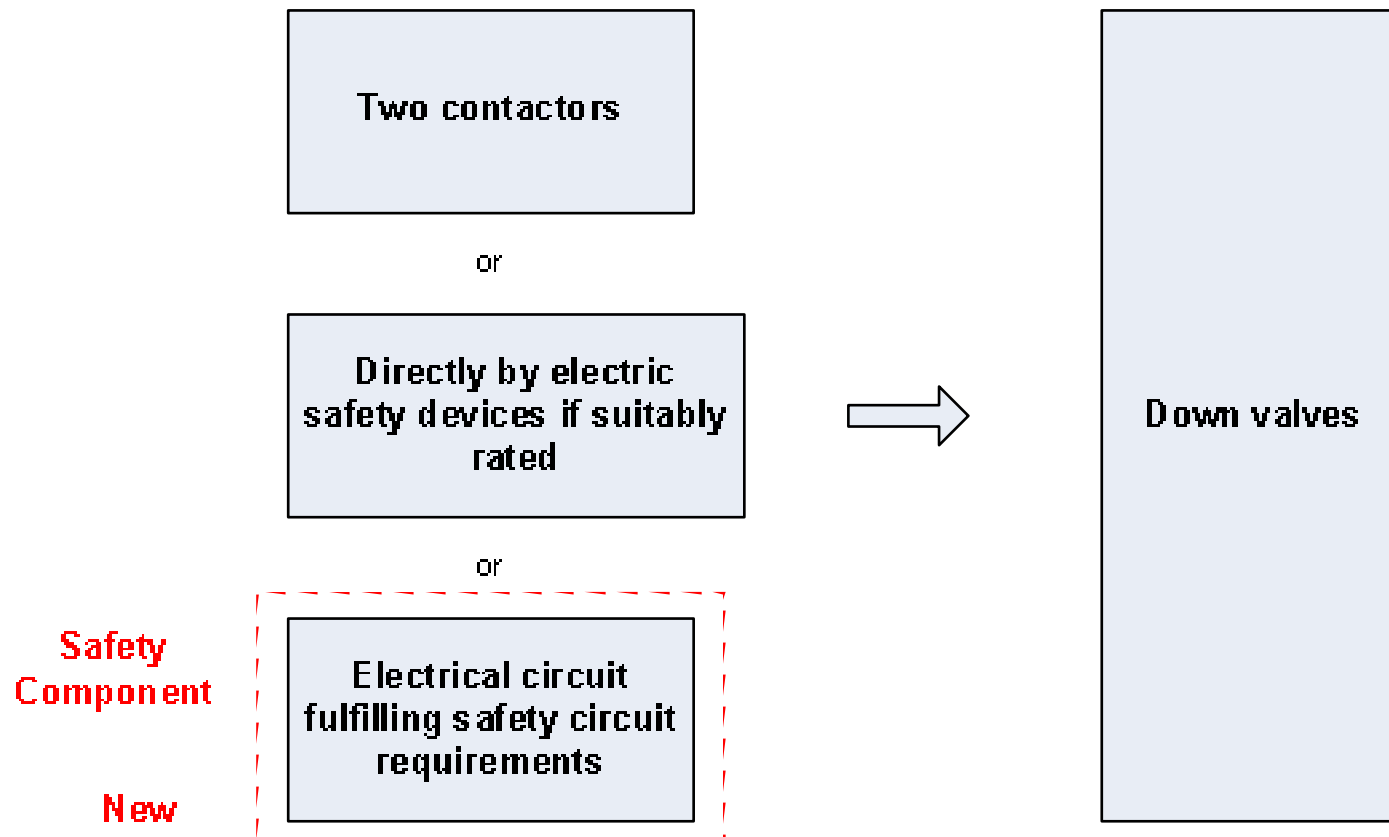
## Removing the power which can cause rotation of the motor



# Hydraulic Drive - Upwards



# Hydraulic Drive - Downwards



# EN 81-20 – Electrical Installation & Appliances



## Limits of application

- Well lighting now under EN81 rules.
- The national requirements relating to electricity supply circuits apply as far as the input terminals of the switches.
- The national requirements apply to the whole lighting and socket outlet circuits of the machine room and the pulley room.
- The electrical equipment of the lift shall comply with the requirements of EN 60204-1 (Electrical equipment of machines) as referenced in the clauses.

