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Power-operated lifting platforms for persons with impaired mobility — Rules for safety, dimensions and functional operation —

Part 2: Powered stairlifts for seated, standing and wheelchair users moving in an inclined plane

Plates-formes élévatrices motorisées pour personnes à mobilité réduite — Règles de sécurité, dimensions et fonctionnement —

Partie 2: Élévateurs inclinés pour usager en position assise, debout ou en fauteuil roulant

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 9386 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9386-2 was prepared by Technical Committee ISO/TC 178, *Lifts, escalators, passenger conveyors*.

ISO 9386 consists of the following parts, under the general title *Power-operated lifting platforms for persons with impaired mobility — Rules for safety, dimensions and functional operation*:

— *Part 1: Vertical lifting platforms*

— *Part 2: Powered stairlifts for seated, standing and wheelchair users moving in an inclined plane*

Annex F is a normative part of this part of ISO 9386. Annexes A, B, C, D, E and G are for information only, giving useful information and guidance to purchasers and installers.

Annex G is included to summarize those clauses within this part of ISO 9386 where separate requirements apply to stairlifts installed in buildings with restricted access or alternatively in buildings with public access.

Introduction

ISO 9386 specifies the safety rules, dimensions and functioning for permanently installed power-operated lifting platforms designed for use by persons with impaired mobility. This part of ISO 9386 covers powered stairlifts for seated, standing and wheelchair users moving in an inclined plane.

The location and dimensions of controls and other parts of the stairlift installation have been chosen to meet the functional needs of disabled persons and are compatible with the guidelines set out in ISO/TR 9527.

It is intended that equipment manufactured according to the requirements of this part of ISO 9386 is for use by disabled persons on a stairway with restricted access. In suitable circumstances, and subject to any special provisions detailed within this part of ISO 9386, such stairlifts may be used by disabled persons on stairways with a wider scope of access or unrestricted access.

Stairlifts manufactured according to the requirements of this part of ISO 9386 will be capable of being operated in a normal domestic environment as regards temperature and humidity. Additional features are likely to be necessary in more rigorous conditions, or if fitted in an external situation.

It is assumed that a stairlift complying with the requirements of this part of ISO 9386 will be used only by person(s) either capable of using it safely and unaided or, if not so capable, who only uses it when adequately attended by an assistant. On installations with restricted access, it is assumed that users will be fully instructed in the operation of the stairlift in accordance with clause A.3. On installations with public access, it is assumed that operating instructions or assistance will be provided.

When, for the sake of clarity, mention is made of a design, this should not be considered to be the only possible design, particularly in relation to recent developments in electronics and microprocessors and their use in control and safety circuits. Any other solution leading to the same result may be applied provided that it can be demonstrated to be equivalent in operation and at least equally safe.

It is recommended that stairlifts manufactured in accordance with this part of ISO 9386 should be subjected to independent verification of compliance through type approval.

Power-operated lifting platforms for persons with impaired mobility — Rules for safety, dimensions and functional operation —

Part 2: Powered stairlifts for seated, standing and wheelchair users moving in an inclined plane

1 Scope

This part of ISO 9386 specifies the safety rules, dimensions and functional operation for permanently installed power-operated stairlifts intended for use by persons with impaired mobility, for seated, standing and wheelchair users moving in a substantially inclined plane.

It is restricted to stairlifts

a) which travel between fixed levels over a staircase or an accessible inclined surface (see note 1);

b) whose rated speed does not exceed 0,15 m/s;

c) whose rail inclination does not exceed 75° from the horizontal;

d) whose carriage is directly retained and guided by a rail or rails (see note 2).

NOTE No enclosure for the path of the stairlift is required.

This part of ISO 9386 does not specify every general technical requirement for all aspects of the electrical, mechanical or building construction.

As far as possible, this part of ISO 9386 specifies only the requirements that materials and equipment need to meet in the interests of safety and functional operation.

Requirements are also included for protection against harmful influences which may be experienced by equipment installed in external locations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9386. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9386 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 606:1994, *Short-pitch transmission precision roller chains and chainwheels*.

ISO 3864:1984, *Safety colours and safety signs*.

ISO 4190-5, *Lifts and service lifts (USA: Elvators and dumbwaiters) — Part 5: Control devices, signals and additional fittings*.

ISO 4344:1983, *Steel wire ropes for lifts*.

ISO 4413:1998, *Hydraulic fluid power — General rules relating to systems*.

ISO 7000:1989, *Graphical symbols for use on equipment — Index and synopsis*.

IEC 60204-1, *Electrical equipment of industrial machines — Part 1: General requirements*.

IEC 60335-1, *Safety of household and similar electrical appliances — Part 1: General requirements*.

IEC 60364, *Electrical installations of buildings.*

IEC 60417-2:1998, *Graphical symbols for use on equipment — Part 2: Symbol originals*.

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code).*

IEC 60617, *Graphical symbols for diagrams*.

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*.

IEC 60742:1983, *Isolating transformers and safety isolating transformers — Requirements*.

IEC 60947-1:1999, *Low-voltage switchgear and controlgear — Part 1: General rules*.

IEC 60947-5-1:1997, *Low-voltage switchgear and controlgear — Part 5: Control circuit devices and switching elements — Section 1: Electromechanical control circuit devices*.

EN 50214, *Flexible cables for lifts*.

CENELEC HD 360 S2, *Circular rubber insulated lift cables for normal use*.

3 Terms and definitions

For the purposes of this part of ISO 9386, the following terms and definitions apply.

3.1
barrier arm
bar or similar device so arranged as to provide, when required, protection against falling from a stairlift

3.2
brake
electromechanical mechanism employed to hold the stairlift in position and/or to bring it to rest smoothly

3.3
carriage
whole moving part of the stairlift designed to carry the passenger or the passenger in a wheelchair

3.4
chain
simplex or duplex transmission chain that, if used as part of a drive system, either transmits rotary motion from one shaft to another or transmits motion directly to the carriage

3.5
chainwheel
wheel having machine-cut teeth specially designed to engage with a chain

3.6
competent person
person who, by virtue of specific training, is competent to assess technically the safety and function of the stairlift

3.7
contactor
relay
electromagnetically operated device of suitable rating for switching an electrical circuit

3.8
controller
assembly of electrical contactors, relays and/or other components which control the movement of the stairlift

3.9
direct-acting stairlift
stairlift in which a hydraulic jack or nut or screw is directly attached to the stairlift

3.10
down-direction valve
electrically controlled valve in a down-direction hydraulic circuit

3.11
drive
generic term covering the various electromechanical drive unit arrangements that cause the carriage to move under electrical power input

3.12
drive unit
complete assembly comprising an electric motor, brake and gearing, which supplies the tractive and braking effort controlling the movement of the carriage

3.13
driving nut
internally threaded annular component that acts in conjunction with a screw to produce linear motion of the carriage

EXAMPLE A rotating screw engaging with a fixed nut, or *vice versa.*

3.14
driving rack
strip incorporating specially shaped teeth with which a driving pinion may engage to form a positive driving means converting rotary motion into linear motion

3.15
driving screw
externally threaded driving component that acts in conjunction with a driving nut

3.16
duty cycle
number of journeys the stairlift is required to perform in a given period of time

3.17
final limit switch
electrical safety switch positively and mechanically operated by movement of the carriage in the event of over-travel

3.18
follow-through
amount of additional free movement provided in the actuation of an electrical switching device after the electrical contact has been broken

3.19
footrest
platform or bracket of adequate strength, so designed that the user is able to stand or to rest his/her feet upon it either during movement of the stairlift or when it comes to rest

3.20
full-load pressure
highest hydraulic system pressure for the stairlift carrying its rated load when at rest

3.21
guide rail
components which direct the course of the platform

3.22
guided chain
chain, which may be either fixed or moving, and which is completely guided over its entire length such that it may transmit a load either in thrust or tension

3.23
hydraulic stairlift
stairlift in which the lifting power is derived from an electric motor, driving a pump which transmits hydraulic fluid to a jack

3.24
journey
movement of the carriage between any two levels which incorporates one start and one stop

3.25
landing
defined level to be served by the stairlift, having adequate space to permit the manœuvring, boarding and alighting of users with a wheelchair where appropriate

3.26
overspeed governor
device which, when the stairlift attains a pre-determined speed, causes the stairlift to stop by application of the safety gear

3.27
pinion
wheel, having machine-cut teeth specially designed to engage with those of other similar toothed wheels or racks, used to transmit relative motion

3.28
platform
flat and substantially horizontal structure that is part of the carriage that supports the user

3.29
powered stairlift
stairlift that uses an external source of power, in contrast to one being operated manually

3.30
pressure-relief valve
valve which limits fluid pressure to a stated value by exhausting fluid

3.31
rack
bar with specially shaped teeth with which a pinion may engage and which forms a positive driving means to convert rotary motion into linear motion

3.32
rated load
load for which the equipment has been built and for which safe operation is guaranteed by the supplier

3.33
rated speed
nominal speed of the stairlift as agreed in the contract for the particular installation

3.34
restricted access
access which is restricted to a known user or users

3.35
rupture valve
valve designed to close automatically when the fluid pressure drop across the valve, caused by increased flow in a predetermined flow direction, exceeds a predetermined amount

3.36
safety circuit
electrical or electronic circuit which has been subjected to failure analysis to confirm an equivalent degree of safety to a safety contact

3.37
safety contact
contact in which the separation of the circuit-breaking elements is made by positive means

3.38
safety factor
ratio, for a particular material under static or dynamic conditions (as defined in the text), of the yield load or the ultimate tensile load (as defined in the text) to the load that can be imposed upon a member by the rated load

3.39
safety gear
mechanical device for stopping and maintaining the carriage stationary on the guides in the event of overspeeding in the downward direction or breaking of the suspension

3.40
safety nut
internally threaded annular component, used in conjunction with a screw/nut drive, so arranged that it does not normally carry the load but is capable of doing so in the event of failure of the threads in the main driving nut

3.41
safety switch
electrical switch incorporating one or more safety contacts

3.42
self-sustaining drive system
drive system that, under free running conditions with the brake lifted, will not permit the stairlift to increase in speed.

NOTE The system will not permit the stairlift to start moving from a standstill with the brake lifted. All other systems are non-self-sustaining.

3.43
sensitive edge
safety device attached to any edge of the stairlift to provide protection against a trapping, shearing or crushing hazard

3.44
sensitive surface
safety device similar in effect to a sensitive edge but so arranged to provide protection over a whole surface, such as the underside of a platform or other large area

3.45
slack rope
chain switch
switch or combination of switches, arranged to stop the stairlift if any suspension rope or chain slackens by a pre-determined amount

3.46
stairlift
appliance for transporting a person or person with a wheelchair between two or more levels by means of a guided carriage moving substantially in the direction of a flight of stairs and travelling in the same path in both upward and downward directions

3.47
stairway
part of a building that provides a route of travel and is formed either by a single flight of stairs or by a combination of two or more flights of stairs and one or more intervening landings

3.48
terminal switch
switch, or combination of switches, arranged to bring the stairlift to rest automatically at or near the landing

3.49
toothed belt
flexible continuous belt, having teeth formed in one or other of its surfaces, and designed to engage with specially cut or moulded teeth in wheels attached to separate shafts in order to provide a drive between the two

3.50
travel
distance between the highest and lowest levels served

3.51
unlocking zone
zone, extending above and below a landing, in which the stairlift must be positioned to enable the appropriate ramp(s) and barrier arm(s) to be unlocked

3.52
user
person(s) for whom the stairlift is installed or designed

4 General requirements for stairlifts

4.1 Pattern of use

The design of the stairlift shall take account of the frequency of usage to which it will be subjected.

4.2 Protection against hazards

Protection so as to minimize the risk of all of the following hazards shall be incorporated:

a) shearing, crushing, trapping or abrading;

b) entanglement;

c) falling and tripping;

d) physical shock and impact;

e) electric shock;

f) fire, attributable to use of the stairlift.

4.3 General design

Components shall be of sound mechanical and electrical construction, using materials that are free from obvious defects and that are of adequate strength and suitable quality. It shall be ensured that the dimensions specified in this part of ISO 9386 are maintained, despite wear. Consideration shall also be given to the need for protection against the effects of corrosion. The transmission of noise and vibration to any surrounding walls and other supporting structures shall be minimised. All materials shall be asbestos free.

4.4 Design guidelines particular to the installation

Ensure that design requirements particular to the installation or the user are taken into account.

4.5 Access for maintenance, repair and inspection

Stairlifts shall be designed, constructed and installed so that components requiring periodic inspection, testing, maintenance or repair shall be easily accessible.

4.6 Fire resistance

Materials used in the construction of the stairlift shall not support combustion, neither shall they be dangerous through the toxic nature and quantity of gas and fumes they may generate in a fire situation.

Plastic components and electrical wiring insulation shall be flame retardant and self-extinguishing.

4.7 Rated speed

The rated speed of the stairlift in the direction of travel shall not be greater than 0,15 m/s when measured at the reference points defined in Figures 1 and 2.

4.8 Rated load

Stairlifts shall be designed either for a capacity of one person, for which the rated load shall be not less than 115 kg, or for a capacity of one person in a wheelchair with a minimum rated load of 150 kg.

If the load to be transported is not known (e.g. in a public building), then it is recommended that the rated load of a wheelchair platform stairlift shall be not less than 225 kg.

