BRITISH STANDARD

BS 5655-1: 1986
EN 81-1:1985
Reprinted, incorporating Amendment No. 1

Lifts and service lifts —

Part 1: Safety rules for the construction and installation of electric lifts

[EN title: Safety rules for the construction and installation of lifts and service lifts — Part 1: Electric lifts]

UDC 621.876.11 – 83:62 – 78:614.8

Cooperating organizations

The European Committee for Standardization, under whose supervision this European Standard was prepared, comprises the national standards organizations of the following Western European countries:

Austria	Österreichisches Normungsinstitut
Belgium	Institut Belge de Normalisation
Denmark	Dansk Standardiseringsraad
Finland	Suomen Standardisoimisliitto, r.y.
France	Association Française de Normalisation
Germany FR	Deutsches Institut für Normung E.V.
Greece	Hellenic Organization for Standardization
Ireland	Institute for Industrial Research and Standards
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Spain	Instituto Nacional de Racionalizacion y Normalización
Sweden	Standardiseringskommissionen i Sverige
Switzerland	Association Suisse de Normalisation
United Kingdom	British Standards Institution

This British Standard, having been prepared under the direction of the Mechanical Handling Standards Committee, was published under the authority of the Board of BSI and comes into effect on 26 September 1986

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Contents

[1)] EN 81-1 contains its own contents list on page 2 of the standard. See also the "explanatory note on the arrangement of EN 81-1", which appears at the end of the national foreword.

National foreword

This Part of BS 5655 has been prepared under the direction of the Mechanical Handling Standards Committee and is identical with European Standard EN 81-1:1985 which reflects Annex 1 of EEC Directive 84/529/EEC dated 17 September 1984.

This revision of BS 5655-1 becomes effective from 26 September 1986 and applies to all new lift installations tendered after that date. The 1979 edition of this standard will be superseded on that date by this revision but it will not be withdrawn until administrative amendments to the technical annex of the EEC Directive have been made.

NOTE BSI Sales Department will respond to orders for BS 5655-1 by supplying this 1986 edition. Copies of the 1979 edition may be obtained by quoting the number "BS 5655-1:79".

It is the first Part of a British Standard relating to lifts and service lifts, which will be progressively published to supersede portions of relevant Parts of BS 2655, the relevant obsolescent requirements being retained for reference purposes and to enable existing lift installations to be maintained. The standard comprises the following Parts.

— *Part 1: Safety rules for the construction and installation of electric lifts (implementing EN 81-1), together with PD 6500 "Explanatory supplement to BS 5655-1";*

— *Part 2: Specification for hydraulic lifts;*

— *Part 3*[2)]*;*

— *Part 4*[2)]*;*

— *Part 5: Specification for dimensions of standard electric lift arrangements (implementing ISO 4190-1 and ISO 4190-3);*

— *Part 6: Code of practice for selection and installation;*

— *Part 7: Specification for manual control devices, indicators and additional fittings (implementing ISO 4190-5);*

— *Part 8: Specification for eyebolts for lift suspension;*

— *Part 9: Specification for guide rails (implementing ISO 7465);*

— *Part 10: Specification for testing and inspection of electric and hydraulic lifts;*

— *Part 11: Specification for modernization or reconstruction*[3)].

Further Parts are anticipated.

Subclause **0.1.4** of the general introduction to EN 81 (see the explanatory note at the end of this national foreword) permits each country to append to the European Standard certain amendments that are necessary to comply with current national legislation or codes of practice; the United Kingdom national variations for Part 1 of EN 81 are given in National appendix V.

Guidance (including UK views on the requirements specified in EN 81-1, clause **12.4.2.1**, paragraph 3) for purchasers and manufacturers of electric lifts regarding the adoption of EEC Council Directives 84/528/EEC and 84/529/EEC in the United Kingdom will be given in a Health and Safety Executive publication. It should be particularly noted that the Directive includes certification requirements for design and component type approval and inspection in support of the test procedures given in Appendix F of EN 81-1. There are also in the Directives special requirements relating to clauses **12.4.2.1**, **13.1.1.4**, **13.1.2** and **F.0.1.6** in the standard.

[2)] Reserved for future publications.

[3)] In preparation.

EXPLANATORY NOTE ON THE ARRANGEMENT OF EN 81-1. EN 81-1 contains the "General introduction" and the "Scope and field of application" for EN 81 as a whole; these are followed by a contents list for Part 1 and then the text of Part 1 (beginning with the "Introduction" to Part 1 and followed by the "Scope and field of application" for Part 1).

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 80, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 81-1

December 1985

UDC 621.876.11-83:62-78:614.8

Supersedes EN 81, Part 1, October 1977, Incorporating Amendment 1-1978
Amendment 2-1984

Key words: Lifts, goods lifts, definitions, building codes, installing, safety requirements, lift cars, landing doors, elevator shafts, compensating ropes, shock absorbers, machine rooms, electrical installations, safety devices, stopping devices, locking devices, name plate, instructions, maintenance, conformity tests, certification.

English version

Safety rules for the construction and installation of lifts and service lifts Part 1: Electric lifts

Règles de sécurité pour la construction et l'installation des ascenseurs et monte-charge
Partie 1: Ascenseurs électriques

Sicherheitsregeln für die Konstruktion und den Einbau von Personen- und Lastenaufzügen, sowie Kleingüteraufzügen
Teil 1: Elektrisch betriebene Aufzüge

This European Standard was accepted by CEN on 1985-06-26. The CEN members are bound to adhere to the CEN Internal Regulations which specify under which conditions this European Standard has to be given, without any alteration, the status of a national standard.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Central Secretariat or to any CEN member.

This European Standard is established by CEN in three official versions (English, French, German). A translation made by another member under its own responsibility, in its own language, and notified to CEN has the same status.

CEN members are the national standards organizations of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 81-1:1985 E

Brief history

This European Standard was drawn up by the Technical Committee CEN/TC 10 "Passenger, goods and service lifts", the secretariat of which is held by AFNOR.

This European Standard was adopted by CEN on the strength of its acceptance by the following member countries:

Belgium, Denmark, France, Germany, Italy, Netherlands, Portugal, Spain, United Kingdom.

Amendment 2 of this standard incorporates:

a) certain technical changes in EN 81-1:1977 decided by the Council of EEC (see Appendix 1 of Directive 84/529/EEC of 17 September 1984);

b) updating of references to other standards (ISO etc.);

c) certain interpretations and comments which clarify the text, but do not affect the technical content of the standard;

d) improvement in the alignment of the three official CEN texts (French, English and German).

Amendment 2 was accepted by CEN as a result of the positive vote of the following member countries:

Denmark, France, Germany, Greece, Italy, Netherlands, Portugal, Spain, United Kingdom.

Contents

0 General introduction

The object of this standard is to define safety rules related to passenger, goods and service lifts with a view to safeguarding persons and objects against the risk of accidents associated with the operation of lifts and service lifts.[4)]

0.1 In drawing up this standard the following methods have been adopted.

0.1.1 An analysis of the risks has been carried out for each component that may be incorporated in a complete lift or service lift installation.

Rules have been drawn up accordingly.

0.1.2 This standard, specially associated with lifts and service lifts, does not repeat all the general technical rules applicable to every electrical, mechanical or building construction. It is of course assumed that all components shall:

0.1.2.1 be correctly designed, be of sound mechanical and electrical construction, be made of materials with adequate strength and of suitable quality and be free of defects.

0.1.2.2 be kept in good repair and working order. It will in particular be ensured that the dimensional requirements remain fulfilled despite wear.

0.1.3 This special standard for lifts and service lifts does not give rules relating to the protection against fire of building elements. However, as these rules have a direct influence on the choice of landing doors and on the specification and design of electrical control systems, it is necessary to refer to them.

0.1.3.1 The choice of the landing doors which depends on the required behaviour in fire, is dealt with in **7.2.2**. The most common structural arrangements have been shown with the corresponding types of door designated by F and S.

However, if statutory requirements lay down for certain arrangements type F instead of type S, the National Committees may make the necessary amendment.

0.1.3.2 The electrical control systems recommended for each example of structural arrangement given are described in Appendix G.

0.1.4 This special standard for lifts and service lifts cannot ignore certain specifications which do not belong intrinsically to the field of these appliances or which are not the cause of barriers to trade, but which have an effect on the safety of users or servicing personnel and the upkeep of the installation.

In certain countries these specifications come within the legislative field or accepted Codes of Practice. The National Committees may, therefore, make one or more of the following amendments to the specifications of the standard which refer to this clause:

a) delete the marked text;

b) provide additional clauses (for example, definitions, clauses concerned, frequency of inspections . . .);

c) replace the value indicated by a value providing greater safety.

NOTE 1 Reference to this clause appears in the body of the standard in the form (N.a, b or c). The clauses concerned are indicated in the margin by the sign Ⓝ.
NOTE 2 These amendments shall form the subject, in each country, of a national appendix.

0.2 It has, however, seemed necessary to establish certain requirements of good construction, either because they are peculiar to lift manufacture or because in the case of lift utilization the requirements may be more stringent than elsewhere.

0.3 As far as possible the standard sets out only the requirements that materials and equipment have to meet in the interests of lift safety.

0.4 When mention is made of a design for the sake of clarity, this should not be considered to be the only possible design; any other solution leading to the same result can be applied if it is equivalent in operation and at least equally safe.

0.5 A study has been made of the various accidents possible with lifts in the following areas.

0.5.1 Types of possible accidents

a) shearing;

b) crushing;

c) falling;

d) impact;

e) trapping;

f) fire;

g) electric shock;

h) damage to material;

i) due to wear;

j) due to corrosion.

0.5.2 Persons to be safeguarded

a) users;

b) servicing and inspection personnel;

c) persons outside the lift well, the machine room and pulley room (if any).

[4)] An interpretation committee has been established to make clear, if necessary, the spirit in which the experts have drafted the various clauses of this standard.

0.5.3 Objects to be safeguarded

a) loads in car;

b) components of the lift or service lift installation;

c) the building in which the lift or service lift is installed.

0.6 In the standard it has been taken into account,

0.6.1 that the users have to be safeguarded against their own negligence and unwitting carelessness;

0.6.2 that there are other categories of users for whom certain rules may be less severe (N.a). In the remainder of the text these users are referred to as "authorized and instructed users".

In the absence of another definition (N.b), it is permissible for the use of a lift to be reserved for authorized and instructed users if the instructions given them concerning its use are issued by the person responsible for the lift and if one of the following two conditions are satisfied:

a) operation of the lift is only possible when a key held by authorized and instructed users only is placed in a lock situated inside or outside the car;

b) the lift is situated on premises to which access by the public is prohibited and which, when not locked, is permanently supervised by one or more agents of the person responsible for the lift.

0.6.3 that there are service lifts, the car of which is, by definition, not accessible to persons, for which certain rules may be less severe or even waived.

0.7 The standard has been drawn up, taking into account in certain cases the imprudent act of a user, but it is necessary to limit this and the possibility of two simultaneous acts of this nature or the abuse of instructions for use has not been considered.

0.8 This standard deals, in the appendices, with the way in which tests must be made on certain components, as well as on the completed lift installation, when such tests are required.

0.8.1 Referring to the lift itself, the appendices mentioned below indicate the maximum which can be required.

0.8.1.1 Appendix C. Technical dossier to be provided when a preliminary authorization is required.

0.8.1.2 Appendix D. Examinations and tests before putting a lift into service.

0.8.1.3 Appendix E. Tile periodical examination and tests, also the examinations and tests after an important modification or after an accident. The frequency of the periodical examination and test may be specified in the national regulations.

0.8.2 Appendix F. Type examinations on certain components of the lift permit limited and simplified testing after installation of a lift and make possible batch production of these components.

1 General scope and field of application

This standard deals with permanently installed new lifts serving defined landing levels, having a car designed for the transportation of persons and/or goods, suspended by rope(s) or chain(s) or supported by one or more rams and moving at least partially between vertical guides or guides slightly inclined to the vertical. [For appliances where the inclination of the guides to the vertical exceeds 15°, this standard may usefully be taken as a basis (N.a, b).] (N)

It does not cover the lifts which come under the following headings: paternosters, rack and pinion elevators, screw-driven elevators, mine lifts, theatrical lifts, appliances with automatic caging, skips, lifts and hoists for building and public works sites, ships' hoists, platforms for exploration or drilling at sea, construction and maintenance appliances. However, this standard may usefully be taken as a basis.

This standard need not be applied (N.a) in the following cases: (N)

a) a lift installed in a private residence or as a means of access to a private residence in a building, such that the lift is inaccessible to the other occupants of the building and to the general public, and if there are specific national rules concerning this type of lift;

b) the installation of lifts serving only two levels, specialized for transporting the handicapped and where the travel does not exceed 4 m, the speed does not exceed 0.1 m/s, and the movement of the car requires continuous pressure on a button.

Certain clauses need not be applied (N.b) to the extent that space does not permit, in the following cases: (N)

a) lifts installed in buildings in existence at the time this standard is brought into application;

b) important modifications (Appendix E) to a lift installed before this standard is brought into application.

This standard is divided into four Parts.

— Part 1: deals with electric lifts;

— Part 2: deals with hydraulic lifts (in preparation);

— Part 3: deals with electric service lifts (in preparation);

— Part 4: deals with hydraulic service lifts (in preparation).

0 Introduction

See general introduction (page 3).

1 Scope and field of application

Part 1 of this standard deals with the lifts defined in clause **3**, driven electrically, where the car is suspended by ropes or chains.

In particular, lifts serving exclusively for the transportation of goods, but having a car dimensioned and constructed to allow access by persons, shall be entered in the category "lifts" and not in the category "service lifts". (See clause **3**, "Definitions".)

2 References

ISO 834:1975, *Fire resistance tests — Elements of building construction.*

ISO 2532:1974, *Steel wire ropes — Vocabulary.*

IEC Publication . . . ., *Clearances and creepage distances for low-voltage contactors (in preparation within SC 28A of the IEC, at present Appendix B of IEC Publication 158/1).*

CENELEC Harmonization Documents,

HD 21 S2:1981, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V.*

HD 22 S2:1981, *Rubber insulated cables of rated voltages up to and including 450/750 V.*

HD 214 S2:1980, *Recommended method for determining the comparative tracking index of solid insulating materials under moist conditions.*

HD 359:1976, *Flat polyvinylchloride sheathed flexible cables.*

HD 360:1976, *Rubber-insulated lift cables for normal use.*

HD 384-4-41:1980, *Electrical installations of buildings — Part 4: Protection for safety — Chapter 41: Protection against electric shock.*

HD 419:1982, *Low-voltage switchgear and controlgear contactors.*

HD 420:1982, *Control switches (low-voltage switching devices for control and auxiliary circuits, including contactor relays).*

HD . . . ., *Classification of external influences (in preparation, at present Clause **32** of IEC Publication 364-3:1977).*

3 Definitions

The following definitions are intended to indicate precisely the technical sense in which the terms are used in the present standard.