## Limits of application continued

- Dimension now given for position of equipment to allow maintenance access.
- Electronic control equipment of brake, motor and down valves shall comply with safety circuit immunity requirements of EN 12016.

## Limits of application continue

- Under normal operation the temperature of directly accessible equipment shall not exceed the limits given in HD/IEC 60364-4-42 Table 42.1.

**Table 42.1 – Temperature limits in normal service for accessible parts of equipment within arm's reach**

| Accessible parts                                     | Material of accessible surfaces | Maximum temperatures °C |
|--|---------------------------------|-------------------------|
| Hand-held means of operation                         | Metallic                        | 55                      |
|  | Non-metallic                    | 65                      |
| Parts intended to be touched but not hand-held       | Metallic                        | 70                      |
|  | Non-metallic                    | 80                      |
| Parts which need not be touched for normal operation | Metallic                        | 80                      |
|  | Non-metallic                    | 90                      |

## Protection against Electric shock

- Protection against electrical shock shall comply with IEC 60364-4-41 and EN 50274.
- Additional protection by means of 30 mA RCD
  - Socket outlets
  - Control circuits for landing controls and indicators and the safety chain having higher voltage than 50 V AC, and
  - Circuits on the lift car having higher voltage than 50 V AC
- Labelling for electrical hazards.



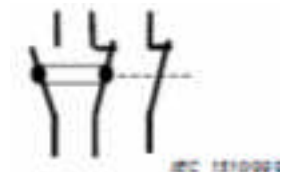
## Contactors, contactor relays, components of safety circuits

- Main contactors shall have auxiliary contact linked with power contacts (mirror contact) according to EN 60947-4-1, Annex F
- Auxiliary contacts of main contactors and Contactor relays shall have mechanically linked contact elements according to Annex L of EN 60947-5-1:2004;
- Relays shall shall have mechanically linked contacts according to EN 50205, in order to ensure that any make contact(s) and any break contact(s) cannot be in closed position simultaneously.

