BS 6440:2011

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Powered vertical lifting platforms having non-enclosed or partially enclosed liftways intended for use by persons with impaired mobility – Specification

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Contents

List of tables

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 60, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 August 2011. It was prepared by Technical Committee MHE/4, *Lifts, hoists and escalators*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard supersedes BS 6440:1999, which is withdrawn.

Relationship with other publications

Related standards for similar devices for use by persons with impaired mobility are BS EN 81-40, BS EN 81-41 and BS 5900 (the latter relates to private dwellings only).

Those items relevant to lifting platforms referenced within BS EN 81-70 have been included within this edition of BS 6440.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- change from a code of practice to a specification;
- changes to meet the essential health and safety requirements of Machinery Directive 2006/42/EC [1] as enacted as the Supply of Machinery (Safety) Regulations 2008 [2].

BS 6440:1999 applied to lifting platforms with fully and partially enclosed liftways travelling over stated distances. A new standard, BS EN 81-41, applies to lifting platforms with enclosed liftways. However, BS EN 81-41 does not specify requirements for lifting platforms with a non-enclosed liftway, which are common on the UK market. The revised BS 6440 specifies requirements for lifting platforms with non-enclosed and partially enclosed liftways.

Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

BSI permits the reproduction of Figure F.1 and Figure G.1. This reproduction is only permitted where it is necessary to use the sample certificates given in these figures during each application of the standard.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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

Introduction

This British Standard may be used as a means to address relevant health and safety requirements of Machinery Directive 2006/42/EC [1], and additionally specifies minimum requirements for the provision of lifting platforms in buildings/constructions.

It is assumed that the lifting platform operates in an ambient temperature in the range 5 °C to 40 °C. For temperatures outside this range, additional measures might be necessary.

This British Standard does not specify requirements for:

- severe conditions (e.g. extreme climates, strong magnetic fields);
- lightning protection;
- potentially explosive atmospheres;
- the handling of materials, the nature of which could lead to dangerous situations;
- lifting platforms of which the primary function is the transportation of goods;
- lifting platforms prone to vandalism;
- earthquakes or flooding;
- fire-fighting, evacuation and behaviour during a fire;
- vibrations;
- the design of concrete, hardcore, timber or other foundation or building arrangement;
- the design of anchorage bolts to the supporting structure;
- type C wheelchairs as defined in BS EN 12183 and/or BS EN 12184;
- balancing weights or counterweights.

This revision of BS 6440 deals with all significant hazards relevant to lifting platforms, when they are used as intended and under the conditions foreseen by the manufacturer. A list of significant hazards is given in Annex A.

In order to determine the specific characteristics of the lifting platform, at least the following issues need to be discussed between the supplier and the specifier:

- environmental conditions;
- civil engineering considerations;
- other aspects related to the place of installation, including safe use of the lifting platform;
- the use and places of use of the machinery;
- fire protection requirements;
- suitability for the user.

Annex B gives information on issues which specifiers are expected to discuss with the supplier in order to select and specify a suitable powered lifting platform.

It is assumed that a powered lifting platform conforming to this standard is for the use of persons either:

- capable of using the lifting platform safely and unaided, either after having been fully instructed in its use, or having observed clear and simple instructions permanently displayed on the equipment; or
- if not capable of safe unaided use of the lifting platform, transported under the care of a fully instructed able-bodied accompanying person for whom additional control facilities can be provided if required. Recommendations for specially adapted control devices are given in Annex C.

1 Scope

This British Standard specifies requirements for the design, manufacture, installation, commissioning, testing, maintenance and dismantling of new permanently installed electrically powered vertical lifting platforms with the following characteristics:

- travelling vertically between predefined levels along a guided path where the inclination to the vertical does not exceed 15°;
- supported or sustained by wire ropes, chains, rack and pinion, hydraulic cylinder (direct or indirect), screw and nut or scissors mechanisms;
- having non-enclosed or partially enclosed liftways;
- having non-enclosed or partially enclosed carriers;
- having a rated speed that is not greater than 0.15 m/s;
- having a travel distance that is not greater than 3.0 m;
- sized for use with type A or type B wheelchairs conforming to BS EN 12183 and/or BS EN 12184.

It is applicable to lifting platforms that are intended primarily for the transport of persons with impaired mobility, with or without a wheelchair.

NOTE 1 The lifting platforms specified in this standard can be used in domestic or non-domestic premises, and can be installed indoors or outdoors. Their installation in some premises might not be practicable.

NOTE 2 Although this British Standard is applicable to new lifting platforms, it can also be used as guidance for the refurbishment and re-installation of existing lifting platforms.

2 Normative references

The following referenced documents may be used in the application of this British Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations – Seventeenth edition*

BS EN 81-1:1998+A3:2009, *Safety rules for the construction and installation of lifts – Part 1: Electric lifts*

BS EN 81-2:1998+A3:2009, *Safety rules for the construction and installation of lifts – Part 2: Hydraulic lifts*

BS EN 349, *Safety of machinery – Minimum gaps to avoid crushing of parts of the human body*

BS EN 953, *Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards*

BS EN 12015, *Electromagnetic compatibility – Product family standard for lifts, escalators and moving walks – Emission*

BS EN 12016, *Electromagnetic compatibility – Product family standard for lifts, escalators and moving walks – Immunity*

BS EN 12183, *Manual wheelchairs – Requirements and test methods*

BS EN 12184, *Electrically powered wheelchairs, scooters and their chargers – Requirements and test methods*

BS EN 12385-4, *Steel wire ropes – Safety – Part 4: Stranded ropes for general lifting applications*

BS EN 13411 (all parts), *Terminations for steel wire ropes*

BS EN 50214, *Flat polyvinyl chloride sheathed flexible cables*

BS EN 60204-1:2006+A1:2009, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

BS EN 60529:1992, *Specification for degrees of protection provided by enclosures (IP code)*

BS EN 60947-1:2007, *Low-voltage switchgear and controlgear – Part 1: General rules*

BS EN 60947-4-1:2010, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

BS EN 60947-5-1:2004+A1:2009, *Low-voltage switchgear and controlgear – Part 5-1: Control/circuit devices and switching elements – Electromechanical control circuit devices*

BS EN ISO 12100, *Safety of machinery – General principles for design – Risk assessment and risk reduction*

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

BS ISO 6336 (all parts), *Calculation of load capacity of spur and helical gears*

ISO 606, *Short-pitch transmission precision roller and bush chains, attachments and associated chain sprockets*

3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS EN ISO 12100 and the following apply.

3.1 barrier
bar or similar device so arranged as to provide protection against persons falling from the carrier

3.2 boarding point
space at the entrance to a lifting platform (at any level) to permit manoeuvring, boarding and alighting of users, with or without wheelchairs

3.3 carrier
part of a lifting platform by which persons are supported in order to be lifted or lowered

3.4 competent person
person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions to enable the required work to be carried out safely

3.5 down direction valve
electrically controlled valve in a hydraulic circuit for controlling the descent of a lifting platform

3.6 drive system
system that causes a lifting platform to move under power input

3.7 driving unit
unit, including the motor, which drives and stops a lifting platform

3.8 electrical safety contact
contact in which the separation of the circuit-breaking elements is made by positive means

3.9 full load pressure
static pressure exerted on the piping directly connected to the hydraulic cylinder, when a lifting platform with the rated load is at rest at the highest boarding point level

3.10 liftway
space through which a carrier and its load travels

3.11 load-carrying nut
internally threaded component which carries the load in conjunction with a screw

3.12 load cycle
start (acceleration from rest to rated speed), over the total travel, stop (deceleration from rated speed) and return travel (start and stop) to the initial position

3.13 minimum static load
load that a lifting platform and its associated suspension attachments have been designed to support

3.14 mechanical blocking device
device that, when set in position, guarantees a minimum safety space beneath the carrier for the purposes of maintenance and inspection

3.15 over-speed governor
device that, when the carrier attains a pre-determined speed, causes the lifting platform to stop and if necessary causes the safety gear to be applied

3.16 person with impaired mobility
person for whom stairs are a barrier to vertical travel

NOTE This could include persons with a permanent or increasing walking impairment; persons who are carrying luggage, cycles or heavy shopping; persons who are using prams, child buggies, wheeled shopper bags, or for other reasons are temporarily impeded when using long ramps or steep stairs; and persons using wheelchairs.

3.17 pressure relief valve
valve which limits the pressure to a pre-determined value by exhausting fluid

3.18 rack
bar with teeth with which a driving pinion engages to form a slip-free driving means of converting rotary motion into linear motion

3.19 rated load
load for which a lifting platform has been designed

3.20 rated speed
design speed of the carrier

3.21 safety circuit
electrical or electronic circuit with an equivalent degree of safety to a circuit containing electrical safety contacts

3.22 safety gear
mechanical device for stopping and maintaining the carrier stationary in case of over-speeding in the downward direction and/or breaking of the suspension

3.23 safety nut
internally threaded component, which is linked to a load-carrying nut but is unloaded during normal service, and which is capable of carrying the load if the load-carrying nut breaks

3.24 screw
external threaded component, which carries the load in conjunction with a load-carrying nut, and which in certain circumstances carries the load imposed by a safety nut

3.25 sensitive edge
device to provide protection against a trapping, shearing or crushing hazard

3.26 sensitive surface
device similar in effect to a sensitive edge (**3.25**) but so arranged as to protect a surface

3.27 shut-off valve
manually operated two-way valve which can permit or prevent flow in either direction

3.28 toe guard
vertical component extending downwards from a lifting platform entrance

3.29 travel
vertical distance between the top and bottom boarding point levels served by a lifting platform

3.30 unlocking zone
zone, extending above and below a boarding point, in which the carrier floor has to be positioned to enable the corresponding gates/doors/ramps or barriers to be unlocked

3.31 vertical lifting platform
device permanently installed to serve fixed boarding points, comprising a guided carrier whose dimensions and means of construction are primarily intended to permit the access of persons with impaired mobility

4 General requirements for lifting platforms

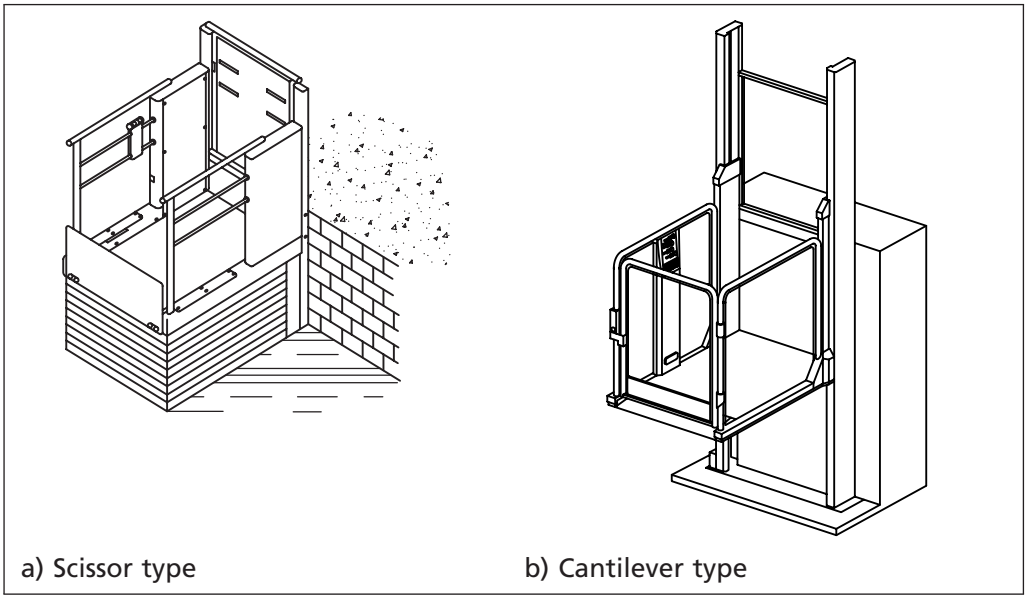
4.1 General

Machinery shall be designed in accordance with this British Standard, and shall be verified in accordance with Annex D and with the principles of BS EN ISO 12100.

NOTE 1 BS EN ISO 12100 covers hazards that are relevant, but not significant, which are not dealt with in this British Standard (e.g. sharp edges).

NOTE 2 Figure 1 shows two different examples of typical lifting platform arrangements. Others are possible.

Figure 1 **Examples of vertical lifting platforms with non-enclosed liftways**



a) Scissor type b) Cantilever type

4.2 Pattern of use

The design of the lifting platform shall be such that it can perform at least ten load cycles (see **3.12**) per hour with maximum rated load.

NOTE Higher numbers of load cycles per hour are subject to negotiation in accordance with the guidance given in Annex B.

4.3 Guarding

Exposed rotating or moving parts (e.g. gearing of the drive unit) with the potential to cause personal injury shall be guarded. Access panels shall be secured by means requiring the use of a tool or key for their release.

Guarding shall be designed and constructed in accordance with BS EN 953, BS EN ISO 13857:2008 and BS EN 349.

4.4 Rated speed

The lifting platform shall have a rated speed not greater than 0.15 m/s.

4.5 Rated load

The rated loads shall be as follows:

a) at least 205 kg, but not more than 500 kg, for a lone user: either standing, or in a type A or type B wheelchair, or in any other wheelchair able to be accommodated on the carrier;

b) at least 280 kg, but not more than 500 kg, for a user: in a type A or type B wheelchair, or in any other wheelchair able to be accommodated on the carrier, with an accompanying person.

NOTE Type A and type B wheelchairs are defined in BS EN 12183 and BS EN 12184.

4.6 Load control

The lifting platform shall meet one of the following requirements:

a) either the lifting platform shall be fitted with a device to prevent normal starting (excluding re-levelling of hydraulic drives) in the event of an overload on the carrier (i.e. when the rated load is exceeded by 75 kg), and in this event the users shall be informed by an audible and visible signal on the carrier; or

b) where the lifting platform is not fitted with an overload device, it shall not be possible to travel in the upwards direction (with 75 kg overload); however, safe travel in the downwards direction shall be possible with the minimum static load (**4.8**).

In either case the gates shall remain unlocked or unlockable (without the use of a tool) in the unlocking zone.

4.7 Carrier floor dimensions

The clear loading area of the carrier, including any sensitive edge, photo cell or light curtain, but excluding hand rails, shall not exceed 2.0 m^2.

For new buildings, the plan dimensions of the carrier floor (including any sensitive edges, photo cells or light curtains, but excluding guardrails/hand holds) shall accommodate a wheelchair and shall be equal to or greater than the minimum dimensions given in Table 1.

NOTE These carrier floor dimensions can accommodate a type A or type B wheelchair as defined in BS EN 12183 and/or BS EN 12184. For existing buildings where space is not available, or non-standard wheelchairs are to be accommodated, other non-standard dimensions may be used.

Table 1 **Minimum plan dimensions of the carrier floor**

Dimensions in millimetres

Minimum plan dimensions (width × length)	**Provision of adjacent entrances**	**Principal use** [A)]
1 100 × 1 400	With an adjacent entrance	Alone or with an accompanying person
800 × 1 400	Without an adjacent entrance	
750 × 1 250	With or without an adjacent entrance	Alone (domestic premises only)

[A)] Person either standing, sitting or in a wheelchair.