The maximum rated load shall be 350 kg.

4.9 General safety factor

Unless stated otherwise in this part of ISO 9386, the safety factor for all parts of the equipment shall not be less than 1,6 based on yield load and the maximum dynamic load. This safety factor is based on steel or equivalent ductile materials. Increased safety factors shall be considered for other materials.

4.10 Resistance to operating forces

4.10.1 The complete stairlift 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. However, local deformation that does not affect the operation of the stairlift arising from the safety gear gripping device is permissible.

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

4.11 Protection of equipment against harmful external influences

4.11.1 General

Mechanical and electrical components shall be protected from the harmful and hazardous effects of external influences that will be encountered at the proposed installation site, for example:

a) the ingress of water and solid bodies;

b) the effects of humidity, temperature, corrosion, atmospheric pollution, solar radiation, etc.;

c) the actions of flora, fauna, etc.

4.11.2 Protection

The protection shall be designed and constructed and the stairlift shall be installed in such a manner that the influences mentioned above do not prevent the stairlift from operating safely and reliably.

4.11.3 Degree of protection for outdoor use

For outdoor use, stairlifts shall have a degree of protection for electrical equipment which is not less than IP4X as defined in IEC 60529:1989.

NOTE 1 Guidance on the construction of equipment, selection of enclosures, selection and treatment of materials, electrical insulating materials, sealing techniques, etc., should be obtained by reference to relevant national standards and International Standards.

The degree of protection shall be increased as necessary appropriate to the location and operating conditions (see 8.4.1).

4.12 Suppression of radio and television interference

The design of the electric motor, contact devices and control devices shall comply with legal requirements for the suppression of electromagnetic interference. However, components necessary to give an adequate degree of suppression shall not be used in any part of a circuit where failure might cause an unsafe condition.

4.13 Guarding

Components (e.g. gearing and the drive unit) shall be guarded so far as is possible to prevent risk of personal injury. Where necessary, guards shall be of imperforate material. Access panels shall be secured by means requiring the use of a tool or key for their release. See also 7.4.5 and 7.7.4.

5 Guide rails and mechanical stops

5.1 Guide rails

5.1.1 Guide rails shall be provided to retain and guide the carriage throughout its travel.

5.1.2 Guide rails shall be made of metal.

5.2 Folding guide rails

5.2.1 Folding guide rails shall not obstruct the stairway or landing when in the folded position.

5.2.2 Manual folding sections shall be counter-balanced.

5.2.3 A safety switch shall be fitted to prevent the stairlift from reaching the folding guide rail section, except when the folding section is correctly positioned for the operation of the stairlift.

On stairlifts with cableless control, the hinged rail position proving switch may act indirectly on the equipment controlling the supply to the driving motor and brake. This is a permissible deviation from 8.6.1.

5.2.4 The control system for motorized folding guide rail drives shall operate from constant pressure (hold-to-run) controls. However, self-maintaining controls may be used if the energy within the motorized folding rail system is less than 4 J.

5.2.5 Motorized drives shall also be capable of emergency manual operation.

5.2.6 The drive to the folding mechanism shall be protected to prevent damage to the mechanism or danger to the user should the folding section of guide rail encounter an obstruction.

5.3 Stairlift guide rail

Only one carriage shall be fitted on any one stairlift guide rail. Any adjacent stairlift guide rail shall be so positioned that there is no crushing or shearing hazard between the carriages when they are in the positions of closest proximity.

5.4 Mechanical end stops

These shall be fitted if it is possible for the stairlift to be driven beyond the extremes of travel.

6 Safety gear and overspeed governor

6.1 General

6.1.1 The stairlift shall be provided with a safety gear. The safety gear shall operate to stop and sustain the stairlift with the rated load taking into account associated shock loads.

There are four exceptions to this requirement, as follows:

a) direct acting hydraulic jack drives do not require a safety gear (see 7.13.6);

b) when the stairlift is driven by worm/segment drive;

c) when the stairlift is driven by a self-sustaining rotating screw or nut (see 6.8 and 7.7.5);

d) other drives provided that

— the failure of a single drive component, excluding rope or chain suspension, cannot cause the stairlift to overspeed (i.e. over 0,3 m/s) in the downward direction,

— the failure shall cause the stairlift to stop by operating a safety switch conforming to 8.6 or other equivalent means.

NOTE It is considered in b) that the multiple segments inherent in this drive system provide an equivalent level of safety to one safety nut and switch.

6.1.2 The safety gear shall be fitted on the stairlift carriage, except on stairlifts with drive system conforming to 7.8 and 7.11.

6.1.3 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 carriage in the downward direction shall release the safety gear.

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

6.1.5 The safety gear shall be designed to grip the guide rail, or equivalent element, securely. The gripping means shall be progressive such as is provided by a cam profile or equivalent mechanism.

6.1.6 Any shaft, jaw, wedge or support that forms part of the safety gear and that is stressed during its operation shall be made of metal or other ductile material.

6.1.7 The application of the safety gear shall not cause the carriage to change inclination by more than 10° for a chair carriage and 5° for a carriage with standing platform or wheelchair platform.

6.2 Control

The safety gear shall be mechanically tripped by an overspeed governor before the stairlift exceeds a speed of 0,3 m/s except on indirectly suspended hydraulic stairlifts where the safety gear may be tripped by a safety rope which is independent of the means of suspension or by slackening or breaking of a suspension rope or chain. On chain-suspended stairlifts with a single suspension chain, the safety gear shall, in addition, be engaged by the slackening or breaking of the suspension chain.

6.3 Release

Release of the safety gear shall only be possible by raising the stairlift. After its release, the safety gear shall remain functional for further use.

Operating instructions shall include advice that the safety gear shall only be released and re-set by a competent person.

6.4 Access for inspection

The safety gear shall be easily accessible for inspection and testing.

6.5 Electrical checking

When the safety gear is engaged, an electrical device conforming to 8.6 and activated by the safety gear shall immediately initiate stopping and shall prevent the starting of the machine.

6.6 Overspeed governor

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

Any friction drive to the overspeed governor shall be independent of the main friction drive on friction drive stairlifts.

On stairlifts with a single suspension chain, it is not permissible to drive the overspeed governor from the suspension chain.

6.7 Rotation monitor unit

If the overspeed governor is friction driven, the control system shall include circuitry to monitor rotation of the overspeed governor driving means during travel. If rotation ceases, the supply to the driving motor and brake shall be interrupted within 10 s or 1 m of travel.

Continuation of the travel may be by releasing the directional control button. Correct function shall be checked at least once during normal travel. User instructions shall give prominent advice that intermittent operation may indicate a malfunction of the overspeed governor and that service attention is required before further use.

The force transmitted to the rotating device by friction shall be at least twice the force necessary to trip the safety gear.

6.8 Safety nut

In the case of the screw and nut type of drives, a second unloaded safety nut shall be provided to carry the load and operate a safety contact in the event of failure of the driving nut such as to afford an equivalent degree of safety to that specified in 6.1. The safety contact shall operate to cause power to be removed from the motor and brake in the event of failure of the driving nut.

Consideration shall be given to the need for protection to the safety contact against the effects of pollution and vibration.

7 Driving units and drive system

7.1 General requirements

NOTE ISO 9085-1 gives guidance concerning the calculation of load capacity of spur and helical gears.

7.1.1 The selected drive method shall be in accordance with one of the systems specified in 7.4 to 7.13.

Other drive methods may be used, provided they achieve an equivalent degree of safety.

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

7.1.3 Safety factors used in the design of geared drive units shall be maintained, even after taking full account of the effects of wear and fatigue likely to arise during the designed life of the geared drive system.

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

a) sunk keys;

b) splines;

c) cross pinning;

d) other methods may be used, provided they achieve an equivalent degree of safety as a), b) and c) above.

Gearing shall be guarded so far as is possible. Any such guards shall be of imperforate material.

7.1.4 If chain or belt intermediate drives are employed within the drive system, then the following conditions shall be met:

a) the output drive gearing shall be on the load side of the chain or belt intermediate drive, and either

b) the output drive gearing shall be self-sustaining, or

c) the brake shall be on the load side of the chain or belt intermediate drive and a minimum of two belts shall be used. The chain or belt intermediate drive shall be monitored by a safety contact that shall disconnect the supply to the motor and brake in the event of breakage of any chain or belt. If V belts are used, the supply to the motor and brake shall also be disconnected in the event of the slackening of any belt.

7.1.5 Rope-suspension or chain-suspension systems shall incorporate a device that, in the event of a slack rope or chain, shall operate a safety contact that shall initiate a break in the electrical supply to the motor and brake and thus prevent any movement of the carriage until the rope or chain is correctly re-tensioned.

7.2 Braking system

7.2.1 General

An electromechanical friction brake shall be fitted (except on hydraulically driven stairlifts which conform to 7.13) which shall be capable of bringing the stairlift to rest within a distance of 20 mm and holding it firmly in position under rated load. The brake shall be mechanically applied and electrically held off. The brake shall not be released in normal operation, unless the electrical supply is simultaneously applied to the stairlift motor. Interruption of the electrical supply to the brake shall be controlled in accordance with 8.3. The brake should be able to stop and hold the stairlift even with a 25 % overload.

7.2.2 Electromechanical brake

The component on which the brake operates shall be positively coupled to the final driving element (e.g. rope drum, chainwheel, screw, nut, etc.) unless the final driving element is self-sustaining.

Brake linings shall be of flame retardant, self-extinguishing material and shall be so secured that normal wear will not weaken their fastenings.

No earth fault or residual magnetism shall prevent the brake from being applied when the electrical supply to the driving motor is interrupted.

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

If one or more coil springs are used to apply the brake shoes, such springs shall be in compression and adequately supported.

7.3 Emergency/manual operation

7.3.1 An emergency operating device shall be provided.

Where emergency operation is achieved by means of a manually operated hand-winding device, the hand-winding unit shall be operated by a smooth spokeless wheel. Alternatively, a standby power supply or device may be used for motorized operation. In this case, it shall be possible to bring the platform with rated load to a landing. Where necessary for reasons of safety, a safety contact shall provide protection against inadvertent operation of the normal controls when under emergency operation.

Instructions for emergency/manual operation shall be prominently displayed and shall state that the stairlift must be switched off and the carriage kept under constant surveillance when subject to emergency operation.

Where the resisting torque of the brake is too great to be overcome by emergency hand-winding, there shall be provided means of releasing the brake. Uncontrolled free-fall conditions shall not be possible under any circumstances. A device which could be left in a locked position shall not be used to hold off the brake.

A direction label in accordance with 12.2.5.2 shall be provided.

7.3.2 If the stairlift is designed to be normally operated by hydraulic means, a self-resetting manually operated lowering valve shall be provided to allow the carriage to be moved at a speed no greater than the rated speed. The operation of this valve shall require a continual manual effort.

In the case of indirect acting hydraulically driven stairlifts where slack rope or chain can occur, manual operation shall not cause an opening of this valve when the pressure is below the minimum operating pressure.

A hand-pump which causes the carriage to move in the upwards direction shall be permanently installed for every stairlift whose carriage 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 limiting the pressure to 2,3 times the full load pressure.

7.4 Additional requirements for rope suspension drive

7.4.1 Ropes

All rope(s) shall comply with ISO 4344. The safety factor of the ropes shall be not less than 12. The safety factor shall be the ratio between the minimum breaking load (N) of the rope and the continuous load imposed by raising the fully loaded carriage at maximum angle. Test certificates for the rope(s) shall be retained on file by the manufacturer and provided upon request. The ends of the ropes shall be fixed to the carriage, counterweight or suspension points by such methods as metal or resin-filled sockets, self-tightening wedge-type sockets, heart thimbles with at least three suitable rope grips or hand-spliced ferrule-secured eyes.

The minimum rope diameter shall be 5 mm.

The safety factor of rope anchorages shall be not less than 10.

A minimum of two ropes shall be fitted on all rope suspended stairlifts. Note that this requirement does not apply to stairlifts with guided rope and ball drive fitted with an arresting device and support system (see 7.8).

Means shall be provided to equalize the tension of the ropes.

Rope traction drive is not permitted.

7.4.2 Winding drums

Winding drums shall be provided with grooves for the suspension ropes. The grooves shall be smoothly finished with rounded edges. Plain winding drums are not permitted. The bottom of the rope groove shall be a circular arc over an angle of not less than 120°. The radius of the grooving shall be not less than 5 % in excess of, and not more than 7,5 % in excess of, the nominal radius of the suspension rope. The grooves shall be pitched so that there is adequate clearance between adjacent turns of rope on the drum and also between any part of rope leading onto the drum and the adjacent turn. Drum grooves shall have a depth not less than one-third of the nominal diameter of the rope. Only one layer of rope shall be wound on the drum.

The diameter of the drum shall not be less than 21 times the nominal diameter of the rope measured at the bottom of the rope groove. There shall be not less than 1,5 dead turns of rope on the drum when the carriage is at its lowest point.

The drum flanges shall project radially by no less than two rope diameters beyond the rope pitch circle diameter.

Winding drums shall be fixed to the driving unit shaft in accordance with 7.1.3.