For convenience of reference they are grouped in alphabetical order rather than according to the types of equipment to which they apply. This is in order to avoid needless repetition.

authorized and instructed user (usager autorisé et averti) (befugter und eingewiesener Benutzer)

person authorized by the person responsible for the installation to use the lift and who has been instructed in its use

available car area (surface utile de la cabine) (Nutzfläche des Fahrkorbes)

area of the car measured at a height of 1.0 m above floor level, disregarding handrails, which is available for passengers or goods during operation of the lift

in the case of a car without doors, a strip 0.1 m deep in front of each car sill is omitted from the calculation of the available area

buffer (amortisseur) (Puffer)

a resilient stop at the end of travel, and comprising a means of braking using fluids or springs (or other similar means)

goods passenger lift (ascenseur de charge)[5] (Lastenaufzug)

a lift mainly intended for the transport of goods, which are generally accompanied by persons

guides (guides) (Führungsschienen)

the components which provide guiding for the car sling or the counterweight, if there is one

instantaneous safety gear (parachute à prise instantanée) (Sperrfangvorrichtung)

a safety gear in which the full gripping action on the guides is almost immediate

instantaneous safety gear with buffered effect (parachute à prise instantanée avec effet amorti) (Sperrfangvorrichtung mit Dämpfung)

a safety gear in which the full gripping action on the guides is almost immediate, but the reaction on the car or counterweight is limited by presence of an intermediate buffering system

[5] The French expression "ascenseur de charge" has been introduced into the French language document with the aim of harmonizing the texts in the three languages of CEN and of simplifying the wording. It does not in any way define a particular or supplementary category of lift.

levelling (nivelage) (Einfahren)

an operation which improves the accuracy of stopping at landings

lift (ascenseur) (Aufzug)

a permanent lifting equipment serving defined landing levels, comprising a car, *whose dimensions and means of construction clearly permit the access of persons*; running at least partially between rigid vertical guides or guides whose inclination to the vertical is less than 15°

lift car (cabine) (Fahrkorb)

a part of the lift which carries the passengers and/or other loads.

lift machine (machine) (Triebwerk)

the unit including the motor which drives and stops the lift

machine room (local des machines) (Triebwerksraum)

a room in which machine or machines and/or the associated equipment are placed

minimum breaking load of a lifting rope (charge de rupture minimale d'un câble) (Mindestbruchkraft eines Seiles)

this load is the product of the square of the nominal diameter of the rope (in square millimetres) and the nominal tensile strength of the wires (in newtons per square milli-metre) and a coefficient appropriate to the type of rope construction. (ISO 2532)

the effective breaking load obtained in a rupture test on a sample of rope following a defined method, shall be at least equal to the minimum breaking load

non-commercial vehicle lift (monte-voitures) (Aufzug zur Beförderung von Kraftfahrzeugen)

a lift whose car is suitably dimensioned for carrying private motor cars

overspeed governor (limiteur de vitesse) (Geschwindigkeitsbegrenzer)

a device which, when the lift attains a predetermined speed, causes the lift to stop, and if necessary causes the safety gear to be applied

passenger (passager) (Fahrgast)

any person transported by a lift

pit (cuvette) (Schachtgrube)

the part of the well situated below the lowest landing level served by the car

positive drive lift (includes drum drive) (ascenseur à treuil attelé) (Trommelaufzug, Kettenaufzug)

a lift suspended by chains or lifting ropes driven by means other than friction

positive drive service lift (includes drum drive) (monte-charge à treuil attelé) (Trommelaufzug/Kettenkleingüteraufzug)

a service lift suspended by chains, or ropes driven by means other than friction

progressive safety gear (parachute à prise amortie) (Bremsfangvorrichtung)

a safety gear in which deceleration is effected by a braking action on the guides and for which special provisions are made so as to limit the forces on the car or counterweight to a permissible value

pulley room (local des poulies) (Rollenraum)

a room not containing the machine, and in which pulleys are located and in which the overspeed governors and the electrical equipment may also be housed

rated load (charge nominale) (Nennlast)

the load for which the equipment has been built and for which normal operation is guaranteed by the vendor

rated speed (vitesse nominale) (Nenngeschwindigkeit)

the speed of the car for which the equipment has been built and for which normal operation is guaranteed by the vendor

re-levelling (isonivelage) (Nachstellung)

an operation, after the lift has stopped, to permit the stopping position to be corrected during loading or unloading, if necessary by successive movements (automatic or inching)

safety gear (parachute) (Fangvorrichtung)

a mechanical drive for stopping, and maintaining stationary on the guides, the lift car or counterweight in case of overspeeding in the downward direction or breaking of the suspension

safety rope (câble de sécurité) (Sicherheitsseil)

an auxiliary rope attached to the car and the counterweight for the purpose of tripping a safety gear in case of suspension failure

service lift (monte-charge) (Kleingüteraufzug)

a permanent lifting equipment serving defined landing levels, comprising a car, the interior of which is *inaccessible to persons* on account of its dimensions and means of construction, running at least partially between rigid vertical guides or guides whose inclination to the vertical is less than 15°

to satisfy the condition of inaccessibility, the car dimensions do not exceed:

a) floor area 1.00 m^2;
b) depth 1.00 m;
c) height 1.20 m.

a height greater than 1.20 m is permissible, however, if the car comprises several permanent compartments, each of which satisfies the above requirements

sling (étrier) (Rahmen)

the metal framework carrying the car or counterweight, connected to the means of suspension. This sling may be integral with the car enclosure

toe guard (garde-pieds) (Schürze)

an apron having a smooth vertical part extending downwards from the sill of the landing or car entrance

traction drive lift (ascenseur à adhérence) (Treibscheiben-Aufzug)

a lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine

traction drive service lift (monte-charge à adhérence) (Treibscheiben-Kleingüteraufzug)

a service lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine

unlocking zone (zone de déverrouillage) (Entriegelungszone)

a zone, extending above and below the stopping level, in which the car floor must be to enable the corresponding landing door to be unlocked

user (usager) (Benutzer)

person making use of the services of a lift installation

well (gaine) (Schacht)

the space in which the car and the counterweight, if there is one, travels. This space is bounded by the bottom of the pit, the walls and the roof of the well

4 Symbols and abbreviations

4.1 Units. The units used are chosen from the International (SI) System of units.

4.2 Symbols

Measurements (in the order they appear in the document)	Symbol	Unit
Rated speed	v	m/s
Sum of the mass of the empty car and the masses of the portion of the travelling cables and any compensation devices, suspended from the car	P	kg
Rated load (mass)	Q	kg
Ratio between the greater and the smaller static force in the parts of the rope located on either side of the traction sheave	$\frac{T_1}{T_2}$	a
Coefficient taking account of the acceleration, deceleration and specific conditions of the installation	C_1	a
Standard acceleration of free fall	g_n	m/s^2
Braking deceleration of the car	a	m/s^2
Coefficient taking account of the variation in profile of the traction sheave groove due to wear	C_2	a
Base of natural logarithms	e	a
Coefficient of friction of ropes in traction sheave grooves	f	a
Coefficient of friction between steel wire ropes and sheaves	μ	a
Angle of wrap of the ropes on the traction sheave	α	rad
Angle of the undercut grooves or semicircular grooves in the traction sheave	β	rad
Angle of the vee grooves in the traction sheave	γ	rad
Diameter of traction ropes	d	mm
Diameter of traction sheave	D	mm
Number of ropes	n	a
Specific pressure of the ropes in the traction sheave grooves	p	N/mm^2
Static force in the ropes to the car at the level of the traction sheave when the car is stationary at the lowest level with its rated load	T	N
Speed of the ropes corresponding to the rated speed of the car	v_c	m/s
Buckling stress in the guides during safety gear operation	σ_k	N/mm^2
Cross section area of a guide	A	mm^2
Buckling factor	ω	a
Coefficient of slenderness	λ	a

Measurements (in the order they appear in the document)	Symbol	Unit
Maximum distance between guide brackets	l_k	mm
Radius of gyration	i	mm
Radiation intensity at a distance of 1 m	W_1	W/cm^2
Radiation intensity measured at a distance equal to half the diagonal of the door entrance being tested	W_Z	W/cm^2
Absorption coefficient of the radiation measuring apparatus	a	%
Conversion factor for radiation measuring	F	[a]
Ratio between the smallest and largest dimensions of the door entrance being tested	L	[a]
Diagonal of the door entrance being tested	Z	m
Width of the "door assembly" being tested	l	m
Width of the free passage of the door being tested	E	m
Number of panels of the door being tested	n_v	[a]
Total permissible mass	$(P + Q)_1$	kg
Tripping speed of overspeed governor	v_1	m/s
Energy which can be absorbed by one safety gear block	K, K_1, K_2	J
Height of free fall	h	m
Mass necessary to compress the spring of a buffer completely	C_r	kg
Total compression of the spring	F_1	m

[a] Measurement without unit

4.3 Abbreviations

Type F door. Door fulfilling all the criteria of fire resistance defined in Appendix **F.2**.

Type S door. Door with only the degree of integrity defined in Appendix **F.2**.

5 Lift well

5.1 General provisions

5.1.1 The requirements of this clause relate to wells containing one or more lift cars.

5.1.2 The counterweight of a lift shall be in the same well as the car.

5.2 Well enclosure

5.2.1 *Each well shall be totally enclosed by imperforate walls, floor and ceiling, as defined in* **5.3**.

The only permissible openings are:

a) openings for landing doors;

b) openings for inspection and emergency doors to the well and inspection traps;

c) vent openings for escape of gases and smoke in the event of fire;

d) ventilation openings;

e) permanent openings between the well and the machine or pulley rooms.

Specific case. When the well is not required to contribute to the protection of the building against the spread of fire, it may be permitted (N.a, b): (N)

a) to limit the height of the walls on faces other than the entrance faces, to a height of 2.5 m above any points normally accessible to persons;

b) at the entrance faces of the well to use mesh or perforated panels upwards from a height of 2.5 m above landing level. (These means of protection are not required if the car door is locked mechanically. (**5.4.3.2.2**)

The dimensions of the mesh or perforations shall not exceed 75 mm measured either horizontally or vertically.

5.2.2 *Inspection and emergency doors — Inspection traps*

5.2.2.1 Inspection and emergency doors, and inspection traps to the well, shall not be permitted except on grounds of safety to users or the requirements of servicing.

5.2.2.1.1 Inspection doors shall have a minimum height of 1.4 m and a minimum width of 0.60 m.

Emergency doors shall have a minimum height of 1.8 m and a minimum width of 0.35 m.

Inspection traps shall have a maximum height of 0.5 m and a maximum width of 0.50 m.

5.2.2.1.2 When the distance between consecutive landing doorsills exceeds 11 m, intermediate emergency doors shall be provided, such that the distance between sills is not more than 11 m. This requirement is not called for in the case of adjacent cars, each fitted with an emergency door meeting the requirements of **8.12.4**.

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

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

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

5.2.2.2.2 Operation of the lift shall automatically depend on the maintenance in the closed position of these doors and traps. For this purpose electric safety devices in conformity with **14.1.2** shall be employed.

The operation of the lift with an inspection trap open may be permitted during inspection operations, if this operation requires continuous actuation of a device (only accessible when the trap is open) allowing the electric safety drive normally proving the closure of the trap to be shunted.

5.2.2.3 Inspection and emergency doors and inspection traps shall be imperforate and satisfy the same requirements for mechanical strength as the landing doors (N.b).

5.2.3 *Ventilation of the well.* The well shall be suitably ventilated. It shall not be used to provide ventilation of rooms other than those for the service of lifts.

Provision shall be made, at the top of the well, for ventilation openings, with a minimum area of 1 % of the horizontal cross section of the well to the outside either directly or via the machine or pulley rooms (N.b, c).

5.3 Walls, floor and ceiling of the well. The structure of the well shall be able to support at least the loads which may be applied by the machine, by the guides at the moment of safety gear operation, or in the case of off-centering of the load in the car, by the action of the buffers, or those which may be applied by the anti-rebound device. For the evaluation of the forces during safety gear operation, or buffer operation, see clause **5**, notes.

The walls, floor and ceiling of the well shall:

a) be made of incombustible durable materials which do not assist the creation of dust (N.b);

b) have sufficient mechanical strength.

In the case of lifts without car doors, the wall facing the car entrances shall possess mechanical strength such that when a force of 300 N is applied at right angles to the wall at any point on either face, being evenly distributed over an area of 5 cm^2 in round or square section, they shall:

a) resist without permanent deformation

b) resist without elastic deformation greater than 10 mm.

5.4 Construction of the walls of lift wells and landing doors facing a car entrance

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

For clearances between car and wall of the lift well facing the car entrance, see clause **11**.

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

5.4.3 ***For lifts with car door***

5.4.3.1 Below each landing sill over a vertical distance of not less than half the unlocking zone plus 50 mm, the wall of the lift well shall comply with the requirements of **5.4.4** a) and **5.4.4** b) below.

In addition, it shall be:

a) either connected to the lintel of the next door, or

b) extended downwards using a hard smooth chamfer whose angle to the horizontal plane shall be at least 60°. The projection of this chamfer on the horizontal plane shall be not less than 20 mm.

5.4.3.2 Elsewhere, the horizontal distance between the wall of the well and the sill or entrance frame of the car or door (or extreme edge of the doors in the case of sliding doors) shall not exceed 0.15 m. The object is to prevent:

a) a person falling down the well;

b) a person getting into the gap between car door and well during normal operation of the lift (it is with this in mind that the measurement of 0.15 m shall be checked, particularly in the case of interlinked telescopic doors).

5.4.3.2.1 A horizontal distance of 0.20 m may be permitted:

a) over a vertical distance of 0.5 m (maximum), or

b) in the case of goods passenger lifts and non-commercial vehicle lifts with vertically sliding doors.

5.4.3.2.2 The conditions laid down in **5.4.3.2** need not be observed if the car is provided with a mechanically locked door which can only be opened in the unlocking zone of a landing door.

The operation of the lift shall automatically depend on the locking of the corresponding car door except in the cases covered in **7.7.2.2**. This locking shall be proved by an electric safety device in conformity with **14.1.2**.

5.4.4 *For lifts without car door:*

a) The assembly described in **5.4.2** shall form a continuous vertical surface composed of smooth and hard elements, such as metal sheets, hard facings or materials equivalent with regard to friction. Plaster faced and glass walls are forbidden. Additionally, this assembly shall extend at least 25 mm on both sides beyond the full car entrance width.

b) Any projections shall be less than 5 mm. Projections exceeding 2 mm shall be chamfered at least 75° to the horizontal.

c) When the landing doors are fitted with recessed handles, the depth of the cavity on the well side shall not exceed 30 mm and the width 40 mm. The walls of the cavity above and below shall form an angle of at least 60°, preferably 75°, with the horizontal. The arrangement of the handles or bars shall limit the risk of catching and prevent fingers from being trapped behind them or becoming wedged.

5.5 Protection of any spaces located below the car or the counterweight

5.5.1 Lift wells should preferably not be situated above a space accessible to persons.

5.5.2 If accessible spaces do exist underneath the car or counterweight, the base of the pit shall be designed for an imposed load of at least 5 000 N/m^2, and:

a) either there shall be installed below the counter weight buffer a solid pier extending down to solid ground, or

b) the counterweight shall be equipped with safety gear.

5.6 Well containing cars and counterweights belonging to several lifts or service lifts

5.6.1 In the lower part of the well there shall be a partition between the moving parts (car or counterweight) of different lifts or service lifts.

This partition shall extend at least from the lowest point of travel of car or counterweight to a height of 2.5 m above the floor of the pit (N.c).

5.6.2 Further, if the horizontal distance between the edge of the car roof and a moving part (car or counterweight) of an adjacent lift or service lift is less than 0.3 m, the partition called for in **5.6.1** shall be extended through the full height of the well and over the effective width.

This width shall be at least equal to that of the moving part (or part of this) which is to be guarded, plus 0.1 m on each side.

5.7 Headroom and pit

5.7.1 *Top clearances for traction drive lifts* (see note 3 at the end of clause **5**).

5.7.1.1 When the counterweight rests on its fully compressed buffer(s), the following four conditions shall be satisfied at the same time:

a) The car guide lengths shall be such as would accommodate a further guided travel, expressed in m, of at least 0.1 + 0.035 v^2 [6)].

b) The free vertical distance between the level of the highest area on the car roof whose dimensions comply with **8.13.1** b) (areas on parts according to **5.7.1.1** c) excluded) and the level of the lowest part of the roof of the well (including beams and components located under the roof) situated in the projection of the roof of the car, expressed in m, shall be at least 1.0 + 0.035 v^2.

c) The free distance, expressed in m, between the lowest parts of the roof of the well and:

1) The highest pieces of equipment fixed on the roof of the car enclosure, except for those covered in 2) below, shall be at least 0.3 + 0.035 v^2.

2) The highest part of the guide shoes or rollers, of the rope attachments and of the header or parts of vertically sliding doors, if any, shall be at least 0.1 + 0.035 v^2.

d) There shall be above the car sufficient space to accommodate a rectangular block not less than 0.5 m × 0.6 m × 0.8 m resting on one of its faces. For lifts with direct roping, the suspension ropes and their attachments may be included in this space, provided that no rope centre-line shall be at a distance exceeding 0.15 m from at least one vertical surface of the block.

5.7.1.2 When the car rests on its totally compressed buffers, the counterweight guide lengths shall be such as would accommodate a further guided travel expressed in m, of at least 0.1 + 0.035 v^2 [6)].

5.7.1.3 When the retardation of the lift is positively monitored, in accordance with **12.8**, the value of 0.035 in **5.7.1.1** and **5.7.1.2** for calculation of clearances may be reduced:

a) to 1/2 for lifts whose rated speed does not exceed 4 m/s;

b) to 1/3 for lifts whose rated speed exceeds 4 m/s.

[6)] 0.035 v^2 represents half the gravity stopping distance corresponding to 115 % of the rated speed [½ × $\frac{(1.15\ v)^2}{2g_n}$ = 0.0337 v^2 rounded to 0.035 v^2].

However, this value may not in either event be less than 0.25 m.

5.7.1.4 For lifts which are fitted with compensating ropes having a tensioning pulley equipped with an anti-rebound device (braking or lock-down device), the value of 0.035 v^2 may be replaced in the calculation of the clearances by a figure related to the possible travel of that pulley (depending on the roping used) plus 1/500 of the travel of the car, with a minimum of 0.2 m to take account of the elasticity of the ropes.

5.7.2 ***Top clearances for positive drive lifts***

5.7.2.1 The travel of the car upwards from the top floor until it strikes the upper buffers shall be at least 0.5 m. The car shall be guided to the limit of its buffer stroke.

5.7.2.2 When the upper buffers are fully compressed by the car the following conditions shall be satisfied at the same time.

a) The free vertical distance between the level of the highest area on the car roof whose dimensions comply with **8.13.1** b) (areas on parts according to **5.7.2.2** b) excluded) and the level of the lowest part of the roof of the well (including beams and components located under the roof) situated in the projection of the roof of the car, shall be at least 1.0 m.

b) The free distance between the lowest part of the roof of the well and:

1) The highest pieces of equipment fixed on the car roof, except for those covered by 2) below, shall be at least 0.3 m.

2) The highest part of the guide shoes or rollers, of the rope attachments, or of the header, or the parts of vertically sliding doors, if any, shall be at least 0.1 m.

c) There shall be above the car sufficient space to accommodate a rectangular block not less than 0.5 m × 0.6 m × 0.8 m resting on one of its faces. For lifts with direct roping, the suspension ropes or chains and their attachments may be included in this space, provided that no rope, or chain, centre-line shall be at a distance exceeding 0.15 m from at least one vertical surface of the block.

5.7.2.3 When the car rests on the fully compressed buffers the guide lengths of the counterweight, if there is one, shall be such as would accommodate a further guided travel of at least 0.3 m.

5.7.3 ***Pit***

5.7.3.1 The lower part of the well shall consist of a pit, the bottom of which shall be smooth and approximately level, except for any buffer and guide bases and water drainage devices.