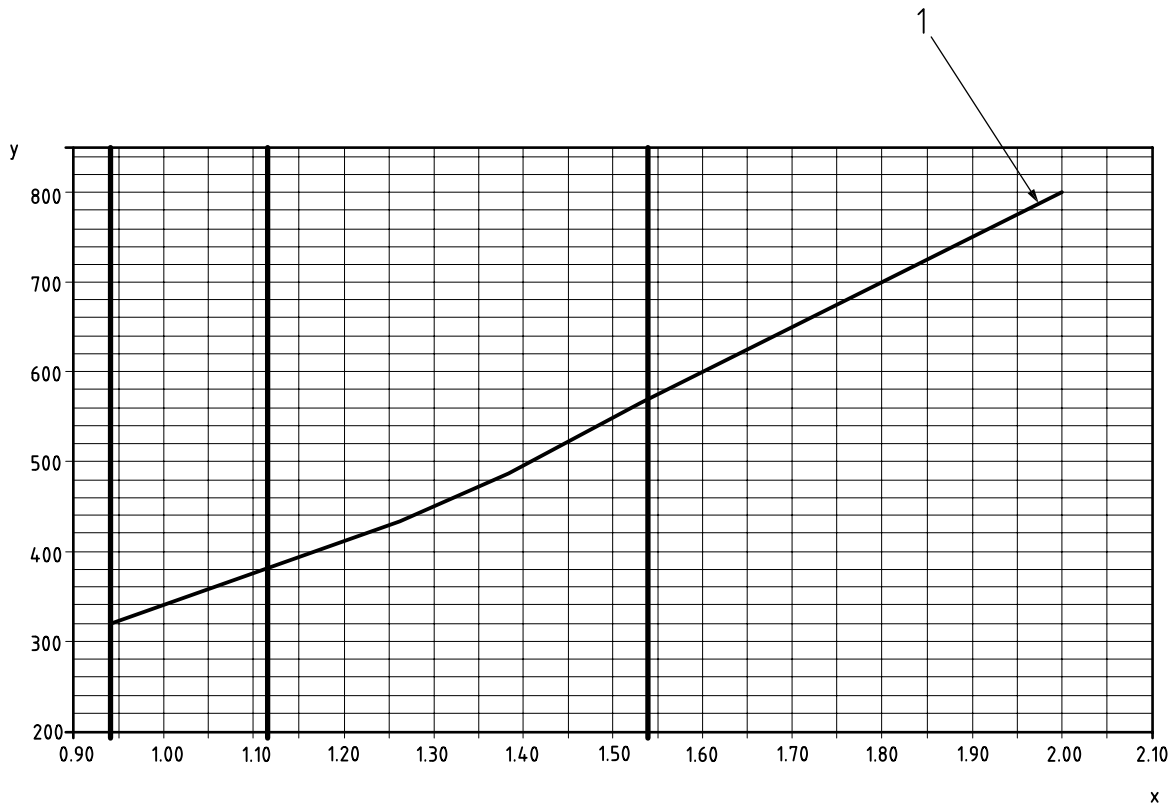
4.8 Mechanical strength of the lifting platform

The carrier and its associated suspension attachments shall be designed to support the minimum static load, as determined in Table 2 and shown in Figure 2, multiplied by a coefficient of 1.25.

Table 2 **Mechanical strength of the lifting platform**

Minimum static load	Maximum available carrier floor area
kg	m²
340	1.00
450	1.30
600	1.60
750	1.90
800	2.00

Figure 2 **Graphical representation of relationship between carrier floor area and minimum static load**



Key

1 Minimum static load

x Platform area (m²)

y Load (kg)

NOTE Vertical lines indicate standard carrier floor sizes.

4.9 Resistance to operating forces

The complete lifting platform installation shall resist, without permanent deformation, the forces imposed on it during normal operation, during the application of the safety devices and at impact on mechanical stops when travelling at the rated speed and 110% rated load. However, local deformation is permissible provided that it that does not affect the operation of the lifting platform or any of its safety devices arising from the safety gear gripping device.

Guiding components, their attachments and joints shall withstand deflections due to uneven loading without affecting operation.

When the following fatigue stress test is carried out, there shall be no deterioration to the lifting platform that could adversely affect its normal use. If necessary, friction components shall be replaced.

a) The test shall be carried out for all load-bearing components and joints that are critical to fatigue. The test shall take into account the degree of stress fluctuation and the number of stress cycles, which can be a multiple of the number of load cycles.

b) The test shall be carried out over the maximum travel with one third of the load cycles at no load, one third of the load cycles at half the rated load, and one third of the load cycles at rated load.

c) At least 50 000 load cycles shall be tested.

4.10 Protection of equipment against harmful external influences

4.10.1 Protection for outdoor use

For outdoor use, lifting platforms shall have a sufficient degree of protection for electrical equipment depending on site conditions, which shall be not less than class IP54 as defined in BS EN 60529:1992.

4.10.2 Other protections

If a lifting platform is to be installed in an adverse environment, the specifier and supplier shall determine the measures needed to ensure that safe operation is achieved.

NOTE Adverse environments are those that could affect safe operation. Examples include:

- *the effects of humidity, atmospheric pollution, solar radiation, swimming pool environs, rain/ice/high wind, etc.;*
- *the actions of flora and fauna.*

4.11 Lifting platform support/guide system

NOTE 1 Scissor mechanisms are considered as guided systems.

The lifting platform support system shall be such that the carrier edges cannot tilt more than ±10 mm from the horizontal when supporting an evenly distributed load of 1.25 times the rated load.

Lifting platform support/guide system structural members shall meet the design requirements of this British Standard.

NOTE 2 Generally the support/guide structural members are made of metals such as steel, cast iron, aluminium alloy or other equivalent malleable and ductile metals/alloys.

NOTE 3 The effects of ageing, operating temperature range and fire resistance should be taken into account.

The guide rails, their joints and attachments shall be designed according to the minimum static load in order to withstand the loads and forces imposed on them.

NOTE 4 Attention is drawn to the recommended working coefficients given in Machinery Directive 2006/42/EC [1].

Deflections of the guide rails during operation shall be such that:

a) unintended unlocking of the gates does not occur;

b) the operation of the safety devices is not affected; and

c) collision of moving parts with other parts is not possible.

4.12 Safety gear and over-speed governor

4.12.1 Safety gear

4.12.1.1 General

The lifting platform shall be provided with a safety gear meeting the requirements of BS EN 81-1:1998+A3, **F.4**. The safety gear shall operate to stop and sustain the carrier with the minimum static load as defined in Table 2, multiplied by a coefficient of 1.25, except in the following circumstances:

a) on direct acting hydraulic drives; and/or

b) when the carrier is driven by a self-sustaining rotating screw and nut, together with a safety nut.

The safety gear shall be fitted to the carrier.

When the safety gear is applied, no decrease in the tension of any rope or chain or other mechanism used for applying the safety gear or motion of the carrier in the downward direction shall cause the safety gear to be released from its operation.

The safety gear shall be capable of stopping and sustaining the carrier, carrying its rated load, within a distance of 150 mm from where the safety gear is engaged.

The safety gear shall grip the guide rail, or equivalent element, securely.

Any shaft, jaw, wedge or support that forms part of the safety gear and that is stressed during its operation shall be made entirely of a material that meets the design requirements of this British Standard.

NOTE 1 Generally any shaft, jaw, wedge or support is made of metals such as steel, cast iron or other equivalent malleable and ductile metals/alloys.

NOTE 2 The effects of ageing, operating temperature range and fire resistance should be taken into account.

The application of the safety gear shall not cause the carrier to change inclination by more than 56 mm.

4.12.1.2 Actuation

The safety gear shall be either:

a) mechanically tripped before the carrier exceeds a speed of 0.3 m/s by an over-speed governor; or

b) on indirectly suspended hydraulic lifts only, tripped by a safety rope which is independent of the means of suspension, or by slackening or breaking of a suspension rope or chain.

If the over-speed governor derives its drive from a main suspension chain or rope, the safety gear shall be operated by a mechanism actuated by the breaking or slackening of the means of suspension.

4.12.1.3 Release

Release of the safety gear shall be possible only by raising the carrier. It shall not be possible for the lifting platform to be put back into service without manual resetting.

4.12.1.4 Access to the safety gear

The safety gear shall be so positioned that it is accessible for inspection, testing and resetting. It shall be protected by covers, which shall be removable only with a tool or key.

4.12.1.5 Electrical checking

When the safety gear is engaged, a bistable electrical device conforming to **7.9** and activated by the safety gear shall immediately initiate stopping and shall prevent the further starting of the machine.

4.12.2 Over-speed governor

4.12.2.1 General

The over-speed governor shall meet the requirements of BS EN 81-1:1998+A3, **F.4**.

Any friction drive to the over-speed governor shall be independent of the main friction drive on friction drive lifting platforms.

The over-speed governor or another device shall, by means of an electric safety device conforming to **7.9**, initiate the stopping of the lifting machine no later than the moment the tripping speed of the over-speed governor is reached.

If, after release of the safety gear (**4.12.1.3**), the over-speed governor does not automatically reset itself, an electric safety device conforming to **7.9** shall prevent the starting of the lifting platform.

4.12.2.2 Over-speed governor ropes and safety ropes

The minimum breaking load of the rope shall have a safety factor of at least 8, which shall be calculated as 8 times either:

a) the tensile force produced in the rope of the over-speed governor, or the safety rope, when tripped (using a friction factor μ_{max} equal to 0.2) for traction type over-speed governors; or

b) the tensile force specified by the manufacturer that is required to operate the safety gear, or the clamping device for safety ropes.

The ratio of the pitch diameter of the pulleys for the over-speed governor rope to the nominal rope diameter shall be not less than 30:1.

In the event of breakage or excessive rope stretch of the over-speed governor rope, the machine shall be stopped by an electric safety device conforming to **7.9**.

The tensile force in the over-speed governor rope produced by the governor, when tripped, shall be not less than the greater of the following two values:

1) twice that necessary to engage the safety gear; or

2) 300 N.

5 Access for maintenance, repair and inspection

5.1 Working areas on the carrier

Where machinery is to be maintained or inspected from the carrier, the following requirements shall be met.

a) Where there is a risk of crushing, a mechanical device shall be fitted and shall ensure a minimum 300 mm clear space between the parts of the carrier and rigid parts of the liftway.

b) Any necessary devices for emergency operation and for dynamic tests (such as brake tests, safety gear tests) shall be arranged so that they can be operated from outside the liftway.

Where a risk assessment indicates that there is a risk of injury to persons through open inspection panels, these panels shall be interlocked.

5.2 Working areas under the carrier

Where the design of the lifting platform requires that it is to be maintained or inspected from underneath the carrier, the following requirements shall be met.

a) A manually positioned mechanical blocking device shall be provided to enable the carrier to be held in a raised position.

   1) The blocking device shall stop the carrier travelling downwards at rated speed with a load of 1.1 times the rated load.

   2) The blocking device shall be clearly marked with its intended purpose and position.

b) Any necessary devices for emergency operation and for dynamic tests (such as brake tests, safety gear tests) shall be arranged so that they can be operated from outside the liftway.

5.3 Access to equipment and machinery

Machinery and equipment shall be located inside the machinery cabinet, which shall consist of imperforate walls, floor, roof and access panels or door(s).

Any door(s) shall:

a) not open towards the inside of the cabinet;

b) be provided with a key-operated lock;

c) be capable of being re-closed and re-locked without a key.

Any access panels shall be capable of being removed only using a key or a tool.

There shall be no openings other than:

1) ventilation openings for cooling;

2) necessary openings for the functioning of the lifting platform between the non-enclosed liftway and the machinery cabinet;

3) ventilation openings for escape of gases and smoke in the event of fire.

The machinery cabinet openings shall conform to the following requirements.

i) The openings shall be protected in accordance with BS EN ISO 13857:2008.

ii) The ingress protection shall be at least IP2X as specified in BS EN 60529:1992 for indoor installations (see **4.10.1** for outdoor installations).

6 Driving units and drive systems

6.1 General requirements

Drive systems shall meet the requirements in **6.1** to **6.4** for all systems, together with the additional requirements in **6.5**, **6.6**, **6.7** or **6.8** as appropriate for the specific type of system.

All types of drive systems, except hydraulic, shall be powered in both directions of travel.

After the fatigue test specified in **4.9** has been carried out, the safety factors of geared drive units shall remain within the specified limits.

Unless forming an integral part of the shaft or other driving unit, every sheave, rope drum, spur gear, worm and worm wheel, pinion or brake drum shall be fixed to the shaft or driving unit by one of the following methods:

a) sunk keys;

b) splines;

c) cross pinning.

If single chain or belt intermediate drives are employed, then the output drive gearing shall be on the load side of the chain or belt intermediate drive, and either:

1) the output drive gearing shall be self-sustaining; or

2) the brake shall be on the load side of the chain or belt intermediate drive, and a minimum of two belts or chains shall be used. The integrity of the chain or belt shall be monitored electrically by an electric safety device according to **7.9** that disconnects the supply to the motor and brake in the event of breakage of any chain.

If a system with a two-chain intermediate drive is used, the intermediate chain shall be monitored by an electric safety device according to **7.9** that disconnects the supply to the motor and brake in the event of breakage of any chain.

Exposed rotating or moving parts, such as sheaves, pulleys, chain wheels and sprockets, with the potential to cause injury, shall be guarded. The protection devices used shall be constructed so that the rotating parts are visible, and that they do not hinder examination and maintenance operation. If protection devices are perforated, the gaps shall conform to BS EN ISO 13857:2008, Table 4.

When a self-sustaining system is tested under free running conditions (i.e. with the brake released), when carrying the minimum static load multiplied by a coefficient of 1.1, the carrier shall decelerate.

6.2 Braking system

Except on hydraulically driven lifting platforms which conform to **6.8**, an electro-mechanical friction brake shall be fitted, which shall be capable of:

a) bringing the carrier smoothly to rest and holding it firmly in position, when loaded with the rated load plus 75 kg;

b) holding the carrier firmly with the minimum static load stated in Table 2; and

c) being mechanically applied and electrically held off.

The brake shall be designed not to release in normal operation unless the electrical supply is simultaneously applied to the lifting platform motor.

Brake linings shall be made of flame-retardant, self-extinguishing material and shall be designed such that wear does not reduce the security of their fastenings. Residual magnetism shall not prevent the brake from being applied when the electrical supply to the driving motor is interrupted.

Except in the case of self-sustaining drive systems, 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 set of the components is not working, a sufficient braking effort shall still be available to slow the carrier, when travelling downwards at rated speed and with rated load.

NOTE Any solenoid plunger is considered to be a mechanical part; any solenoid coil is not.

Any brake capable of being released by hand shall require a constant force to keep the brake held off.

If coil springs are used to apply the brake shoes, such springs shall be in compression.

The component on which the brake operates shall be coupled to the drum or sprocket or nut or screw by direct and positive mechanical means, unless either the final driving element is self-sustaining, or a system with two chains intermediate drive is employed.

The supply to the brake shall be in accordance with **7.5**.

Whenever the motor of the lifting platform functions as a generator, it shall not be possible for the supply to the electric device operating the brake to be fed from the driving motor.

6.3 Stopping/levelling accuracy

In use:

a) the stopping accuracy of the carrier shall be ±10 mm;

b) a re-levelling accuracy of ±20 mm shall be maintained;

c) stopping distances, except for sensitive edges and surfaces in accordance with **9.9.2**, shall be no greater than 20 mm in response to operation of an electric safety device.

6.4 Emergency/manual operation

6.4.1 General

An emergency control device shall be provided.

The time to move the carrier to the nearest boarding point where the gate can be opened shall be not more than 15 min.

This emergency operation shall be possible from a position outside the liftway (except for hydraulic lowering according to **6.8.12.1**), but with full control of the movement.

The emergency control device shall be in an accessible position. It shall be protected by covers, which shall only be removable with a tool or key.

NOTE It is recommended that emergency operations are carried out by an authorized and competent person.

Emergency operation of hydraulic lifts shall conform to **6.8.12**.

6.4.2 Rack and pinion drives, rope and chain suspension drives, and screw and nut drives

Emergency operation shall be achieved by means of a manually operated hand-winding device. An electric safety device shall prevent operation of the normal controls. Where the manual effort is greater than 30 N to overcome the brake by emergency hand-winding, and the lifting platform has a self-sustaining drive system, a means shall be provided of releasing the brake. The means shall not be capable of locking the brake in the released position.

Where emergency operation is achieved using a standby power supply, it shall be capable of bringing the carrier carrying the rated load to a boarding point. An electric safety device shall prevent operation of the normal controls. When on emergency electrical operation, the following conditions shall be met.

a) The maximum speed shall not be greater than 0.05 m/s.

b) The controls shall be hold-to-run controls.

The following electric safety devices, where necessary, shall be bridged:

1) slack rope device;

2) emergency stop;

3) safety gear electric safety device and over-speed governor electric safety device;

4) sensitive edges, photo cells or light curtains.

A label in accordance with **10.2.4**, indicating the direction of travel, shall be provided.

6.5 Additional requirements for rack and pinion drive

6.5.1 General

The carrier shall be supported, raised and lowered by means of one or more pinions, meshing with the rack. The drive shall be by means of one or more motors.