7.4.3 Pulleys and diverter pulleys

Pulleys shall include additional security to retain the rope in case of wear and ageing. The grooves shall be smoothly finished with rounded edges. The bottom of the groove shall have the same profile as for drum grooving, but the depth of the groove shall be not less than 1,5 times the nominal diameter of the rope. The angle of flare of the sides of pulley grooves shall be approximately 50°.

The diameter of pulleys, measured at the bottom of the groove, shall be not less than 21 times the nominal rope diameter.

7.4.4 Angle of deflection

The maximum angle of deflection (fleet angle) in relation to the grooves shall not exceed 4°.

7.4.5 Retaining of the rope

Drums, and if necessary pulleys, shall be guarded so as to ensure that the rope is retained in the grooving under all circumstances and to ensure that trapping between rope and drum or pulley cannot occur. Ropes shall also be guarded if their position is such as to create a hazard.

7.5 Additional requirements for rack and pinion drive

NOTE 1 This type of positive drive is particularly applicable to stairlifts that are required to negotiate curves and/or changes in inclination.

NOTE 2 In order that full advantage may be taken of the safety potential of this type of drive, particular care should be taken in the design of the gearing from the motor to the driving pinion and, in particular, to the strength of the output shaft.

7.5.1 Driving pinion

The driving pinion shall be made from metal and shall be designed to resist wear. The safety factor used in the design of any driving pinion shall be maintained, even after taking full account of the effects of dynamic loading, wear and fatigue likely to arise during the designed life of the driving pinion and associated components. Undercutting of the gear teeth shall be avoided by using an adequate number of teeth. The pinion shall be fixed to the output shaft in accordance with 7.1.3.

7.5.2 Driving rack(s)

Rack(s) shall be made from metal having properties matching those of the pinion in wear and impact strength and shall possess an equivalent safety factor.

The rack(s) shall be securely attached to the rail(s) particularly at their ends and means shall be provided to maintain the pinion and rack constantly in positive mesh under all conditions of load. Any joints in the rack shall be accurately aligned to avoid faulty meshing or damage to teeth.

7.5.3 Guarding

Guards shall be fitted to minimize trapping hazards between the rack and pinion and any other part (see 4.13).

On curved rail stairlifts consideration shall be given to the need for warnings adjacent to possible hazards.

7.6 Additional requirements for chain suspension drive

NOTE Chain drive systems that are both fixed and guided may be regarded as rack and pinion drive systems.

7.6.1 Chainwheels

All driving chainwheels shall be made from metal and have a minimum of 16 machine-cut teeth. A minimum of 8 teeth shall be engaged. The minimum angle of engagement shall be 140°. Driving chainwheels shall be fixed to the drive shaft in accordance with 7.1.3.

7.6.2 Chains

All chains shall comply with the requirements of ISO 606. The safety factor of the chain(s) shall be not less than 10 based on ultimate tensile strength. The safety factor shall be the ratio between the minimum breaking load (N) of any chain and the continuous load imposed in raising the fully loaded carriage at maximum angle. Test certificates for the chain(s) shall be retained on file by the manufacturer and provided upon request (see annex B).

The strength of connecting links and chain anchorages shall be not less than that of the chain.

A single suspension chain shall only be used on stairlifts with restricted access, with load capacity less than 125 kg and with either a chair carriage or a carriage with standing platform (see 6.2 and 6.6).

When two or more suspension chains are used, means shall be provided to equalize their tensions.

Terminal and intermediate chain connections shall be positive and secure against misconnection.

7.6.3 Protection and guarding

Means shall be provided to avoid jamming owing to misfeeding or slackening of the chains and to prevent the chains from leaving the chainwheels or riding over the teeth of the chainwheels.

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

7.7 Additional requirements for screw and nut drive

7.7.1 Driving screw

The driving screw shall be made of metal with an adequate impact strength, shall be designed to resist wear and shall have a safety factor of not less than 6 based on ultimate tensile strength and dynamic load except if the screw is subjected to a compressive load, when a minimum factor of safety of 3 against buckling shall apply.

NOTE Rotating screws require particular care to ensure the factor of safety against buckling is maintained.

7.7.2 Driving nut

The nut shall be made from a metal compatible with the screw with respect to wear and impact strength and shall possess an equivalent safety factor. A low friction coating of a plastic or similar material is permissible.

7.7.3 Screw/nut assembly

The drive to the rotating component shall be directly controlled by a brake. However, chain or belt intermediate drives are permitted if the requirements of 7.1.4 are fulfilled. The rotating component shall be restrained against axial or radial movement by means of adequately supported bearings.

7.7.4 Guarding

Means shall be provided to guard effectively all moving parts and to prevent the fouling of the screw threads with dirt or other foreign matter.

7.7.5 Safety nut

On self-sustaining screw and nut drives, a safety nut may be used in place of a safety gear [see 6.1.1 c) and 6.8]. The nut shall posses an equivalent safety factor to the driving nut.

7.8 Additional requirements for guided rope and ball drive

One rope may be used in such systems if the arrangement is combined with an arresting device and support system.

The safety factor of the lifting rope shall be not less than 12. The safety factor shall be the ratio between the minimum breaking load of the rope and the load imposed on the rope at the driving wheel when raising the fully loaded carriage at maximum angle, taking into account friction from the support balls.

The load-bearing balls shall be fastened on the rope in such a way that the 12 times factor of safety as above is achieved by the number of balls that lie on the gear wheel at the same time.

The rope attachments shall have a minimum factor of safety of 10 based on ultimate tensile strength.

7.9 Additional requirements for worm-toothed segment drive

7.9.1 The toothed segments shall be of metal, possibly with lining, and so dimensioned that the safety factor against breakage is at least 6 based on ultimate tensile strength at the intended maximum allowed static load. Adjacent segments shall always overlap each other.

7.9.2 The lifting worm shall be made of metal. The material of the worm shall be more resistant against wear than the material of the toothed segments. The worm shall be dimensioned so that the maximum static load on each loaded screw thread does not exceed 1/6 of the allowable breaking load. At least two threads shall always be in engagement simultaneously.

7.9.3 Radial movement of the worm shall be restricted so that worm/segment engagement shall be not less than 2/3 of the nominal. The worm shall be securely located against displacement, even in the event of failure of the main driving shaft.

7.9.4 If the drive is not self-sustaining, the carriage shall be fitted with a safety gear and overspeed governor.

7.10 Additional requirements for friction/traction drive

7.10.1 The traction between the traction wheels and the track shall be proved by calculations and test at the rated load plus 25 %. It should be confirmed that this will be achieved, even after the effects of wear during normal service. The traction wheels shall adjust automatically to ensure that the traction grip is maintained, even despite the effects of wear (see also 6.6).

7.10.2 The traction wheels shall be made of metal, except that the running surface may consist of a tyre of other material, provided wear or failure of this does not reduce the traction grip below the specified minimum.

7.11 Additional requirements for guided chain drive

7.11.1 A guided chain drive with a fixed chain shall be regarded as a rack and pinion drive system.

7.11.2 A guided chain drive with a movable chain shall be regarded as a chain suspension drive system, calculated in conformity with 7.6, except that if the safety gear acts on the chain and if the chain is solidly guided so

as to provide a support between the carriage and the point of operation of the safety gear then, in the event of chain breakage, the chain and its guides shall be regarded as a supported drive system. When the chain is acting as a supporting system, a minimum safety factor of 3 against buckling shall apply for the supporting chain and its guides.

7.12 Additional requirements for guided chain drive with bearing rollers and bearing segments

7.12.1 The complete suspension means consisting of the guided chain, the bearing rollers, the bearing segments and their fixings shall have a minimum factor of safety of 6 based on ultimate tensile strength, except that the guided chain shall have a minimum factor of safety of 10.

7.12.2 There shall be a minimum of two bearing rollers and two bearing segments in engagement and the loading shall be shared equally.

7.13 Additional requirements for hydraulic drive

NOTE Guidance and recommendations for the design of reliable and safe hydraulic systems are given in ISO 4413. Graphical and circuit symbols to be used on hydraulic circuit diagrams are given in ISO 1219-1.

7.13.1 Pressures

7.13.1.1 For the calculation of stresses in components such as valves, jacks and pipes (excluding flexible hoses), the following shall be taken into account:

a) maximum static hydraulic full load pressure;

b) minimum safety factor of 1,7 referred to the proof stress of the materials;

c) minimum safety factor of 2,3 for friction losses and pressure peaks.

7.13.1.2 For the calculation of compressive stresses in jacks at their fully extended position, the following shall be taken into account:

a) maximum pressure equal to 140 % of the full load pressure ;

b) minimum safety factor of 2,3.

7.13.1.3 Flexible hoses shall withstand at least 8 times the full load pressure.

7.13.2 Jacks

Grey cast-iron or other brittle materials shall not be used in the construction of jacks and their associated connecting links.

The jacks shall be so mounted that they are subjected to axial loads only. They shall be provided with stops at the limit of their stroke or with equally effective means to prevent the piston rod from travelling beyond the limits of the jack.

7.13.3 Pressure-relief valve

The hydraulic circuit shall include a pressure-relief valve installed between the pump and the non return valve. The valve shall be adjusted to limit the pressure to a maximum of 140 % of the full-load pressure.

7.13.4 Non-return valve

The hydraulic circuit shall include a non-return valve to prevent the return of oil from the cylinder through the pump or pressure-relief valve.

7.13.5 Control valves

Valve spindles or plungers shall be positively restrained to prevent their ejection from the valve casing.

Electrically operated valves, in particular the lowering valve(s), shall be designed to return to their rest position by the hydraulic pressure from the jack and by at least one guided compression spring per valve.

7.13.6 Protection against hydraulic system failure

When the stairlift travel is greater than 500 mm, the hydraulic system shall include a rupture valve fitted directly to the cylinder outlet, or other effective device, which in the event of failure in any part of the hydraulic circuit (excluding the jack) shall arrest the descent of the stairlift.

The rupture valve shall be

— integral with the cylinder; or

— directly and rigidly flange-mounted; or

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

— connected directly to the cylinder by threading.

The rupture valve shall be provided with a thread ending with a shoulder. The shoulder shall butt up against the cylinder.

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

7.13.7 Protection against creeping

Protection against creeping shall be provided on stairlifts with hydraulic drive whose travel exceeds 500 mm.

Examples of methods by which this may be achieved are as follows:

— electric anti-creep system;

— pawl device;

— tripping of the safety gear or a clamping device by downward movement of the stairlift.

The stairlift shall be prevented from creeping more than 50 mm below floor level.

7.13.8 Pressure gauge

Provision shall be made in the hydraulic circuit between the non-return valve and the jack for a pressure gauge and isolation valve to be fitted for test purposes.

7.13.9 Reservoir

The oil reservoir shall be of closed construction and shall incorporate a covered filler, a breather, a means for determining the fluid level and a filter.

7.13.10 Piping and supports

All piping shall be supported in accordance with ISO 4413 to eliminate undue stress at joints, bends and fittings and particularly at any section of the hydraulic system subject to vibration.

Rigid pipes and flexible hoses shall be protected by means of ferrules where they pass through walls, floors, panels or bulkheads.

Couplings shall not be located within ferrules.

7.13.11 Flexible hoses

Flexible hoses shall be installed in such a manner that:

a) sharp flexing and straining of the hose during operation of the stairlift is avoided;

b) the torsional deflection of the hose is minimized;

c) the hose is located or protected to avoid damage;

d) the hose is adequately supported or has vertical termination if the weight of the hose could cause undue strain.

The hoses shall be compatible with the hydraulic fluid used in the system and shall be permanently marked with their maximum working pressure (see 7.13.1.3).

7.13.12 Manual/emergency operation

The requirements of 7.3.2 shall apply.

8 Electrical installation and equipment

8.1 General

8.1.1 Stairlifts shall be connected to a dedicated power supply conforming with the relevant part of IEC 60364, terminating at a main switch and fuse or overload device. The requirement for the supply to be dedicated does not apply to battery-operated stairlifts.

NOTE 1 National requirements for electrical distribution circuits cease to be applicable at the inlet terminals of the main switch referred to above.

NOTE 2 National interpretation of "dedicated power supply" is permissible.

8.1.2 The electrical installation and equipment shall comply with the requirements of either IEC 60204-1 or IEC 60335-1 as appropriate.

The nominal main d.c. voltage or a.c. voltage between conductors and between conductors and earth shall not exceed 250 V for control and safety circuits. Mains-supplied control circuits, other than line-to-earth neutral supplies, shall be derived from the secondary winding of an isolating transformer complying with IEC 60742. One line of the control circuit shall be earthed (or grounded on isolated circuits) and the other line shall be fused in accordance with Figure 4.

SELV protected circuits in accordance with the relevant part of IEC 60364 may be considered as an alternative, provided an equivalent level of safety can be assured. Equivalent requirements for battery-powered stairlifts are given in 8.12.

8.1.3 The operating voltage of the drive unit shall not be greater than 500 V.

8.1.4 The neutral conductor and any circuit-protective conductor shall be separate.

8.1.5 The resistance of the insulation between conductors and between conductors and earth shall be greater than 1 000 Ω/V with a minimum of

a) 500 kΩ for power circuits and circuits containing electrical safety devices;

b) 250 kΩ for other circuits.

8.2 Drive contactors

8.2.1 Main contactors (as required in 8.3) shall be to a minimum specification of

a) utilisation category AC-3 for contactors for a.c. motors, and

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

as specified in IEC 60947-4-1:1990.