Symbol on device



Symbol on circuit diagram



Same as above can be used



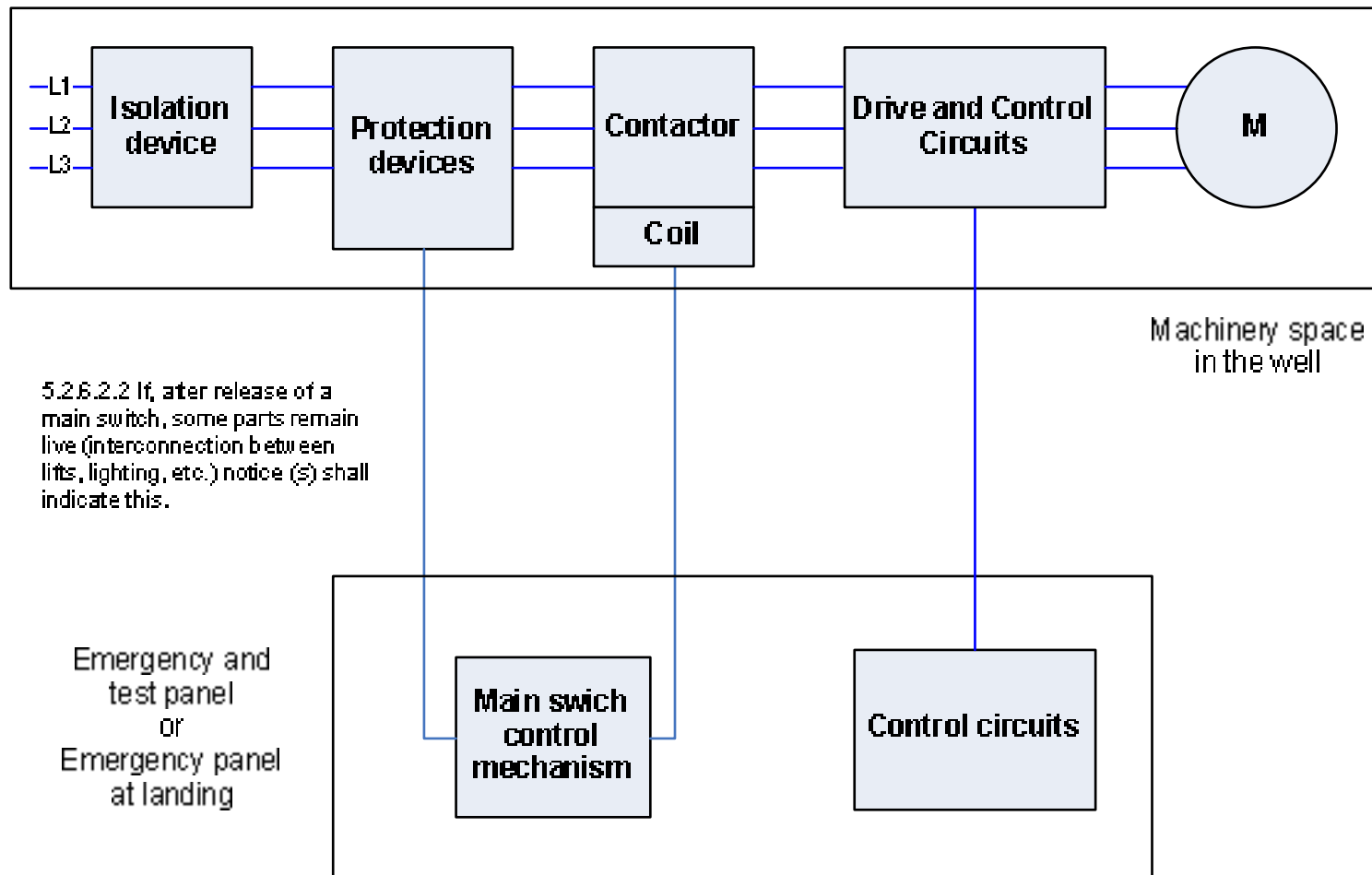
## Protection of electrical equipment

- Protection of motors against overheating shall be provided for each motor.

## Main switches

- Main switch shall comply with EN 60204-1
- Alarm device battery charger can be supplied from car light supply or from control supply

## Remotely controlled Main switch



## Electric wiring

- Wiring shall comply with EN 60204-1 as referenced

## Control of the supply for lighting and socket outlets

- Additional well lighting lamps on the car roof shall be connected to the car light circuit switched from the car roof.