Guards or shields shall be provided to prevent the penetration of foreign bodies between each drive or safety pinion and geared rack.

6.5.2 Load distribution

When there is more than one drive pinion in mesh with the rack, then either a self-adjusting means shall be provided to effectively share the loading on each drive pinion, or the drive system shall be provided with a load sharing device so as to accommodate all normal conditions of load distribution between the pinions.

6.5.3 Pinion

The driving pinion shall be designed with a safety factor of not less than 2.0 against the endurance limit for tooth strength. Each pinion shall have a minimum safety factor of 1.4 against the endurance limit for pitting. The safety factors shall be determined after the effects of wear, and fatigue, over the life of the product have been taken into account. Gear teeth shall not be undercut.

6.5.4 Rack

The racks shall be securely attached. Joints in the rack shall be accurately aligned to avoid faulty meshing or damage to teeth.

The rack shall be made of material having properties matching those of the pinion in terms of wear, and shall be designed in accordance with BS ISO 6336, with regard to tooth strength and pitting. If the rack is subjected to a compressive load, a minimum safety factor of 3.0 shall be used in the buckling calculations.

The rack shall have a minimum safety factor of 2.0 against the static limit for tooth strength, using the maximum wear value specified by the manufacturer.

6.5.5 Rack/pinion engagement

Means shall be provided to maintain the rack and all the driving and safety device pinions in correct mesh under no load, half load and full load conditions.

The means shall not rely upon the carrier guide rollers or shoes. The mesh shall be deemed to be correct when the pitch circle diameter of the pinion is coincident with, or not more than one third of, the module beyond the pitch line of the rack.

Means shall be provided to ensure that the width of the rack is always in full lateral engagement with pinion teeth of full form.

The pinion teeth and the rack teeth shall be square to each other in all planes, within a tolerance of ±0.5°.

6.6 Additional requirements for rope and chain suspension drive

6.6.1 General

Rope and chain suspension systems shall have one of the following two methods of drive:

a) drum and ropes; or

b) sprockets and chains.

6.6.2 Ropes and chains

Carriers shall be suspended from either steel wire ropes, or steel chains with parallel links (Galle type) or roller chains.

Ropes shall conform to BS EN 12385-4, and the nominal diameter of the ropes shall be not less than 6 mm.

Chains shall conform to ISO 606.

The safety factor of the suspension ropes shall be not less than 12. The safety factor of the chains shall be not less than 10.

NOTE The safety factor is the ratio between the minimum breaking load, in newtons, of one rope and the maximum force, in newtons, in this rope, when the carrier loaded with its rated load.

There shall be either at least two ropes or at least two chains. The individual ropes or chains shall be independent of each other.

Rope suspension or chain suspension systems shall incorporate an activating device that, in the event of a slack rope or chain, operates an electric safety device conforming to **7.9** that initiates a break in the electrical supply to the motor and brake, and thus prevents any movement of the carrier until the rope or chain is correctly re-tensioned.

6.6.3 Rope/chain terminations

The junction between the rope/chain and the termination shall support at least 80% of the minimum breaking load of the rope/chain.

The ends of the ropes shall be fixed to the carrier and suspension points by means conforming to BS EN 13411.

6.6.4 Pulley, drum and sprocket

The ratio between the pitch diameter of pulleys or drums and the nominal diameter of the suspension ropes shall be not less than 25:1.

The drum shall be helically grooved to match the manufacturer's specification of the ropes used. There shall be only one layer of rope wound on the drum. When the carrier rests on its fully compressed cushioned stops, one and a half turns of rope shall remain in the grooves of the drum. The angle of deflection (fleet angle) of the ropes in relation to the grooves shall not exceed 4°.

All driving sprockets shall be made from metal and shall have a minimum of 16 machine-cut teeth. A minimum of eight teeth shall be engaged. The angle of engagement shall be not less than 140°.

NOTE Generally suitable metals include steel, cast iron or other equivalent malleable and ductile metals/alloys.

Means shall be provided to avoid jamming caused by mis-feeding or slackening of the chains, and to prevent the chains from leaving the sprockets or riding over the teeth of the sprockets.

Guards shall be fitted to prevent trapping hazards between sprocket and chain, or between chain and any other part.

6.6.5 Distribution of load between the ropes or the chains

An automatic device shall be provided for equalizing the tension of suspension ropes or chains.

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

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

6.7 Additional requirements for screw and nut drive

6.7.1 Precautions against free fall and over-speed descent of the carrier

Devices, or combinations of devices and their actuation, shall be provided to prevent an over-speed descent greater than 0.3 m/s.

These devices shall be either:

a) a safety gear and over-speed governor in accordance with **4.12**; or

b) a self-sustaining screw and nut system and a safety nut in accordance with **6.7.2** and **6.7.3**.

6.7.2 Self-sustaining screw and nut system

When a self-sustaining system is tested under free running conditions (i.e. with the brake released), when carrying the minimum static load multiplied by a coefficient of 1.1, the carrier shall decelerate.

6.7.3 Safety nut

An unloaded safety nut shall be provided to carry the load and operate an electric safety device in the event of failure of the driving nut, to provide an equivalent degree of safety to that specified in **4.12.1**. The electric safety device shall conform to **7.**9 and shall remove the power from the motor and brake in the event of failure of the driving nut.

In adverse environmental conditions (see **4.10.2**), the electric safety device shall be protected against the effects of pollution and vibration.

The safety nut shall be designed such that a safety factor of at least 5.0 is guaranteed under rated load, including any dynamic forces that result from a collapsing load-carrying nut and any associated torque conditions.

6.7.4 Drive of the carrier

Screw and nut drives shall be direct acting.

If several screws and nuts are used, the load transmitted to each screw and nut shall be equal.

Mechanical fixings shall be provided to prevent separation of sections of a multiple section screw column. Joints in the screw shall be accurately aligned to avoid faulty meshing or damage to the nuts.

Screws and their joints in tension shall be designed such that a safety factor of at least 5.0 is guaranteed under minimum static load, the carrier weight and maximum torque conditions.

Screws and their joints in compression shall be designed on the maximum length of the screw such that a safety factor of at least 3.0 against buckling is guaranteed, when a load is imposed of the minimum static load plus the carrier weight.

The load-carrying nut shall have a hardness less than or equal to that of the mating screw.

The load-carrying nut shall be readily accessible for inspection and the measurement of its wear.

The load-carrying nut shall be designed such that, at state of maximum wear, a safety factor of at least 5.0 is guaranteed under rated load and torque conditions.

The safety nut and its connection to the load-carrying nut shall be designed such that a safety factor of at least 5.0 is provided under rated load and torque conditions, including dynamic forces caused by collapsing load-carrying nut.

In case of a lifting platform, with compressive loads on the screw, the connection between the carrier and the nut(s) shall be self-aligning.

The load nut shall be mechanically fixed to the carrier to prevent separation.

6.8 Additional requirements for hydraulic drive

6.8.1 General provisions

Hydraulic drives shall be either direct acting or indirect acting.

If several hydraulic cylinders are used to raise the carrier, they shall be hydraulically connected to ensure pressure equilibrium.

Indirect acting hydraulic drives shall have suspension ropes or chains conforming to **6.6**.

6.8.2 General requirements for hydraulic cylinders

Hydraulic cylinders (ram assemblies, jacks) shall be calculated in accordance with BS EN 81-2:1998+A3, Annex K to meet the following requirements.

a) A safety factor of at least 1.7 (referred to the proof stress $R_{P0.2}$) shall be provided when the cylinder and ram are subjected to forces resulting from a pressure equal to 2.3 times the full load pressure.

b) For the calculation[1)] of the elements of telescopic hydraulic cylinders with synchronizing means, the full load pressure shall be substituted by the highest pressure that occurs in an element due to the hydraulic synchronizing means.

c) In the thickness calculations, a value shall be added of 1.0 mm for cylinder walls and cylinder bases, and 0.5 mm for walls of hollow rams for single and telescopic hydraulic cylinders.

d) Hydraulic cylinders under compressive loads, when in their fully extended position, and under the forces resulting from a pressure equal to 1.4 times full load pressure, shall have a safety factor of at least 2.0 against buckling.

e) A safety factor of at least 2.0 (referred to the proof stress $R_{P0.2}$) shall be provided when hydraulic cylinders are under tensile loads resulting from a pressure equal to 1.4 times the full load pressure.

f) The design of the stop shall be such that the average retardation of the carrier does not exceed 1.0 g_n and, in the case of an indirect acting lifting platform, that the retardation does not result in the rope or chain becoming slack.

1) Abnormally high pressure conditions can sometimes arise during installation because of incorrect adjustment of the hydraulic synchronizing means. This should be taken into account.

Hydraulic cylinders shall meet the following additional requirements.

1) A means shall be provided to stop the ram at the end of its stroke.

2) If a hydraulic cylinder extends into the ground it shall be installed in a protective tube. If it extends into other spaces it shall be protected against damage. The hydraulic cylinder shall be installed in such a way that it can be easily inspected for corrosion.

3) In the same manner as for item 2), the following items shall be protected:

   i) rupture valve(s)/restrictor(s);

   ii) rigid pipes connecting a rupture valve(s)/restrictor(s) with the cylinder;

   iii) rigid pipes connecting rupture valve(s)/restrictor(s) with each other.

4) The hydraulic cylinder shall be provided with an air-venting device, if required.

6.8.3 Connection carrier/ram (hydraulic cylinder)

For a direct acting lifting platform, except scissor mechanism drives, the connection between the carrier and the hydraulic cylinder shall be such as to ensure that all the forces are axially applied. The connection means shall be secure.

For an indirect acting lifting platform and scissor mechanism drives, the head of the ram (cylinder) shall be guided, except for pulling hydraulic cylinders, where the pulling arrangement prevents bending forces on the ram. No parts of the ram head guiding system shall be incorporated within the vertical projection of the carrier.

6.8.4 Telescopic hydraulic cylinders

Telescopic hydraulic cylinders shall meet the requirements below, in addition to the general requirements for hydraulic cylinders specified in **6.8.2**.

Stops shall be provided between successive sections to prevent the rams from leaving their respective cylinders.

The length of the bearing of each section of a telescopic hydraulic cylinder without external guidance shall be not less than 2.0 times the diameter of the respective ram.

Telescopic hydraulic cylinders shall be provided with mechanical or hydraulic synchronizing means.

When ropes or chains are used as synchronizing means, the following requirements shall be met.

a) There shall be at least two independent ropes or chains.

b) Guards shall be fitted to prevent trapping hazards between pulleys and sprockets.

c) The safety factor (see Note) shall be not less than:

   1) 12 for ropes;

   2) 10 for chains.

   NOTE The safety factor is the ratio between the minimum breaking load in newtons (N) of one rope (or chain) and the maximum force in this rope (or chain).

The maximum force shall be calculated using the following data:

i) the force resulting from the full load pressure;

ii) the number of ropes (or chains);

d) A device shall be provided which prevents the speed of the carrier in downward movement exceeding the rated speed downward, v_d, by more than 0.15 m/s in the event of failure of the synchronizing means.

6.8.5 Piping

6.8.5.1 General

All hydraulic system components, piping and fittings that are subject to pressure shall:

a) be appropriate to the hydraulic fluid used;

b) be protected against damage during installation, e.g. any abnormal stress due to fixing, torsion or vibration;

c) be protected against damage, in particular of mechanical origin.

Pipes and fittings shall be appropriately fixed and accessible for inspection.

If pipes (either rigid or flexible) pass through walls or floors, they shall be protected by means of ferrules. The dimensions of the ferrules shall be such as to allow the dismantling, if necessary, of the pipes for inspection.

No coupling shall be sited inside a ferrule.

6.8.5.2 Rigid pipes

Rigid pipes and fittings between the cylinder and any of the following shall be calculated in accordance with BS EN 81-2:1998+A3, Annex K:

a) the non-return valve;

b) the down direction valve(s);

c) the rupture valve.

In the thickness calculations, a value shall be added of 1.0 mm for the connection between the cylinder and the rupture valve, if any, and 0.5 mm for the other rigid pipes.

When telescopic hydraulic cylinders with more than two stages and hydraulic synchronizing means are used, an additional safety factor of 1.3 shall be taken into account for the calculation of the pipes and fittings between the rupture valve (where fitted) and the non-return valve or the down direction valve(s).

6.8.5.3 Flexible hoses

The flexible hose between cylinder and non-return valve or down direction valve shall have a safety factor of at least 8.0 (full load pressure/bursting pressure).

The flexible hose and its couplings between cylinder and non-return valve or down direction valve shall withstand, without damage, a test pressure of five times full load pressure.

The flexible hose shall be marked in an indelible manner with:

a) the name of the manufacturer or the trade mark;

b) the test pressure;

c) the date of the test.

The flexible hose shall be fixed with a bending radius not less than that specified by the hose manufacturer.

6.8.6 Stopping the machine and checking its stopped condition

An electrical safety device shall be provided that will enable the machine to be stopped. The device shall be controlled as follows.

a) For upward motion, the supply to the electric motor shall be interrupted by at least two independent contactors, the main contacts of which shall be in series in the motor supply circuit.

b) For downward motion, the supply to the down direction valve(s) shall be interrupted either:

   1) by at least two independent electrical devices connected in series; or

   2) directly by the electrical safety device.

If one of the main contacts of a contactor or one of the electrical safety devices has not opened whilst the carrier is stationary, a further start shall be prevented.

6.8.7 Hydraulic control and safety devices

6.8.7.1 Hydraulic circuit isolation

Means shall be provided to isolate the hydraulic cylinder from the non-return valve and the down direction valve(s).

6.8.7.2 Non-return valve

A non-return valve shall be provided. It shall be installed in the circuit between the pump(s) and the shut-off valve.

The non-return valve shall be capable of holding the carrier with the minimum static load at any point in its travel when the supply pressure drops below the minimum operating pressure.

The closing of the non-return valve shall be effected by the pressure from the hydraulic cylinder and by either at least one guided compression spring, or by gravity, or by spring(s) and gravity.

6.8.7.3 Pressure relief valve

A pressure relief valve shall be provided. It shall be connected to the circuit between the pump(s) and the non-return valve. The hydraulic fluid shall be returned to the tank.

The pressure relief valve shall normally be adjusted to limit the pressure to a maximum of 140% of the full load pressure. Where there are high internal losses (head loss, friction), the pressure relief valve may be set to a greater value, but shall not exceed 170% of full load pressure. In the latter case, for the calculations of the hydraulic equipment (including hydraulic cylinder), a fictitious full load pressure equal to the following shall be used:

$$\frac{\text{Selected pressure setting}}{1.4}$$

In the calculations required by **6.8.2**d), the over-pressure factor of 1.4 shall then be replaced by a factor corresponding to the increased setting of the pressure relief valve.

6.8.7.4 Down direction valve

Down direction valves shall be held open electrically. Their closing shall be effected by the pressure from the hydraulic cylinder and by at least one guided compression spring per valve.

6.8.8 Protection against hydraulic system failure

One of the following three protection methods shall be used.

a) **Rupture valve**, fitted directly to the cylinder outlet, which in the event of failure of any part of the hydraulic circuit, excluding the hydraulic cylinder, shall arrest the descent of the carrier. The rupture valve shall be:

1) integral with the cylinder; or

2) directly and rigidly flange mounted; or

3) placed close to the cylinder and connected to it by means of short rigid pipes, having welded, flanged or threaded connections; or

4) connected directly to the cylinder by threading. In this case, the rupture valve shall be provided with a thread ending with a shoulder, which shall butt up against the cylinder.

NOTE 1 Other types of connections such as compression fittings or flared fittings are not permitted between the cylinder and the rupture valve.

The rupture valve shall be capable of stopping the carrier in downward movement, and keeping it stationary. The rupture valve shall be tripped at the latest when the speed reaches a value equal to rated speed downward, v_d, plus 0.15 m/s.

Rupture valves shall be selected to be compatible with the same pressure and flow parameters as those used for the cylinder.