8.2.2 If, because of the power they carry, relays must be used to operate the main contactors, those relays shall belong to the following categories as specified in IEC 60947-5-1:1997.

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

b) DC 13 for relays controlling d.c. contactors.

8.2.3 Each contactor specified in 8.2.1 and 8.2.2 shall operate such that:

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

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

These conditions shall be maintained even if one of the contacts becomes welded together.

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

8.3 Motor and brake circuits for stopping the machine and checking its stopped condition

8.3.1 Motors supplied directly from a.c. mains

The supply to the motor and brake shall be interrupted by two independent contactors, the contacts of which shall be in series in the motor and brake supply circuits. If, whilst the stairlift is stationary, one of the contactors has not opened the main contacts, further movement of the stairlift shall be prevented at the latest at the next change in the direction of motion.

8.3.2 A.c or d.c. motors controlled and supplied by solid-state elements

One of the following methods shall be used:

a) as 8.3.1; or

b) a system consisting of:

— a contactor interrupting the current at all poles; the coil of the contactor shall be released at least before each change in direction; if the contactor does not release, any further movement of the stairlift shall be prevented;

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

— a monitoring device to verify the blocking of the flow of energy each time the stairlift is stationary.

If, during a normal stopping period, the blocking by the static elements is not effective, the monitoring device shall cause the contactor to release and any further movement of the stairlift shall be prevented.

8.3.3 Electrical supply to the drive motor and brake

This 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 safety contact.

Stopping distances shall be no greater than:

— 20 mm in response to operation of a safety contact or safety circuit;

— 50 mm in response to termination of a directional signal or following the failure of the electrical supply.

8.4 Creepage and clearance distances and enclosure requirements

8.4.1 Enclosure requirements

The live parts of controllers and safety contacts shall be located within a protective enclosure of at least IP2X.

Covers shall be retained by clamping devices requiring the use of a tool for their removal. Consideration shall be given to the need for additional security by the use of a fixing or lock requiring a key or special tools on stairlifts with public access.

Where necessary (e.g. for outdoor use), an increased degree of protection shall be provided appropriate to the location and operating conditions.

8.4.2 Creepage and clearance distances

Creepage and clearance distances for power circuits, safety circuits and any components connected after safety circuits or safety contacts and whose failure would cause an unsafe condition shall conform to the requirements of IEC 60947-1:1999, Table XV, in accordance with the working voltage and subclause 6.1.3.2 of IEC 60947-1:1999, minimum pollution degree 2. Printed wiring material column not to be used.

8.5 Protection against electrical faults

8.5.1 Any one of the faults listed below, occurring in the electrical equipment of the stairlift, shall not, on its own, be the cause of dangerous malfunction of the stairlift:

a) absence of voltage;

b) voltage drop;

c) phase reversal on multiphase 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.

The non-opening of a safety contact need not be considered.

8.5.2 The earthing of an energized circuit, in which there is a safety contact, shall cause the immediate halt and prevent re-starting of the stairlift.

8.6 Electric safety devices

8.6.1 The electric safety devices (for example, those listed in Table 1) shall act directly on the equipment controlling the supply to the driving motor and brake.

NOTE An unsafe condition is failure to respond to a safety switch or device.

Movement of the machine shall be prevented or it shall be caused to stop immediately as indicated in 8.3. The electric safety devices shall consist of either

a) one or more safety contacts satisfying 8.6.4 directly cutting the supply to the contactors referred to in 8.2 or their relay contactors, or

b) one or more safety contacts satisfying 8.6.4 not directly cutting the supply to the contactors referred to in 8.2 or their relay contactors in conjunction with safety circuits satisfying 8.10.

8.6.2 If, because of the power to be transmitted, relay contactors are used to control the machine, these shall be considered as equipment directly controlling the supply to the machine for starting and stopping.

8.6.3 A safety switch shall not be placed in a return conductor or a circuit-protective conductor.

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

Positive opening is achieved when all the contact-breaking elements are brought to their open position and when, for a significant part of the travel, there are no resilient members (e.g. springs) between the moving contacts and the part of the actuator to which the actuating force is applied.

The design shall be such as to minimize the risk of a short circuit resulting from component failure.

8.6.5 Abrasion of conductive material shall not lead to short circuiting of contacts.

Table 1 — Examples of electrical safety switches or devices

Switch or device	Relevant clauses
Safety switch for detecting slack in a suspension rope or chain	7.1.5
Carriage stop safety switch	8.14.1
Switches operated by sensitive edges or surfaces	9.2.3 9.3.4 9.4.7
Final limit switch	8.15
Safety gear switch	6
Barrier arm position switch	9.4.6
Screw/nut drive failure switch	6.8
Ramp safety switch	9.4.6.1
Seat rotation or movement switch	9.2.2

8.6.6 If safety contacts are accessible to non-competent persons, they shall be so constructed that these contacts cannot be rendered inoperative by simple means.

NOTE A magnet or bridge piece is not considered to be a simple means.

8.7 Time delay

Provision shall be made for a delay of a minimum of 1 s between the stopping of the stairlift and its being re-started in either direction.

8.8 Protection of the driving motor

Driving motors shall be protected against overloading and potentially damaging excess currents by means of a suitable device which automatically disconnects the supply. The device may automatically re-set after an appropriate interval.

8.9 Electrical wiring

8.9.1 Conductors, insulation and earth bonding

8.9.1.1 Nominal cross-sectional area

The nominal cross-sectional area of all conductors shall be appropriate to the current rating. Wired power and safety circuit conductors shall be no smaller than 0,5 mm^2.

8.9.1.2 Insulation

If a duct or cable contains conductors whose circuits have different voltages, all those conductors or cables shall have insulation suited to the highest voltage.

8.9.1.3 Trailing cables

8.9.1.3.1 Trailing electrical power and control cables shall be securely clamped at each end to ensure no mechanical load is transmitted to cable terminations. Provision shall be made to protect the cable from abrasion.

8.9.1.3.2 It is recommended that flat cables shall be constructed in accordance with EN 50214 and round cables shall be constructed in accordance with CENELEC HD360 S2.

8.9.1.3.3 No conductor shall be smaller than 0,5 mm^2. In addition, power and safety circuit conductors shall be no smaller than 0,75 mm^2. Any earthing conductor shall be no smaller than the supply conductor with the largest cross-sectional area.

8.9.1.4 Continuity conductors

All earth continuity conductors shall be copper, except when slip-rings or tracks and carbon brushes are used. At least one slip-ring or track and carbon brush and trailing cable way should be dedicated to the earth path.

8.9.1.5 Nut or screw

Any nut or screw used for clamping a conductor shall not be used for clamping any other component.

8.9.1.6 Earth bonding

All exposed metalwork, other than conductors, liable to become electrically charged shall be earth bonded [see 10.1.3 b) referring to the earth bond test]. See also Figure 5 showing the grounding requirements for battery operated stairlifts.

8.9.2 Terminals and connectors

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

8.9.2.2 Terminations shall cause no damage to the conductors or insulation.

8.9.2.3 Mains input terminals shall be conveniently accessible within the equipment and shall be identified to indicate the correct polarity, i.e. 'L' for line and 'N' for neutral. The main earth terminal shall be located conveniently near the main input and identified by an earth symbol.

8.9.2.4 Earthing terminals of the stud type shall be of a size appropriate to the conductor current rating and a minimum of M3. They shall not be used for securing any component, nor shall it be possible to loosen the connection without the use of a tool. All earth conductors shall be terminated with suitably crimped or soldered terminations.

8.9.3 Electrical identification

Terminals, connectors and electrical components shall, where appropriate, be marked with a suitable means of identification.

8.10 Safety circuits

8.10.1 Safety circuits shall comply with the requirements of 8.5 and 8.6 relative to the appearance of a fault.

Faults should be considered for open-circuit and short circuit for passive components (resistors, capacitors, inductors, etc.) and, in addition, change-of-function for active components (transistors, integrated circuits, etc.) (see annex F).

8.10.2 All parts of the safety circuit shall be designed to meet the creepage and clearance distances defined in 8.4.2.

8.10.3 All components of the safety circuit shall be used within the worst case limits and within manufacturers recommendations for voltage, current and duty.

8.10.4 Safety circuits shall be designed such that the stairlift is only allowed to operate whilst all safety circuits are functioning correctly.

8.10.5 Any fault or combination of faults which in themselves do not lead to an unsafe condition but when combined with a further fault would cause an unsafe condition shall cause the stairlift to be stopped at the latest at the next stage of direction.

However, a combination of more than three faults can be disregarded if the safety circuit is built out of at least two channels. In the case of different status, the stairlift shall be stopped at the latest at the next change of direction.

8.10.6 Safety circuits shall be subjected to a safety and failure analysis in accordance with the requirements of annex F.

8.11 Residual current devices

All electrical circuits, other than supplies to charging units on battery-operated stairlifts, carrying a voltage greater than 50 V above earth shall be protected by the use of a residual current device (RCD). The maximum rated tripping current shall be 30 mA. The maximum trip time at rated tripping current shall be 200 ms. The maximum trip time at 5 times the rated tripping current shall be 40 ms.

Where possible, the testing of this device shall not cause spurious tripping of any other similar device fitted to the mains supply circuit.

The validity of this clause is subject to local requirements concerning electrical supply.

8.12 Additional requirements for battery-powered operation

8.12.1 For battery-powered stairlifts, the control circuit voltage shall not exceed 60 V.

8.12.2 Batteries shall not leak, even when tilted at an angle. Batteries shall not emit fumes during normal operation, including charging.

8.12.3 A fuse shall be fitted in line with the battery supply which is only accessible by the use of an appropriate tool(s). This fuse shall isolate the battery supply within half a second of the supply being short circuited and within 5 s of twice the average peak current being drawn.

8.12.4 The charging arrangement for the batteries shall be as Figure 5 a) for a.c. charging and Figure 5 b) for d.c. charging. The maximum voltage potential when measured with respect to earth shall be as follows:

a) for protected charge contacts, 250 V a.c. or 60 V d.c.;

b) for exposed charge contacts, 25 V a.c. or 60 V d.c.

NOTE Protected means it is not possible to touch the contacts without the use of tools.

Battery charging should be carried out at points where the stairlift is expected to be stationary between journeys. Usually this is at each end of the rail.

8.12.5 Battery terminals shall be physically protected against short circuiting.

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

8.12.7 The carriage isolating switch shall cause the battery to be isolated from the control and drive motor circuits.

8.12.8 Battery capacity and charging rate shall be appropriate to the conditions of service after taking into account the travel and anticipated duty rating.

8.12.9 If the stairlift is brought to rest out of the reach of the charge contacts, this shall be indicated to the user visually or audibly.

8.12.10 The carriage chassis shall be grounded as shown in Figure 5.

8.12.11 The battery charger shall not damage or overcharge the battery, even after long periods on charge.

8.12.12 The requirements of 8.12.8 do not apply to battery back-up systems.

8.13 Cableless controls

NOTE Cableless control is suitable for applications where it is not possible or desirable to have a physical link between the stairlift carriage and the landing controls (e.g. on a battery-powered stairlift).

8.13.1 The cableless control system shall be designed to work with a single stairlift. It shall be designed such that the stairlift shall not respond to signals from another stairlift or other similar cableless control system (For example, by use of an appropriate frequency spectrum, coded signals and range.)

8.13.2 Redundancy shall be provided within both the transmitter and the receiver. Within the transmitter, this may be achieved by the means specified in 8.14.2.

8.13.3 On stairlifts with public access, the remote control device must be in a fixed position adjacent to the stairlift, unless it is under the supervision of a qualified attendant.

8.13.4 Carriage mounted stop switches, safety contacts and safety circuits shall override all directional signals (whether from the carriage controls or from the cableless controls) and the stairlift shall stop within 20 mm in accordance with 7.2.1.

8.13.5 The cableless communication link must remain effective throughout the length of the carriage travel. The requirements of 8.3.3 shall be maintained at all points during travel.

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

8.13.7 The cableless control system shall be designed so as to be no less safe than a wired control system in the event of component failure.

8.14 Operating devices

8.14.1 Operating devices shall be provided at each landing and on the carriage. These shall be used to control the directional movement of the stairlift and their function shall be "hold to run". In buildings with private access, the landing controls may be omitted if not required by the user.

The position of control devices must be suitable for the requirements of the intended user, whether seated, standing, or in a wheelchair.

A bi-stable safety switch shall be fitted on the stairlift carriage that, when operated, shall directly interrupt the safety circuit.

This switch shall be clearly visible and accessible to the user, easy to operate, and protected by position or design against inadvertent operation.

8.14.2 Means shall be provided on each landing control station (where fitted) that, when operated, shall directly interrupt the circuit to the associated directional controls.

8.14.3 Wherever necessary (e.g. to restrict unauthorized use), an on/off lockable switch shall be provided to restrict the use of the stairlift to the intended user.

8.14.4 When the user has difficulty in operating normal control devices, it may be necessary to consider special devices to suit the particular disability. Recommendations for such devices are given in annex C.

8.15 Terminal limit switches and final limit safety switches

8.15.1 Terminal limit switches and final limit safety switches shall be provided.

The opening of the final limit safety switch shall prevent further movement of the stairlift, in both directions of travel, until the stairlift has been correctly re-positioned manually.