After the building-in of guide fixings, buffers, any grids, etc., the pit shall be impervious to infiltration of water.

5.7.3.2 If there is an access door to the pit, other than the landing door, it shall comply with the requirements of **5.2.2**.

Such a door shall be provided if the pit depth exceeds 2.5 m and if the layout of the building so permits.

If there is no other access a permanent means shall be provided inside the well, easily accessible from the landing door, to permit competent persons to descend safely to the floor of the pit. This shall not project into the clear running space of the lift equipment.

5.7.3.3 When the car rests on its fully compressed buffers, the following conditions shall be simultaneously fulfilled.

a) There shall be in the pit sufficient space to accommodate a rectangular block not less than 0.5 m × 0.6 m × 1.0 m resting on one of its faces.

b) The clear distance between the bottom of the pit and

1) the lowest portions of the car, except for items detailed in 2) below, shall be at least 0.5 m;

2) the lowest parts of the guide shoes or rollers of safety gear blocks, toe guards or parts of vertical sliding doors, shall be at least 0.1 m.

5.7.3.4 There shall be in the pit:

a) a *switch* accessible on opening the door to the pit to stop the lift and keep it stopped, such that there is no risk of mistaking the stop position (see **15.7**).

This switch shall conform to the requirements of **14.2.2.3**;

b) an electric *socket outlet* (**13.6.2**).

5.8 Exclusive use of the lift well. The well shall be exclusively for the lift. It shall not contain cables or devices, etc., other than for the lift. (The well may, however, contain heating equipment for the lift well excluding hot water or steam heating; however, any control and adjustment devices shall be located outside the well.)

5.9 Lighting of the well. The well shall be provided with permanent electric lighting, allowing it to be lit during repairs or servicing, even when all doors are closed.

This lighting shall comprise one lamp at most 0.5 m from the highest and lowest points in the well with intermediate lamps at 7 m, maximum spacing.

If use is made of the exception provided for in **5.2.1**, specific case, this lighting may not be necessary if the electric lighting existing in the neighbourhood of the well is sufficient.

Clause 5. Notes

NOTE 1 *Evaluation of the vertical forces during safety gear operation.* The force (N) in *each* guide developed during safety gear operation may be evaluated approximately according to the following formulae:

a) instantaneous safety gear:

1) except captive roller type $25(P + Q)$

2) captive roller type $15P + Q)$

b) progressive safety gear $10\ P + Q)$

where

P = sum of the mass of the empty car and the masses of the portion of the travelling cables and any compensation devices, suspended from the car (kg)

Q = rated load (kg)

NOTE 2 *Evaluation of the reaction at the bottom of the pit at the moment of safety gear operation or activation of buffers.* The reactions (N) may be evaluated as follows:

beneath each guide:

10 times the mass of the guide (kg) plus the reaction (N) at the moment of operation of the safety gear (if the guides are suspended, the reaction at the points of attachment shall be evaluated by analogy with what is done in the case of guides supported at the bottom of the pit)

beneath the car buffer supports:

$40(P + Q)$[7)]

beneath the counterweight buffer supports:

40 times the mass (kg) of the counterweight.

NOTE 3 *Graph illustrating the top clearances for traction drive lifts.* Figure 1 is a graph illustrating these clearances.

6 Machine and pulley rooms

6.1 General provisions

6.1.1 Machines, their associated equipment and pulleys, shall be accessible only to authorized persons (maintenance, inspection and rescue).

6.1.2 The machine and its associated equipment shall be in a special room, comprising solid walls, ceiling and door and/or trap.

6.1.2.1 As exceptions to the above requirements:

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

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

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

a) the examinations and tests and the maintenance operations may be carried out from the machine room;

b) the openings between the machine room and the well are as small as possible.

6.1.2.1.3 The overspeed governor may be installed in the well, provided that the examinations and tests and the maintenance operations may be carried out from outside the well.

6.1.2.1.4 The divertor pulleys and the traction sheaves in the well shall be provided with devices to avoid:

a) bodily injury;

b) the suspension ropes or chains leaving their grooves if slack;

c) the introduction of foreign objects between ropes and grooves.

6.1.2.1.5 The devices used shall be such that they do not hinder examinations and tests or maintenance operations. The dismantling of these devices shall be necessary only in the following cases;

a) replacement of a rope;

b) replacement of a pulley;

c) re-cutting of the grooves.

6.1.2.2 The machines, their associated equipment and pulleys, may be placed in rooms used for other purposes (N.a, b) (exceptional access e.g. to flat roofs) if they are separated from the rest of the room by an enclosure at least 1.8 m high provided with a lockable access door. (N)

6.1.2.3 Machine or pulley rooms, or enclosures referred to in **6.1.2.2** shall not be used for purposes other than lifts. They shall not contain ducts, cables or devices other than for the lift.

These rooms may, however, contain:

a) machines for service lifts or escalators;

b) equipment for air-conditioning or heating of these rooms, excluding hot water (N.a) or steam heating; (N)

c) fire detectors or extinguishers, with a high operating temperature, appropriate for the electrical equipment, stable over a period of time, and suitably protected against accidental impact.

6.1.2.4 The machine rooms shall preferably be placed above the well.

[7)] Value of "P" is different in notes 1 and 2 due to the fact that the portions of the travelling cables and compensation devices, supported by the car, vary according to the position of the car in the well.

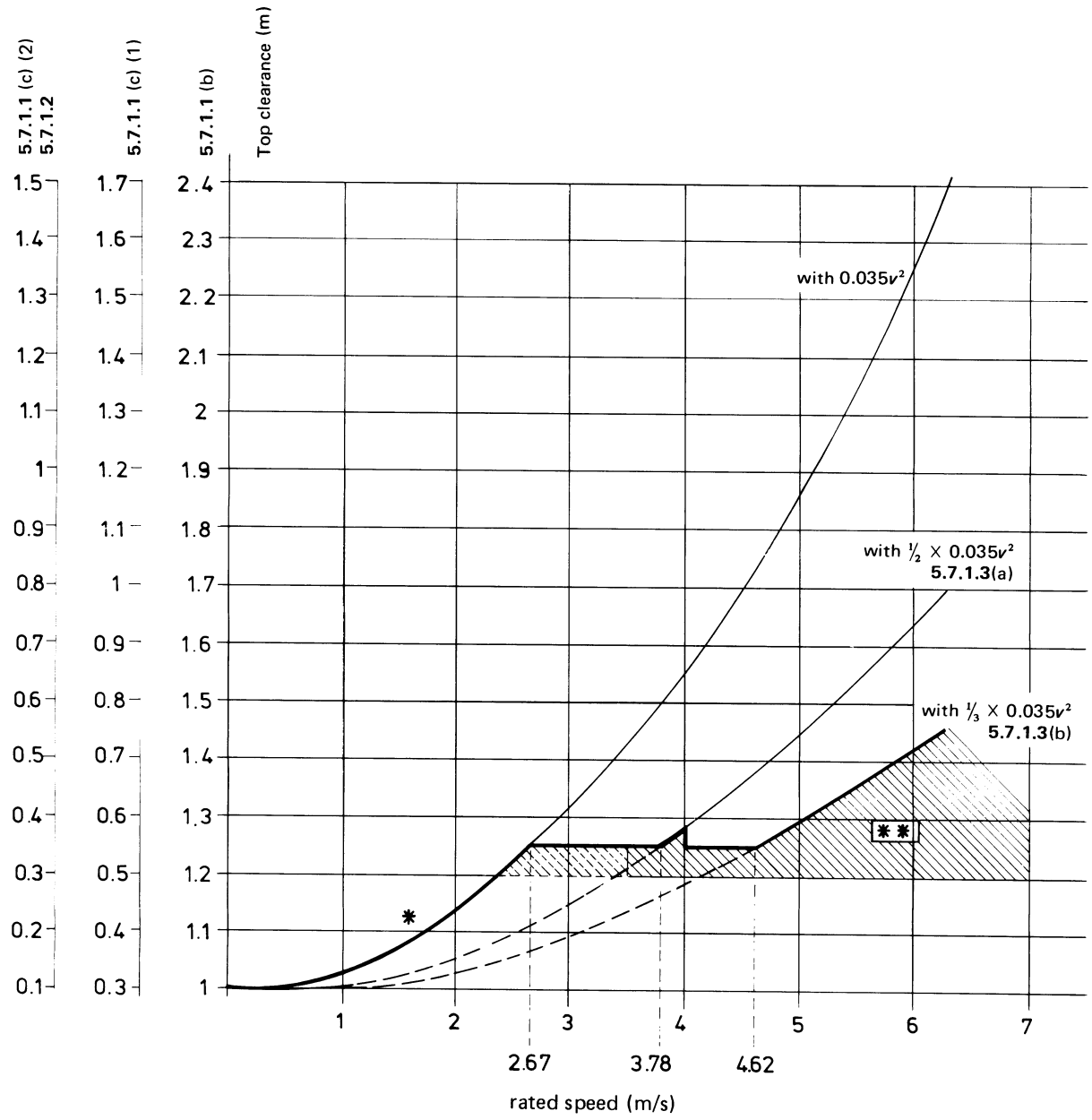
6.2 Access

6.2.1 Access from the public way to the interior of the machine and pulley rooms shall:

a) be capable of being properly lit by a) permanent electric light fixture(s);

b) be easy to use in complete safety in all circumstances without necessitating entry into private premises;

The access ways to the machine rooms and the entrances themselves shall be at least 1.8 m high. Door sills and edges with height not exceeding 0.4 m are not taken into consideration (N.c). (N)



* In heavy lines: minimum clearance possible when maximum advantage is taken of the possibilities afforded in **5.7.1.3**

** Area of values which can be obtained by calculations in accordance with **5.7.1.4** in the case of lifts with compensation pulleys fitted with an anti-rebounded device. This device is only required for speeds of over 3.5 m/s but is not prohibited for lower speeds.

These values depend on the design of the anti-rebound device and the travel of the lift.

Figure 1 — Graph illustrating the top clearances for traction drive lifts (5.7.1)

6.2.2 Access for persons to machine or pulley rooms shall, for preference, be effected entirely by way of stairs

If it is impractical to install stairs, then ladders may be used which satisfy the following conditions (N.b, c):

a) they shall not be liable to slip or to turn over;

b) they shall, when in position, form an angle of between 70° and 76° with the horizontal, unless they are fixed and their height is less than 1.5 m;

c) they shall be exclusively used for this purpose and be kept always available in the vicinity of the access level; the necessary provisions shall be made for that purpose;

d) adjacent to the top end of the ladder, there shall be one or more hand holds within easy reach;

e) when the ladders are not fastened, fixed attachment points shall be provided.

6.2.3 Means of access shall be provided for the hoisting of heavy equipment during erection and, if need be, its replacement, so that this can be done safely, especially avoiding handling on stairs.

6.3 Construction and equipment of machine rooms

6.3.1 *Mechanical strength, floor surface, sound insulation*

6.3.1.1 Machine rooms shall be so constructed to withstand the loads and forces to which they will normally be subjected.

They shall be in durable material not favouring the creation of dust.

6.3.1.2 Room floors shall be of non-slip material.

6.3.1.3 When the function of the building requires it (e.g. dwellings, hotels, hospitals, schools, libraries, etc.) the walls, floors and ceilings of machine rooms shall absorb substantially the sounds associated with the operation of the lifts (N.b).

6.3.2 *Dimensions*

6.3.2.1 The dimensions of machine rooms shall be sufficient to permit easy and safe access for servicing personnel to all the components, especially the electrical equipment.

In particular there shall be provided:

a) a clear horizontal area in front of the panels and the cabinets. This area is defined as follows: (N.c)

depth, measured from the external surface of the enclosures, at least 0.7 m. This distance may be reduced to 0.6 m in front of protruding controls, (handles, etc.).

width, the greater of the following values: 0.5 m or the full width of the cabinet or panel.

b) a clear horizontal area of at least 0.5 m × 0.6 m for servicing and inspection of moving parts at points where this necessary and, if need be, manual emergency operation (**12.5.1**);

c) access ways to these clear spaces which shall have a width of at least 0.5 m. This value may be reduced to 0.4 m in areas where there are no moving parts.

6.3.2.2 In no case shall the clear height for movement or working be less than 1.8 m (N.c).

This full height for movement or working is taken to the underside of the structural roof beams and measured from:

a) the floor of the access area;

b) the floor of the working area.

6.3.2.3 There shall be a clear vertical distance of at least 0.3 m above the rotating parts of the machine.

6.3.2.4 When the machine room floor comprises a number of levels, differing by more than 0.5 m, stairways or steps and guard rails shall be provided.

6.3.2.5 When the floor of the machine room has any recesses greater than 0.5 m deep and less than 0.5 m wide, or any channels, they shall be covered.

6.3.3 *Doors and trap doors*

6.3.3.1 Access doors shall have a minimum width of 0.6 m and a minimum height of 1.8 m (N.c). They shall not open towards the inside of the room.

6.3.3.2 Access trap doors for persons shall give a clear passage at least 0.8 m × 0.8 m, and shall be counter-balanced.

All trap doors, when they are closed, shall be able to support two persons, i.e. able to resist a vertical force of 2 000 N at any position, without permanent deformation.

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

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

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

Trap doors used only for access of material can be locked from the inside only.

6.3.4 *Other openings.* The dimension of holes in the slab and room floor shall be reduced to a minimum.

With the aim of removing the danger of objects falling through openings situated above the well, including those for electric cables, ferrules shall be used, which project at least 50 mm above the slab or finished floor.

6.3.5 ***Ventilation and temperature***

6.3.5.1 Machine rooms shall be ventilated. They shall be such that the motors, and equipment, as well as electric cables, etc., are protected as far as possible from dust, harmful fumes and humidity (N.b).

Stale air from other parts of the building shall not be extracted into the machine room.

6.3.5.2 The ambient temperature in the machine room shall be maintained between + 5 °C and + 40 °C.

6.3.6 *Lighting and socket outlets.* The machine room shall be provided with permanent electric lighting on the basis of at least 200 lux at floor level. The supply for this lighting shall be in conformity with **13.6.1**.

A switch placed inside close to the access point or points, at an appropriate height, shall control lighting of the room on entry.

One or more socket outlets (**13.6.2**) shall be provided.

6.3.7 *Handling of equipment.* One or more metal supports or hooks, as appropriate, shall be provided in the machine room ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment during erection and, if need be, its replacement.

6.4 Construction and equipment of pulley rooms

6.4.1 ***Mechanical strength, floor surface***

6.4.1.1 The pulley rooms shall be so constructed to withstand the loads and forces to which they will normally be subjected.

They shall be in durable material, not favouring the creation of dust.

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

6.4.2 ***Dimensions***

6.4.2.1 Pulley room dimensions shall be sufficient to provide easy and safe access for servicing personnel to all the equipment.

The requirements of **6.3.2.1** b) and c) are applicable.

6.4.2.2 The height under the roof shall be at least 1.5 m (N.c).

6.4.2.2.1 There shall be a clear space of at least 0.3 m high above the pulleys, except in the case of double wrap or deflection pulleys.

6.4.2.2.2 If there are control panels in the pulley room the provisions of **6.3.2.1** and **6.3.2.2** apply to this room.

6.4.3 ***Doors and trap doors***

6.4.3.1 Access doors shall have a minimum width of 0.6 m and minimum height of 1.4 m (N.c). They shall not open towards the inside of the room.

6.4.3.2 Access trap doors for persons shall give a clear passage of at least 0.8 m × 0.8 m and shall be counter-balanced.

All trap doors, when they are closed, shall be able to support two persons, i.e. able to resist a vertical force of 2 000 N at any position, without permanent deformation.

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

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

6.4.3.3 Doors or trap doors shall be fitted with locks having a key, which can be opened without a key from inside the room.

6.4.4 *Other openings.* The dimensions of holes in the slab and pulley room floor shall be reduced to a minimum.

With the aim of removing the danger of objects falling through openings situated over the well, including those for electric cables, ferrules shall be used which project at least 50 mm above the slab or finished floor.

6.4.5 *Stop switch.* There shall be installed in the pulley room, close to the point of access, a stop switch, allowing the lift to be stopped and kept stopped, so arranged that there is no risk of mistaking the stop position (see **15.4.4**). The switch shall conform to the requirements of **14.2.2.3**.

6.4.6 *Temperature.* If there is a risk of frost or condensation in the pulley rooms, precautions shall be taken to protect the equipment (for example, heating of the bearing oil).

If the pulley rooms also contain electrical equipment, the ambient temperature shall be maintained between + 5 °C and + 40 °C.

6.4.7 *Lighting and socket outlets.* The pulley room shall be provided with permanent electric lighting, which shall be of adequate intensity. The supply for this lighting shall be in conformity with **13.6.1**. A switch, placed inside, close to the access point, at an appropriate height, shall control the lighting of the room on entry. One or more socket outlets (**13.6.2**) shall be provided.

7 Landing doors

7.1 General provisions

7.1.1 The openings in the well giving access to the lift car shall be provided with imperforate landing doors.

When closed, the clearance between panels, or between panels and uprights, lintels or sills, shall be as small as possible.

This condition is considered to be fulfilled when these clearances do not exceed 6 mm. The second sentence of **0.1.2.2** general introduction, does not apply to this value.

These clearances are measured at the back of recesses, if present.

To avoid the risk of shearing during operation, the exterior face of automatically operated sliding doors shall not have recesses or projections exceeding 3 mm. Edges of these shall be chamfered in both directions of movement.

Exception to these requirements is made for the access to the unlocking triangle defined in Appendix B.