## Protection against electric faults

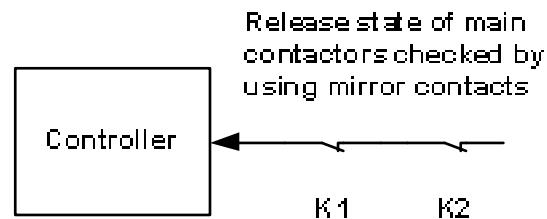
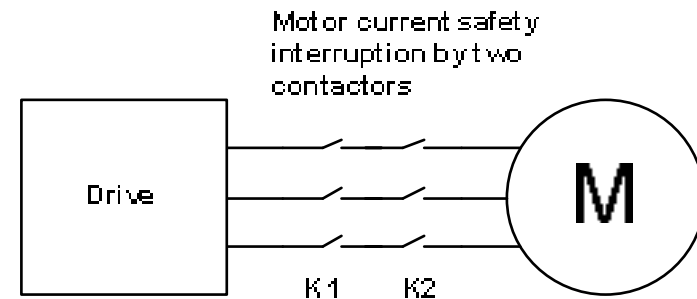
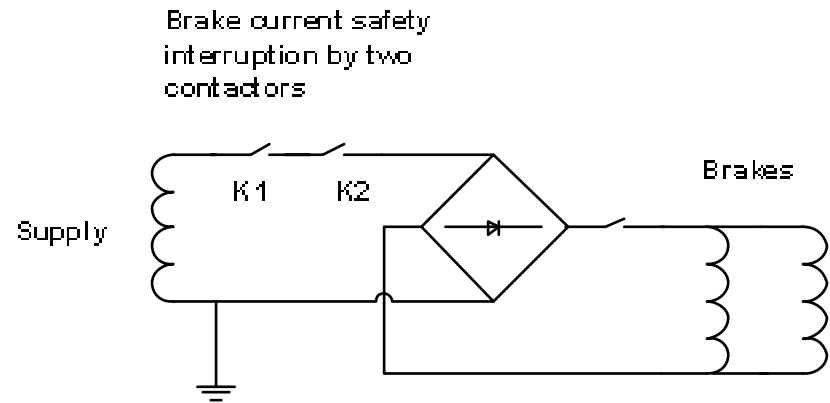
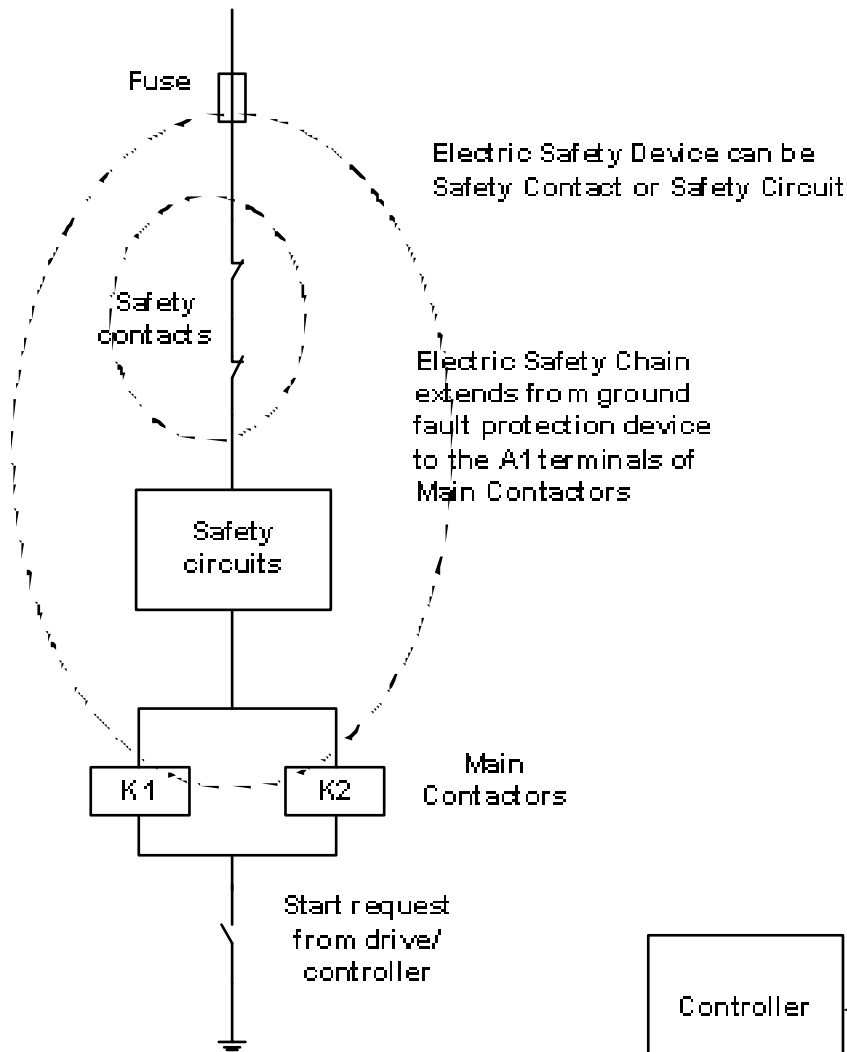
An earth fault in a circuit in which there is an electric safety device or in a circuit controlling the brake or in a circuit controlling the down valve shall stop the lift