8.15.2 The lower final limit safety switch may be omitted in the case of hydraulic drives or those drives incorporating slack rope or slack chain safety switches. In addition, both upper and lower final limit safety switches may be omitted when the design of the drive system is such that overtravel beyond the normal limits of travel is not possible, even without the use of mechanical end stops.

The lower final limit safety switch may be omitted if the lower terminal limit switch is a safety switch and if bottom overtravel results in operation of the carriage, standing platform, footrest or wheelchair platform underside safety switches.

8.16 Emergency alarm devices

8.16.1 Wheelchair platform stairlifts in buildings with public access shall be fitted with an emergency alarm device. The installer should consult the purchaser or user concerning the positioning of the alarm signal.

NOTE Consideration should be given to the desirability of providing an alarm system that would alert a dependable assistant or summon help from beyond the immediate location of the stairlift. This is especially relevant to the users of wheelchair platform stairlifts.

8.16.2 Emergency alarm devices shall either

a) be fed from a supply that is separate from the main supply to the driving motor, or

b) be equipped with a standby power source (such as battery back-up).

9 Carriage

9.1 General requirements

9.1.1 Types of carriage

Various forms of carriage are permissible for conveying the intended user, depending upon individual needs. The broad classifications are as follows:

a) chair carriage (9.2);

b) standing platform (9.3);

c) wheelchair platform (9.4).

9.1.2 Special adaptations

If special adaptations are necessary to cope with individual user circumstances, consideration shall be given to the need for additional safety features.

In multi-user situations, special adaptations shall not inhibit access or reduce safety protection to the general user.

9.1.3 Combined type of carriage

If a combined type of carriage is required (e.g. chair carriage and standing platform) safety features shall be incorporated equivalent to those specified for each of the types of carriage concerned.

9.1.4 Construction

The carriage shall consist of a mobile trolley, which is retained, supported and guided by one or more rails, upon which a chair, platform or other purpose-made adaptation to carry the user is supported and securely attached.

Any part or edge of the carriage that is intended to be used as a supporting hand-hold shall have clearance of at least 80 mm from any part of the fixed installation to prevent a hand being trapped during the travel of the carriage.

9.1.5 Load plate

A load plate shall be securely mounted in a prominent and visible position, either on the carriage or at each landing adjacent to the stairlift. The plate shall carry a legend similar in content and layout to the following.

a) For a seated or standing platform stairlift:

THE RATED LOAD IS ONE PERSON WITH A MAXIMUM WEIGHT OF *XX* kg

b) For a wheelchair stairlift:

THE RATED LOAD IS ONE PERSON AND A WHEELCHAIR WITH A MAXIMUM COMBINED WEIGHT OF *XX* kg

Examples of such load plates are shown in Figure 6. The height of the lettering used on the load plate shall be as specified in Figure 6.

9.1.6 Nameplate

There shall also be securely attached, in a prominent position, a nameplate or plates which include(s) at least the supplier's address and the reference number of the stairlift.

9.1.7 Minimum clearance dimensions

Recommended minimum clearance dimensions are shown in Figure 7.

In buildings with public access, these dimensions shall be achieved if possible. If these dimensions cannot be achieved, warning notices shall be prominently displayed and consideration shall be given to the need for additional safety devices.

9.2 Chair carriage

NOTE A chair carriage should only be considered in a building with public access where there is insufficient space for a wheelchair platform.

9.2.1 Chair

The chair on the carriage shall consist of a seat, backrest, armrest(s) [or hand-grip(s)] and a footrest so arranged to provide a safe support for the user. The top of the backrest shall be not less than 300 mm above the surface of the seat. Footrests shall be foldable.

The surface of the footrest shall be covered with slip-resistant material.

NOTE 1 The seat and armrest(s) [or hand grip(s)], as appropriate, may be arranged to fold up when not in use.

NOTE 2 The chair may be capable of suitable movement, e.g. rotation.

When the chair is stationary at its normal position at any landing, the height of the surface of the footrest above the floor shall not exceed 200 mm. If it is desired to mount the chair from a step or landing above floor level, then the measurement of 200 mm shall be taken from this point.

Provision for a safety belt or other safety restraint shall be fitted. In public situations, a safety belt or safety restraint shall be fitted.

9.2.2 Sliding or rotating seats

Stairlifts with sliding or rotating seats shall, by means of a safety contact, be incapable of operation unless the seat is in its fully operational position. Such seats shall be secured at the extremes of their travel by a releasable mechanical lock or equivalent means.

9.2.3 Sensitive edges and surfaces

9.2.3.1 Sensitive edges and sensitive surfaces shall be fitted as follows:

a) to the upstairs edge of the footrest;

b) to the under-surface of the footrest, if the distance from the floor to the underside of the footrest is less than 120 mm;

c) to the underside of the footrest when folded, if the distance from the floor to the underside of the folded footrest is less than 120 mm;

d) on the upstairs and downstairs surfaces of the carriage structure adjacent to the rail;

e) under the carriage if the distance to the floor is less than 120 mm.

NOTE Additional guidance is given in ISO 13854 on sensitive edges and sensitive surfaces.

9.2.3.2 Consideration shall also be given to the need for additional protection, for example between any fixed abutments such as at the rail terminations.

9.2.3.3 The operation of any sensitive edge or sensitive surface shall initiate a break in the electrical supply to the motor and brake in the direction in which the carriage is operating. This shall be achieved by the use of a safety contact or safety circuit. Where appropriate, operation of controls in the opposite direction of travel to enable the obstacle to be cleared shall be possible.

9.2.3.4 Consideration shall be given to the provision of resilience or follow through in the operation of the sensitive edge or surface.

9.2.3.5 The average force required to operate any sensitive edge shall not exceed 30 N when measured at each end and the midpoint.

The average force required to operate any sensitive surface shall not exceed

a) 50 N for surfaces with an area equal to or less than 0,15 m^2, or

b) 100 N for surfaces with an area greater than 0,15 m^2,

when measured at two diagonally opposite corners and the centre point.

Wherever possible, any other part of the carriage that may come into forceful contact with the user or other persons shall be suitably contoured, padded or protected.

9.3 Carriage with standing platform

9.3.1 Standing platforms

Standing platforms are not suitable for use in public situations.

The standing platform shall be of a basic size of at least 325 × 350 mm. The platform shall be provided with hand-grips and supports for the user when travelling or when stepping on or off.

The surface of the platform shall be covered with slip-resistant material.

Where applicable, the requirements of 9.2 shall apply.

9.3.2 Barrier arm

A barrier arm shall be provided to protect the downside of the standing platform with a minimum height of between 900 mm and 1100 mm above the level of the platform.

Controls shall be provided for a standing user which shall be inoperable unless the barrier arm is in the extended position.

9.3.3 Height above floor level

When the stairlift is stationary at its normal position at any landing, the height of the standing platform surface above the floor shall not exceed 200 mm.

If it is desired to mount the standing platform from a step or landing above floor level, then the measurement of 200 mm shall be taken from this point.

NOTE If necessary to conserve space, the platform, barrier and, if fitted, the seat and armrest(s) or hand-grip(s), as appropriate, may be arranged to fold away when not in use.

9.3.4 Sensitive edges and surfaces

9.3.4.1 Sensitive edges and sensitive surfaces shall be fitted as follows:

a) to the upstairs edge of the standing platform;

b) to the under-surface of the standing platform;

c) to the underside of the standing platform when folded, if the distance from the floor to the underside of the folded standing platform is less than 120 mm;

d) on the upstairs and downstairs surfaces of the carriage structure adjacent to the rail;

e) under the carriage if the distance to the floor is less than 120 mm.

NOTE Additional guidance is given in ISO 13854 on sensitive edges and sensitive surfaces.

9.3.4.2 Consideration shall also be given to the need for additional protection, for example between any fixed abutments such as at the rail terminations.

9.3.4.3 The operation of any sensitive edge or sensitive surface shall initiate a break in the electrical supply to the motor and brake in the direction in which the carriage is operating. This shall be achieved by the use of a safety contact or safety circuit. Where appropriate, operation of controls in the opposite direction of travel to enable the obstacle to be cleared shall be possible.

9.3.4.4 Consideration shall be given to the provision of resilience or follow through in the operation of the sensitive edge or surface.

9.3.4.5 The average force required to operate any sensitive edge shall not exceed 30 N when measured at each end and the midpoint.

The average force required to operate any sensitive surface shall not exceed

a) 50 N for surfaces with an area equal to or less than 0,15 m^2, or

b) 100 N for surfaces with an area greater than 0,15 m^2.

when measured at two diagonally opposite corners and the centre point.

Wherever possible, any other part of the carriage that may come into forceful contact with the user or other persons shall be suitably contoured, padded or protected.

9.4 Carriage with wheelchair platform

9.4.1 Platform floor

The platform floor shall be of a slip-resistant material.

9.4.2 Platform size

The recommended maximum platform size is 900 mm wide by 1 250 mm long.

In buildings with public access, the minimum platform size shall be 750 mm wide by 900 mm long.

The dimensions given above do not include ramps. Hand-rail projections up to a maximum of 50 mm are not considered as reducing platform dimensions.

9.4.3 Folding platforms

Folding platforms shall be protected against falling accidentally. Manually operated folding platforms shall be counter-balanced (see also 9.4.6).

9.4.4 Ramps and toe-guards

9.4.4.1 Ramps shall be fitted on all platform access edges. They shall have an inclination which is no greater than that given below. A step of up to 15 mm high is permissible at the leading edge of any ramp.

Ramping inclinations shall not be greater than:

a) 1 : 4 on a vertical rise of up to 50 mm;

b) 1 : 6 on a vertical rise of up to 75 mm.

9.4.4.2 The height of all ramps shall be a minimum of 100 mm above the unfolded platform surface when the ramp is in the raised position.

9.4.4.3 Non-access edges of the platform shall be protected by roll-off guards with a minimum height above the unfolded platform surface of 75 mm.

9.4.4.4 Pits are permitted only in private dwellings. The maximum depth shall be 100 mm. The clearance between the edges of the pit and the platform shall be no greater than 20 mm.

9.4.5 Platform side protection

9.4.5.1 The side of the platform adjacent to the stairlift rail shall be of solid construction, extending to a minimum height of 1 000 mm above the unfolded platform surface. If the solid construction does not extend for the full length of the platform side, the remainder of the platform shall be protected in accordance with 9.4.4.3.

A hand-rail shall be fitted to this solid platform side, positioned between 800 mm and 1 000 mm above the surface of the unfolded platform. The hand-rail shall be spaced a minimum of 30 mm from the carriage side panel, so as to provide a convenient hand-hold for users.

9.4.5.2 The other sides of the platform shall be protected as follows.

a) On all stairlifts a barrier arm shall protect the downstairs end of the platform. Additionally, on stairlifts with curved guide rails and on all stairlifts where the stairway end of the platform is at a greater height than 300 mm above the nosing line, barrier arms shall protect both upper and lower ends of the platform and at least half of the adjacent side.

b) Exceptionally on straight stairways with a clearance between the platform and the staircase enclosure of 100 mm or less, the barrier arm protection on the side opposite from the stairlift solid side panel may be omitted.

c) Gaps between adjacent barrier arms shall be not less than 80 mm.

d) The barrier arm height above the unfolded platform shall be between 800 mm and 1 000 mm.

9.4.5.3 Where necessary, barrier arms shall be counter-balanced or similarly protected against uncontrolled movement.

9.4.6 Barrier arms and ramp safety switches and locks

9.4.6.1 All barrier arms and ramps shall be fitted with safety switches that shall prevent operation of the stairlift unless the following conditions are met:

a) with the platform folded down, all barrier arms shall be extended and ramps fully raised;

b) with the platform folded up, all barrier arms shall be folded; in this position ramps shall be suitably and safely located.

9.4.6.2 All barrier arms and ramps, except the upper barrier arm, shall be provided with a locking device that automatically and mechanically locks the barrier arm in the extended position and the ramp in the raised position when the platform is unfolded, except when the platform is within the relevant unlocking zone extending a maximum of 150 mm along the rail from the landing level.

The locking component shall be retained in position by gravity, or a permanent magnet, or a guided compression spring or equivalent positive means and shall not be capable of inadvertent release.

Barrier arms shall be extended and ramps shall be raised and their locks positively engaged when the platform is in the unfolded position when outside an unlocking zone. Release of a lock shall only be possible through the action of the intended release mechanism.

It shall only be possible to release a lock manually from the platform or the landing by the use of a tool or equivalent device intended for use in an emergency.

An arrangement of electrical safety contacts that are operated positively and mechanically shall confirm correct engagement of this lock and shall prevent operation of the stairlift if the lock is not engaged by the time the stairlift reaches the end of the unlocking zone.

9.4.7 Sensitive edges and surfaces

9.4.7.1 Sensitive edges and sensitive surfaces shall be fitted as follows:

a) to the upstairs edge of the wheelchair platform;

b) to the under-surface of the wheelchair platform;

c) to the underside of the wheelchair platform when folded, if the distance from the floor to the underside of the folded platform is less than 120 mm;

d) under the carriage if the distance to the floor is less than 120 mm.

NOTE Additional guidance is given in ISO 13854 on sensitive edges and sensitive surfaces.

9.4.7.2 Consideration shall also be given to the need for additional protection, for example between any fixed abutments such as at the rail terminations.