The rupture valve shall meet the requirements of BS EN 81-2:1998+A3, **F.7**.

b) **Combination of restrictor, down direction valve and non-return valve**, which in the event of failure of any part of the hydraulic circuit (excluding the hydraulic cylinder) shall prevent the downward speed of the carrier with rated load exceeding the rated speed. In addition, if an emergency stop or safety edge is operated, it shall arrest the descent of the carrier.

All three devices shall be:

1) integral with the cylinder; or

2) directly and rigidly flange mounted; or

3) placed close to the cylinder and connected to it by means of short rigid pipes, having welded, flanged or threaded connections.

NOTE 2 Other types of connections such as compression fittings or flared fittings are not permitted between the cylinder and the devices.

c) **Restrictor**, fitted directly to the cylinder outlet, which in the event of failure of any part of the hydraulic circuit (excluding the hydraulic cylinder) shall prevent the downward speed of the carrier with rated load from exceeding the rated speed. The restrictor shall be:

1) integral with the cylinder; or

2) directly and rigidly flange mounted; or

3) placed close to the cylinder and connected to it by means of short rigid pipes, having welded, flanged or threaded connections; or

4) connected directly to the cylinder by threading. In this case, the restrictor shall be provided with a thread ending with a shoulder, which shall butt up against the cylinder.

NOTE 3 Other types of connections such as compression fittings or flared fittings are not permitted between the cylinder and the restrictor.

6.8.9 Filters

In the circuit between the tank and the pump(s), and in the circuit between the shut-off valve and the down direction valve(s), filters or similar devices shall be installed. The filter or similar device between the shut-off valve and the down direction valve shall be accessible for inspection and maintenance.

6.8.10 Checking the pressure

A pressure gauge point shall be provided. It shall be connected to the circuit between the non-return valve or the down direction valve(s) and the shut-off valve.

If a pressure gauge is permanently fitted, a shut-off valve shall be provided between the main circuit and the connection for the pressure gauge.

The connection shall be provided with an internal thread of either M 20 × 1.5 or G 1/2 in.

6.8.11 Tank

The tank shall be designed and constructed to facilitate:

a) the checking of the level of the hydraulic fluid in the tank;

b) the filling and draining of the hydraulic fluid.

6.8.12 Emergency operation

*NOTE See also **6.4.1**.*

6.8.12.1 Moving the carrier downwards

The lifting platform shall be provided with a manually operated emergency lowering device allowing the carrier, even in the case of a power failure, to be lowered to a level where the user can leave it.

The speed of the carrier shall not exceed 0.08 m/s or the rated speed, whichever is the lower.

The operation of the device shall require a continual manual force, and the device shall be so constructed to avoid accidental operation when not in use.

In the case of indirect acting lifting platforms where a slack rope (or chain) condition can occur, manual operation shall not cause the sinking of the ram beyond that causing the slack rope/chain.

In the case of a direct acting hydraulic lifting platform, where there is no access possible under the carrier, the emergency lowering device may be operated either on or off the carrier.

NOTE When the emergency lowering device is fitted on the carrier, this permits persons being transported to lower the carrier in an emergency, in order to undertake a self rescue.

When the emergency lowering device is located on the carrier and where the lifting height is greater than 1.0 m, it shall be possible to operate the emergency lowering device from outside the carrier.

6.8.12.2 Moving the carrier upwards

A hand-pump which causes the carrier to move in the upwards direction shall be permanently installed for every lifting platform whose carrier is fitted with a safety gear or a clamping device.

The hand-pump shall be connected to the circuit between the non-return valve or down direction valve(s) and the shut-off valve.

The hand-pump shall be equipped with a pressure relief valve set to limit the system pressure to 2.3 times the full load pressure.

6.8.13 Electrical anti-creep system/re-levelling

An electrical anti-creep/re-levelling system shall be provided, which shall level the carrier to not more than ±20 mm at boarding points.

Re-levelling and the anti-creep function shall operate only in the unlocking zone of the corresponding boarding point, with the gate open or closed.

The anti-creep switching device shall be an electrical safety contact conforming to **7.9.2** or electrical safety device conforming to **7.9**.

The carrier shall not be able to move with boarding point gates open unless all of the following conditions are met.

a) All movement of the carrier outside the unlocking zone is prevented by at least one switching device mounted in the bridge or shunt of the gate and lock electric safety devices.

b) This switching device is either:

   1) an electrical safety contact conforming to **7.9.2**; or

   2) connected in such a way as to meet the requirements for safety circuits specified in **7.9**.

c) If the operation of the switches is dependent upon a device which is indirectly mechanically linked to the carrier, e.g. by rope, belt or chain, the breaking of or slackening in the connecting link causes the machine to stop through the action of an electric safety device conforming to **7.9**.

7 Electrical equipment

7.1 Power supply

Except for battery-operated lifting platforms, the power supply shall be dedicated and protected by an RCD conforming to BS 7671. Socket outlets shall conform to BS 7671.

7.2 Conductors of different circuits

Conductors shall conform to BS EN 60204-1:2006+A1, **13.1.3**.

7.3 Insulation resistance of the electrical installation

The insulation resistance, when measured between each live conductor and earth, shall be not less than the value given in Table 3 for the appropriate nominal circuit voltage.

Table 3 **Insulation resistance**

Nominal circuit voltage V	**Test voltage (d.c.)** V	**Insulation resistance** MΩ
SELV	250	≥0.25
≤500	500	≥0.5
>500	1 000	≥1.0

When the circuit includes electronic devices, phase and neutral conductors shall be connected together during measurement.

7.4 Drive contactors

Contactors (as required in **7.5**) shall meet the requirements for one of the following categories as specified in BS EN 60947-4-1:2010:

a) utilization category AC-3 for contactors for a.c. motors; and

b) utilization category DC-3 for contactors for d.c. motors.

If relays are used to operate the main contactors, those relays shall meet the requirements for one of the following categories as specified in BS EN 60947-5-1:2004+A1:

1) AC-15 for relays controlling a.c. contactors;

2) DC-13 for relays controlling d.c. contactors.

Each contactor shall operate such that:

i) if one of the "break" contacts (i.e. normally closed) is closed, then all the "make" contacts are open; and

ii) if one of the "make" contacts (i.e. normally open) is closed, all the "break" contacts are open.

Contactors for reversing the direction of travel shall be electrically interlocked.

7.5 Motor and brake supply

Where motors and/or any brakes are controlled and supplied by solid-state elements, one of the following control methods shall be used:

a) a system whereby the supply to the motor and any brake is interrupted by two independent contactors, the contacts of which are in series in the motor and any brake supply circuits. If, whilst the carrier is stationary, one of the contactors has not opened the main contacts, further movement of the carrier shall be prevented at the latest at the next change in the direction of motion; or

b) a system consisting of:

   1) a contactor interrupting the current at all poles;

   2) an independent control device blocking the flow of energy in the static elements;

   3) a monitoring device to verify the blocking of the flow of energy each time the carrier is stationary.

If, during a normal stopping period, the blocking of the flow of energy in the static elements fails, the monitoring device shall cause the contactor to release, and any further movement of the carrier shall be prevented at the latest at the next call registration for a change in the direction of motion.

The electrical supply to the drive motor and brake shall be interrupted following the termination of a direction control signal, or following the failure of the electrical supply, or upon the operation of any electric safety device.

7.6 Enclosure requirements and electrical creepage and clearance distances

The live parts of controllers and electrical safety contacts shall be located within a protective enclosure providing ingress protection of at least IP2X as specified in BS EN 60529:1992.

Covers shall be retained by clamping devices requiring the use of a tool for their removal.

Heating or cooling means shall be used to ensure that any electronic components contained in the enclosure operate in the ambient temperature range specified by the manufacturer.

Where an enclosure containing control equipment is fixed to a building surface, the requirements specified in BS EN 60204-1:2006+A1, **6.2.2** shall be met.

Electrical creepage and clearance distances for the following circuits and components shall conform to BS EN 60947-1:2007, Table 15, in accordance with the working voltage and BS EN 60947-1:2007, **3.2**:

a) power circuits;

b) safety circuits;

c) any components connected after safety circuits or electrical safety contacts, the failure of which would cause an unsafe condition.

The minimum pollution degree shall be taken as 2 and the printed wiring material column in the table shall not be used.

7.7 Electromagnetic compatibility

The electromagnetic compatibility shall conform to BS EN 12015 and BS EN 12016.

7.8 Protection against electrical faults

If any fault, or combination of faults, occurs that can lead to a dangerous situation, the carrier shall be stopped, at the latest, at the next operating sequence.

When tested by means of simulation, any single applicable fault listed below, occurring in the electrical equipment of the lifting platform, shall not, on its own, cause any loss of function of the lifting platform such as to cause a dangerous situation:

a) absence of voltage;

b) voltage drop;

c) phase reversal on multi-phase supplies;

d) insulation fault between an electrical circuit and metalwork or earth;

e) short circuit or open circuit, change of value or function in an electrical component such as, for example, resistor, capacitor, transistor or lamp;

f) non-attraction, or incomplete attraction, of the moving armature of a contactor or relay;

g) non-separation of the moving armature of a contactor or relay;

h) non-opening or non-closing of a contact;

i) loss of continuity of a conductor.

NOTE The non-opening of an electrical safety contact need not be considered.

The earthing of an energized circuit, in which there is an electric safety device, shall cause the immediate halt and prevent restarting of the lifting platform.

7.9 Electric safety devices

7.9.1 General provisions

When tested in accordance with BS EN 81-1:1998+A3, Annex H, electric safety devices that contain electronic components shall meet the pass criteria specified in that annex.

During operation of an electric safety device, movement of the carrier shall be prevented or it shall be caused to stop immediately.

NOTE A list of appropriate electrical safety devices includes those given in Table 4.

Table 4 **Electrical safety devices**

Devices	Relevant subclause
Safety gear device	**4.12.1.5**
Over-speed governor	**4.12.2.1**
Slack rope and chain safety device	**6.6**
Screw/nut drive failure device	**6.7.3**
Electrical anti-creep device	**6.8.13**
Final limit switch	**7.9.5**
Boarding point stopping switch	**7.9.5**
Gate locking safety device for closed position of boarding point gates	**8.7**
Devices operated by sensitive edges, surfaces, photo cells or light curtains	**9.9.2**

The electric safety devices shall consist of either:

a) one or more electrical safety contacts conforming to **7.9.2**, directly cutting the supply to the contactors referred to in **7.4** or their relay-contactors; or

b) safety circuits consisting of one or more electrical safety contacts conforming to **7.9.2**, not directly cutting the supply to the contactors referred to in **7.4** or their relay-contactors.

The gate locking safety device shall meet the requirements specified in BS EN 81-1:1998+A3, **F.1**.

Except where explicitly permitted (see **6.8.13** and **9.9.2**), no electric equipment shall be connected in parallel with an electric safety device.

Connections to different points of the electric safety chain shall be permitted only for gathering information. The monitoring devices used for that purpose shall fulfil the requirements for safety devices.

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

An output signal emanating from an electric safety device shall not be altered by an extraneous signal emanating from another electric device placed further down the same circuit.

Devices which record or delay signals shall not, even in the event of a fault, prevent the stopping of the machine through the functioning of an electric safety device.

The construction and arrangement of the internal power supply units shall not alter the output signals of the electric safety devices due to the effects of switching.

7.9.2 Electrical safety contacts

The operation of an electrical safety contact shall be by positive separation of the circuit-breaking devices. This separation shall occur even if the contacts have welded together.

NOTE The opening of the electrical safety contact is achieved when all the contact-breaking elements are brought to their open position.

During at least the last 50% of the opening travel, there shall be no resilient members (e.g. springs) between the moving contacts and the part of the actuator to which the actuating force is applied.

The electrical safety contacts shall be provided for a rated insulation voltage of 250 V if the enclosure provides a degree of ingress protection of at least IP 4X as specified in BS EN 60529:1992, or 500 V if the degree of protection of the enclosure is less than IP 4X.

The electrical safety contacts shall meet the requirements for one of the following categories as defined in BS EN 60947-5-1:2004+A1:

a) AC-15 for safety contacts in a.c. circuits;

b) DC-13 for safety contacts in d.c. circuits.

If the degree of protection is equal to or less than IP4X, the clearances shall be at least 3 mm, the creepage distances at least 4 mm and the distances for breaking contacts at least 4 mm after separation. If the protection is better than IP4X, the creepage distance may be reduced to 3 mm.

In the case of multiple breaks, the distance after separation between the contacts shall be at least 2 mm.

7.9.3 Operation of electric safety devices

When operating to ensure safety, an electric safety device shall prevent the setting in motion of the machine or immediately initiate its stopping.

The electric safety devices shall act directly on the equipment controlling the supply to the machine in accordance with **7.5**.

If relays are used to control the main contactors that are used to control the machine, these shall be the relays directly controlling the supply to the machine for starting and stopping.

7.9.4 Actuation of electric safety devices

If the devices for actuating electric safety devices are through the nature of their installation accessible to persons, they shall be so built that these electric safety devices cannot be rendered inoperative by a single bridge piece.

7.9.5 Boarding point stopping devices, final limit electric safety devices and mechanical stops

Boarding point stopping devices and final limit safety switches shall be provided (but see Notes 1 and 2).

A boarding point stopping device shall be provided to stop the carrier at the boarding point under normal operation (see **6.8.13**).

In the event of over-travel, the opening of the final limit safety device in accordance with **7.9** shall prevent further movement under power of the carrier in both directions of travel. It shall operate at the latest before the end of the unlocking zone. The return to service of the lifting platform shall not occur automatically.

Where a mechanical stop is not provided, the boarding point stopping device shall be a safety device in accordance with **7.9**.

NOTE 1 The lower final limit electric safety device may be omitted in the case of hydraulic drives or those drives incorporating slack rope or slack chain electric safety devices. In addition, the lower final limit electric safety devices may be omitted when the design of the drive system is such that over-travel beyond the normal limits of travel is not possible, even without the use of mechanical end stops.

NOTE 2 The lower final limit electric safety device may be omitted if the lower boarding point stopping device is an electric safety device and if bottom over-travel results in operation of the underside electric safety devices of the carrier.

Mechanical stops shall be designed to withstand an impact at rated speed whilst carrying a load of 1.1 times the rated load.

7.10 Protection of the driving motor

Driving motors shall be protected against overloading and potentially damaging excess currents by means of a device that automatically disconnects the supply.

NOTE The device may automatically reset after an appropriate interval.

Where protection is provided by means of a temperature-monitoring device, the carrier may continue in operation to a normal stop at a boarding point in order to allow the user to leave the carrier. An automatic return to normal operation of the lifting platform shall occur only after the equipment has cooled to be within the manufacturer's specified temperature range.

7.11 Electrical wiring

The cross-sectional area of conductors shall conform to BS EN 60204-1:2006+A1, **12.4**.

Insulation shall conform to BS EN 60204-1:2006+A1, **13.1.3**. All exposed metalwork, other than conductors, shall be earth bonded.

Trailing electrical power and control cables shall be securely clamped at each end to ensure that no mechanical load is transmitted to cable terminations. Flat cables shall be constructed in accordance with BS EN 50214.

Connectors and devices of the plug-in type shall be protected by position or design against accidental misconnection.

Terminals, connectors and electrical components shall be marked with a means of identification conforming to BS EN 60204-1:2006+A1.

7.12 Additional requirements for battery-powered supply

For battery-powered lifting platforms, the control circuit voltage shall not exceed 60 V.

A fuse shall be fitted in line with the battery supply near the negative pole of the battery, which shall be accessible only by the use of a tool(s). This fuse shall isolate the battery supply within 0.5 s of the supply being short-circuited and within 5 s of twice-average peak current being drawn.

The charging arrangement for the batteries shall be as shown in Figure 3a) for a.c. charging and Figure 3b) for d.c. charging. The maximum voltage potential when measured with respect to earth shall be in accordance with BS EN 60204-1:2006+A1, **6.2**.

Battery terminals and charge contacts shall be physically protected against short-circuiting.

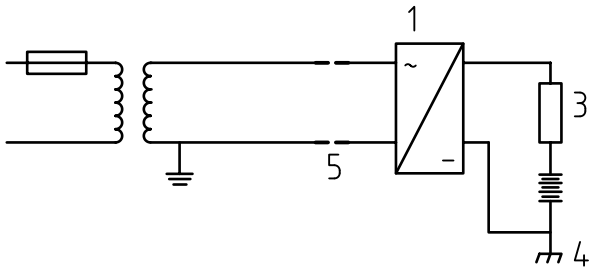
A secure location or fixing for the batteries shall be provided.