If first earth fault alone is not dangerous then continue to destination is accepted

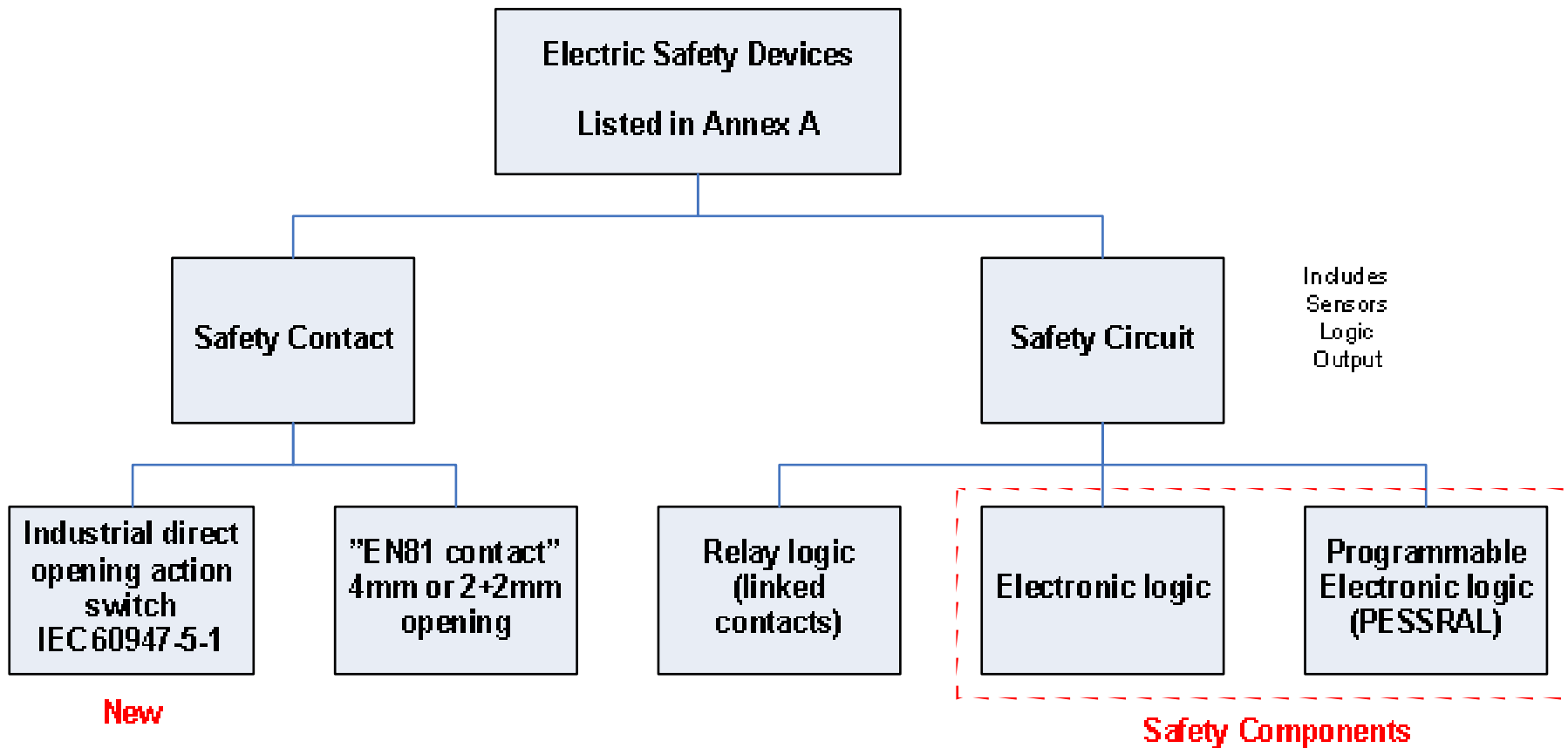
# EN 81-20 – Electric Safety Devices



# Electric Safety Devices – Classical Safety Chain



# Electric Safety Devices – Different Types



## Actuation of electric safety devices

- Mechanical failures which can impact the safety function shall be considered

## PSSRAL

- When the design includes software, it shall be possible to identify the failure state of the device, either by built-in system or by an external tool, if this external tool is a special tool, it shall be available on the site.

## Annex A

- Tables A.1 and A.2 combined
- SIL levels of electric safety devices have been mostly set to be the same in comparative ISO standards.
- Exception that check of retardation in case of reduced stroke buffers is now SIL 3 due to greater reduction

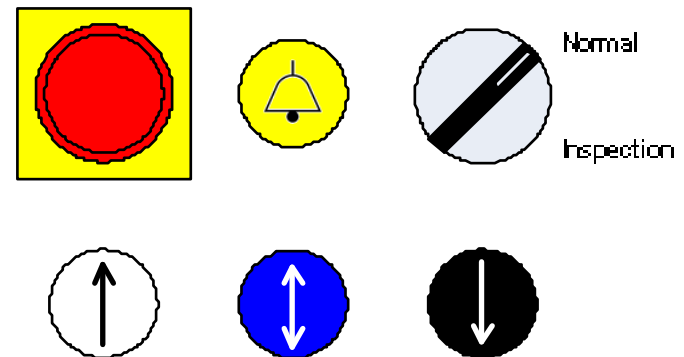
# EN 81-20 - Controls



- All docking operations are deleted as no longer being of relevance to the market.
- The overload shall be detected at the latest when the rated load is exceeded by 10% with a minimum of 75 kg.
- Monitoring the normal slowdown of the machine in case of reduced buffer stroke shall be electric safety devices in conformity with 5.11.2.
- Preliminary operations added

## Inspection operation

- Inspection control station added in to the pit.
- Blue “Run” button added to act with up and down buttons.
- Push buttons shall comply to EN 60947-5-1.
- Button colors derived from EN 60204-1.
  - Inspection speed shall not exceed 0,30 m/s when vertical distance above any standing area on car roof or in pit is 2,0 m or less.
  - If more than one inspection control station is switched to “INSPECTION”, it shall not be possible to move the car from any of them unless the same push buttons on the inspection control stations are operated simultaneously.



## Emergency Electrical Operation

- Now required also for hydraulic lift
- Maximum speed 0.3m/s
- Inspection operation priority over  
Emergency Electrical Operation more  
clearly defined

## Protection for maintenance operations

- The control system shall be provided with means to:
  - Prevent the lift from answering to landing calls
  - Prevent the lift from answering remote commands
  - Disable the automatic door operation
  - Give at least terminal floor calls for maintenance.
- The means shall be clearly indicated and only accessible to authorized persons.

## Landing and car door bypass device

- Required for maintenance purposes in the control panel or in the emergency and test panel
- Only car or landing door contacts can be bypassed at one time
- Separate monitoring signal for car door shall prove that car door is closed before movement

## Faulty door contact monitoring

- Correct operation of Car door and Landing door electric safety devices and car door monitoring signal used for bypass function shall be monitored
- Short circuits and jumpers shall be detected and normal operation prevented