9.4.7.3 The operation of any sensitive edge or sensitive surface shall initiate a break in the electrical supply to the motor and brake in the direction in which the carriage is operating. This shall be achieved by the use of a safety contact or safety circuit. Where appropriate, operation of controls in the opposite direction of travel to enable the obstacle to be cleared shall be possible.

9.4.7.4 Consideration shall be given to the provision of resilience or follow through in the operation of the sensitive edge or surface.

9.4.7.5 The force required to operate any sensitive edge shall not exceed 30 N as the average of measurements at each end and the midpoint.

The average force required to operate any sensitive surface shall not exceed

a) 50 N for surfaces with an area equal to or less than 0,15 m^2, or

b) 100 N for surfaces with an area greater than 0,15 m^2,

when measured at two diagonally opposite corners and the centre point.

Wherever possible, any other part of the carriage that may come into forceful contact with the user or other persons shall be suitably contoured, padded or protected.

9.4.8 Hinged actuation of the platform

When the hinged actuation of the wheelchair platform or barrier arms is by powered means, it shall also be possible to fold these components manually, for example in the event of electrical or mechanical failure in order to clear the stairway for other users.

9.4.9 Barrier arms, ramps and locks

Barrier arms, ramps and locks shall withstand without permanent deformation a force of 300 N applied in any direction at any point. Additionally, barrier arms shall withstand a force of 1 000 N applied horizontally on the centre line of the platform width.

9.4.10 Landing control positions

If the operator at the landing control positions does not have a direct view of the platform at all points during travel, it shall not be possible to operate the platform in the unfolded position from the landing controls.

9.4.11 Folding seat

On stairlifts with public access, provision shall be included for fitting a folding seat.

10 Testing, inspection and servicing

10.1 Test and examination after installation

10.1.1 Immediately upon completion of installation and prior to being put into service, stairlifts shall be subjected to a thorough examination and test by a qualified person on behalf of the manufacturer or his agents, in accordance with annex B.

10.1.2 A test and examination certificate which declares at least all the information and the results of all checks both on-site and off site listed in annex B shall be completed.

10.1.3 The stairlift shall be subjected to electrical tests by instruments as follows.

a) A d.c. voltage not less than twice the operating voltage (r.m.s. value of an a.c. supply) shall be applied for the measurement of insulation resistance, except that for tests on low voltage circuits the test voltage need not exceed 500 V d.c.

   The resistance of the insulation between conductors and between the conductors and earth shall be greater than 1000 Ω/V with a minimum of

   1) 500 kΩ for power circuits and circuits containing electrical safety devices;

   2) 250 kΩ for other circuits.

   Control electronics not forming part of the safety or drive motor circuit may be disconnected during this test.

b) When applying a test voltage of not more than 40 V, the resistance between any accessible metal part and the main earth terminal (or ground on isolated circuits) shall not exceed 0,5 Ω.

As an alternative to the above, check that the circuit breaker or fuse protecting the safety circuit will trip or blow if the safety circuit is earthed on the carriage and at each end of the rail.

For SELV-protected circuits, note the requirements of the relevant part of IEC 60364.

10.1.4 Tests to verify the correct tripping speed of the overspeed governor (or on hydraulic systems, the rupture valve) and the correct function of the safety gear at rated load and speed shall be carried out. These may be carried out off-site. If the safety gear test is carried out off-site, an additional functional test on the safety gear shall be carried out on-site at the time of installation, but this need not be at full load.

10.1.5 Copies of all certificates following test, hand-over, inspection or service shall be retained on file by the supplier for a period of at least 10 years and shall be made available to the purchaser or the purchaser's representative on request.

10.2 Periodic examinations, tests and servicing

10.2.1 Guidance shall be provided to the purchaser on periodic examination and servicing, and testing following alterations to the equipment.

10.2.2 The guidance referred to in 10.2.1 shall include advice that stairlifts should be kept in good repair and working order, with emphasis of the need for routine servicing, and advice on the risk of damage to equipment or injury to users if recommended servicing intervals are exceeded.

11 Technical literature

The supplier shall provide the owner of the stairlift with technical literature written in the language(s) of the country in which the machine is installed.

NOTE The need for additional languages is a matter of judgement and is not a requirement.

The technical literature shall be retained on-site and shallinclude the following minimum information, as appropriate:

a) the name and address of the owner or user;

b) the name and address of the manufacturer and the supplier;

c) year of installation;

d) serial number;

e) rated load in kilograms;

f) full operating instructions;

g) an electrical circuit wiring diagram in accordance with IEC 60617 showing the electrical connections and components, together with all necessary identification markings (see 8.9.3);

h) an acknowledgement that the purchaser and/or user has received proper instruction and demonstration on the correct and safe usage of the stairlift;

i) in buildings with public access, a technical register with pages for reports of any accidents, details of servicing, inspection and any major modifications to the machine (see note);

j) recommended intervals for routine inspection and servicing;

k) the name, address and telephone number of person(s) to contact in the event of emergency or breakdown.

NOTE In buildings with private access it is permissible for such records to be maintained off-site by the company responsible for routine inspection and servicing.

12 Labels, notices and operating instructions

12.1 General

The information, operating instructions, etc., listed in 12.2 shall be displayed. The text shall be legible, readily understandable and in accordance, where applicable, with ISO 4190-5. The height of the letters in the legends shall not be less than 10 mm for upper-case letters and 7 mm for lower-case letters. The legends shall be written in a language appropriate to the country in which the stairlift is installed.

Where required by national legislation, appropriate safety signs in accordance with ISO 3864 shall be used in association with relevant notices.

The labels, etc., bearing the legends and symbols shall be positively fixed in position and shall be of tear-resistant durable material.

Consideration should be given to the need for the provision of information in tactile or auditory form where appropriate.

12.2 Information to be displayed

12.2.1 Carriage

Notices bearing the following minimum information shall be displayed on the carriage:

a) the rated load, in kilograms, for one person or one person in a wheelchair;

b) the name of the supplier and the serial number.

See Figure 6 for examples of typical loadplates.

12.2.2 Function devices

The function of all devices controlling the operation of the stairlift shall be identified.

12.2.3 Emergency alarm device

Any emergency alarm device specified in 8.16 shall be coloured yellow and shall be identified by a bell symbol, (Symbol No. 5013 in IEC 60417-2:1998) and, in addition, shall bear the legend "STAIRLIFT ALARM".

12.2.4 Disabled persons' symbol

On stairlifts with public access, an International Symbol of Access (ISA) (Symbol No. 0100 of ISO 7000:1989) shall be displayed at each landing. The height of the symbol shall be not less than 50 mm.

12.2.5 Emergency manual operation

12.2.5.1 Detailed step-by-step emergency manual operating instructions in accordance with 7.3.1 shall be displayed in a prominent position on the hand-winding shaft housing or the machinery enclosure as appropriate.

12.2.5.2 A direction label such as that shown in Figure 3, indicating the direction of movement of the carriage, shall be fitted in a prominent position on the hand-winding shaft housing or on the winding handle.

12.2.5.3 On hydraulic powered stairlifts, a notice bearing the following legend shall be displayed adjacent to the manual lowering value:

"DANGER — Emergency Lowering Valve"

12.2.6 Operation by the main electrical switch

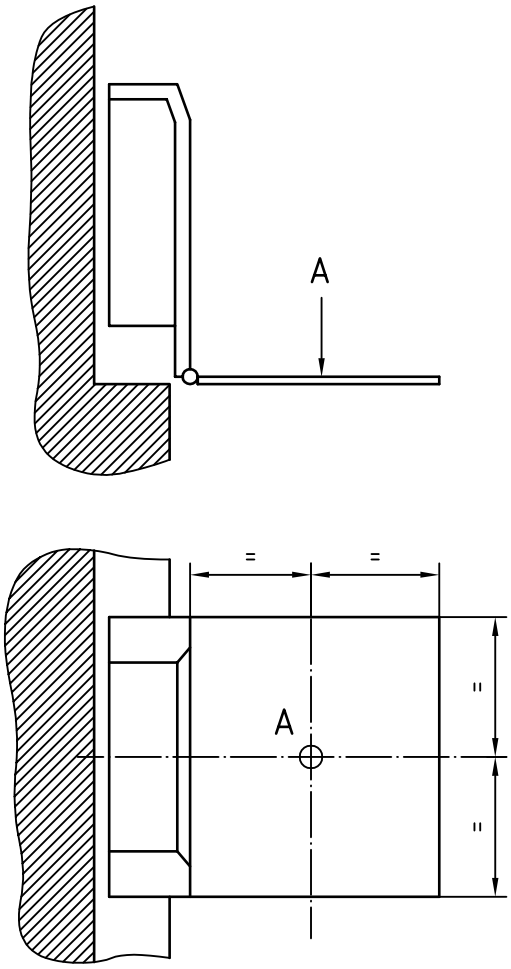
12.2.6.1 On stairlifts with public access, the switch for the main electrical supply to the stairlift shall be identified.

12.2.6.2 For hydraulically powered stairlifts, the switch identification shall also bear the following legend:

"Switch off only when the stairlift is at the lowest level"

12.3 Operating instructions

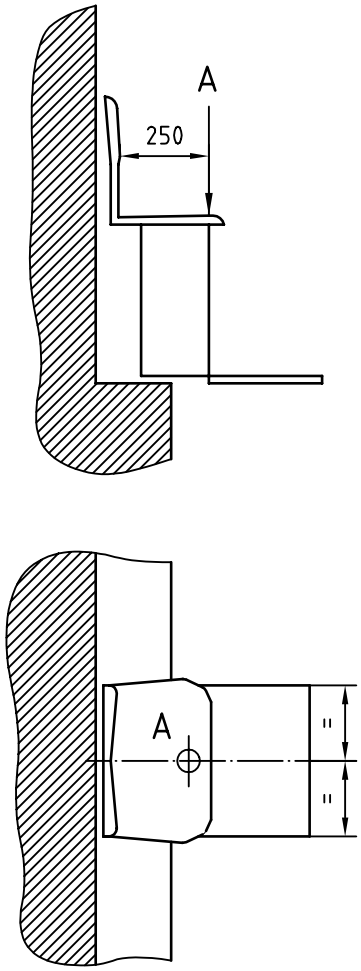
On stairlifts with public access where assistance to users is not available, detailed operating instructions shall be provided.



NOTE Point A is the reference point for speed calculation.

Figure 1 — Reference point for wheelchair and standing user

Dimension in millimetres



NOTE 1 Point A is the reference point for speed calculation.

NOTE 2 For stairlifts with combined seated and standing function, use Figure 1.

NOTE 3 The speed of the stairlift when measured at point A shall not exceed the maximum rated speed at any point in the travel.

Figure 2 — Reference point for seated user

Dimension in millimetres

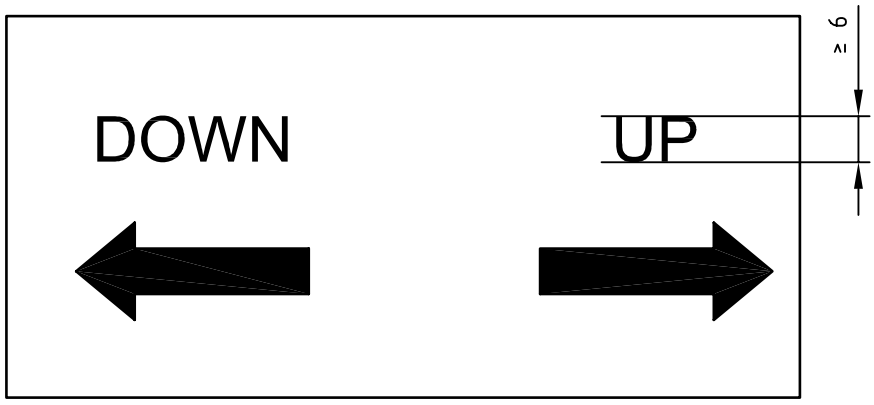
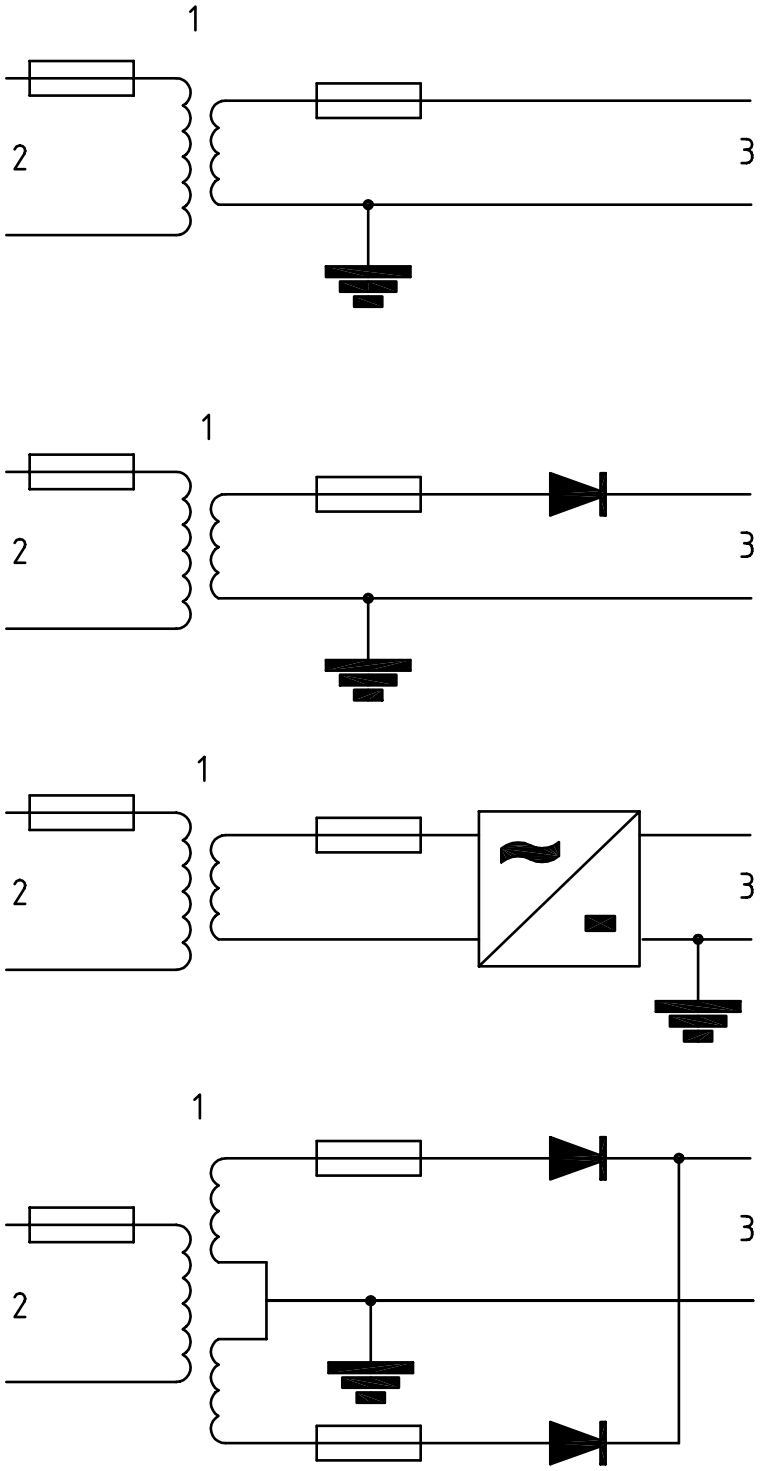