7.1.2 For details of the faces on the well side of landing doors see **5.4**.

7.2 Strength of doors and their frames

7.2.1 Doors and their frames shall be constructed in such a way that they will not become deformed in the course of time. To this end, it is recommended that they are made of metal.

The use of glass, even armoured, or of plastic materials, as part of a door panel is only permitted for the vision panels covered by **7.6.2.2**.

7.2.2 *Behaviour under fire conditions* (N.a) (see also the introductory note to Appendix **F.2**).

Landing doors shall be of a model which has undergone a fire test following the procedure described in Appendix **F.2** and satisfied the criteria laid down therein.

7.2.2.1 Doors satisfying all the criteria are hereafter designated by the letter F.

7.2.2.2 Doors satisfying only the criteria for integrity are hereafter designated by the letter S.

7.2.2.3 Choice of types of doors according to structural arrangements: see general introduction, **0.1.3.1** and examples in Figure 2.

NOTE 1 The walls of the well and the doors (apart from the lift doors) are shown with a double line when they are fire resistant, without prejudging their degree of resistance.

Fire resistant doors are presumed to close automatically, either always or in case of fire.

NOTE 2 In the case of a structural arrangement not shown in Figure 2, the choice of the type of door should be made by comparison.

7.2.3 *Mechanical strength*. Doors, with their locks, shall possess mechanical strength such that in the locked position and when a force of 300 N is applied at right angles to the panel at any point on either face, being evenly distributed over an area of 5 cm^2 in round or square section, they shall:

a) resist without permanent deformation;

b) resist without elastic deformation greater than 15 mm;

c) operate satisfactorily after such a test.

7.2.3.1 Under the application of the force defined above in the case of lifts without car doors, the elastic deformation of the landing door towards the well interior shall not exceed 5 mm.

7.2.3.2 Under the application at the most unfavourable point of a manual force (without a tool) of 150 N in the direction of opening of horizontal sliding doors, the clearances defined in **7.1.1** may exceed 6 mm, but they shall not exceed 30 mm.

7.3 Height and width of doors

7.3.1 *Height.* Landing doors shall have a minimum clear height of 2 m.

7.3.2 *Width.* The clear entrance of the landing doors shall not extend more than 0.05 m in width beyond the clear car entrance on either side unless appropriate precautions are taken.

7.4 Sills, guides, door suspension

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

It is recommended that a slight counter slope be provided in front of each landing sill to avoid water from washing, sprinkling, etc., draining into the well.

7.4.2 *Guides*

7.4.2.1 Landing doors shall be designed to avoid, during normal operation, derailment, jamming, or displacement at the extremities of their travel.

7.4.2.2 Horizontally sliding landing doors shall be guided top and bottom.

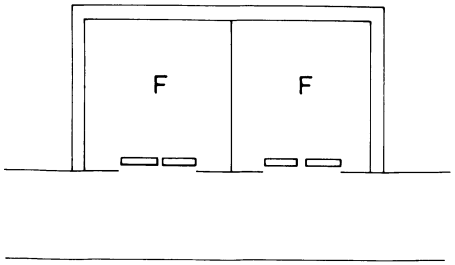
7.4.2.3 Vertically sliding landing doors shall be guided at both sides.

7.4.3 *Suspension of vertically sliding doors*

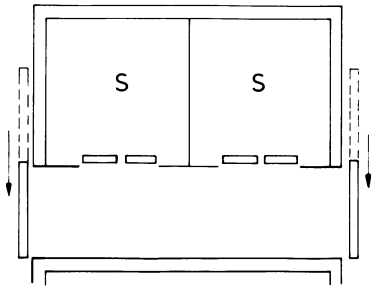
7.4.3.1 Panels of vertically sliding landing doors shall be fixed to two independent suspension elements.

7.4.3.2 Suspension elements shall be designed with a safety factor of at least 8.

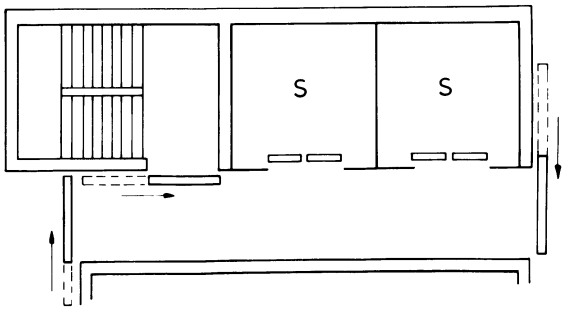
7.4.3.3 The diameter of suspension rope pulleys shall be at least 25 times the rope diameter.



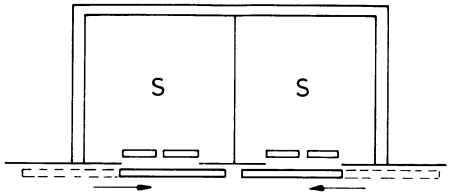
1. The lift landings are not isolated



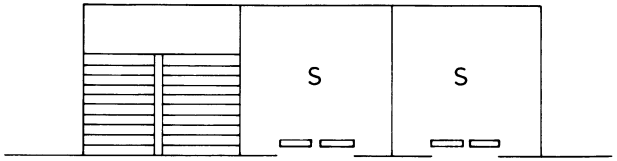
2. The lift landings are isolated



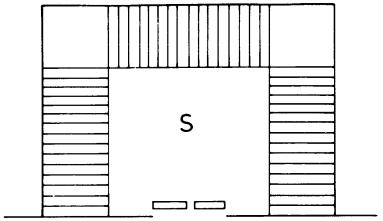
3. The lift landings and the stairwell are isolated



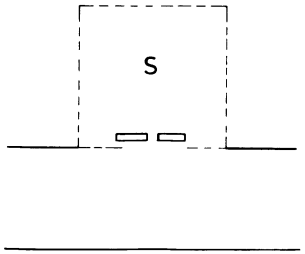
4. The lift doors are backed up by separate fire resisting doors



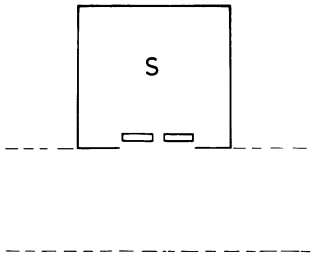
5. The lift landings common to stair landings are not isolated



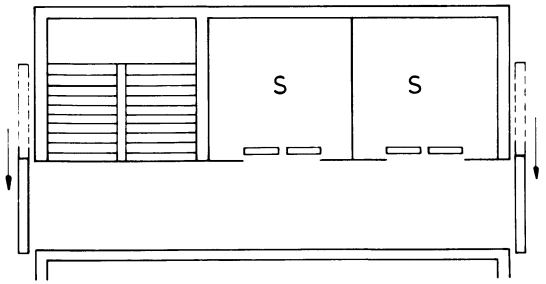
6. Lift completely surrounded by a stairwell



7. Lift adjoining a building



8. Lift installed in a hall or open space within a building



9. The lift landings common to stair landings are isolated

Figure 2 — Examples of arrangements

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

7.5 Protection in relation to door operation

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

7.5.2 *Doors with power operation.* Doors with power operation shall be designed to reduce to a minimum the harmful consequences of a person being struck by a door panel.

To this end the following requirements shall be met.

7.5.2.1 *Horizontally sliding doors*

7.5.2.1.1 *Automatic power operated doors*

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

7.5.2.1.1.2 The kinetic energy of the landing door and the mechanical elements to which it is rigidly connected, calculated or measured[8] at the average closing speed[9] shall not exceed 10 J.

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

a) This protective device may be that of the car door (see **8.7.2.1.1.3**).

b) The effect of the device may be neutralized during the last 50 mm of travel of each door panel.

c) In the case of a system which makes the sensitive protective device inoperative after a fixed period of time, to counteract persistent obstructions when closing the door, the kinetic energy defined above shall not exceed 4 J during movement of the door with the protective device inoperative.

7.5.2.1.2 *Doors where closing is carried out under the continuous control of the users (e.g. by continuous pressure on a button).* When the kinetic energy, calculated or measured as laid down in **7.5.2.1.1.2**, exceeds 10 J, the average closing speed of the fastest panel shall be limited to 0.3 m/s.

7.5.2.2 *Vertically sliding doors.* This type of sliding door shall only be permitted for goods passenger lifts and non-commercial vehicle lifts.

Power closing of this type of door is permitted if all the following conditions are fulfilled:

a) closing is carried out under the continuous control of the users;

b) the average closing speed of the panels is limited to 0.3 m/s;

c) the car door is of perforated or mesh panel construction as provided for in the specific case of **8.6.1**;

d) the car door is at least two-thirds closed before the landing door begins to close.

7.5.2.3 *Other types of doors.* When using other types of doors (e.g. hinged) with power operation, where there is a risk when opening or closing, of striking persons, precautions similar to those laid down for other power operated sliding doors shall be taken.

7.6 Local lighting and "car here" signal lights

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

7.6.2 *"Car here" indication*

7.6.2.1 In the case of landing doors with manual opening, the user must be able to know, before opening the door, whether the car is there or not.

7.6.2.2 To this effect, there shall be installed:

a) either one or more transparent vision panels conforming to the following conditions:

1) mechanical strength as specified in **7.2.3**;

2) minimum thickness of 6 mm;

3) minimum glazed area per landing door of 0.015 m^2 with a minimum of 0.01 m^2 per vision panel;

4) width of at least 60 mm, and at most 150 mm. The lower edge of vision panels which are wider than 80 mm shall be at least 1 m above floor level;

b) or, an illuminated "car here" signal which can only light up when the car is about to stop or has stopped at the particular landing. The signal shall remain illuminated all the time the car remains there.

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[8] Measured using, for example, a device consisting of a graduated piston acting on a spring with a spring constant of 25 N/mm, and fitted with an easy sliding ring allowing the extreme point of movement at the moment of impact to be measured. An easy calculation allows the graduation corresponding to the limits fixed to be determined.

[9] The average closing speed of a sliding door is calculated over its whole travel, less:
25 mm at each end of the travel in the case of centrally closing doors;
50 mm at each end of the travel in the case of side closing doors.

7.7 Locking and closed landing door check

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

The unlocking zone shall not extend more than 0.2 m above and below the landing level.

In the case, however, of mechanically operated car and landing doors operating simultaneously, the unlocking zone may extend to a maximum of 0.35 m above and below the landing level.

7.7.2 ***Protection against shearing***

7.7.2.1 It shall not be possible in normal operation to start the lift nor keep it in motion if a landing door (or any of the panels in the case of a multi-panel door) is open. However preliminary operations preparing for the movement of the car may take place.

7.7.2.2 *Specific cases.* Operation with doors open is permitted in the following zones:

a) in the unlocking zone to permit levelling or relevelling at the corresponding floor level, provided the requirements of **14.2.1.2** are met;

Ⓝ b) (N.a) in a zone extending to a maximum height of 1.65 m above the landing level to permit the loading or unloading of the car by authorized and instructed users (see general introduction, **0.6.2**), provided the requirements of **8.4.3**, **8.14** and **14.2.1.5** are met.

In addition:

1) the clear height between the landing door header and the floor of the car shall be not less than 2 m;

2) whatever the position of the car inside this zone, it must be possible, without special operation, to effect the complete closure of the landing door.

7.7.3 *Locking and emergency unlocking.* Each landing door shall be provided with a locking device satisfying the requirement of **7.7.1**. This device shall be protected against deliberate misuse.

7.7.3.1 The effective locking of the landing door in the closed position shall precede the movement of the car. However, operations preparing for the movement of the car may take place. The locking must be proved by an electric safety device in conformity with **14.1.2**.

7.7.3.1.1 The car shall not be able to start until the locking elements are engaged by at least 7 mm (Appendix **F.1**).

7.7.3.1.2 The connection between one of the contact elements which breaks the circuit, and the device which locks mechanically, shall be direct and foolproof, but adjustable if necessary.

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

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

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

7.7.3.1.6 The lock shall resist, without permanent deformation during the test laid down in Appendix **F.1** a minimum force at the level of the lock and in the direction of opening of the door of:

a) 1 000 N in the case of sliding doors;

b) 3 000 N on the locking pin, in the case of hinged doors.

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

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

If the locking element is maintained in position by the action of a permanent magnet, it shall not be possible to neutralize its effect by simple means (e.g. heat or shock).

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

7.7.3.1.9 Inspection of the working parts shall be easy, as, for example, by use of a vision panel.

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

7.7.3.2 *Emergency unlocking.* Each of the landing doors shall be capable of being unlocked from the outside with the aid of a key which will fit the unlocking triangle as defined in Appendix B.

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

After an emergency unlocking, the locking device shall not be able to remain in the unlocked position with the landing door closed, when there is no action to unlock.

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

7.7.4 ***Electrical device for proving the landing door closed***

7.7.4.1 Each landing door shall be provided with an electrical device for proving the closed position in conformity with **14.1.2**, so that the conditions imposed by **7.7.2** are satisfied.

7.7.4.2 In the case of horizontally sliding landing doors, coupled with car doors, this device may be in common with the device for proving the locked condition, provided that it is dependent upon the effective closing of the landing door.

7.7.4.3 In the case of hinged landing doors, this device shall be placed adjacent to the closing edge of the door or on the mechanical device proving the closed condition of the door.

7.7.5 ***Requirements common to devices for proving the locked condition and the closed condition of the door***

7.7.5.1 It shall not be possible, from positions normally accessible to persons, to operate the lift with a landing door open or unlocked, after one single action not forming part of the normal operating sequence.

7.7.5.2 The means used to prove the position of a locking element shall have positive operation.

7.7.6 ***The case of horizontally or vertically sliding doors with multiple panels, mechanically linked***

7.7.6.1 When a horizontally or vertically sliding door comprises several panels which are directly mechanically linked, it is permitted:

a) to lock only one panel, on condition that this single locking will prevent the opening of the other panels;

b) to place the door closed proving device laid down in **7.7.4.1** or **7.7.4.2**, on a single panel.

7.7.6.2 When the panels are indirectly mechanically linked (e.g. by rope, belt or chain) such linkage shall be designed to resist any normally anticipated forces, be constructed with special care, and checked periodically.

It is permitted to lock only one panel on condition that this single locking will prevent the opening of other panels, and that these are not fitted with a handle. The closed position of the other panel(s), not locked by the locking device, shall be proved by an electric safety device in conformity with **14.1.2**.

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

8 Car and counterweight

8.1 Height of car

8.1.1 The interior clear height of the car shall be at least 2 m.

8.1.2 The clear height of the car entrance(s) for the normal access of users shall be at least 2 m.

8.2 Available car area, rated load, number of passengers

8.2.1 *General case.* To prevent an overloading of the car by persons the available area of the car shall be limited. To this end the relationship between rated load and maximum available area is given in Table 1.1.

NOTE Recesses and extensions, even of height less than 1 m, whether protected or not by separating doors, are only permitted if their area is taken into account in the calculation of maximum available car area.

Table 1.1

Rated load, mass	Maximum available car area	Rated load, mass	Maximum available car area
kg	m^2	kg	m^2
100[a]	0.37	900	2.20
180[b]	0.58	975	2.35
225	0.70	1 000	2.40
300	0.90	1 050	2.50
375	1.10	1 125	2.65
400	1.17	1 200	2.80
450	1.30	1 250	2.90
525	1.45	1 275	2.95
600	1.60	1 350	3.10
630	1.66	1 425	3.25
675	1.75	1 500	3.40
750	1.90	1 600	3.56
800	2.00	2 000	4.20
825	2.05	2 500[c]	5.00

[a] Minimum for 1 person lift

[b] Minimum for 2 person lift

[c] Beyond 2 500 kg add 0.16 m^2 for each extra 100 kg.
For intermediate loads the area is determined by linear interpolation.

8.2.2 *Goods passenger lifts and non-commercial vehicle lifts other than those covered by* **8.2.3**. The requirements of **8.2.1** shall be applied and, in addition, design calculations shall take into account not only the rated load but also the weight of handling devices which may enter the car.

8.2.3 *Non-commercial vehicle lifts, the use of which is reserved for authorized and instructed users (general introduction,* **0.6.2**). The rated load shall be calculated at a rate of at least 200 kg/m^2 of available car area.

8.2.4 *Number of passengers.* The number of passengers shall be obtained from:

either, the formula, $\frac{\text{rated load}}{75}$, and the result rounded down to the nearest whole number

or, Table 1.2

whichever gives the smaller value.

8.3 Walls, floor and roof of the car

8.3.1 The car shall be completely enclosed by walls, floor and roof, the only permissible openings being as follows:

a) entrances for the normal access of users;

b) emergency trap doors and doors;

c) ventilation apertures.

8.3.2 The walls, floor and roof shall have sufficient mechanical strength. The assembly comprising the sling, guide shoes, walls, floor and roof of the car shall have sufficient mechanical strength to resist the forces which will be applied in normal lift operation, in safety gear operation or impact of the car on its buffers.

8.3.2.1 Each wall of the car shall have a mechanical strength such that during the application of a force of 300 N, applied at right angles to the wall, at any point, from the inside of the car towards the outside, this force being evenly distributed over an area of 5 cm^2 in round or square section, the wall

a) resists without any permanent deformation, and

b) resists without elastic deformation greater than 15 mm.

8.3.2.2 The car roof shall satisfy the requirements of **8.13**.

8.3.3 The walls, floor and roof shall not be made of materials likely to become dangerous through too great flammability or through the nature and quantity of gas and fumes they may generate.