A means to isolate the battery shall be provided, which shall isolate the control and drive motor circuits.

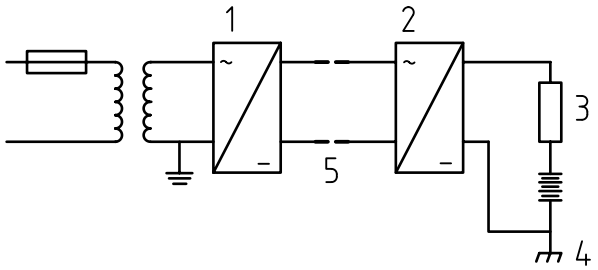
The carrier shall be earthed as shown in Figure 3.

Batteries shall be provided in leak-proof enclosures and shall not emit fumes during normal operation, including charging.

Figure 3 **Charging supply for battery-powered lifting platforms**



a) a.c. charge contacts



b) d.c. charge contacts

Key

1 a.c. – d.c. converter

2 d.c. – d.c. converter

3 Control circuit 60 V max.

4 The ⏚ symbol denotes that the negative side of the battery supply is connected to the chassis of the lifting platform

5 Charge contacts

NOTE Earthing is not required on SELV-protected charging circuits.

7.13 Control devices

NOTE Recommendations for the provisions and use of specially adapted control devices, switches and sensors are given in Annex C.

7.13.1 Push button control devices

Where push button control devices are used, they shall meet the requirements given in Table 5.

7.13.2 Joystick control devices

Where joystick control devices are used, they shall meet the requirements given in Table 6.

7.13.3 Rocker switch control devices

Where rocker switch control devices are used, they shall meet the requirements given in Table 7.

Table 5 **Push button control devices**

Element	Requirement
Minimum area of the active part of the button	Inscribed circle with a diameter of 20 mm
Identification of active part of button	Identifiable visually and by touch from faceplate or surrounds
Identification of faceplate	Colour to contrast with its surrounds
Operating force (see **C.3**)	1.0 N to 5.0 N (or shielded touch controls)
Position of symbol	On the active part (or 10 mm to 15 mm left of it)
Minimum size of symbol and/or text	Upper case 10 mm; lower case (x-height) 7 mm
Minimum separation between active parts of buttons	10 mm
Height of any control button from the floor level (see Annex B)	Wheelchair users only: 300 mm to 900 mm Wheelchair and ambulant users: 900 mm to 1 100 mm
Minimum lateral space from the centre line of any buttons to a corner in the carrier or outside the boarding point	400 mm

Table 6 **Joystick control devices**

Element	Requirement
Identification of faceplate/position of joystick	Colour to contrast with its surrounds
Operating force (see **C.3**)	2.5 N to 5.0 N
Position of symbol	Within 50 mm of the joystick
Minimum size of symbol and/or text	Upper case 10 mm; lower case (x-height) 7 mm
Minimum separation between joystick and any other button or control device	40 mm
Height of joystick from the floor level (see Annex B)	Wheelchair users only: 300 mm to 900 mm Wheelchair and ambulant users: 900 mm to 1 100 mm
Minimum lateral space from the centre line of the joystick to a corner in the carrier or outside the boarding point	400 mm

Table 7 **Rocker switch control devices**

Element	Requirements
Identification of faceplate/position of rocker switch	Colour to contrast with its surrounds
Operating force (see **C.3**)	2.5 N to 5.0 N
Position of symbol	Preferably on active part (or 10 mm to 15 mm left of it)
Minimum size of symbol and/or text	Upper case 10 mm; lower case (x-height) 7 mm
Minimum distance between rocker switch and any other button or control device	10 mm
Height of rocker switch from the floor level (see Annex B)	Wheelchair users only: 300 mm to 900 mm Wheelchair and ambulant users: 900 mm to 1 100 mm
Minimum lateral space from the centre line of the rocker switch to a corner in the carrier or outside the boarding point	400 mm

7.13.4 Cable-less controls

A cable-less control system shall control only a single lifting platform. The control system shall not respond to signals from another lifting platform or other similar cable-less control system.

NOTE This can be achieved, for example, by the use of an appropriate frequency spectrum, coded signals and range.

Where lifting platforms are installed in public buildings, the cable-less control system shall be in a fixed position in order that it cannot be removed.

The cable-less communication link shall be designed so as to be fail-safe in the event of signal failure.

8 Liftways

8.1 Liftway floor

The liftway floor shall be able to support a loading of at least 250 kg/m^2.

8.2 Top clearances

The vertical clearance between the floor of the carrier and the lowest parts of overhead obstacles shall be not less than 2.0 m when the carrier is in contact with the final limit switch or the upper mechanical stop.

8.3 Adjacent surfaces

For adjacent surfaces 10 mm or less from any part of the carrier, any projections on the surfaces shall be as follows (see Figure 4):

a) if they include projections up to 1.5 mm, they may have square corners;

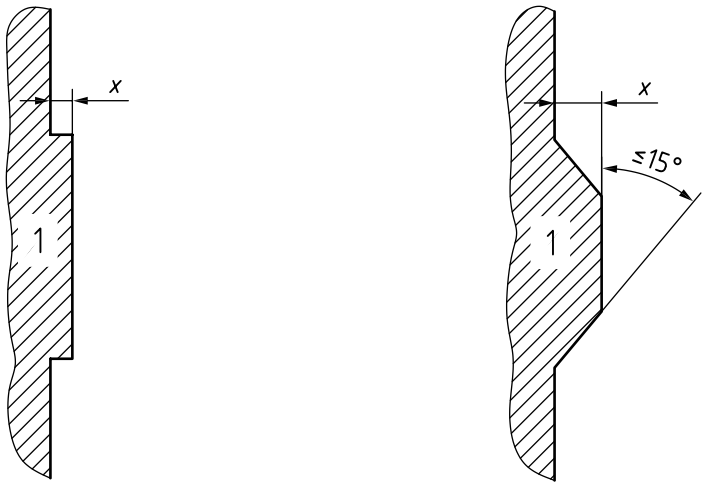
b) if they include projections from 1.5 mm up to 5 mm, they shall have a minimum of 15° vertical chamfers on all edges.

Adjacent surfaces greater than 10 mm and less than 100 mm from the carrier shall have a sensitive edge, photo cell or light curtain located along any affected sides.

NOTE There is a risk of crushing if the part of the structure is less than 100 mm to an adjacent surface.

Figure 4 **Dimensions of permissible projections on adjacent surfaces**

Dimensions in millimetres



a) Projections (x) ≤1.5 mm b) Projections (x) from 1.5 mm up to 5 mm

Key

1 Door surface of enclosure wall

Adjacent surfaces greater than 100 mm and less than 300 mm from the carrier, which do not form a continuous vertical surface, shall have a sensitive edge, photo cell or light curtain located along any affected sides.

8.4 Inspection doors and traps

If any inspection doors and/or traps are provided, they shall not obstruct the travel of the carrier, when in the open position. They shall be capable of being opened only with the aid of a key or a tool.

8.5 Liftway entrances

The gate shall extend to a height of not less than 1.1 m above the floor of the upper boarding point level.

8.6 Construction of boarding point gates

Boarding point gates shall be a minimum of 800 mm wide, shall require a force less than 30 N to open and shall be provided with a vision panel when over 1.1 m high. They shall not open into the liftway.

During any loss of the normal power supply, it shall be possible to close any power-operated gates manually.

Any glazing materials used in boarding point gates shall conform to **9.8**.

Any perforate gaps that are under, over, at any side or between the boarding point gates above and below the maximum travel of the carrier floor shall not have a gap with a width greater than 10 mm.

Gates shall have a mechanical strength such that in the locked position and when a force of 300 N, being evenly distributed over an area of 500 mm^2 in round or square section, is applied at right angles to the panel at any point on either face, they are able to resist that force:

a) without permanent deformation; and

b) without elastic deformation greater than 15 mm.

8.7 Boarding point gate unlocking zone

It shall not be possible in normal operation to open a boarding point gate when the carrier is more than 50 mm from the boarding point level of that gate.

It shall not be possible to make the lifting platform start or continue in motion with a boarding point gate unlocked when the carrier is more than 50 mm from the boarding point level of that gate.

8.8 Boarding point locking devices

It shall not be possible to make the carrier start or continue in motion with a boarding point gate open. The closed position shall be detected by an electric safety device conforming to **7.9**.

An electric safety device conforming to **7.9** shall be provided to detect whether the locking elements are engaged.

The connection between one of the contact elements which opens the circuit and the device which mechanically locks shall be positive and fail-safe, but adjustable if necessary.

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

It shall not be possible for unlocking to occur under the effect of gravity in the event of the spring no longer fulfilling its function.

The locking device shall be protected against the ingress of solids to IP5X as specified in BS EN 60529:1992.

Boarding point locking devices shall have a mechanical strength such that in the locked position and when a force of 3 000 N is applied horizontally at right angles to either side of the closing edge of the gate, it shall be able to resist that force:

a) without any reduction of the effectiveness of the lock and its fixings;

b) without elastic deformation greater than 15 mm;

c) without permanent deformation.

The gate shall remain operational after the force is removed.

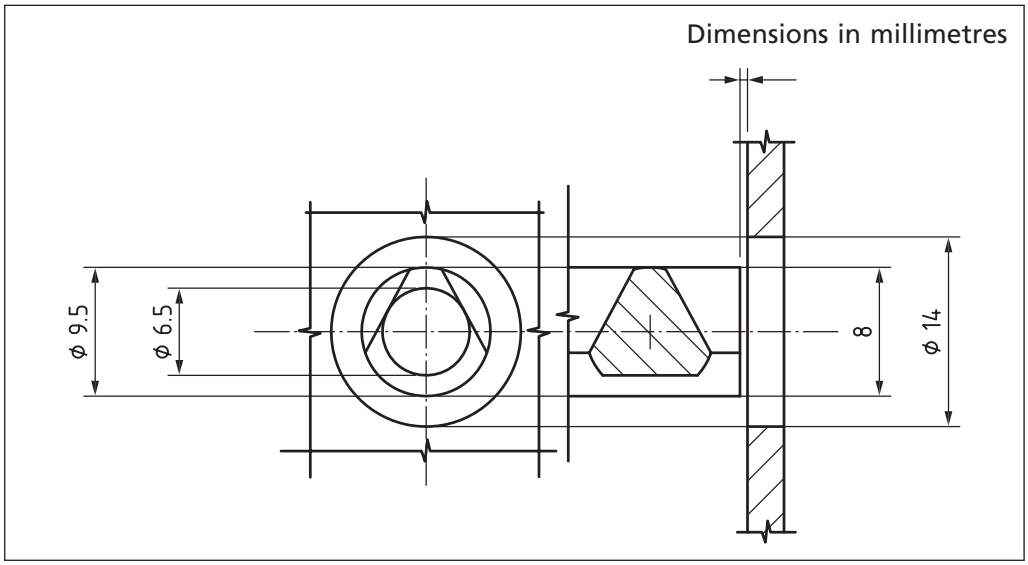
Locks on boarding point gates shall be located at, or close to, the closing edge of the gate and shall continue to lock effectively in the event of the gate sagging.

The locking devices shall be designed and situated to be inaccessible from both the outside and the inside when in normal use.

8.9 Boarding point gate emergency unlocking

It shall be possible to unlock each boarding point gate from the outside with the aid of a key or a tool specified by the manufacturer, e.g. such as that to fit the unlocking triangle shown in Figure 5. After emergency opening, it shall be possible to close and lock the gates without the use of a tool.

Figure 5 **Unlocking triangle**



8.10 Protection during boarding point gate operation

The effort needed to resist movement of a power-operated gate shall not exceed 150 N, as measured at its leading edge.

The kinetic energy of any power-operated gate and of the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed, shall not exceed 10 J.

To allow users to enter and leave the carrier unhindered, the door dwell time shall initially be set to 5 s. The control system shall allow the door dwell time to be adjustable between 2 s and 20 s. The means of the adjustments shall not be accessible to users.

8.11 Bridging steps

8.11.1 General

Where bridging steps are used, landing gates shall not be provided.

*NOTE Bridging step systems are designed for use in dwellings only. An example of a bridging system is shown in Figure 6. See also **9.10** regarding the carrier construction of lifting platforms for the personal use of trained persons.*

8.11.2 Construction of bridging steps

Bridging steps shall have:

a) any rise between 155 mm and 220 mm with any going between 245 mm and 260 mm;

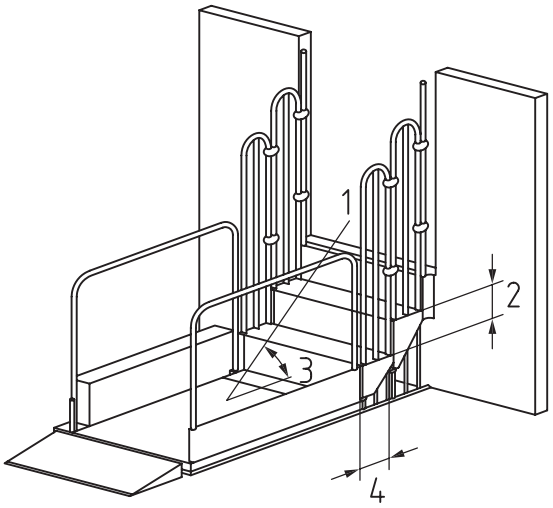
b) a maximum pitch of 42°;

c) level treads.

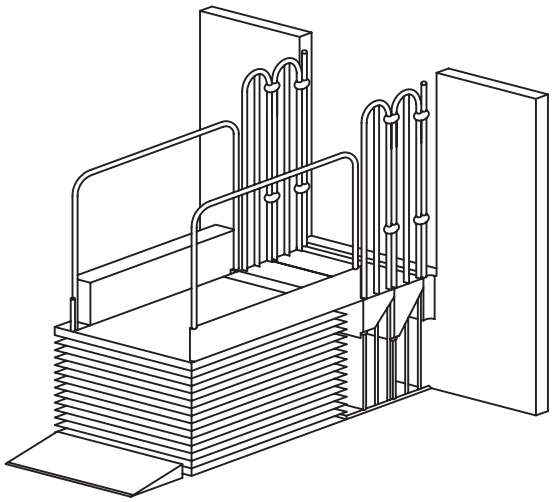
8.11.3 Guarding of step treads

Step treads shall be guarded at the sides where there is a travel greater than 500 mm. The guarding shall be 900 mm high, measured vertically from the pitch line, and shall not allow a 100 mm sphere to pass through any openings in the guarding.

Figure 6 **Example of bridging steps**



a) Lowered position



b) Raised position

Key

1 Pitch line
2 Rise
3 Pitch
4 Going

9 Carrier construction

9.1 Protection of access sides

A carrier gate/barrier shall be provided to the lower level access sides of the carrier, with dimensions as follows.

a) For travels up to 1 000 mm, the carrier gate/barrier shall be 900 mm to 1 100 mm high and shall comprise an intermediate bar and a kick plate 100 mm high above the carrier floor.

b) For travels over 1 000 mm, the carrier gate/barrier shall be not less than 1 100 mm high, and shall have a kick plate 100 mm high above the carrier floor, which shall not allow a 100 mm sphere to pass through any openings in the guarding.

Carrier gates/barriers shall be able to withstand the application of a force of 300 N, acting at right angles at any point and any directions over an area of 500 mm^2 (of round or square section) without any permanent deformation.

Carrier/barrier locking shall conform to **8.7** and **8.8**, and emergency unlocking to **8.9**.

During carrier gate operation, protection conforming to **8.10** shall be provided.

9.2 Protection of non-access sides

Non-access edges of carriers that are not within 10 mm of a full-height wall shall be protected as follows.

a) For travels up to 1 000 mm, a barrier/guardrail shall be provided, 900 mm to 1 100 mm high and comprising an intermediate bar and a kick plate extending upwards to a point 100 mm above the carrier floor.

b) For travels over 1 000 mm, a barrier/guardrail shall be provided, a minimum of 1 100 mm high with a kick plate extending upwards to a point 100 mm above the carrier floor, which shall not allow a 100 mm sphere to pass through any openings in the guarding.