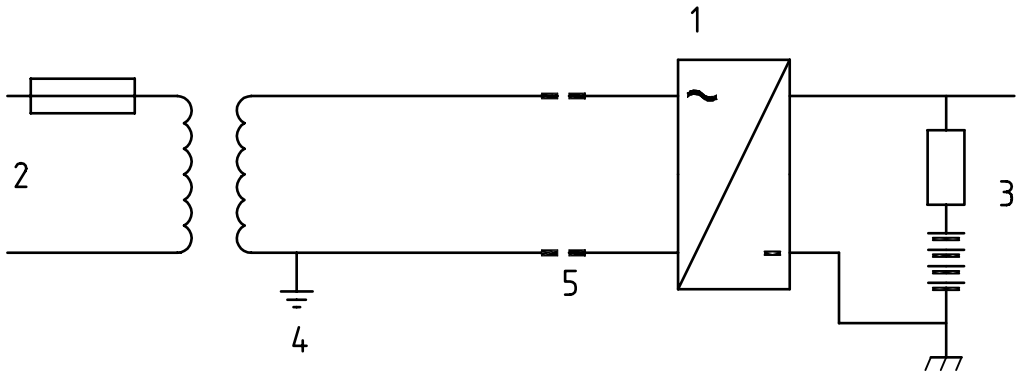
Figure 3 — Example of a typical direction label (hand-winding)



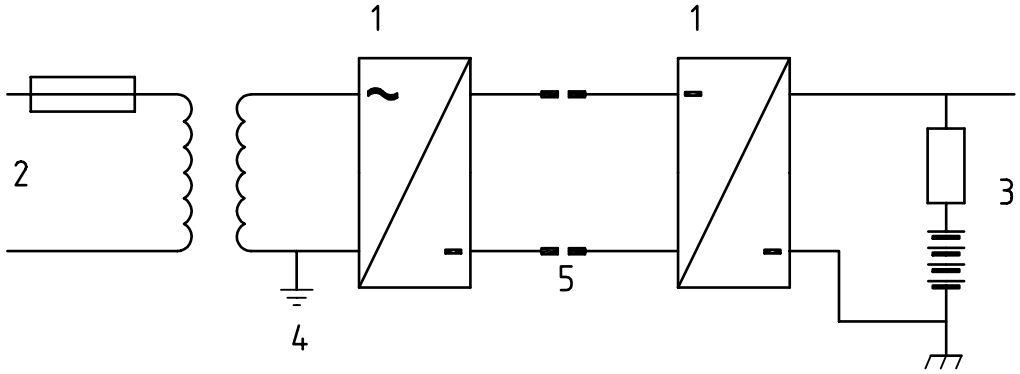
Key

1 Isolating transformer
2 Primary supply
3 Control circuit

Figure 4 — Control circuit supply



a) A.c. charge contacts



b) D.c. charge contacts

Key

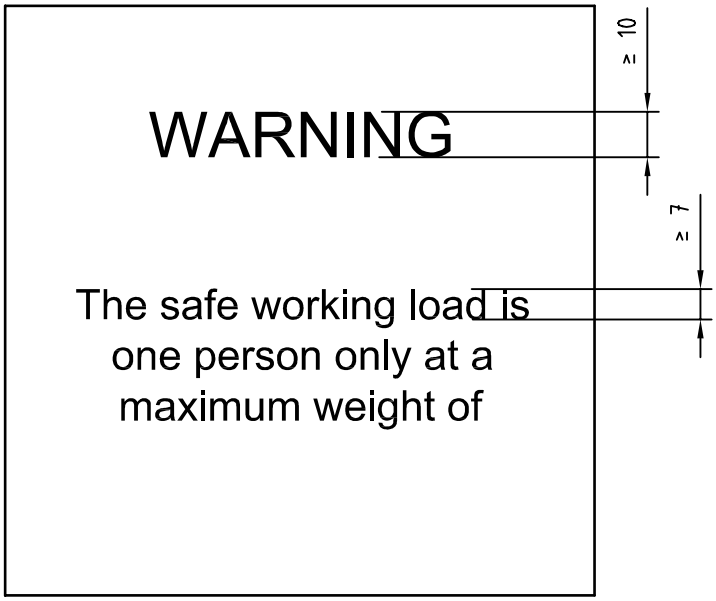
1 Step-up a.c.-d.c. converter
2 Step-up d.c.-d.c. converter
3 Control circuit 60 V max.
4 See note
5 Charge contacts

NOTE The symbol denotes that the negative side of the battery supply is connected to the stairlift carriage chassis.

Earthing is not required on SELV-protected charging circuits.

Figure 5 — Charging supply circuit for battery-powered stairlifts

Dimensions in millimetres



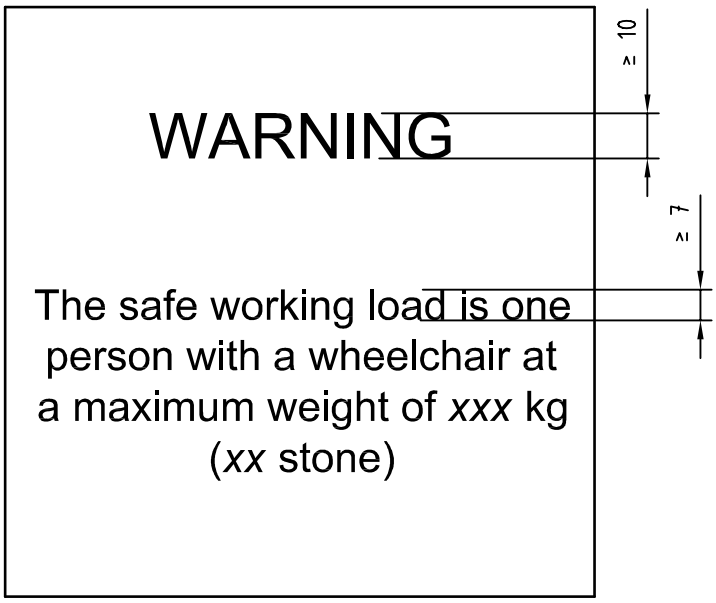
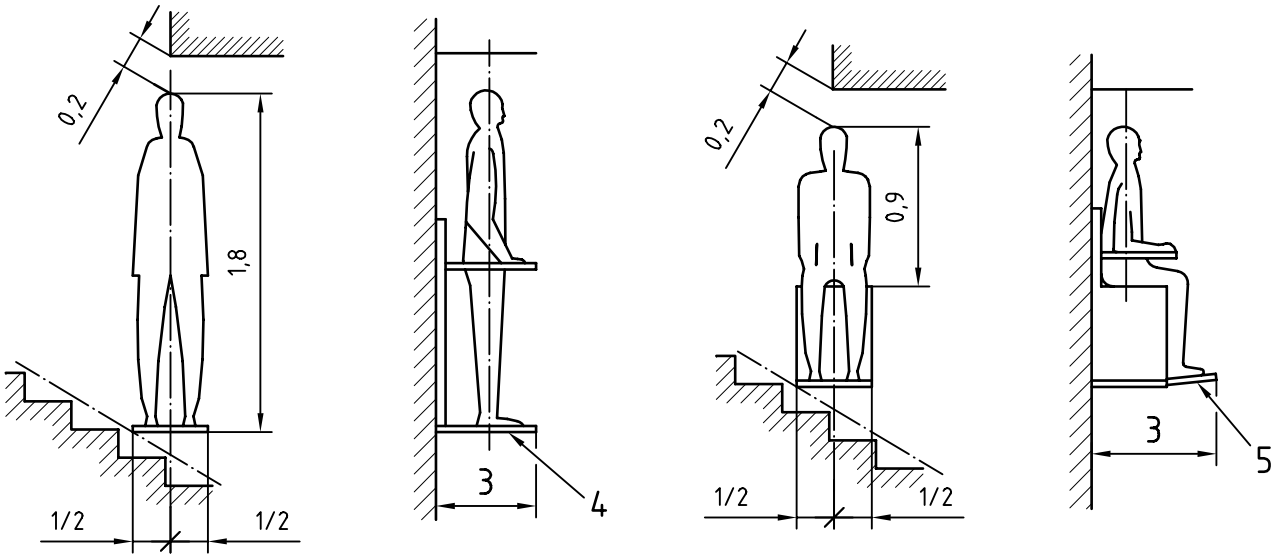
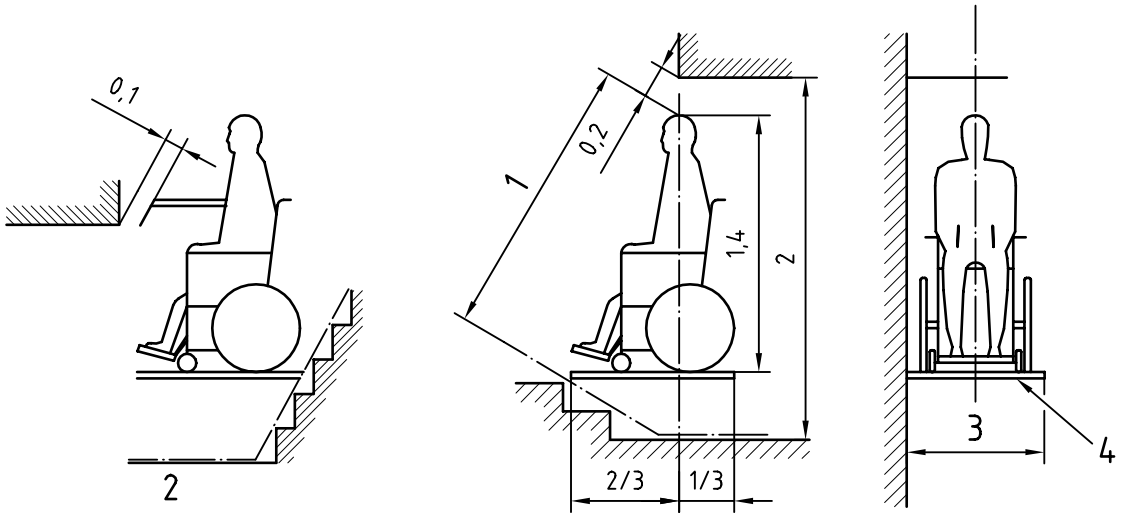


Figure 6 — Examples of load plates

Dimensions in metres



a) Standing passenger **b) Seated passenger**



c) Passenger in wheelchair

Key

1 Liftway height
2 Minimum clearance dimension required at high angles of inclination
3 Width of stairlift pathway
4 Platform
5 Foot-rest

— · — · — Limitation of clear stairlift pathway.

NOTE The headroom dimensions shown should be achieved across the complete width of the stairlift pathway.

Figure 7 — Minimum clearance dimensions

Annex A
(informative)

Guidance in selection and purchase of suitable stairlifts

NOTE The guidance given in this annex is to assist in the selection of a suitable stairlift. It reminds purchasers and installers of additional factors that will require their attention.

A.1 Selection of stairlift

A.1.1 Suitability

A.1.1.1 When selecting a powered stairlift, consider if the needs of the user are likely to change in the future.

A.1.1.2 Select a stairlift with a rated load that is capable of carrying the maximum foreseeable load.