8.4 Toe guards

8.4.1 Each car sill shall be fitted with a toe guard which extends to the full width of the clear landing entrance which it faces. This vertical section shall be extended downwards by a chamfer whose angle with the horizontal plane shall be greater than 60°. The projection of this chamfer on the horizontal plane shall be not less than 20 mm.

Table 1.2

Number of passengers	Minimum available car area	Number of passengers	Minimum available car area
	m^2		m^2
1	0.28	11	1.87
2	0.49	12	2.01
3	0.60	13	2.15
4	0.79	14	2.29
5	0.98	15	2.43
6	1.17	16	2.57
7	1.31	17	2.71
8	1.45	18	2.85
9	1.59	19	2.99
10	1.73	20	3.13
Beyond 20 passengers add 0.115 m^2 for each extra passenger.			

8.4.2 The height of the vertical portion shall be at least 0.75 m.

8.4.3 In the case of a lift with a docking operation (**14.2.1.5**), the height of the vertical portion shall be such that, with the car in the highest loading or unloading position, it extends at least 0.10 m below the landing sill.

8.5 Car entrance

8.5.1 Car entrances shall be provided with doors.

8.5.2 Although the presence of a door is preferable in all cases, it may however be permitted for goods passenger lifts, for one car entrance or two opposite car entrances not to be fitted with doors (N.a, b) if, in addition to the provisions of **8.2.1**, the following conditions are simultaneously fulfilled:

a) the lift is reserved for authorized and instructed users (general introduction, **0.6.2**);

b) the rated speed does not exceed 0.63 m/s;

c) the depth of the car, measured perpendicular to the doorless sill, is greater than 1.5 m;

d) the number of passengers is calculated as laid down in **8.2.4**, disregarding however for each door-less car entrance an area of 0.1 m depth and of width equal to the width of the doorless car entrance;

e) the buttons or switches for car control, stop and alarm are at least 0.4 m from the car entrance.

8.6 Car doors

8.6.1 The car doors shall be imperforate.

Special case. Goods passenger lifts and non-commercial vehicle lifts may use vertically sliding car doors, opening upwards, and these may be in mesh or perforated panel form. The dimensions of the mesh or perforations shall not exceed 10 mm horizontally and 60 mm vertically.

8.6.2 The car doors when closed shall, apart from the necessary clearances, completely close the car entrances.

Specific case. In the case of a lift, the use of which is reserved for authorized and instructed users (General introduction, **0.6.2**), where the height of the car entrance is greater than 2.5 m, the height of the car door may be limited to 2 m if the following conditions are simultaneously fulfilled:

a) the door slides vertically;

b) the rated speed of the lift does not exceed 0.63 m/s.

8.6.3 When closed, the clearance between panels, or between panels and uprights, lintels or sills, shall be as small as possible.

This condition is considered to be fulfilled when these clearances do not exceed 6 mm. The second sentence of **0.1.2.2**, general introduction, does not apply to this value.

These clearances are measured at the back of recesses, if present. Exception is made for vertically sliding doors, according to **8.6.1** special case.

8.6.4 In the case of hinged doors, they shall strike stops to prevent them swinging outside the car.

8.6.5 Any vision panels incorporated in car doors shall satisfy the requirements of **7.6.2.2** a). Such a vision panel is obligatory if one exists in the landing doors to ascertain the presence of the car. Their positions shall coincide when the car is at the level of the landing. However, this vision panel is not necessary in the car door when the latter is automatic and remains in the open position when the car is stationary at the level of a landing.

8.6.6 *Sills, guides, door suspension.* The provisions of **7.4** relevant to car doors shall be observed.

8.6.7 *Mechanical strength.* Car doors in the closed position shall possess sufficient mechanical strength such that, when a force of 300 N is applied at right angles to the door, at any point, from the inside of the car towards the outside, this force being evenly distributed over an area of 5 cm^2 in round or square section, they can:

a) resist without permanent deformation;

b) resist without elastic deformation greater than 15 mm;

c) operate satisfactorily after such a test.

8.7 Protection during operation of doors

8.7.1 *General.* The doors and the surrounds shall be designed in such a way as to minimize the harmful consequences of jamming of a part of a person, clothing or other object.

In order to avoid the risk of shearing during operation of the power operated sliding doors, the face of the doors on the car side shall not have any hollows or projections of more than 3 mm. Exception is made for vertically sliding doors according to **8.6.1** special case. The edges shall be chamfered.

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

To this effect, the following requirements shall be met.

8.7.2.1 *Horizontally sliding doors*

8.7.2.1.1 *Automatically power operated doors*

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

8.7.2.1.1.2 The kinetic energy of the car door and of the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed, as in **7.5.2.1.1.2**, shall not exceed 10 J.

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

a) The effect of the device may be neutralized during the last 50 mm of travel of each door panel.

b) In the case of a system which makes the sensitive protection device inoperative after a fixed period of time, to counteract persistent obstructions when closing the door, the kinetic energy defined above shall not exceed 4 J during movement of the door with the protective device inoperative.

8.7.2.1.2 *Doors where the closing is carried out under the continuous control of the users (e.g. by constant pressure on a button).* When the kinetic energy calculated or measured as indicated in **7.5.2.1.1.2** exceeds 10 J, the average closing speed of the fastest panels shall be limited to 0.3 m/s.

8.7.2.2 *Vertically sliding doors*. Power closing of this type of door is permitted if all the following conditions are fulfilled simultaneously:

a) the lift is a goods passenger lift;

b) the closing is carried out under the permanent control of the users;

c) the average closing speed of the panels is limited to 0.3 m/s.

8.8 Requirements for entrances of lift cars without doors. When a car entrance has no door, in order to minimize the risks of pinching or crushing between the car sill and the wall of the well, a photoelectric or similar device shall be used.

8.9 Electrical device for proving the car doors closed

8.9.1 It shall not be possible in normal operation to start the lift nor keep it in motion if a car door (or one panel of a multi-panel door) is open. Preliminary operations preparing for the movement of the car may take place

However, movement of the lift with car door open is permitted under the conditions laid down in **7.7.2.2**.

8.9.2 Each car door shall be provided with an electrical device for proving the closed position in conformity with **14.1.2** so that the conditions imposed by **8.9.1** are satisfied.

8.10 Case of horizontally or vertically sliding doors comprising several mechanically interlinked panels

8.10.1 If a horizontally or vertically sliding door comprises several directly mechanically linked panels, it is permitted:

a) to place the device (**8.9**) on a single panel (the rapid panel in the case of telescopic doors);

b) to place the device (**8.9**) on the door driving element if the mechanical connection between this element and the panels is direct;

c) in order to ensure locking, in the case and conditions laid down in **5.4.3.2.2**, to lock only one panel, provided that this single locking prevents the opening of the other panels (by hooking the panels in the closed position in the case of telescopic doors).

8.10.2 If the panels are indirectly mechanically linked (e.g. by rope, belt or chain) such means of linkage shall be designed to resist any normally anticipated forces, be constructed with special care and examined periodically.

It is permitted to place the device (**8.9**) on a single panel, provided that,

a) this is not the driven panel, and

b) the driven panel is mechanically linked directly to it.

8.11 Opening the car door

8.11.1 In order to permit passengers to leave the lift car, if the lift stops for any reason close to a landing, it shall be possible with the car stopped and the supply to the door operator (if any) disconnected:

a) to open or partly open the car door by hand from the landing;

b) to open or partly open the car door together with the landing door linked to it if they are coupled, by hand from within the car.

8.11.2 The opening of the car door provided for in **8.11.1** shall be able to be carried out at least in the unlocking zone.

The force necessary to open it shall not exceed 300 N.

In the case of lifts covered by **5.4.3.2.2** the opening of the car door from inside the car shall be possible only when the car is in the unlocking zone.

8.11.3 The opening of the car door with the lift in motion, the rated speed of which exceeds 1 m/s, shall require a force greater than 50 N.

This requirement is not obligatory in the unlocking zone.

8.12 Trap doors and emergency doors

8.12.1 Assistance to passengers in the car shall always come from outside, being provided in particular by the emergency operation mentioned in **12.5**.

8.12.2 If there is an emergency trap door in the car roof to permit the rescue and evacuation of passengers, it shall measure at least 0.35 m × 0.50 m.

8.12.3 An emergency trap door is obligatory to permit the rescue and evacuation of passengers in the case of lifts where one or two car entrances do not have a door.

8.12.4 Emergency doors may be used in the case of adjacent cars, provided, however, that the horizontal distance between cars does not exceed 0.75 m (see especially **5.2.2.1.2**).

If emergency doors exist, they shall measure at least 1.8 m high and 0.35 m wide.

8.12.5 If emergency trap doors or doors are installed, they shall conform to **8.3.2** and **8.3.3**, also to the following:

8.12.5.1 Emergency trap doors and doors shall be provided with a means for manual locking.

8.12.5.1.1 Emergency trap doors shall be opened from outside the car without a key and from inside the car with a key suited to the triangle defined in Appendix B.

Emergency trap doors shall not open towards the inside of the car.

Emergency trap doors in the open position shall not project beyond the edge of the lift car.

8.12.5.1.2 Emergency doors shall be opened from outside the car without a key and from inside the car using a key suited to the triangle defined in Appendix B.

Emergency doors shall not open towards the outside of the car.

Emergency doors shall not be located in the path of a counterweight or in front of a fixed obstacle (except for beams separating the cars) preventing passage from one car to another.

8.12.5.2 The locking called for in **8.12.5.1** shall be proved by means of an electric safety device in conformity with **14.1.2**.

This device shall cause the lift to stop if the locking ceases to be effective.

Restoring the lift to service shall only be possible after deliberate relocking.

8.13 Car roof

8.13.1 Further to the requirements of **8.3**:

a) the car roof shall be able to support two persons, i.e. able to resist a vertical force of 2 000 N at any position without permanent deformation;

b) the roof of the car shall provide at one point a clear area for standing of at least 0.12 m^2, in which the lesser dimension is at least 0.25 m.

c) the car roof shall be so designed as to permit the installation of a balustrade. According to local regulations, the installation of balustrades may be required.

8.13.2 If there are pulleys fixed to the car sling, they shall be provided with effective devices to avoid:

a) bodily injury;

b) the suspension ropes, if slack, leaving their grooves;

c) the introduction of objects between ropes and grooves.

These devices shall be so constructed as not to hinder inspection or maintenance of the pulleys.

In the case of chains, similar arrangements shall be made.

8.14 Car header. If an empty space can exist between the car roof and the header of a landing door when this door is opened, the upper part of the car entrance shall be extended upwards, over the whole width of the landing door, by a rigid vertical panel to fill the empty gap considered. This possibility is to be envisaged in particular in the case of a lift with a docking operation (**14.2.1.5**).

8.15 Equipment on top of the car. The following shall be installed on top of the car:

a) control device in conformity with **14.2.1.3** (inspection operation);

b) stopping device in conformity with **14.2.2.3** and **15.3**;

c) socket outlet in conformity with **13.6.2**.

8.16 Ventilation

8.16.1 Cars with imperforate doors shall be provided with ventilation apertures in the upper and lower parts of the car.

8.16.2 The effective area of ventilation apertures situated in the upper part of the car shall be at least 1 % of the available car area, and the same also applies for the apertures in the lower part of the car.

The gaps round the car doors may be taken into account in the calculation of the area of ventilation holes, up to 50 % of the required effective area.

8.16.3 Ventilation apertures shall be built or arranged in such a way that it is not possible to pass a straight rigid rod 10 mm in diameter through the car walls from the inside.

8.17 Lighting

8.17.1 The car shall be provided with electrical lighting that is permanently illuminated ensuring a light intensity of at least 50 lux at floor level and on the control devices.

8.17.2 If lighting is of the incandescent type, there shall be at least two lamps connected in parallel.

8.17.3 There shall be an automatically rechargeable emergency supply which is capable of feeding at least a 1 W lamp for 1 h in case of an interruption of the normal lighting supply. This lighting shall come on automatically upon failure of the normal lighting supply.

8.17.4 If the supply referred to above is also used to feed the emergency alarm signal called for in **14.2.3**, its capacity shall be rated accordingly.

8.18 Counterweight

8.18.1 If the counterweight incorporates filler weights, necessary measures shall be taken to prevent their displacement. To this effect the following shall be used:

a) either a frame in which the fillers are secured, or

b) if the fillers are made of metal, and if the rated speed of the lifts does not exceed 1 m/s, a minimum of two tie-rods on which the fillers are secured.

8.18.2 If pulleys are fixed to the counterweight they shall be provided with devices to avoid:

a) the suspension ropes, if slack, leaving the grooves;

b) the introduction of objects between ropes and grooves.

The devices shall be so constructed as not to hinder inspection or maintenance of the pulleys.

In the case of chains, similar arrangements shall be made.

8.18.3 In the case of a drum drive, there shall be no counterweight.

9 Suspension, compensation, safety gear and overspeed governor

9.1 Types of suspension, number of ropes or chains

9.1.1 Cars and counterweights shall be suspended from steel wire ropes, or steel chains with parallel links (Galle type) or roller chains.

9.1.2 The ropes shall correspond to the following conditions:

a) the nominal diameter of the ropes shall be at least 8 mm;

b) the tensile strength of the wires shall be:

1) 1 570 N/mm^2 or 1 770 N/mm^2 for ropes of single tensile;

2) 1 370 N/mm^2 for the outer wires and 1 770 N/mm^2 for the inner wires of ropes of dual tensile;

c) the other characteristics (construction, extension, ovality, flexibility, tests . . . .) shall at least correspond to those specified in the relevant International Standards.

9.1.3 The minimum number of ropes (or chains) shall be two.

Ropes (or chains) shall be independent.

9.1.4 Where reeving is used the number to take into account is that of the ropes or chains and not the falls.

9.2 Ratio between diameter of sheaves or pulleys (or drums) and diameter of ropes, safety factor of ropes and chains

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

9.2.2 The safety factor of the suspension ropes shall be at least:

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

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

c) 12 in the case of drum drive.

The safety factor is the ratio between the minimum breaking load (N) of one rope (or one chain) and the maximum force (N) in this rope (or in this chain), when the car is stationary at the lowest level, with its rated load. For the calculation of this maximum force the following shall be taken into consideration: the number of ropes (or chains), the reeving factor (in case of reeving), the rated load, the mass of the car, the mass of the rope (or chain) and the mass of the portion of the travelling cables and any compensation devices suspended from the car.

9.2.3 The junction between the rope and the rope terminations, according to **9.2.3.1**, shall be able to resist at least 80 % of the minimum breaking load of the rope.

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

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

9.2.4 The safety factor of the suspension chains shall be at least 10.

The safety factor is defined in a manner analogous to that indicated in **9.2.2** for ropes.

9.2.5 The ends of each chain shall be fixed to the car, counterweight or suspension points by suitable terminations. The junction between the chain and the chain termination shall be able to resist at least 80 % of the minimum breaking load of the chain.

9.3 Rope traction for traction drive lift. Specific pressure

9.3.1 Rope traction shall be such that the following two conditions are fulfilled:

a) it shall not be possible to raise the car when the counterweight is resting on the buffers, and the lift machine is rotated in the “up” direction;

b) the formula in note 1 at the end of clause **9** shall be satisfied.

9.3.2 The specific pressure of the suspension ropes in the traction sheave grooves shall conform to the requirements of note 2 at the end of clause **9**.

9.4 Winding up of ropes for drum drive lifts

9.4.1 The drum which can be used in the conditions laid down in **12.2.1** b) shall be helically grooved and the grooves shall be suited to the ropes used.

9.4.2 When the car rests on its fully compressed buffers, one and a half turns of rope shall remain in the grooves of the drum.

9.4.3 There shall only be one layer of rope wound on the drum.

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

9.5 Distribution of load between the ropes or the chains

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

9.5.1.1 For chains engaging with sprockets, the ends fixed to the car as well as the ends fixed to the counterweight shall be provided with such equalization devices.

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

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

9.5.3 In the case of two rope or two chain suspension of the car an electric safety device in conformity with **14.1.2** shall cause the lift to stop in case of abnormal relative extension of one rope or chain.

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

9.6 Compensating ropes

9.6.1 Compensating ropes with tensioning pulleys shall be used if the rated speed of the lift exceeds 2.5 m/s, and the following conditions shall apply:

a) the tension shall be provided by gravity;

b) the tension shall be checked by an electric safety device in conformity with **14.1.2**;

c) the ratio between the pitch diameter of the pulleys and the nominal diameter of the compensating ropes shall be at least 30.

9.6.2 When the rated speed exceeds 3.5 m/s there shall be, in addition to **9.6.1**, an anti-rebound device.

The operation of the anti-rebound device shall initiate the stopping of the lift machine by means of an electric safety device in conformity with **14.1.2**.

9.7 Protection of sprockets and pulleys used for diversion, reeving and compensation.

Devices shall be provided to avoid:

a) bodily injury;

b) the ropes leaving their grooves, or the chains leaving their sprockets, if slack;

c) the introduction of objects between ropes (or chains) and grooves (or sprockets).

The devices used shall be so constructed that they do not hinder inspection or maintenance of the pulleys or sprockets.

9.8 Safety gear

9.8.1 *General provisions*

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

9.8.1.2 In the case envisaged in **5.5.2** b), the counterweight shall also be equipped with safety gear, operating only on a downward moving counterweight, capable of stopping it, at the tripping speed of the overspeed governor (or if the suspension devices break in the specific case of **9.8.3.1**), by gripping the guides, and of holding the counterweight there.