Guardrails shall be able to withstand the application of a force of 300 N, acting at right angles at any point and any directions over an area of 500 mm^2 (of round or square section) without any permanent deformation.

9.3 Tip-up seat

Where a tip-up seat is provided, the seat shall have the following characteristics:

- seat height from the floor: 500 mm ±20 mm;
- depth: 300 mm to 400 mm;
- width: 400 mm to 500 mm;
- supported mass: 100 kg.

9.4 Guardrail/hand hold

The gripping part of the guardrail/hand hold shall have cross-sectional dimensions between 25 mm and 60 mm, with a minimum radius of 10 mm.

The free space between any fixed wall and the gripping part shall be not less than 35 mm. This clearance shall be increased to a minimum of 100 mm if the guardrail/hand hold is adjacent to a moving surface.

The height of the top edge of the gripping part shall be not less than 900 mm or greater than 1 100 mm from the carrier floor.

If the guardrail/hand hold position obstructs the buttons or controls, the guardrail/hand hold shall be interrupted so that clear access to the buttons or controls is provided.

NOTE The guardrail/hand hold should be profiled to minimize the risk of injury.

9.5 Toe guard

A toe guard, extending over the full width of the boarding point entrance it faces, shall be provided under each carrier sill. The vertical dimensions of the toe guard shall be at least equal to half the unlocking zone (see Figure 7).

9.6 Floor covering

The floor covering of the carrier shall be slip-resistant.

NOTE See Annex B for further guidance.

9.7 Lowest level carrier access ramp

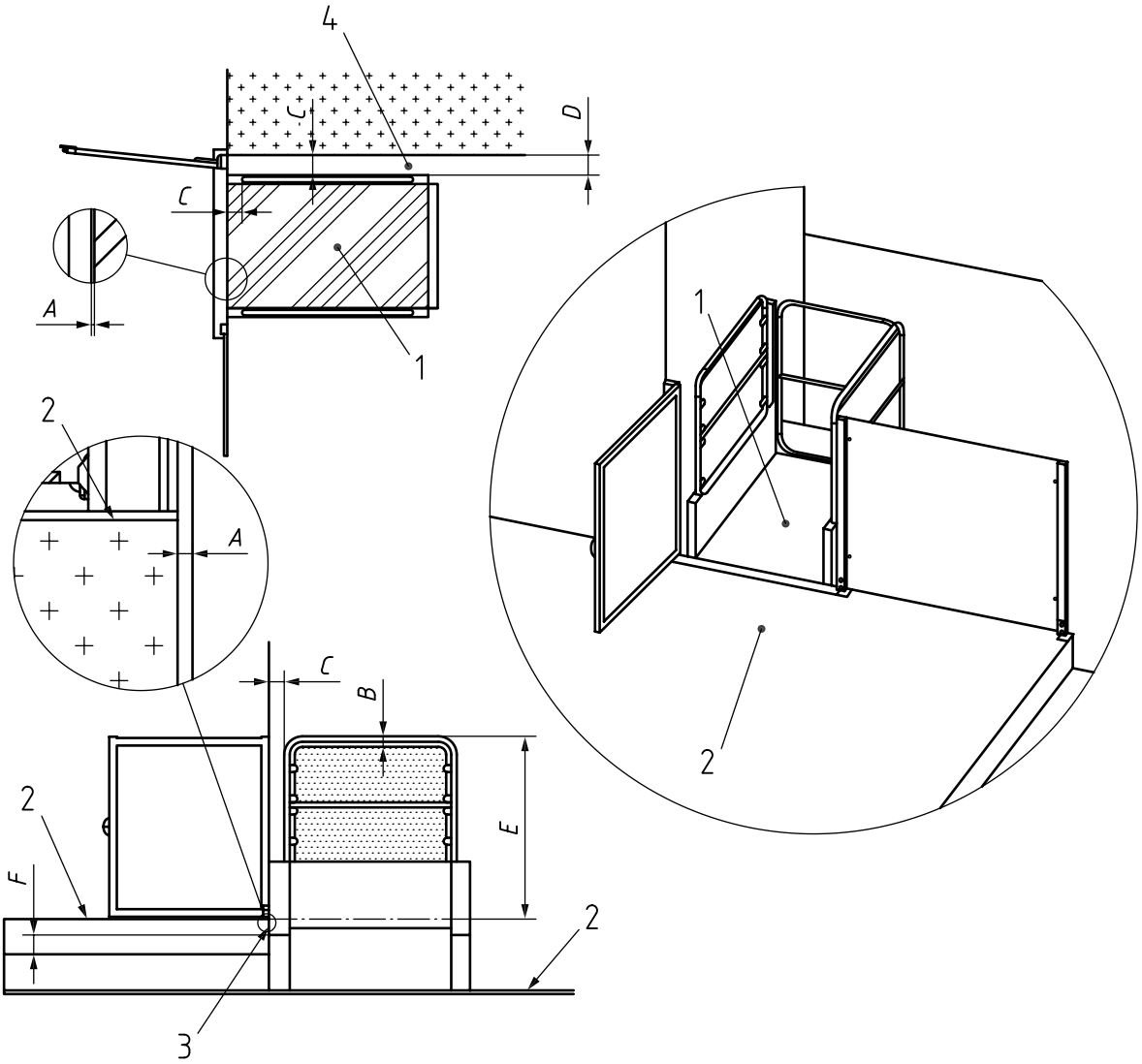
Ramps shall be fitted on all carrier access edges incorporating a step greater than 15 mm high. They shall have an inclination, which shall be no greater than:

- 1:4 on a vertical rise up to 50 mm;
- 1:6 on a vertical rise up to 75 mm;
- 1:8 on a vertical rise up to 100 mm;
- 1:12 on a vertical rise over 100 mm.

NOTE A step of up to 15 mm high is permissible at the leading edge of any ramp.

The entrance shall be provided with a sill or ramp, which shall withstand the passage of rated loads on to the carrier.

Figure 7 **Dimensions and clearances for lifting platforms with non-enclosed liftway and carrier without walls and ceiling**



Key

1 Carrier
2 Boarding point level
3 Toe guard area
4 Protection area
A Adjacent surfaces without sensitive edges ≤10 mm (see **8.3**)
B Distance between guardrail/hand hold and fixed surfaces ≥35 mm (see **9.4**)
C Distance between guardrail/hand hold and moving surfaces ≤10 mm or ≥100 mm (see **9.4**)
D Adjacent surfaces with sensitive edges >10mm but ≤100 mm (see **8.3**)
E Guardrail/hand hold height 900 mm to 1 100 mm (see **9.4**)
F Toe guard height 25 mm (see **9.5**)

9.8 Glass

When glass is used, it shall either conform to Table 8 or it shall be tested in accordance with BS EN 81-1:1998+A3, Annex J.

Glass panels shall be fixed in such a way that the forces specified in this standard (**8.6**, **9.1**, **9.2**) are transferred without permanent deformation of the fixing(s) of the glass.

Table 8 **Glass panels**

Dimensions in millimetres

Type of glass	Minimum thickness	
	1 000 mm max. diameter of inscribed circle	**2 000 mm max. diameter of inscribed circle**
Laminated and toughened	08 (4 + 4 + 0.76)	10 (5 + 5 + 0.76)
Laminated	10 (5 + 5 + 0.76)	12 (6 + 6 + 0.76)

9.9 Edge and surface protection

9.9.1 Under-surface protection

All potential trapping hazards, arising from any part of the carrier under-surface, shall be eliminated as follows:

a) by surrounding the space under the carrier with a bellows unit or similar device to prevent access, and by protecting the entire periphery of the carrier with sensitive edges; or

b) by providing a sensitive surface over the entire area of the under-surface of the carrier.

9.9.2 Sensitive surfaces, sensitive edges, photo cells and light curtains

The operation of any sensitive surface, sensitive edge, photo cell or light curtain shall initiate a break in the electrical supply to the motor and brake in the direction in which the carrier is operating. This shall be achieved by the use of a safety device (see **7.9**).

The operation of these safety devices shall stop the carrier before any rigid parts come into forceful contact. It shall be possible to drive the car away in the opposite direction to clear the obstruction.

For a sensitive surface, the mean forces, measured in two diagonally opposite corners and at the centre point of the sensitive surface, that are required to actuate this safety device shall not exceed:

a) 50 N for surfaces with an area equal to, or less than, 0.15 m^2;

b) 100 N for surfaces with an area greater than 0.15 m^2.

NOTE Sensitive surfaces operating in the down direction may be overridden by positive means when the closing edge of the sensitive surface is within 10 mm of the boarding point floor.

For a sensitive edge, the mean force required to actuate these devices shall not exceed 30 N when measured at each end and at the mid-point.

9.10 Carrier construction of lifting platforms for the personal use of trained persons (domestic use) using wheelchairs

9.10.1 General

Lifting platforms for the personal use of trained persons using wheelchairs shall conform to **9.3** to **9.9**, and additionally to **9.10.2** to **9.10.5**.

9.10.2 Key locking

Key locking shall be provided in the form of either a physical key or a wireless key fob, which shall allow a single operation of the lifting platform at any time. If a physical key is used, it shall not be removable in the enabled position.

9.10.3 Protection of access sides for lifting platforms with travel up to 1 000 mm

For lifting platforms with travel up to 1 000 mm, to prevent a wheelchair overrunning the edge of the carrier, the lower carrier boarding point sides shall be protected with a roll-off guard of at least 100 mm in height, which shall cover the useable width of the carrier. This guard shall be activated by movement of the carrier away from the lower boarding point.

The roll-off guard shall remain in the raised and locked position until the carrier returns to the lower boarding point. It shall be provided with a safety contact that stops the carrier within 200 mm of the lower level if the guard does not become raised.

The raised guard shall be able to withstand the application of a force of 300 N, acting at right angles at any point over an area of 500 mm^2 (of round or square section), without the effective vertical height of the guard reducing to below 100 mm, and without any permanent deformation.

9.10.4 Protection of access sides for lifting platforms with travel above 1 000 mm

For lifting platforms with travel above 1 000 mm, a gate shall be provided, which shall conform to **9.1**.

9.10.5 Carrier protection (non-access sides)

Non-access edges of carriers that are not within 10 mm of a full-height wall shall be protected as follows.

a) For lifting platforms with travel up to 1 000 mm, a roll-off guard conforming to **9.10.3** shall be provided.

b) For lifting platforms with travel above 1 000 mm, a barrier/guardrail shall be provided, (1 100 ±25) mm high and comprising an intermediate bar and a kick plate 100 mm above the carrier floor.

10 Information

10.1 General

Operating instructions shall be provided, which shall include advice that safety-related components should only be adjusted and reset by a competent person.

NOTE BS EN ISO 12100 specifies general requirements for information, location and nature of the information for use, signals and warning devices, markings, signs (pictograms), written warnings, and accompanying documents (in particular the instruction handbook).

10.2 Signals and warning devices

10.2.1 General

All labels, notices, markings and operating instructions shall be indelible, legible and readily understandable (if necessary aided by signs or symbols). They shall be untearable, of durable material and placed in a visible position.

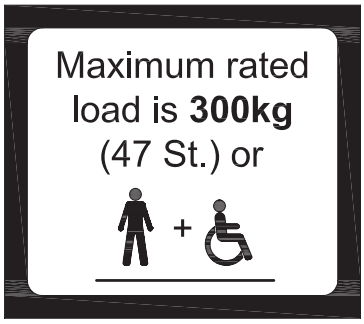
10.2.2 Rated load

The rated load shall be clearly displayed on the lifting platform and visible from the boarding point.

The height of the text or symbols that indicate the rated load shall be at least 10 mm for upper case and at least 7 mm for the x-height of lower case (i.e. the height of the lower case "x").

NOTE A typical load plate is shown in Figure 8.

Figure 8 **Typical load plate**



10.2.3 Identification of control devices

The function of all devices controlling the operation of the lifting platform shall be identified (see **7.13**).

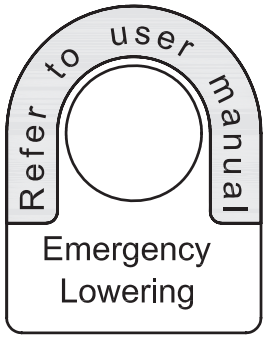
10.2.4 Emergency manual operation

Detailed step-by-step emergency operating instructions in accordance with **6.4** and **6.8.12** shall be included in the operating instructions specified in **10.1**.

Where it is possible for the device to be operated to move the carrier in both the up and the down direction, a direction label indicating the direction of movement of the carrier when the device is operated shall be fitted in a prominent position.

On hydraulic powered lifting platforms, a notice bearing the words shown in Figure 9 shall be displayed adjacent to the manual lowering valve.

Figure 9 **Typical manual lowering legend**

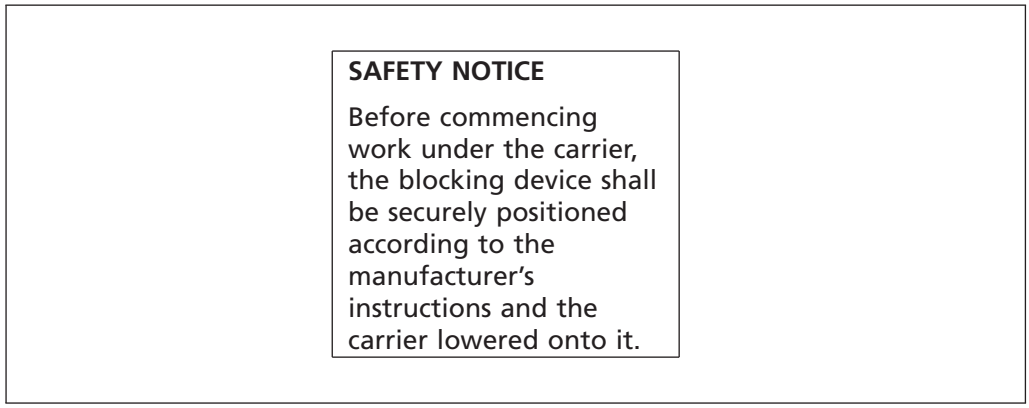


10.2.5 Safety notice

The lifting platform shall have a safety notice providing instructions to maintenance and other trained and authorized personnel, and giving all safety precautions to be followed when working under the carrier (see **5.2**). Safety instructions shall be located so as to be visible at the point of access to the underside of the carrier.

NOTE A typical safety notice is shown in Figure 10.

Figure 10 **Typical safety notice**



10.2.6 Main isolation switch

The switch for the main electrical supply to the lifting platform shall be identified.

For hydraulically powered lifting platforms, the switch identification shall also bear the following legend:

"Switch off only when the carrier is at the lowest level."

10.3 Documents

10.3.1 General

The following information, where relevant, shall be provided in documentation supplied with the equipment:

a) the intended use;

b) specific warnings against any reasonably foreseeable misuse (e.g. lifting platforms are not intended for use in a fire emergency, unless extra provisions are made);

c) recommended intervals for routine inspection and servicing (see Annex E), including the specification of spare parts where the use of incorrect parts would affect the safety of the lifting platform;

d) warning of residual risks;

e) a repeat of the information with which the machinery is marked;

f) instructions for use of the controls;

g) emergency operations, including the method to be followed in the event of an accident or breakdown;

h) a statement that when a safety gear has tripped, only a competent person should attempt to release it, and that after its release it should be checked to ensure that it remains functional for further use;

i) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;

j) a statement that the emission sound pressure level at the operator's position is expected not to exceed 70 dB(A);

k) an electrical circuit wiring diagram showing the electrical connections and components, together with all necessary identification markings;

l) assembly instructions, including:

1) forces imposed upon the building structure;

2) anchorage requirements;

3) electrical connection requirements;

m) instructions to be carried out when power is lost, e.g. send the carrier to the lowest level and ensure all doors/gates are closed;

n) acceptance certificate from the end user;

NOTE Annex F gives an example of a typical certificate.

o) an instruction that dismantling should be carried out only by a competent person (see **10.5**).

10.3.2 Marking

Each lifting platform shall be marked legibly and indelibly with at least the following particulars:

a) the business name and full address of the manufacturer and, where applicable, their authorized representative;

b) year of construction;

c) designation of series or type, if any;

d) serial or identification number;

e) rating information and rated load.