A.1.1.3 Ensure that the user(s) can be safely transported on the stairlift, whether sitting, standing, or seated in a wheelchair.

A.1.1.4 Where either manual or automatic operation are optionally available for devices such as doors, barriers or hinged platforms, consider which is more appropriate for the user.

A.1.2 Control (operating) devices

A.1.2.1 Consider the position, type and number of operating controls that would suit users with differing disabilities.

A.1.2.2 Consider whether a key switch, electronic card or similar means is necessary to restrict the use of the stairlift to authorized users.

A.1.3 Location of the stairlift

Check that the proposed location of the stairlift is suitable. For example, check the following:

a) that the installation will not obstruct normal activities in and about the building;

b) that the site location and proposed supporting structure is strong enough to support the stairlift;

c) where necessary, that adequate wheelchair manœuvring space will be available at each landing level served;

d) that the class of protection against external influences is adequate for the intended application.

A.1.4 Duty cycle

The anticipated maximum number of journeys per hour should be determined by the purchaser and communicated to the supplier.

A.2 Electrical supply and lighting

Ensure that a suitable electrical supply is available.

Ensure that adequate lighting is available on the landings in the vicinity of the hoist-way entrances.

A.3 Operating/emergency instructions

Ensure that operation of the stairlift is demonstrated to the user and that the user is fully instructed on its safe use, including:

— instruction on the correct emergency operating procedure in the case of breakdown;

— the names, addresses and telephone numbers of persons to contact for emergency service.

A.4 Maintenance

Ensure that the purchaser is informed of requirements for the examination, testing and servicing of the stairlift and of any associated national regulatory requirements.

A.5 Alarm system

Consideration should be given to the desirability of providing an alarm system that would alert a dependable assistant or summon help from beyond the immediate location of the stairlift.

Annex B
(informative)

Recommendation for examination and testing before going into service

It is recommended that the stairlift is inspected for compliance with this part of ISO 9386. Checks should also be carried out before a stairlift is put into service to verify that:

a) all control and operating devices function correctly;

b) all barriers, ramps, locks, hinged platforms and similar devices operate correctly;

c) all electrical safety contacts and devices function correctly;

d) the suspension elements and their attachments are adequate and in order;

e) the suspension rope/chain test certificate is available and in order; the test certificate shall state the safe working load and minimum breaking load;

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

g) the insulation resistance of motor and control circuits (where necessary with electronic components disconnected) conforms to 10.1.3 a);

h) the resistance of the electrical protective path between any accessible metal part of the stairlift and the main earth terminal is in accordance with 10.1.3 b);

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

j) the overspeed governor (and on hydraulic systems, the rupture valve) and the safety gear function correctly in accordance with clause 6 and 7.13.6 and 10.1.4;

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

l) the alarm device (if fitted) when activated operates correctly;

m) all notices, etc., are correctly displayed.

In addition, measure and record the following:

— the electrical supply voltage during the test;

— the electrical control voltage during the test;

— the motor operating current when carrying rated load in both directions of travel (see note);

— the type of motor overload protection provided;

— the motor stall current and tripping time for the motor overload device;

— the stopping distance of the stairlift when carrying rated load in both directions of travel (see note);

— the motor reversal time delay.

NOTE Measurement of running current and stopping distance at full load may be carried out off-site.

Annex C
(informative)

Recommendations for the provisions and use of specially adapted operating devices, switches and sensors

C.1 Operating devices

C.1.1 It is recommended that the operation of the stairlift is by means of conventional pushbuttons, joysticks or similar devices, except where these are unsuitable due to the disability of the user.

C.1.2 In such cases, the operating device placement, whether on a wall, wheelchair, pendant, etc., should be such that accidental operation by the user is minimized.

C.1.3 Regardless of the type of operating switches/devices used, an on/off safety switch shall be fitted on the stairlift carriage in accordance with 8.14.1. Additional stopping devices, which are either specially adapted switches or remotely controlled, may also be fitted.

C.1.4 It is recommended that the output states of the operating switches are electrically/electronically monitored, such that if a fault condition exists, whereby a set of contacts are held closed for greater than a pre-determined period, then a stopping device will prevent any further operation of the stairlift until a competent person repairs the fault. Such a monitor circuit can be part of a motor run time limiter, whose incorporation is also recommended. A suggested "pre-determined period" would be the time required for the full upward lift travel at rated load plus a maximum of 30 s.

C.2 Specially adapted switches

C.2.1 Where switches such as low-force switches, blowpipe-operated switches and pull-cords are used, the design should be such that their immunity to electrical and mechanical interference will prevent accidental operation of the platform.

C.2.2 A device which ensures that the switch has been operated for greater than 0,5 s before the (electrical) command is accepted by the platform controller should be used in order to minimize the effects of electrical interference on touch switches and accidental operation of mechanically sensitive switches.

C.2.3 The switch should switch and, where appropriate be powered by, only extra-low voltages (less than 25 V).

C.2.4 Such a switch may be used to stop the lift if required, in addition to the stopping devices referred to in C.1.3. In this case, C.2.2. is not applicable.

C.2.5 The switch should be positioned at an optimum location for ease of use by the disabled user.

C.3 Sensors

Sensors such as infrared, ultrasonic, microwave movement detectors and pressure mats should not be used to control the platform.

If the disability of the user is such that an adapted switch or a remote control device cannot be operated to control the platform, then the assistance of others should be sought.

Annex D
(informative)

In-use periodic examination, tests and servicing

D.1 Periodic examinations and tests

The stairlift should be thoroughly examined within 6 months of commissioning or completion of major modifications, and thereafter at intervals not exceeding 12 months. Particular attention should be given to the effectiveness of the following features, upon which a report should be prepared:

a) interlocking devices;

b) electrical safety circuits;

c) earthing continuity;

d) ropes, chains, racks, or screws and nuts (as applicable);

e) driving unit and brakes;

f) safety gear;

g) alarm system (if fitted).

A report of the above examination should be prepared, one copy of which should be handed to the purchaser or purchaser's representative, and one copy of which should be retained by the examining authority.

At every examination, the competent person making the examination may advise whether more frequent examinations and servicing will be necessary to ensure continued safety and operation.

If defects are reported, the recommended repair and the period within which the repair should be executed should also be stated.

D.2 Test and examination after major modifications

If any major modifications are carried out on the stairlift, the procedure specified in clause 10 is to be repeated.

If any defect affecting safety is reported and immediate repair is necessary, the stairlift should be taken out of service and the user advised.

In particular, the following are considered as being major modifications:

a) change of rated speed;

b) change of safe working load;

c) change of carriage;

d) change of travel;

e) change of position or type of driving unit;

f) change of interlocks, control or safety circuits;

g) change of any safety sensitive edges or surfaces.

D.3 Servicing

The stairlift and its accessories should be maintained in good working order. To this end, regular servicing by a competent person should be carried out at the same frequency as that specified in D.1. Particular attention should be paid to any alarm system batteries.

Annex E
(informative)

Example of certificate of acceptance by purchaser/user after initial tests and examination

I/We, being the purchaser/user of this stairlift (serial No. .....),

have received, and fully understood, verbal and written instructions, in association with a demonstration

from .....on its correct and safe use.

Signature:

Date:

Address:

Annex F
(normative)

Safety circuits — Requirements for circuit design and component and circuit fault analysis

F.1 Introduction

A number of faults of the electrical equipment of the stairlift may be envisaged. During failure analysis, some faults can be excluded under certain conditions. This annex describes these conditions and gives the requirements on how to fulfil them.

F.2 Failure exclusions: Conditions

Table F.1 shows

a) a list of the major and more usual components used in present electronic technology; the components have been grouped by "families":

   — passive components 1

   — semi-conductors 2

   — miscellaneous 3

   — assembled printed circuits 4

b) a number of identified failures:

   — interruption I

   — short circuit II

   — change value to higher value III

   — change value to lower value IV

   — change of function V

c) the possibility and conditions of failure exclusion.

The first condition for failure exclusion is that components shall always be used within their own worst-case limits, even in the worst-case conditions specified by International Standards, in the field of temperature, humidity, voltage and vibrations.

F.3 Design guidelines

The danger comes from the possibility of bridging one or several safety contacts by local interruption of common lead (earth) combined to one or several other failures. The following recommendations should be given to avoid dangerous situations in the case when information is collected from the safety chain for control purposes, for remote control, alarm control, etc.

a) Design the board and circuits with distances in accordance with specifications 3.1 and 3.6 of Table F.1.

b) Organize a common lead so that the stairlift control common lead comes behind the electronic components. Any rupture will cause a non-operation of the control (danger exists that changes in wiring occur during the stairlift life).

c) Always make calculations about the worst-case condition. (What comes out if ....? Is the current originated by all combinations of possible failures high enough to keep the contactors on?)

d) Always use outside (out of element) resistors as protective devices of input elements; internal resistor of the device should not be considered as safe.

e) Use only components according to listed specifications.

f) Consider backwards voltage coming from electronics. The use of galvanically separated circuits can solve the problems in some cases.

g) The worst-case calculation cannot be avoided, whatever the design. If modifications or additions are made after the stairlift installation, the worst-case calculation, involving new and existing equipment shall be carried out again.

h) Some failure exclusions can be accepted, according to Table F.4.

i) Failures outside stairlift environment need not be taken into consideration.

An interruption of the earth from the main power supply of the building to the controller collection earth bar (rail) can be excluded, providing the installation is made in accordance with IEC 60364-5-54.

F.4 Electronic components: Failure exclusion

The faults to be considered in the electric equipment of a stairlift are listed in 8.10.1.

Failure exclusion shall only be considered provided that components are applied within their worst-case limits of characteristics, value, temperature, humidity, voltage and vibrations.

In Table F.1:

— the "NO" in the cell means failure is not excluded; i.e. it shall be considered;

— the unmarked cell means that the identified fault type is not relevant.

Table F.1 — Failure exclusions

Component	Possible failure exclusion					Conditions		Remarks
	Open circuit	Short circuit	Change to higher value	Change to lower value	Change of function			
1 Passive components								
1.1 Resistor fixed	NO	a)	NO	a)		a) Only for film resistor with varnished or sealed resistance film and axial connection according to the applicable IEC standards, and for wire wound resistors if they are made of a single layer winding protected by enamel or sealed.		
1.2 Resistor variable	NO	NO	NO	NO				
1.3 Resistor, non-linear NTC, PTC, VDR, IDR	NO	NO	NO	NO				
1.4 Capacitor	NO	NO	NO	NO				
1.5 Inductive components: — coil — components	NO	NO	—	NO				
2 Semiconductors								
2.1 Diode, LED	NO	NO			NO			Change of function refers to a change in reverse current value.
2.2 Zener diode	NO	NO		NO	NO			Change to lower value refers to change in Zener voltage. Change of function refers to change in reverse current value.
2.3 Thyristor, Triac, GTO	NO	NO			NO			Change of function refers to self triggering or latching of components.
2.4 Optocoupler	NO	a)			NO	a) May be excluded under condition that the optocoupler is in accordance with IEC 60747-5, and the isolation voltage is at least in accordance with IEC 60664-1:1992, Table 1.		Open circuit means open circuit in one of the two basic components (LED and photo transistor). Short circuit means short circuit between them.
2.4 Optocoupler						Voltage phase to earth derived from rated system voltage up to and including	Preferred series of impulse withstand voltages in volts for installation	
						V r.m.s. and c.d	category III	
						300	4 000	
						600	6 000	
						1 000	8 000	

Table F.1 *(continued)*

Component	Possible failure exclusion					Conditions	Remarks
	Open circuit	Short circuit	Change to higher value	Change to lower value	Change of function		
2.5 Hybrid circuits	NO	NO	NO	NO	NO		
2.6 Integrated circuits	NO	NO	NO	NO	NO		Change of function to oscillation "and" gates becoming "or" gates, etc.
3 Miscellaneous							
3.1 Connectors Terminals Plugs	NO	a)				a) Short circuit can be excluded provided the minimum creepage and clearance distances as defined in clause 8.4.2 have been adhered to.	
3.2 Neon bulb	NO	NO					
3.3 Transformer	NO	a)	b)	b)		a), b) May be excluded under condition that isolation voltage between windings and core is in line with IEC 60742 and the working voltage is the highest possible voltage of Table 6 between live and earth.	Short circuits include short circuits of primary or secondary windings, or between primary and secondary coils. Change in value refers to change of ratio by partial short circuit in a winding.
3.4 Fuse		a)				a) May be excluded if the fuse is correctly rated, and constructed according to the applicable IEC standards.	Short circuit means short circuit of the blown fuse.
3.5 Relay	NO	a) b)				a) Provided the relay device conforms to the requirements of 8.2, short circuits between the coil and contacts and between the contacts. b) Welding of contacts can not be excluded.	
3.6 Printed circuit board (PCB)	NO	a)				a) Short circuit may be excluded provided the minimum creepage and clearance distances as defined in 8.4.2 have been adhered to.	
4 Assembly of components on printed circuit board (PCB)	NO	a)				a) Short circuit may be excluded provided the minimum creepage and clearance distances as defined in 8.4.2 have been adhered to.	

Annex G
(informative)

Summary of different requirements for private/public access

Clause

8.13.3

8.14.1

9.1.7

9.3.1

9.4.2

9.4.11

11 i)

12.3

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