9.8.2 *Conditions of use for different types of safety gear*

9.8.2.1 Car safety gear shall be of the progressive type if the rated speed of the lift exceeds 1 m/s. It can be:

a) of the instantaneous type with buffered effect if the rated speed does not exceed 1 m/s;

b) of the instantaneous type if the rated speed does not exceed 0.63 m/s.

9.8.2.2 If the car carries several safety gears they shall all be of the progressive type.

9.8.2.3 The safety gear of the counterweight shall be of the progressive type if the rated speed exceeds 1 m/s, otherwise the safety gear may be of the instantaneous type.

9.8.3 *Methods of control*

9.8.3.1 The safety gear of the car and counterweight shall each be tripped by its own overspeed governor.

Specific case. The safety gear of counterweights may be tripped by the failure of the suspension gear or by a safety rope if the rated speed does not exceed 1 m/s.

9.8.3.2 The tripping of safety gears by devices which operate electrically, hydraulically or pneumatically is forbidden.

9.8.4 *Retardation.* For progressive safety gear the average retardation in the case of free fall with rated load in the car shall lie between 0.2 g_n and 1.0 g_n.

9.8.5 *Release*

9.8.5.1 The release of the safety gear on the car (or the counterweight) shall only be possible by raising the car (or the counterweight).

9.8.5.2 After its release, the safety gear shall be in a condition to operate normally.

9.8.5.3 After the release of the safety gear it shall require the intervention of a competent person to return the lift to service.

9.8.6 ***Constructional conditions***

9.8.6.1 It is forbidden to use the jaws or safety blocks as guide shoes.

9.8.6.2 For safety gear of the instantaneous type with buffered effect, the design of the buffering systems shall be of the energy accumulation type with buffered return movement or the energy dissipation type, satisfying the requirements of **10.4.2** or **10.4.3**.

9.8.6.3 The safety gear operating devices shall preferably be located at the lower part of the car.

9.8.6.4 It shall be possible to seal adjustable components.

9.8.7 *Inclination of the car floor in the case of safety gear operation.* When the safety gear operates, the load (if any) being uniformly distributed, the floor of the car shall not incline more than 5 % from its normal position.

9.8.8 *Electrical checking*. When the car safety gear is engaged, a device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation. This device shall be an electric safety device in conformity with **14.1.2**.

9.9 Overspeed governor

9.9.1 Tripping of the overspeed governor for the car safety gear shall occur at a speed at least equal to 115 % of the rated speed and less than:

a) 0.8 m/s for instantaneous safety gears except for the captive roller type;

b) 1 m/s for safety gears of the captive roller type;

c) 1.5 m/s for instantaneous safety gears with buffered effect and for progressive safety gear used for rated speeds not exceeding 1.0 m/s.

d) $1.25v + \frac{0.25}{v}$ for progressive safety gear for rated speeds exceeding 1.0 m/s.

9.9.2 ***Choice of tripping speeds***

9.9.2.1 For lifts where the rated speed exceeds 1 m/s, it is recommended to choose a tripping speed as close as possible to the upper limit indicated in **9.9.1**.

9.9.2.2 For lifts with very heavy rated loads and low rated speeds, the overspeed governor shall be specially designed for this purpose.

It is recommended to choose a tripping speed as close as possible to the lower limit indicated in **9.9.1**.

9.9.3 The tripping speed of an overspeed governor for a counterweight safety gear shall be higher than that for the car safety gear, not, however, exceeding it by more than 10 %.

9.9.4 The tensile force in the overspeed governor rope produced by the governor, when tripped, shall be at least the greater of the following two values:

a) either 300 N, or

b) twice that necessary to engage the safety gear.

9.9.5 The direction of rotation, corresponding to the operation of the safety gear, shall be marked on the overspeed governor.

9.9.6 ***Overspeed governor ropes***

9.9.6.1 The overspeed governor shall be driven by a very flexible wire rope.

9.9.6.2 The breaking load of the rope shall be related by a safety factor of at least 8 to the tensile force produced in the rope of the overspeed governor when tripped.

9.9.6.3 The nominal rope diameter shall be at least 6 mm.

9.9.6.4 The ratio between the pitch diameter of the overspeed governor pulley and the nominal rope diameter shall be at least 30.

9.9.6.5 The rope shall be tensioned by a tensioning pulley. This pulley (or its tensioning weight) shall be guided.

9.9.6.6 During the engagement of the safety gear, the governor rope and its attachments shall remain intact, even in the case of a braking distance greater than normal.

9.9.6.7 The rope shall be easily detachable from the safety gear.

9.9.7 *Response time.* The response time of the overspeed governor before tripping shall be sufficiently short not to permit a dangerous speed to be reached before the moment of safety gear operation.

9.9.8 *Accessibility*. The overspeed governor shall be completely accessible in all circumstances.

If located in the well it shall be accessible from outside the well.

9.9.9 *Possibility of tripping the overspeed governor.* During checks or tests it shall be possible to operate the safety gear at a lower speed than that indicated in **9.9.1** by tripping the overspeed governor in some way.

9.9.10 The means of adjusting the overspeed governor shall be sealed after setting the tripping speed.

9.9.11 ***Electrical checking***

9.9.11.1 The overspeed governor or another device shall, by means of an electric safety device in conformity with **14.1.2**, initiate the stopping of the lift machine before the car speed, either up or down, reaches the tripping speed of the governor.

However, for rated speeds not exceeding 1 m/s, this device:

a) may operate at latest at the moment when the tripping speed of the governor is reached if the car speed is linked to the frequency of the mains up to the moment of the application of the brake;

b) shall operate at the latest when the car speed reaches 115 % of the rated speed if the lift operates on variable voltage or continuous speed regulation.

9.9.11.2 If after release of the safety gear the overspeed governor does not automatically reset itself, an electric safety device (**14.1.2**) shall prevent the starting of the lift while the overspeed governor is in the tripped condition. This device may, however, be made inoperative in the case provided for in **14.2.1.4.3**.

Return to service shall be by a competent person.

9.9.11.3 The breakage or slackening of the governor rope shall cause the motor to stop by means of an electric safety device (**14.1.2**).

Clause 9. Notes

NOTE 1 *Traction.* The following formula shall be satisfied:

$$\frac{T_1}{T_2} \times C_1 \times C_2 \leq e^{fa}$$

where

T_1/T_2 = ratio between the greater and the smaller static force in the portions of rope situated on either side of the traction sheave in the following cases:

car stationary at the lowest landing with a load equivalent to 125 % of the rated load;

car stationary at the highest landing level, unloaded.

C_1 = coefficient taking account of acceleration, deceleration and specific conditions of the installation.

$$C_1 = \frac{g_n + a}{g_n - a}$$

g_n = standard acceleration of free fall (m/s^2);

a = braking deceleration of the car (m/s^2).

The following minimum values of C_1 may be permitted:

1.10 for rated speeds $0 < v \leqslant 0.63$ m/s;

1.15 for rated speeds $0.63 \text{ m/s} < v \leqslant 1.00$ m/s;

1.20 for rated speeds $1.00 \text{ m/s} < v \leqslant 1.60$ m/s;

1.25 for rated speeds $1.60 \text{ m/s} < v \leqslant 2.50$ m/s.

For rated speeds exceeding 2.50 m/s, C_1 shall be calculated for each specific case but shall not be less than 1.25.

C_2 = coefficient taking account of the variation in profile of the groove due to wear;

$C_2 = 1$ for semicircular or undercut grooves;

$C_2 = 1.2$ for vee grooves;

e = base of natural logarithms;

f = friction factor of the ropes in the grooves;

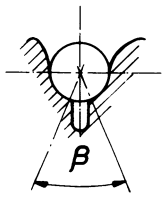
$$f = \frac{\mu}{\sin \gamma/2} \text{ for vee grooves;}$$

$$f = \frac{4\mu(1 - \sin \beta/2)}{\pi - \beta - \sin \beta} \text{ for semicircular}$$

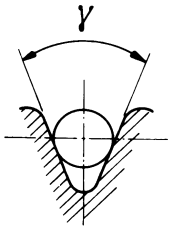
grooves or undercut grooves;

a = angle of wrap of the ropes on the traction sheave (rad);

β = angle of the undercut grooves or semicircular grooves in the traction sheave (rad) ($\beta = 0$ for semicircular grooves);



γ = angle of the vee grooves in the traction sheave (rad);



μ = coefficient of friction between steel ropes and cast iron pulleys = 0.09.

NOTE 2 *Specific pressure of the ropes in the grooves.* The specific pressure is calculated according to the following formulae:

$$p = \frac{T}{ndD} \times \frac{8\cos \beta/2}{\pi - \beta - \sin \beta}$$

for undercut or semicircular grooves

$$p = \frac{T}{ndD} \times \frac{4.5}{\sin \gamma/2} \quad \text{for vee grooves}$$

In no case shall the specific pressure of the ropes exceed the following value, with the car loaded with its rated load:

$$p \leqslant \frac{12.5 + 4v_c}{1 + v_c}$$

It is the responsibility of the manufacturer to take account of the individual characteristics and the conditions of use in the choice of pressure.

The following symbols apply:

d = diameter of the ropes (mm);

D = diameter of the traction sheave (mm);

n = number of ropes;

p = specific pressure (N/mm^2);

T = static force in the ropes to the car at the level of the traction sheave, when the car is stationary at the lowest landing level with its rated load (N);

v_c = speed of the ropes corresponding to the rated speed of the car (m/s).

10 Guides, buffers and final limit switches

10.1 General provisions concerning guides

10.1.1 The strength of the guides (see the notes at the end of the clause), their attachments and joints shall be sufficient to withstand the forces imposed due to the operation of the safety gear and deflections due to uneven loading of the car. These deflections shall be limited to values that will not affect the normal operation of the lift.

10.1.2 The fixing of the guides to their brackets and to the building shall permit compensation, either automatically or by simple adjustment, of effects due to normal settling of the building or shrinkage of concrete.

A rotation of the attachments by which the guide could be released shall be prevented.

10.2 Guiding of the car and counterweight

10.2.1 The car and counterweight shall each be guided by at least two rigid steel guides.

10.2.2 For rated speeds exceeding 0.4 m/s, the guides shall be made from drawn steel, or the rubbing surfaces shall be machined.

10.2.3 The requirements of **10.2.2** shall apply whatever the speed, when progressive safety gear is used.

10.3 Car and counterweight buffers

10.3.1 Buffers shall be placed at the bottom limit of travel for cars and counterweights.

If the buffers travel with the car or counterweight they shall strike against a pedestal at least 0.5 m high at the end of the travel.

Specific case. This pedestal is not required for the counterweight buffers if, in the pit, it is impossible to gain involuntary access under the counterweight [for example: by providing screens whose mesh conforms to **5.2.1** specific case b)].

10.3.2 In addition to the requirements of **10.3.1** positive drive lifts shall be provided with buffers on the car top to function at the upper limit of travel.

If the lifts are provided with counterweights, these upper buffers shall not function until the counterweight buffers are fully compressed.

10.3.3 Energy accumulation type buffers may only be used if the rated speed of the lift does not exceed 1 m/s.

10.3.4 Energy accumulation type buffers with buffered return movement may only be used if the rated speed of the lift does not exceed 1.6 m/s.

10.3.5 Energy dissipation type buffers may be used whatever the rated speed of the lift.

10.4 Stroke of car and counterweight buffers

10.4.1 *Energy accumulation type buffers*

10.4.1.1 The total possible stroke of the buffers shall be at least equal to twice the gravity stopping distance corresponding to 115 % of the rated speed ($0.0674\ v^2 \times 2 \approx 0.135\ v^2$), the stroke being expressed in metres and v (rated speed) in metres per second.

However, the stroke shall not be less than 65 mm.

10.4.1.2 Buffers shall be designed to cover the stroke defined above under a static load of between 2.5 and 4 times the sum of the mass of the car and its rated load (or the mass of the counterweight).

10.4.2 *Energy accumulation type buffers with buffered return movement*

The requirements of **10.4.1** apply to this type of buffer.

10.4.3 *Energy dissipation type buffers*

10.4.3.1 The total possible stroke of the buffers shall be at least equal to the gravity stopping distance corresponding to 115 % of the rated speed ($0.067\ v^2$), the stroke being expressed in metres and v (rated speed) in metres per second.

10.4.3.2 When the retardation of the lift at the ends of its travel is monitored according to the requirements of **12.8**, the speed at which the car (or counterweight) comes into contact with the buffers may be used instead of the rated speed, when calculating the buffer travel according to **10.4.3.1**. However, the stroke shall not be less than:

a) 50 % of the stroke calculated according to **10.4.3.1** if the rated speed does not exceed 4.00 m/s;

b) 33⅓ % of the stroke calculated according to **10.4.3.1** if the rated speed exceeds 4.00 m/s.

In any event, the stroke shall not be less than 0.42 m.

10.4.3.3 With the rated load in the car, in the case of free fall, the average retardation during action of the buffers shall not exceed g_n. Retardation of more than 2.5 g_n shall not be longer than 0.04 s. The speed of impact on the buffers to be considered is equal to that for which the stroke of the buffer is calculated (see **10.4.3.1** and **10.4.3.2**).

10.4.3.4 The operation of the lift shall depend on the return of the buffers to their normal extended position after operation. The device for checking this shall be an electric safety device in conformity with **14.1.2**.

10.4.3.5 Buffers, if hydraulic, shall be so constructed that the fluid level may easily be checked.

10.5 Final limit switches

10.5.1 Final limit switches shall be provided.

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

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

10.5.2 *Control of the final limit switches*

10.5.2.1 Separate control devices must be used for normal terminal stopping and final limit switches.

10.5.2.2 In the case of positive drive lifts, control of the final limit switches shall be effected:

a) either by a device linked to the movement of the machine, or

b) by the car and by the counterweight, if there is one, at the top of the well, or

c) if there is no counterweight, by the car at the top and the bottom of the well.

10.5.2.3 In the case of traction drive lifts, control of the final limit switches shall be effected:

a) either directly by the car at the top and bottom of the well, or

b) by a device which is indirectly linked to the car, e.g. by a rope, belt or chain. In this case, breakage of or slack in this linkage shall cause the machine to stop by means of an electric safety device in conformity with **14.1.2**.

10.5.3 *Method of operation of final limit switches*

10.5.3.1 The final limit switches shall:

a) for drum drive lifts, open directly when required by mechanical separation of the circuits feeding the motor and brake.

Provisions shall be made so that the motor cannot feed the brake solenoid.

b) for traction drive lifts, single or two speed, either

1) break circuits according to a) above, or

2) open by an electric safety device (**14.1.2**) the circuit directly supplying the coils of the two contactors the contacts of which are in series in the circuits supplying the motor and brake. Each of these contactors shall be capable of breaking the circuit under load.

c) in the case of variable voltage or continuously variable speed lifts, cause the rapid stopping of the machine.

10.5.3.2 After the operation of the final limit switches, the return to service of the lift shall only be effected by the intervention of a competent person.

If there are several limit switches at each end, one of them at least shall prevent movement in both directions, and this one at least shall require the intervention of a competent person.

10.6 Safety device in case the car or counterweight meets an obstruction when moving downwards

10.6.1 *Drum drive lifts.* Drum drive lifts shall have a slack rope or slack chain device to open the control circuit and cause the lift to stop if the car (or counterweight) meets an obstacle when moving downwards.

The device used shall be in conformity with **14.1.2**.

10.6.2 *Traction drive lifts*

10.6.2.1 Traction drive lifts shall incorporate a device to cause the lift to stop, and keep it stopped, if:

a) when a start is initiated, the lift machine does not rotate;

b) the car (or counterweight) is stopped in downward movement by an obstacle which causes the ropes to slip on the traction sheave.

10.6.2.2 This device shall function in a time which does not exceed the smaller of the following two values:

a) 45 seconds;

b) time for travelling the full travel, plus 10 seconds, with a minimum of 20 seconds if the full travel time is less than 10 seconds.

10.6.2.3 This device shall not affect the movement of the car under either the inspection operation or the emergency electrical operation, if any.

Clause 10. Notes

NOTE 1 *Buckling stresses in the guides*

The buckling stress σ_k in the guides during safety gear operation may be evaluated approximately by means of the following formulae:

instantaneous safety gear: (except captive roller type) $\sigma_k = \frac{25(P+Q)\omega}{A} (\mathrm{N/mm^2})$

captive roller type safety gear: $\sigma_k = \frac{15(P+Q)\omega}{A} (\mathrm{N/mm^2})$

progressive safety gear: $\sigma_k = \frac{10(P+Q)\omega}{A} (\mathrm{N/mm^2})$

σ_k shall not exceed:

140 N/mm^2 for steel of 370 N/mm^2 grade;

210 N/mm^2 for steel of 520 N/mm^2 grade;

(interpolate for intermediary values).

P = sum of the mass of the empty car and the masses of the portion of the travelling cables and any compensation devices, suspended from the car (kg);

Q = rated load (kg);

A = cross-sectional area of the guide (mm^2);

σ_k = buckling stress in the guides (N/mm^2);

ω = buckling factor read in the tables as a function of λ (see Table 2 and Table 3);

$\lambda = \frac{l_k}{i}$ = coefficient of slenderness;

l_k = maximum distance between guide brackets (mm);

i = radius of gyration (mm).

NOTE 2 *Strokes required for the buffers*

Figure 3 is a graph illustrating these strokes.