NOTE Attention is drawn to the Supply of Machinery (Safety) Regulations 2008 [2] in respect of the requirement for CE marking.

10.4 Verification tests on each machine before first use

Immediately upon completion of installation and prior to being put into service, the lifting platform shall be subjected to a thorough examination and test by a competent person to determine that:

a) all control devices function correctly;

b) all door locking devices operate correctly;

c) the stopping distance of the carrier is within specified limits;

d) all electrical safety devices function correctly;

e) the suspension elements and their attachments are in order;

f) the correct clearance dimensions from the surrounding structure are maintained throughout the full travel of the carrier;

g) the lifting platform does not fail any electrical tests including insulation and earth continuity;

h) the polarity of the mains supply connection is correct;

i) a certificate has been provided showing the correct tripping speed of the over-speed governor (or on hydraulic systems, the rupture valve);

j) on screw and nut systems, the safety gear functions correctly under free fall at rated load and speed;

k) the mechanism for emergency/manual operation operates correctly;

l) any alarm device when activated operates correctly;

m) the mechanical blocking device is provided and effective;

n) all notices, etc., are correctly displayed;

o) the triggering of the overload detection device operates correctly (rated load +75 kg);

p) it does not fail a dynamic test, or an equivalent test, at the rated speed with the rated load multiplied by a coefficient of 1.10;

q) it does not suffer permanent deformation after a static test with the rated load and clear of the ground floor, multiplied by a coefficient of 1.25;

r) the distance between main nut and safety nut is within the manufacturer's limits;

s) the positioning of the safety nut electric safety device is correct.

A test and examination document shall be completed which declares at least all the information and the results of all checks on-site listed above. This shall held by the installer, together with any other declarations.

NOTE An example test document is shown in Annex G.

10.5 Dismantling

The operating instructions (see **10.1**), and the documentation [see **10.3.1**o)] shall include a statement that if the lifting platform has to be disassembled, this should be done by a competent person who has been fully trained in its installation and is qualified to provide safe disconnection to the mains terminal.

Annex A (informative)

List of significant hazards

The lists of hazards, hazardous situations and events given in this annex are not exhaustive, nor are they prioritized according to BS EN ISO 12100. Whilst it is recognized that BS EN 1050 was replaced by BS EN ISO 14121-1, which in turn was replaced by BS EN ISO 12100, the former standard contained a list of hazards found to be more suitable to lifting applications, and these have been included in this annex where indicated.

Table A.1 lists all the hazards, hazardous situations and events that have been identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk. Table A.1 also gives subclause references for the relevant safety recommendations and protective measures given in this British Standard.

Before supplying any lifting platform, it is important to review the risks in Table A.1 to check that all site-specific hazards have been identified.

NOTE 1 Hazards resulting from allergic reactions to persons are not addressed in this standard, but advice on such materials is given in BS EN 81-70:2003, Annex D.

NOTE 2 Annex D indicates the means of verifcation of the requirements specified in BS 6440.

Table A.1 **Significant hazards relating to the general design and construction of lifting platforms** *(1 of 4)*

Item	Hazards	Relevant clauses in BS 6440:2011
General hazards, hazardous situations and hazardous events		
1	**Mechanical hazards**	
1.0a)	Shape	**8.3**, **8.6**, **8.11.2**, **8.11.3**, Clause **9**
1.0b)	Relative location	**8.4**, **9.4**, **9.5**, **9.9**
1.0c)	Mass and stability (potential energy of elements might move under the effect of gravity)	**4.5**, **4.6**, **4.8**, **4.11**, **4.12.1**, **6.7.1** to **6.7.4**
1.0d)	Mass and velocity (kinetic energy of elements in controlled motion)	**4.4**, **4.9**, **4.11**, **4.12**, **6.1**, **6.8.13**, **8.10**
1.0e)	Inadequacy of energy inside the machinery	Not relevant to this product
1.0f)	Accumulation of energy inside elastic elements (springs)	**6.8**, **8.10**
1.0g)	Accumulation of energy inside liquids and gases under pressure	**6.8**
1.0h)	The effect of vacuum	Not relevant to this product
1.1	Crushing hazard	**4.3**, **5.1**, **5.2**, **5.3**, **9.2**, **9.4**, **9.5**, **9.9**
1.2	Shearing hazard	**4.3**, **5.1**, **5.3**, **8.4**, **8.6**, **9.5**
1.3	Cutting or severing hazard	**5.1**, **5.3**, **8.4**, **8.6**, **9.5**, **9.8**
1.4	Entanglement hazard	**4.3**, **5.1**, **5.3**, **8.3**, Clause **9**
1.5	Drawing-in or trapping hazard	**4.3**, **6.1**, **6.3**, **6.6**, **8.3**, **9.4**, **8.6**, **9.9**
1.6	Impact hazard	**6.1**, **6.3**, **9.9**
1.7	Stabbing or puncture hazard	**6.1**, **6.2**, **6.3**, **9.4**, **9.8**, **9.9**
1.8	Friction or abrasion hazard	**4.3**, Clause **9**
1.9	High pressure fluid ejection hazard	**5.3**, **6.8**
1.10	Falling hazard	**4.3**, **4.12.1**, **6.1**, **6.8.2**, **6.8.6**, **8.11.3**, **9.1**, **9.10.3**, **9.10.4**
2	**Electrical hazards**	
2.1	Electrical contact of persons with live parts	**5.3**, **7.1**, **7.2**, **7.3**, **7.11**, **7.12**
2.2	Electrical contact of persons with parts which have become live under faulty conditions	**7.6**, **7.8**, **7.9.2**, **7.11**

Table A.1 **Significant hazards relating to the general design and construction of lifting platforms** *(2 of 4)*

Item	Hazards	Relevant clauses in BS 6440:2011
2.3	Approach to live part under high voltage	Not relevant to this product
2.4	Electrostatic phenomena	Not relevant to this product
2.5	Thermal phenomena	Not relevant to this product
3	**Thermal hazards**	
3.1	Burns and scalds	**5.3**, **7.10**, **7.12**
3.2	Hot or cold environment	Not relevant to this product
4	**Noise**	**10.3.1**j)
5	**Vibration hazards**	Not relevant to this product
6	**Hazards generated by radiation**	
6.1	Low frequency, radio frequency and micro waves	Not relevant to this product
6.2	Infrared, visible and ultraviolet light	Not relevant to this product
6.3	X and gamma rays	Not relevant to this product
6.4	Alpha, beta rays etc.	Not relevant to this product
6.5	Lasers	Not relevant to this product
7	**Materials**	
7.1	Liquids and gases	**6.8**, **7.12**
7.2	Contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	**6.8**, **7.12**
7.3	Fire or explosion hazards	**6.8**, **7.12**
7.4	Biological hazards	**6.8**, **7.12**, Clause **10**
8	**Ergonomic hazards**	
8.1	Unhealthy postures	**5.1**, **7.13**
8.2	Anatomic inadequacy	**7.13**
8.3	Personal protection equipment	Not relevant to this product
8.4	Lighting	**B.2.3**
8.5	Stress	Clause **10**
8.6	Human error	Clause **10**, **8.3**
8.7	Inadequate controls	Clause **10**
8.8	Inadequate visual display	Clause **10**
9	**Hazard combinations**	**7.8**
10	**Unexpected start-up, over-run or over-speed**	
10.1	Failure of the control system	**6.2**, **6.4**, **6.8.12**, **7.8**, **10.2.4**
10.2	Restoration of supply	**10.2.6**
10.3	External influences on electrical equipment	Not relevant to this product
10.4	Wind, gravity	Not relevant as travel will be limited
10.5	Errors in software	Not relevant to this product
10.6	Operator error	**4.6**
11	**Failure to stop/stopping the machine in the best possible conditions**	
11.1	Unsafe position	**6.3**, **6.4**, **6.8.12**, **6.8.13**
12	**Variation in speed**	
12.1	Over-speeding	**4.12.2.1**

Table A.1 **Significant hazards relating to the general design and construction of lifting platforms** *(3 of 4)*

Item	Hazards	Relevant clauses in BS 6440:2011
13	**Failure of the power supply**	
13.1	Over-speeding	**4.12.2, 6.2, 7.7**
13.2	Unexpected start	**7.9.1, 7.9.3**
13.3	Change of direction	**7.4**
13.4	Loss of memory	**7.4**
13.5	Unsafe position	**6.3, 7.8**
13.6	Entrapment	**6.4, 6.8.12, 10.2.3, 10.2.4**
14	**Failure of the control circuit/failure of controls**	
14.1	Failure/disorder of the control system	**6.2, 6.4, 7.8**
14.2	Failure to stop	**4.12.1.2, 7.4, 7.8, 7.13.4**
14.3	Unexpected stop	**7.9**
14.4	Unexpected start	**7.9**
14.5	External influences	**7.7**
14.6	Failure to start	**4.6, 7.4, 7.8, 7.9.2**
14.7	Maintenance operation	**7.1, 7.9**
14.8	Unexpected activation	**7.9, 7.8**
14.9	Brake remains lifted	**6.2, 7.5**
14.10	Prevent stopping	**6.2**
14.11	Ineffective protection	**7.2, 7.3, 7.6, 7.11**
14.12	Isolation	**7.1, 10.2.6**
14.13	Restoration of the energy after an interruption	**6.2, 6.4, 7.8**
14.14	External influences on the electrical equipment	**7.7, 7.8**
15	**Errors in fitting**	Clause **10**
16	**Break-up during operation**	
16.1	Stress failure (and fatigue)	**4.2, 4.8, 4.9, 4.11, 4.12, 6.1, 6.2, 6.5, 6.6, 6.7, 6.8**
16.2	Falling	**4.8, 4.9, 4.11, 4.12, 6.1, 6.2, 6.5, 6.6, 6.7, 6.8**
17	**Falling or ejected objects or fluids**	
17.1	Falling objects	**5.3**
18	**Loss of stability**	
18.1	Overturning	**4.9, 4.11**
18.2	Falling	**4.9, 4.11, 4.12, 6.8.2, 8.5**
19	**Slip, trip and fall**	
19.1	Slipping	**9.6**
19.2	Tripping	**9.7**
19.3	Falling	**8.5, 8.6, 8.8, 9.2**
19.4	Falling from the landing	**8.5, 8.6, 8.8**
Additional hazards, hazardous situations and hazardous events due to mobility		
Hazards 20 to 26 relate to mobile equipment (BS EN 1050) and are therefore not relevant to this product		
Additional hazards, hazardous situations and hazardous events due to lifting		
27	**Mechanical hazards and hazardous events**	
27.1	Load fall and collision etc. caused by:	
27.1.1	Lack of stability	**4.8, 4.9, 4.11, 4.12**
27.1.2	Overloading	**4.9, 4.11, 4.12**
27.1.3	Amplitude	**4.4, 4.11, 4.12, 7.5**

Table A.1 **Significant hazards relating to the general design and construction of lifting platforms** *(4 of 4)*

Item	Hazards	Relevant clauses in BS 6440:2011
27.1.4	Unexpected movement of load	**4.9, 9.4**
27.1.5	Holding devices	**4.12.1, 6.2, 7.5**
27.1.6	Collision of more than one machine	Not relevant to this product
27.2	From access of persons to load support	**5.2, 5.3**
27.3	From derailment	**4.9, 4.11, 4.12**
27.4	Mechanical failure	**4.2, 4.9, 4.11, 4.12, 6.5, 6.6, 6.7, 6.8**
27.5	Failure of pulleys	**6.6.2**
27.6	Failure of ropes and chains	**6.6**
27.7	Friction brakes	**6.2, 6.4**
27.8	Abnormal assembly, testing and use	Clause **10**, Annex A
27.9	Impact on persons of load or counterweight	**5.2**
28	**Electrical hazard**	
28.1	Lightning	**B.2.3**
29	**Ergonomic hazard**	
29.1	Insufficient visibility	Not relevant to this product
Additional hazards, hazardous situations and hazardous events due to underground work *Hazards 30 to 33 are not relevant to this product (BS EN 1050)*		
Additional hazards, hazardous situations and hazardous events due to the lifting or moving of persons		
34	**Mechanical hazards and hazardous events**	
34.1	Inadequate mechanical strength/working coefficients	**4.5, 4.6, 4.8, 4.9, 4.11, 6.1, 6.2, 6.5, 6.6, 6.7, 6.8, 9.1, 9.2, 9.3, 9.9.2, 9.10.3**
34.2	Failing of loading control	**4.6**
34.3	Failure of car controls	**7.13, 8.5, 8.6, 8.7, 8.8, 8.9**
34.4	Over speed of car	**4.4, 4.12**
34.5	Loss of integrity of fixings	**4.9, 4.11, 4.12**
35	**Falling of persons from car**	**8.5, 8.6, 8.7, 8.8, 8.9, 9.1, 9.2, 9.3, 9.4, 9.6**
36	**Falling/overturning of car**	
36.1	Preventing of falling or overturning	**8.5, 8.6, 8.7, 8.8, 8.9, 9.1, 9.2, 9.3, 9.4, 9.6**
36.2	Acceleration and braking	**4.4, 4.12.1**
37	**Human error/behaviour**	**8.3, 8.6, 9.7, 9.1, 9.2, 9.5, 9.6, 9.8, 9.9, 9.10**, Clause **10**

Annex B (informative) Guidance for the exchange of information between manufacturer/supplier and specifier

NOTE This annex provides guidance to enable manufacturers/suppliers to select and specify a suitable powered lifting platform, and to remind purchasers and owners of new and re-sited lifting platforms of other factors for their attention. Most of the guidance in this annex is applicable to any installation.

B.1 Selection of lifting platform

B.1.1 Suitability of lifting platform

The following issues need to be addressed when determining the general suitability of the lifting platform.

a) Consider the current abilities of the user(s) (where known) when selecting a lifting platform, including whether the needs of the user(s) are likely to change in the future.

b) Ensure that a suitable lifting platform is selected with a rated load that is capable of carrying the maximum foreseeable load.

c) Ensure that the user(s) can be safely transported on the lifting platform, whether sitting, standing, or seated in a wheelchair.

d) Consider, where either manual or automatic operation is optionally available for devices such as gates, which is more appropriate for the user(s).

e) Ensure that the location of the lifting platform does not restrict the means of emergency access or egress of public buildings.

f) Ensure that the anticipated maximum number of journeys per hour determined by the purchaser is communicated to the supplier.

B.1.2 Controls

The following issues need to be addressed when determining the suitability of the controls.

a) Identify any potential user difficulties in operating the control, e.g. if an intended user has the use of only one hand.

b) Consider the need to have a suitably located "attendant" control if the user(s) cannot operate the machine independently.

c) Consider the need for key locking and platform protection if the lifting platform is to be used by an authorized user(s) (see **9.10**).

d) Consider the suitability of constant pressure controls.

B.1.3 Relationships between the lifting platform, the building and the proposed location

Consideration needs to be given to siting of the equipment in order to avoid hazards, congestion and inconvenience, both in relation to present circumstances and foreseeable developments. Expert advice may be sought on the positioning of the lifting platform with respect to the building construction and the external effects at the proposed location, including:

a) that sufficient space is provided in the access corridors/passages for wheelchairs, or any other special assistance devices;

b) that where a wheelchair is not used, sufficient landing spaces are available;

c) that where a wheelchair is used, there is an unobstructed manoeuvring space of 1 500 mm × 1 500 mm (public access) or 1 200 mm × 1 200 mm (private domestic use), or a straight access route at least 900 mm wide;

d) the suitability of the proposed location with respect to obstructing other entrances;

e) whether there are any hazards presented by doors, windows or furniture when open;

f) the presence of any other potential trapping areas;

g) the provision of adequate lighting at each boarding point, the platform floor and control buttons to ensure at least 50 lx, and preferably 100 lx, at each point, when the lifting platform is in use;

h) that the floor of the car has a colour which contrasts with the boarding point floor;

i) the suitability of the location for the secure fixing of the lifting platform to the building structure;

j) that the boarding point entrances, including any ramps, at each landing are suitable to support the maximum loads imposed by those using the lifting platform;

k) that the site location and proposed supporting structure is strong enough to support the lifting platform;

l) that permanent access for maintenance operators is provided;

m) that the dimensions of working areas in front of any machinery cabinets are, as far as is reasonably practicable, sufficient for safe working;

n) that the protection of the lifting platform against external influences is adequate for the intended application;

o) that the transmission of noise and vibration to any surrounding walls and other supporting structures is taken into account;

p) that the floor under the lifting platform is designed to support the loads and forces imposed on it by the lifting platform and any person accessing the area.