Table 2 — Buckling factor ω as a function of λ for steel of 370 N/mm^2 grade

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.04	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	20
30	1.08	1.09	1.09	1.10	1.10	1.11	1.11	1.12	1.13	1.13	30
40	1.14	1.14	1.15	1.16	1.16	1.17	1.18	1.19	1.19	1.20	40
50	1.21	1.22	1.23	1.23	1.24	1.25	1.26	1.27	1.28	1.29	50
60	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.39	1.40	60
70	1.41	1.42	1.44	1.45	1.46	1.48	1.49	1.50	1.52	1.53	70
80	1.55	1.56	1.58	1.59	1.61	1.62	1.64	1.66	1.68	1.69	80
90	1.71	1.73	1.74	1.76	1.78	1.80	1.82	1.84	1.86	1.88	90
100	1.90	1.92	1.94	1.96	1.98	2.00	2.02	2.05	2.07	2.09	100
110	2.11	2.14	2.16	2.18	2.21	2.23	2.27	2.31	2.35	2.39	110
120	2.43	2.47	2.51	2.55	2.60	2.64	2.68	2.72	2.77	2.81	120
130	2.85	2.90	2.94	2.99	3.03	3.08	3.12	3.17	3.22	3.26	130
140	3.31	3.36	3.41	3.45	3.50	3.55	3.60	3.65	3.70	3.75	140
150	3.80	3.85	3.90	3.95	4.00	4.06	4.11	4.16	4.22	4.27	150
160	4.32	4.38	4.43	4.49	4.54	4.60	4.65	4.71	4.77	4.82	160
170	4.88	4.94	5.00	5.05	5.11	5.17	5.23	5.29	5.35	5.41	170
180	5.47	5.53	5.59	5.66	5.72	5.78	5.84	5.91	5.97	6.03	180
190	6.10	6.16	6.23	6.29	6.36	6.42	6.49	6.55	6.62	6.69	190
200	6.75	6.82	6.89	6.96	7.03	7.10	7.17	7.24	7.31	7.38	200
210	7.45	7.52	7.59	7.66	7.73	7.81	7.88	7.95	8.03	8.10	210
220	8.17	8.25	8.32	8.40	8.47	8.55	8.63	8.70	8.78	8.86	220
230	8.93	9.01	9.09	9.17	9.25	9.33	9.41	9.49	9.57	9.65	230
240	9.73	9.81	9.89	9.97	10.05	10.14	10.22	10.30	10.39	10.47	240
250	10.55										
For steel qualities with intermediary strengths, determine the value of ω by linear interpolation.											

Table 3 — Buckling factor ω as a function of λ for steel of 520 N/mm^2 grade

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.11	20
30	1.11	1.12	1.12	1.13	1.14	1.15	1.15	1.16	1.17	1.18	30
40	1.19	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	40
50	1.28	1.30	1.31	1.32	1.33	1.35	1.36	1.37	1.39	1.40	50
60	1.41	1.43	1.44	1.46	1.48	1.49	1.51	1.53	1.54	1.56	60
70	1.58	1.60	1.62	1.64	1.66	1.68	1.70	1.72	1.74	1.77	70
80	1.79	1.81	1.83	1.86	1.88	1.91	1.93	1.95	1.98	2.01	80
90	2.05	2.10	2.14	2.19	2.24	2.29	2.33	2.38	2.43	2.48	90
100	2.53	2.58	2.64	2.69	2.74	2.79	2.85	2.90	2.95	3.01	100
110	3.06	3.12	3.18	3.23	3.29	3.35	3.41	3.47	3.53	3.59	110
120	3.65	3.71	3.77	3.83	3.89	3.96	4.02	4.09	4.15	4.22	120
130	4.28	4.35	4.41	4.48	4.55	4.62	4.69	4.75	4.82	4.89	130
140	4.96	5.04	5.11	5.18	5.25	5.33	5.40	5.47	5.55	5.62	140
150	5.70	5.78	5.85	5.93	6.01	6.09	6.16	6.24	6.32	6.40	150
160	6.48	6.57	6.65	6.73	6.81	6.90	6.98	7.06	7.15	7.23	160
170	7.32	7.41	7.49	7.58	7.67	7.76	7.85	7.94	8.03	8.12	170
180	8.21	8.30	8.39	8.48	8.58	8.67	8.76	8.86	8.95	9.05	180
190	9.14	9.24	9.34	9.44	9.53	9.63	9.73	9.83	9.93	10.03	190
200	10.13	10.23	10.34	10.44	10.54	10.65	10.75	10.85	10.96	11.06	200
210	11.17	11.28	11.38	11.49	11.60	11.71	11.82	11.93	12.04	12.15	210
220	12.26	12.37	12.48	12.60	12.71	12.82	12.94	13.05	13.17	13.28	220
230	13.40	13.52	13.63	13.75	13.87	13.99	14.11	14.23	14.35	14.47	230
240	14.59	14.71	14.83	14.96	15.08	15.20	15.33	15.45	15.58	15.71	240
250	15.83										
For steel qualities with intermediary strengths, determine the value of ω by linear interpolation.											

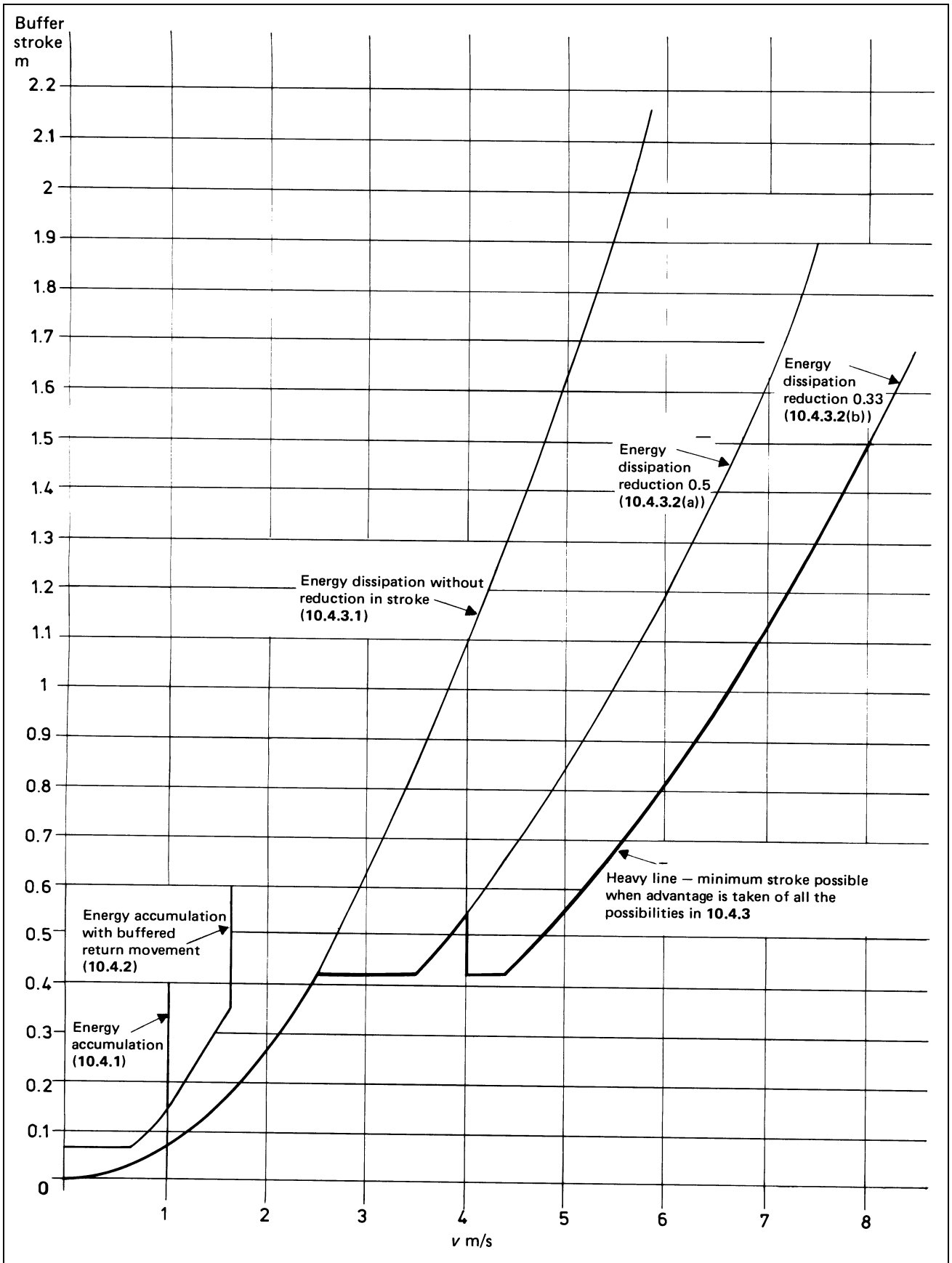


Figure 3 — Graph illustrating the strokes required for buffers (10.4)

11 Clearances between the car and the lift well wall, and between car and counterweight

11.1 General provision. The clearances specified in the standard shall be maintained not only during the examination and tests before the lift is put into service, but also throughout the life of the lift.

11.2 Clearances between car and wall facing the car entrance, for lifts with car doors

11.2.1 The horizontal distance between the inner surface of the lift well and the sill or framework of the car entrance or door (or entrance edge of doors in the case of sliding doors) shall not exceed 0.15 m.

Specific cases. The distance given above:

a) may be extended to 0.2 m over a height not exceeding 0.5 m;

b) may be extended to 0.2 m throughout the travel on goods passenger lifts and non-commercial vehicle lifts in which the doors are vertically sliding;

c) is not limited in the cases covered by **5.4.3.2.2**.

11.2.2 The horizontal distance between the sill of the car and sill of the landing doors shall not exceed 35 mm.

11.2.3 The horizontal distance between the car door and the closed landing doors or the access distance between the doors during the whole of their normal operation shall not exceed 0.12 m.

11.3 Clearances between car and wall facing the car entrance, for lifts without car doors

11.3.1 The horizontal distance between the inner surface of the lift well and the sill or uprights of the car entrance frame shall not exceed 20 mm.

11.3.2 If the free height of the car entrance is less than 2.5 m, the horizontal distance between the car entrance header and the well shall be between 0.07 m and 0.12 m.

The use of a moving device to close this gap is not permitted.

11.4 Clearances between car and counterweight. The car and its associated components shall be at a distance of at least 0.05 m from the counterweight (if there is one) and its associated components.

12 Lift machine

12.1 General provision. Each lift shall have at least one machine of its own.

12.2 Drive of the car and the counterweight

12.2.1 Two methods of drive are permissible:

a) by traction (use of sheaves and ropes);

b) by positive drive if the rated speed does not exceed 0.63 m/s, i.e.:

1) either use of a drum and ropes without counterweights, or

2) use of sprockets and chains. The calculations of the driving elements shall take into account the possibility of the counterweight, if there is one, (or the car) resting on its buffers.

12.2.2 Use may be made of belts for coupling the motor or motors to the component on which the electro-mechanical brake (**12.4.1.2**) operates. A minimum of two belts shall be used.

12.3 Use of overhung pulleys or sprockets. In the case of the use of overhung traction sheaves or sprockets, effective precautions shall be taken to avoid the following:

a) the ropes leaving their grooves, or chains leaving their sprockets;

b) objects lodging between the grooves and the ropes (or between sprockets and chains) in the case where the machine is not above the well.

These precautions shall not prevent examination and servicing of traction sheaves and sprockets.

12.4 Braking system

12.4.1 ***General provisions***

12.4.1.1 The lift shall be provided with a braking system which operates automatically:

a) in the event of loss of the mains power supply;

b) in the event of the loss of the supply to control circuits.

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

12.4.2 ***Electro-mechanical brake***

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

All the mechanical components of the brake which take part in the application of the braking action on the drum or disc shall be installed in two sets and be of dimensions such that if one of the components were not working on the brake drum or disc a sufficient braking effort to slow down the car when containing the rated load would continue to be exercised.

However, national regulations may postpone the enforcement of the requirements of the previous sentence.

12.4.2.2 The component on which the brake operates shall be coupled to the traction sheave (or drum or sprocket).

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

12.4.2.3.1 The interruption of this current shall be effected by at least two independent electrical devices, whether or not integral with those which cause interruption of the current feeding the lift machine.

If, when the lift is stationary, one of the contactors has not opened the main contacts, further movement shall be prevented, at the latest at the next change in the direction of motion.

12.4.2.3.2 When the motor of the lift is likely to function as a generator, it shall not be possible for the electric device operating the brake to be fed by the driving motor.

12.4.2.3.3 Braking shall become effective without supplementary delay after opening of the brake release circuit. (The use of a diode or capacitor connected directly to the terminals of the brake coil is not considered as a means of delay.)

12.4.2.4 Any machine fitted with a manual emergency operating device (**12.5.1**) shall be capable of having the brake released by hand and require a constant effort to keep the brake open.

12.4.2.5 The brake shoe pressure shall be exerted by guided compression springs or weights.

12.4.2.6 Braking shall be effected by application on the brake drum or disc by at least two shoes, pads or calipers.

12.4.2.7 Band brakes are forbidden.

12.4.2.8 Brake linings shall be incombustible.

12.5 Emergency operation

12.5.1 If the manual effort required to move the car in the upward direction with its rated load does not exceed 400 N the machine shall be provided with a manual means of emergency operation allowing the car to be moved to a landing with the aid of a smooth wheel.

12.5.1.1 If the wheel is removable, it shall be located in an easily accessible place in the machine room. It shall be suitably marked if there is any risk of confusion as to the machine for which it is intended.

12.5.1.2 It shall be possible to check easily from the machine room whether the car is in an unlocking zone. This check may be made, for example, by means of marks on the suspension or governor ropes.

12.5.2 If the effort defined in **12.5.1** is greater than 400 N, a means of emergency electrical operation from the machine room shall be provided in accordance with **14.2.1.4**.

12.6 Speed. The speed of the lift car, half loaded, in downward motion, in mid-travel, excluding all acceleration and deceleration periods, shall not exceed the rated speed by more than 5 %, when the supply is at its rated frequency, and the motor voltage is equal to the rated voltage of the equipment[10)].

12.7 Stopping the machine and checking its stopped condition. The stopping of the machine by means of an electric safety device, in conformity with **14.1.2**, shall be controlled as detailed below.

12.7.1 *Motors supplied directly from a.c. or d.c. mains.* The supply shall be interrupted by two independent contactors, the contacts of which shall be in series in the supply circuit. If, whilst the lift is stationary, one of the contactors has not opened the main contacts, further movement of the car shall be prevented at the latest at the next change in the direction of motion.

12.7.2 ***Drive using a "Ward-Leonard" system***

12.7.2.1 *Excitation of the generator supplied by classical elements.* Two independent contactors shall interrupt, either

a) the motor generator loop, or

b) the excitation of the generator, or

c) one the loop and the other the excitation of the generator.

If, whilst the lift is stationary, one of the contactors has not opened the main contacts, further movement of the car shall be prevented, at the latest at the next change in direction of motion.

In cases b) and c) effective precautions shall be taken to prevent the rotation of the motor in the case of a residual field, if any, in the generator (e.g. suicide circuit).

12.7.2.2 *Excitation of the generator supplied and controlled by static elements.* One of the following methods shall be used:

a) the same methods as specified in **12.7.2.1**;

b) a system consisting of:

1) a contactor interrupting the excitation of the generator or the motor generator loop.

The coil of the contactor shall be released at least before each change in direction of motion. If the contactor does not release, any further movement of the lift shall be prevented;

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

[10)] It is good practice that in the above conditions the speed is not lower than a value 8 % below the rated speed.

3) a monitoring device to verify the blocking of the flow of energy each time the lift 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 lift shall be prevented.

Effective precautions shall be taken to prevent the rotation of the motor in the case of a residual field, if any, in the generator (e.g. suicide circuit).

12.7.3 *A.C. or d.c. motor supplied and controlled by static elements.* One of the following methods shall be used:

a) Two independent contactors interrupting the current to the motor.

If, while the lift is stationary, one of the contactors has not opened the main contacts, any further movement shall be prevented, at the latest at the next change in direction of motion.

b) A system consisting of:

1) 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 lift shall be prevented.

2) A control device blocking the flow of energy in the static elements.

3) A monitoring device to verify the blocking of the flow of energy each time the lift 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 lift shall be prevented.

12.8 Checking the slowdown of the machine when reduced stroke buffers are used in accordance with 10.4.3.2

12.8.1 Devices shall check that the slowdown is effective before arrival at terminal landings.

12.8.2 If the slowdown is not effective these devices shall cause the car speed to be reduced in such a way that, if the car comes into contact with the buffers, the striking speed shall not exceed that for which the buffers were designed.

12.8.3 If the device checking the slowdown is not independent of the direction of travel, a device shall check that the movement of the car is in the intended direction.

12.8.4 If these devices, or some of them, are placed in the machine room:

a) they shall be operated by a device directly coupled to the car;

b) the information relating to the car position shall not depend on devices driven by traction, friction, or by synchro-motors;

c) if a connection by tape, chain or rope is used to transmit the position of the car to the machine room, breakage of or slack in such a connecting device shall cause the machine to stop through the action of an electric safety device in conformity with **14.1.2**.

12.8.5 The control and functioning of these devices shall be so designed that together with the normal speed regulation system there results a slowdown control system complying with the requirements of **14.1.2**.

12.9 Protection of machinery. Effective protection shall be provided for accessible rotating parts which may be dangerous, in particular:

a) keys and screws in the shafts;

b) tapes, chains, belts;

c) gears, sprockets;

d) projecting motor shafts;

e) fly-ball type overspeed governors.

Exception is made for traction sheaves, handwinding wheels, brake drums and any similar smooth, round parts. Such items shall be painted yellow, at least in part.