B.2 Electrical supply

It is preferred that the electrical supply is not provided through a pre-payment meter. If this cannot be avoided, then a battery back-up, or similar means, should be provided that allows the completion of any journey in progress.

It is preferred that the electrical supply is provided adjacent to the lifting platform for local lighting during inspection and servicing.

B.3 Other considerations

If the machine is for a user living alone for long periods, or for several users, or if the application is external, the following additional issues should be considered.

a) An alarm system to a suitable responsible person could be desirable. Recommendations for alarm systems are given in DD CLC/TS 50134-7.

b) Emergency lighting at the platform location could be desirable.

c) Alarm systems and emergency lighting should not operate from the mains power supply. These facilities should be available to the user(s) at all times.

B.4 Change of use

If a change of use of the powered lifting platform is desired, this should be discussed with the manufacturer, as certain alterations could be required.

Examples of changes of use are:

a) change of type and weight of wheelchair;

b) change of user disability;

c) installation at another site.

All changes of use should entail a review of the installation.

Annex C (informative) Recommendations for the provisions and use of specially adapted control devices, switches and sensors

C.1 Control devices

It is recommended that the operation of the lifting platform is by means of conventional pushbuttons, joysticks or similar devices, except where these are unsuitable due to the disability of the user.

In such cases, the control device placement, whether on a wall, wheelchair, pendant, etc., should be such that accidental operation by the user is minimized.

C.2 Assistance

If the disability of a dedicated user is such that an adapted switch or a remote control device cannot be operated to control the lifting platform, other technical solutions may be sought that could enable the user to operate the lifting platform.

C.3 Specially adapted switches

Where switches such as blowpipe operated switches or pull-cords are used, the design should be such that their immunity to electrical and mechanical interference will prevent accidental operation of the lifting platform.

Additional stopping devices, which are either specially adapted switches or remotely controlled stopping devices, may also be fitted.

Annex D (normative) Verification of safety requirements and/or protective measures

D.1 Verification of design

The safety requirements and measures specified in this British Standard shall be verified by means of the tests and inspections shown in Table D.1.

NOTE It is recommended that all verification records are kept by the manufacturer.

Table D.1 **Means of verification of the safety requirements and/or measures** *(1 of 3)*

Sub-clause	Safety requirements (clause/subclause title)	Visual inspection [A)]	Performance check/test [B)]	Measure-ment [C)]	Drawing/ calculation [D)]	User info [E)]
4	**General requirements for lifting platforms**					
4.1	General	✓	✓	✓	✓	✓
4.2	Pattern of use	✓	✓		✓	✓
4.3	Guarding	✓	✓	✓	✓	
4.4	Rated speed			✓	✓	
4.5	Rated load			✓	✓	✓
4.6	Load control		✓	✓		
4.7	Carrier floor dimensions			✓		
4.8	Mechanical strength of the platform		✓		✓	
4.9	Resistance to operating forces		✓		✓	
4.10	Protection of equipment against harmful external influences	✓	✓		✓	✓
4.10.1	Degree of protection for outdoor use	✓			✓	
4.10.2	Other protections	✓			✓	
4.11	Lifting platform support/guide system	✓	✓	✓	✓	
4.12	Safety gear and over-speed governor [F)]	✓	✓	✓	✓	
5	**Access for maintenance, repair and inspection**					
5.1	Working areas on the carrier	✓		✓		✓
5.2	Working areas under the carrier	✓		✓		✓
5.3	Access to equipment and machinery	✓		✓		✓
6	**Driving units and drive systems**					
6.1	General requirements	✓	✓	✓	✓	
6.2	Braking system	✓	✓	✓	✓	
6.3	Stopping/levelling accuracy		✓	✓		✓
6.4	Emergency/manual operation	✓	✓			✓
6.5	Additional requirements for rack and pinion drive	✓	✓	✓	✓	

Table D.1 **Means of verification of the safety requirements and/or measures** *(2 of 3)*

Sub-clause	Safety requirements (clause/subclause title)	Visual inspection [A)]	Performance check/test [B)]	Measure-ment [C)]	Drawing/ calculation [D)]	User info [E)]
6.6	Additional requirements for rope and chain suspension drive	✓	✓	✓	✓	
6.7	Additional requirements for screw and nut drive	✓	✓	✓	✓	
6.8	Additional requirements for hydraulic drive	✓	✓	✓	✓	
7	**Electrical equipment**					
7.1	Power supply	✓		✓	✓	✓
7.2	Conductors of different circuits	✓			✓	
7.3	Insulation resistance of the electrical installation	✓		✓	✓	✓
7.4	Drive contactors	✓			✓	
7.5	Motor and brake supply	✓	✓	✓	✓	
7.6	Enclosures requirements and electrical creepage and clearance distances	✓	✓	✓	✓	
7.7	Electromagnetic compatibility		✓	✓	✓	✓
7.8	Protection against electrical faults	✓	✓		✓	
7.9	Electric safety devices	✓	✓	✓	✓	
7.10	Protection of the driving motor		✓		✓	✓
7.11	Electrical wiring	✓			✓	
7.12	Additional requirements for battery-powered supply	✓	✓	✓	✓	✓
7.13	Control devices					
7.13.1	Push button control devices	✓	✓	✓	✓	✓
7.13.2	Joystick control devices	✓	✓	✓		✓
7.13.3	Rocker switch control devices	✓	✓	✓		✓
7.13.4	Cable-less controls		✓			✓
7.14	Electrical socket outlet					✓
8	**Liftways**					
8.1	Liftway floor				✓	✓
8.2	Top clearances					✓
8.3	Adjacent surfaces					✓
8.4	Inspection door and traps	✓	✓			✓
8.5	Liftway entrances	✓		✓	✓	
8.6	Construction of boarding point gates	✓	✓	✓	✓	
8.7	Boarding point gate unlocking zone	✓	✓	✓	✓	

Table D.1 **Means of verification of the safety requirements and/or measures** *(3 of 3)*

Sub-clause	Safety requirements (clause/subclause title)	Visual inspection [A)]	Performance check/test [B)]	Measure-ment [C)]	Drawing/ calculation [D)]	User info [E)]
8.8	Boarding point locking devices	✓	✓			
8.9	Boarding point gate emergency unlocking	✓	✓			✓
8.10	Protection during boarding point gate operation	✓	✓	✓	✓	✓
8.11	Bridging steps					
8.11.1	**General**	✓				
8.11.2	Construction of steps	✓		✓		
8.11.3	Guarding of steps	✓		✓		
9	**Carrier construction**					
9.1	Protection access sides	✓	✓	✓		
9.2	Platform protection non-access sides	✓		✓		
9.3	Tip up seat	✓		✓		✓
9.4	Guardrail/hand hold	✓		✓		
9.5	Toe guard	✓		✓		
9.6	Floor covering	✓			✓	
9.7	Lowest level platform access ramp	✓		✓		
9.8	Glass	✓		✓		
9.9	Edge and surface protection	✓	✓	✓		
9.10	Carrier construction of lifting platforms for the personal use of trained persons (domestic use) using wheelchairs					
9.10.1	General	✓				
9.10.2	Key locking	✓	✓			✓
9.10.3	Protection of access sides for lifting platforms with travel up to 1 000 mm	✓	✓	✓		
9.10.4	Protection of access sides for lifting platforms with travel above 1 000 mm	✓	✓	✓		
9.10.5	Carrier protection (non-access sides)	✓		✓		

A) Visual inspection will be used to verify the features necessary for the requirement by visual examination of the components supplied.

B) A performance check/test will verify whether the features provided perform their function in such a way that the requirement is met.

C) Measurement will verify by the use of instruments whether requirements are met, to the specified limits.

D) Drawings/calculations will verify whether the design characteristics of the components provided meet the requirements.

E) Verify that the relevant point is dealt with in the instruction handbook or by marking.

F) See verification tests for safety gear and over-speed governor from BS EN 81-41.

Annex E (informative) In-use periodic examinations, servicing and tests

NOTE The recommendations given below are intended to be supplied by the manufacturer as part of the accompanying documentation.

E.1 Periodic examinations

Publicly or workplace installed lifting platforms should be thoroughly examined at intervals not exceeding 6 months, or at an interval advised according to a written scheme of examination.

Lifting platforms installed in domestic premises should be thoroughly examined at intervals not exceeding 12 months.

Particular attention should be given in any report to the effectiveness of the following features:

a) interlocking devices;

b) electrical safety devices;

c) earthing continuity;

d) supporting and suspension means for lifting;

e) driving unit and brakes;

f) devices for preventing free fall and descent with excessive speed, e.g. safety gear;

g) alarm system;

h) safety edges;

i) internal surfaces (distances, surfaces and sharp edges);

j) guides and guide shoes or rollers;

k) lighting and any emergency lighting;

l) moving parts (check for wear).

E.2 Maintenance

Regular servicing should be carried out at the periodicity recommended by the manufacturer and as specified in the instruction handbook provided by the manufacturer. It is important that the person carrying out the servicing is provided with the necessary tools and instructions and has received appropriate training and possesses sufficient experience of the equipment to be serviced.

A log book/record card should be provided to document visits and actions.

Annex F (informative)

Certificate of acceptance from end user

It is necessary to obtain a certificate of acceptance from the end user after initial tests and examination have been carried out [see **10.3.1**n)].

A typical certificate is shown in Figure F.1.

Figure F.1 **Typical certificate of acceptance**

I/we [the purchaser/user of the lifting platform (serial no. . . . .)] have received and understood verbal and written instructions and a demonstration on correct and safe use of the lifting platform, from . . . . . .

Signature(s) . . . . . .

Date . . . . . .

Address . . . . . .

. . . . . .

. . . . . .

Annex G (informative) Certificate for test and examination after installation of lifting platform

An example of a certificate is shown in Figure G.1.

Figure G.1 **Example of a certificate for test and examination after installation of lifting platform** *(1 of 3)*

1. Description

Location . . . . . .

Manufacturer . . . . . .

Lifting platform serial no . . . . . .

Electrical supply . . . . . V . . . phase . . . . . Hz

Travel . . . . . m

Number of levels served . . . . .

Rated load . . . . . kg

Rated speed . . . . . m/s

2. Examinations and tests

2.1 All lifting platforms

(a) Earthing arrangements

Is the lifting platform bonded to earth by a separate protective conductor? . . . . .

Is metalwork enclosing live electrical conductors bonded to the main earthing terminal by protective conductors? . . . . .

Does the resistance of the earth protective path exceed 0.1 Ω? . . . . .

(b) Insulation resistance to earth

Power circuits . . . . . MΩ

Safety circuits . . . . . MΩ

(c) Voltages

Mains voltage at time of test V

Control circuit voltage at full load V

Is the polarity of the mains correct [see BS 6440:2011, **7.8**c)]? . . . . .

(d) Carrier under-surface protection (see BS 6440:2011, 9.9.1)

Are sensitive surfaces/edges provided? . . . . .

Do safety devices operate correctly? . . . . .

(e) Levelling accuracy (see BS 6440:2011, 6.3)

Is the stopping accuracy of the carrier ±10 mm? . . . . .

Is the re-levelling accuracy of the carrier ±20 mm? . . . . .

In response to operation of an electric safety device is the stopping distance of the carrier, except for safety edges and surfaces no greater than 20 mm? . . . . .

Figure G.1 **Example of a certificate for test and examination after installation of lifting platform** *(2 of 3)*

(f) Barrier/gate interlocks

Are all gates or barriers fitted with appropriate interlocks (see BS 6440:2011, **8.8**)? . . . . .

Do interlocks operate correctly (see BS 6440:2011, **8.7**, **8.8**)? . . . . .

(g) Liftway protection

Is the vertical clearance between the floor of the carrier and the lowest parts of overhead obstacles not less than 2.0 m when the carrier is in contact with the final limit switch or the upper mechanical stop (see BS 6440:2011, **8.2**)? . . . . .

Do any sensitive edges operate correctly (see BS 6440:2011, **9.9.2**)? . . . . .

(h) Load plate and notices

Is a load plate and other notices fitted on the lifting platform, as appropriate (see BS 6440:2011, **10.2**)? . . . . .

(i) Performance

For one round trip of the empty carrier:

What is the raising time? . . . . . s

What is the lowering time? . . . . . s

(j) Load test

Does overload detection device operate correctly (see BS 6440:2011, **4.6**)? . . . . .

Confirm that there has been no failure or permanent deformation after load tests have been performed . . . . .

(k) Blocking device

Is a manually operated blocking device provided (see BS 6440:2011, **5.2**)? . . . . .

Does the device operate correctly? . . . . .

(l) Protection against free fall, over-speed or excessive speed

Confirm the availability of any certificates verifying the operation of device(s) to prevent free fall or descent with excessive speed

Device	Certificate number
.....	.....
.....	.....

Does the certificate for the equipment provided show either the correct tripping speed of the over-speed governor (see BS 6440:2011, **6.7.1**) or the means to protect against hydraulic systems failure (see BS 6440:2011, **6.8.8**)? . . . . .

(m) Control devices

Do all control devices function correctly (see BS 6440:2011, **7.13**)? . . . . .

Figure G.1 **Example of a certificate for test and examination after installation of lifting platform** *(3 of 3)*

(n) Emergency operation

Does the mechanism for emergency/manual operation operate correctly (see BS 6440:2011, **6.4**, **6.8.12**, Clause **12**)? . . . . .

2.2 Mechanically driven lifting platforms

(a) Suspension system

Is the rope/chain test certificate available and satisfactory? . . . . .

Are the rope/chain terminations correctly made and secured (see BS 6440:2011, **6.6.3**)? . . . . .

(b) Safety gear, braking system and safety nut (see BS 6440:2011, 4.12)

Does the mechanical safety gear operate effectively? . . . . .

Does the brake sustain the carrier with the 125% rated load? . . . . .

Does the slack rope/chain switch (if applicable) operate correctly? . . . . .

On screw drive lifting platforms, what is the initial distance between drive nut and safety nut? . . . . .

2.3 Hydraulically driven lifting platforms

Maximum working pressure . . . . . bar

Pressure relief valve setting (if applicable) . . . . . bar

3. Conformity

Does the lifting platform conform to BS 6440:2011? Yes ☐

No ☐

If NO, state reasons:

. . . . . .

. . . . . .

4. Declaration

I/we certify that on . . . . . the lifting platform at . . . . . was installed and examined to the manufacturer's instructions. This certificate gives an accurate report of the results of the examination.

Signature(s) . . . . . .

Qualification(s) . . . . . .

Address . . . . . .

. . . . . .

Date . . . . . .

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5900, *Specification for powered domestic lifts with partially enclosed cars and no lift-well enclosures*

BS EN 81-40, *Safety rules for the construction and installation of lifts – Part 40: Special lifts for the transport of persons and goods – Stairlifts and inclined lifting platforms intended for persons with impaired mobility*

BS EN 81-41, *Safety rules for the construction and installation of lifts – Special lifts for the transport of persons and goods – Part 41: Vertical lifting platforms intended for use by persons with impaired mobility*

BS EN 81-70:2003, *Safety rules for the construction and installation of lifts – Part 70: Particular applications for passenger and goods passenger lifts – Accessibility to lifts for persons including persons with disability*

BS EN 1050 (withdrawn), *Safety of machinery – Principles for risk assessment*

BS EN ISO 14121-1 (withdrawn), *Safety of machinery – Risk assessment – Part 1: Principles*

DD CLC/TS 50134-7, *Alarm systems – Social alarm systems – Part 7: Application guidelines*

Other publications

[1] EUROPEAN COMMUNITIES. 2006/42/EC. Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC. Luxembourg: Office for Official Publications of the European Communities, 2006.

[2] GREAT BRITAIN. Supply of Machinery (Safety) Regulations 2008. London: The Stationery Office.

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