13 Electric installations and appliances

13.1 General provisions

13.1.1 *Limits of application*

13.1.1.1 The requirements of this standard relating to the installation and to the constituent components of the electrical equipment apply:

a) to the main switch of the power circuit and dependent circuits;

b) to the switch for the car lighting circuit and dependent circuits.

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

13.1.1.2 The national requirements relating to electricity supply circuits shall apply as far as the input terminals of the switches referred to in **13.1.1.1**. They shall apply to the whole lighting circuit of the machine room, the pulley room and the lift well and pit.

13.1.1.3 The requirements of this standard for circuits dependent on the switches referred to in **13.1.1.1** are based, as far as possible, taking into account the specific needs of lifts, on existing standards:

on the international level: IEC;

on the European level: CENELEC.

Whenever one of these standards is used, its references are given, together with the limits within which it is used.

When no precise information is given, the electrical equipment used shall conform to the accepted Codes of Practice relating to safety.

13.1.1.4 Countries which have not explicitly stated that they are in favour of one of the IEC or CENELEC standards cannot, according to **13.1.1.1** and **13.1.1.2**, refuse equipment in conformity with the requirements of the present standard, but they may, whenever the standard involved is quoted, define components of equivalent quality which, nationally, will also be acceptable (N.b).

13.1.2 In the *machine* and *pulley rooms,* Protection against direct contact is necessary, by means of casings providing a degree of protection of at least IP 1X.

13.1.3 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) 500 000 Ω[11] for power circuits and electric safety device circuits;

b) 250 000 Ω[11] for other circuits (controls, lighting, signalling, etc.).

13.1.4 The mean value in direct current or the r.m.s. value in alternating current of the voltage between conductors or between conductors and earth, shall not exceed 250 V for control and safety circuits.

13.1.5 The neutral conductor and the earth-continuity conductor shall always be separate.

13.2 Contactors, relay-contactors, components of safety circuits

13.2.1 *Contactors and relay contactors*

13.2.1.1 The main contactors (i.e. those necessary to stop the machine as per **12.7**) shall belong to the following categories as defined in CENELEC HD419 (IEC 158-1, mod).

a) AC-3 for contactors for a.c. motors.

b) DC-2 for contactors for d.c. power.

These contactors shall in addition allow 10 % of starting operations to be made as inching.

13.2.1.2 If, because of the power they carry, relay contactors must be used to operate the main contactors, those relay contactors shall belong to the following categories as defined in CENELEC HD420 (IEC 337-1, mod).

a) AC-11 for controlling a.c. electromagnets.

b) DC-11 for controlling d.c. electromagnets.

13.2.1.3 Both for the main contactors referred to in **13.2.1.1** and for the relay contactors referred to in **13.2.1.2**, it may be assumed in the measures taken to comply with **14.1.1.1** that:

a) if one of the break contacts (normally closed) is closed, all the make contacts are open;

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

13.2.2 *Components of safety circuits*

13.2.2.1 When devices as per **13.2.1.2** are used, as relays in a safety circuit, the assumptions of **13.2.1.3** shall also apply.

13.2.2.2 If relays are used which are such that the break and make contacts are never closed simultaneously for any position of the armature, the possibility of partial attraction of the armature [**14.1.1.1** f)] can be disregarded.

13.2.2.3 Devices (if any) connected after electrical safety devices shall meet the requirements of **14.1.2.2.2** as regards the creep distances and the air gaps (not the separation distances).

This requirement does not apply to the devices mentioned in **13.2.1.1**, **13.2.1.2** and **13.2.2.1** and which themselves fulfil the requirements of CENELEC HD419 (IEC 158-1, mod) and CENELEC HD420 (IEC 337-1, mod).

13.3 Protection of motors

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

13.3.2 Motors directly connected to the mains shall be protected against overloads by means of manual reset (except as provided for in **13.3.3**) automatic circuit-breakers which shall cut off the supply to the motor in all live conductors.

13.3.3 When the detection of overloads operates on the basis of temperature increases in the windings of the motor, the circuit-breaker may be closed automatically after sufficient cooling down has taken place.

13.3.4 The provisions of **13.3.2** and **13.3.3** apply to each winding if the motor has windings supplied by different circuits.

[11] These values are provisional and will be aligned later with those adopted by CENELEC committee 64.

13.3.5 When the lift motors are supplied from DC generators driven by motors, the lift motors shall also be protected against overloads.

13.4 Main switches

13.4.1 Machine rooms shall contain, for each lift, a main switch capable of breaking the supply to the lift on all the live conductors. This switch shall be capable of interrupting the highest current involved in normal conditions of use of the lift.

This switch shall not cut the circuits feeding:

a) car lighting or ventilation, if any;

b) socket outlet on the car roof;

c) lighting of machine and pulley rooms;

d) socket outlet in the machine room;

e) lighting of the lift well;

f) alarm device.

13.4.2 The main switches as defined in **13.4.1** shall have stable open and closed positions.

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

NOTE If the machine room has several points of access, or if the same lift has several machine rooms each with its own point(s) of access, a circuit breaker contactor may be used, release of which shall be controlled by an electric safety device, in conformity with **14.1.2**, inserted in the supply circuit to the coil of the circuit breaker contactor. The re-engagement of the circuit breaker contactor shall not be carried out or made possible except by means of the device which caused its release. The circuit breaker contactor shall be used in conjunction with a manually controlled isolating switch.

13.4.3 In the case of a group of lifts, if, after the opening of the main switch for one lift, parts of the operating circuits remain live, these circuits shall be capable of being separately isolated in the machine room, if necessary by breaking the supply to all the lifts in the group.

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

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

13.5 Electric wiring

13.5.1 In the machine and pulley rooms and lift wells, the conductors and cables (with the exception of travelling cables) shall be selected from those standardized by CENELEC and of a quality at least equivalent to that defined by HD 21 S2 and HD 22 S2 taking into account the information given in **13.1.1.3**.

13.5.1.1 Conductors such as those in conformity with CENELEC HD 21.3 S2, parts 2 (HO7V-U and HO7V-R), 3 (HO7V-K), 4 (HO5V-U) and 5 (HO5V-K) may be used in all circuits, except for machine power circuits, provided that they are installed in conduits (or trunking) made either of metal or plastics or the conductors are protected in an equivalent manner.

NOTE These provisions replace those in the guide to use appearing in Appendix 1 of CENELEC HD 21.1S2.

13.5.1.2 Rigid cables such as those in conformity with 2 of CENELEC HD 21.4 S2 may only be used in visible mountings fixed to the walls of the well (or of the machine room) or installed in ducting, trunking or similar fittings.

13.5.1.3 Ordinary flexible cables such as those in conformity with 3(HO5RR-F) of CENELEC HD 22.4 S2 and 5(HO5VV-F) of CENELEC HD 21.5 S2, may be used only in ducting, trunking or fittings ensuring equivalent protection.

Flexible cables with a thick sheath such as those in conformity with 5 of CENELEC HD 22.4 S2 may be used like rigid cables in the conditions defined in **13.5.1.2**, and for connection to a movable appliance (except as travelling cables for connection to the car) or if they are subject to vibrations.

Travelling cables in conformity with CENELEC HD 359 and CENELEC HD 360 shall be accepted as cables for connection to the car, within the limits laid down by these documents. In all cases, the travelling cables selected shall be of at least equivalent quality.

13.5.1.4 The requirements of **13.5.1.1**, **13.5.1.2** and **13.5.1.3** need not apply:

a) to conductors or cables not connected to electric safety devices on landing doors, provided that:

1) they are not subject to a rated output of more than 100 VA;

2) the voltage, between poles (or phases) or between a pole (or one of the phases) and earth, to which they are normally subject does not exceed 50 V;

b) to the wiring of operating or distribution devices in cabinets or on panels:

1) either between different pieces of electric equipment, or

2) between these pieces of equipment and the connection terminals.

13.5.2 *Cross-sectional area of conductors.* The cross-sectional area of the conductors of electric safety circuits of doors shall be not less than 0.75 mm^2.

13.5.3 ***Method of installation***

13.5.3.1 The electric installation shall be provided with the indications necessary to make it easy to understand.

13.5.3.2 Connections, connection terminals and connectors, except those defined in **13.1.2**, shall be located in cabinets, boxes or on panels provided for this purpose.

13.5.3.3 If, after the opening of the main switch or switches of a lift, some connection terminals remain live, they shall be clearly separated from terminals which are not live, and if the voltage exceeds 50 V, they shall be suitably marked.

13.5.3.4 Connection terminals whose accidental interconnection could lead to a dangerous malfunction of the lift shall be clearly separated unless their method of construction obviates this risk.

13.5.3.5 In order to ensure continuity of mechanical protection, the protective sheathing of conductors and cables shall fully enter the casings of switches and appliances, or shall terminate in a suitably constructed gland.

NOTE Enclosed frames of landing and car doors are regarded as appliance casings.

However, if there is a risk of mechanical damage due to movement of parts or sharp edges of the frame itself, the conductors connected to the electric safety device shall be protected mechanically.

13.5.3.6 If the same ducting or cable contains conductors whose circuits have different voltages, all the conductors or cables shall have the insulation specified for the highest voltage.

13.5.4 *Connectors.* Connectors and devices of the plug-in type placed in safety circuits shall be so designed and arranged that, if their withdrawal does not require the use of a tool, it is impossible to re-insert the plug incorrectly.

13.6 Lighting and socket outlets

13.6.1 The electric lighting supplies to the car, the well and the machine and pulley rooms, shall be independent of the supply to the machine, either through another circuit or through connection to the machine supply circuit on the supply side of the main switch or the main switches laid down in **13.4**.

13.6.2 The supply to socket outlets required on the car roof, in the machine and pulley rooms and in the pit, shall be taken from the circuits referred to in **13.6.1**.

These socket outlets are:

either of type 2 P + PE, 250 V

or supplied at a safety extra-low voltage in accordance with CENELEC HD 384.4.41, subclause **411**.

NOTE The use of the above socket outlets does not imply that the supply cable has a cross-sectional area corresponding to the rated current of the socket outlet. The cross-sectional area of the conductors may be smaller, provided that the conductors are correctly protected against excess currents.

13.6.3 ***Control of lighting circuits and supply circuits for socket outlets***

13.6.3.1 A switch shall control the supply to the circuit of the car. (If the machine room contains several lift machines it is necessary to have one switch per car.) This switch shall be located close to the corresponding main power switch.

13.6.3.2 A switch shall control the supply to the circuit of the machine room, well and pit. This switch shall be located inside and close to the access to the machine room.

13.6.3.3 Each circuit controlled by the switches laid down in **13.6.3.1** and **13.6.3.2** shall have its own protection.

14 Protection against electric faults; controls; priorities

14.1 Protection against electric faults

14.1.1 *General provisions.* Any one of the faults envisaged in **14.1.1.1** in the electric equipment of the lift shall not, on its own, be the cause of a dangerous malfunction of the lift.

14.1.1.1 *Faults envisaged*

a) absence of voltage;

b) voltage drop;

c) loss of continuity of a conductor;

d) insulation fault in relation to the metalwork or the earth;

e) short circuit or open circuit in an electrical component such as resistor, capacitor, transistor, 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 of a contact;

i) non-closing of a contact;

j) phase reversal (N.a). (N)

14.1.1.2 The non-opening of a contact need not be considered in the case of safety contacts conforming to the requirements of **14.1.2.2**.

14.1.1.3 The earthing to the metalwork or the earth of a circuit in which there is an electric safety device shall:

a) either cause the immediate stopping of the machine, or

b) prevent restarting of the machine after the first normal stop.

The return to service shall not be possible except by a competent person.

14.1.2 ***Electric safety devices***

14.1.2.1 *General provisions*

14.1.2.1.1 During operation of one of the electric safety devices listed in Appendix A, movement of the machine shall be prevented or it shall be caused to stop immediately as indicated in **14.1.2.4**. The electric safety devices shall consist of:

a) either one or more *safety contacts* satisfying **14.1.2.2**, **14.1.2.2** *directly* cutting the supply to the contactors referred to in **12.7** or their relay contactors;

b) or *safety circuits* satisfying **14.1.2.3**, consisting of:

1) either one or more safety contacts satisfying **14.1.2.2** *not directly* cutting the supply to the contactors referred to in **12.7** or their relay contactors, or

2) contacts not satisfying the requirements of **14.1.2.2**.

14.1.2.1.2 *(Kept free)*

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

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

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

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

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

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

In particular, voltage peaks arising from normal operation of the lift or other equipment on the network shall not create inadmissible disturbances in electronic components (noise immunity).

14.1.2.1.9 Appendix A specifies the type of electric safety device which can be used in each case.

14.1.2.2 *Safety contacts*

14.1.2.2.1 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.

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

The safety contacts shall belong to the following categories as defined in CENELEC HD 420 (IEC 337-1 mod)

a) AC 11 for safety contacts in ac circuits.

b) DC 11 for safety contacts in dc circuits.

14.1.2.2.3 If the protective enclosure is not of at least type IP 4X the air gaps and creep distances shall be at least 6 mm and the distances for breaking contacts at least 4 mm after separation.

The live parts of safety contacts shall be accommodated in a protective enclosure. However, this requirement is not obligatory in the conditions of external influence considered as normal in the harmonization document drawn up by TC 64 of CENELEC (at present **32** of IEC Publication 364).

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

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

14.1.2.3 *Safety circuits*

14.1.2.3.1 *(Kept free)*

14.1.2.3.2 Safety circuits shall comply with the requirements of **14.1.1** relative to the appearance of a fault.

14.1.2.3.3 Furthermore:

a) If one fault combined with a second fault can lead to a dangerous situation, the lift shall be stopped at the latest at the next operating sequence in which the first faulty element should participate. All further operation of the lift shall be impossible as long as this fault persists.

The possibility of the second fault occurring after the first, and before the lift has been stopped by the sequence mentioned, is not considered.

b) If a dangerous situation can only occur through the combination of several faults, the stopping and maintaining in a stopped position of the lift shall be brought about at the latest before the possible appearance of the fault which, in conjunction with the already existing faults, would lead to the dangerous situation.

c) On restoration of the power supply after it has been disconnected, maintenance of the lift in the stopped position is not necessary, provided that during the next sequence stopping is reimposed in the cases covered by **14.1.2.3.3** a) and b).

d) In redundancy-type circuits measures shall be taken to limit as far as possible the risk of defects occurring simultaneously in more than one circuit arising from a single cause.

14.1.2.4 *Operation of electric safety devices.* When operating to ensure safety, an electric device shall prevent the setting in motion of the machine or initiate immediately its stopping. The electric supply to the brake shall likewise be broken.

The electric safety devices shall act directly on the equipment controlling the supply to the machine in accordance with the requirements of **12.7**.

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.

14.1.2.5 *Control of electric safety devices.* The components controlling the electric safety devices shall be built so that they are able to function properly under the mechanical stresses resulting from continuous normal operation.

If the devices for controlling electric safety devices are through the nature of their installation accessible to persons, they must be so built that these electric safety devices cannot be rendered inoperative by simple means.

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

In the case of redundancy-type safety circuits, it shall be ensured by mechanical or geometric arrangements of the transmitter elements that a mechanical fault shall not cause loss of redundancy.

Transmitter elements of safety circuits shall withstand, independently of the direction, a vibration of sine-wave form, with a frequency f of between 1 Hz and 50 Hz and an amplitude a (mm) which is given as a function of f by the equations:

$a = 25/f$ for $1 < f \leqslant 10$ Hz

$a = 250/f^2$ for $10 < f \leqslant 50$ Hz.

Transmitter elements of safety circuits mounted on cars or doors shall withstand, independently of the direction, an acceleration of $\pm$ 30 m/s^2.

NOTE Where shock absorbers for transmitter elements are fitted, they shall be considered as part of the transmitter elements.

14.2 Controls

14.2.1 *Control of lift operations.* Control shall be effected electrically.

14.2.1.1 *Normal operation.* This control shall be by the aid of buttons. These shall be placed in boxes, such that no live parts are accessible.

The use of ropes, cords or rods as a means of control between the car and the machine room is only permitted in very special cases (very humid, corrosive or explosive atmosphere).

14.2.1.2 *Levelling and re-levelling with doors open.* In the specific case referred to in **7.7.2.2** a) movement of the car with landing and car doors open is permitted for levelling and re-levelling on condition that:

a) The movement is limited to the unlocking zone [**7.7.2.2** a)].

1) All movement of the car outside the unlocking zone shall be prevented by at least one switching device mounted in the bridge or shunt of the door and lock safety devices.

2) This switching device shall either:

be a safety contact satisfying the requirements of **14.1.2.2**, or

be connected in such a way as to satisfy the requirements for safety circuits in **14.1.2.3**.

3) If the operation of the switches is dependent upon a device which is indirectly mechanically linked to the car, e.g. by rope, belt or chain, the breaking of or slack in the connecting link shall cause the machine to stop through the action of an electric safety device in conformity with **14.1.2**.

4) During levelling operations, the means for making the electric safety devices of doors inoperative shall only function after the stopping signal for a landing has been given.

b) The speed of levelling does not exceed 0.8 m/s. On lifts with manually controlled landing doors, there shall be a check that:

1) for machines whose maximum speed of rotation is determined by the fixed frequency of the supply, that the control circuit for the low speed movement only has been energized;

2) for other machines, the speed at the moment the unlocking zone is reached does not exceed 0.8 m/s.

c) The speed of re-levelling does not exceed 0.3 m/s. It shall be checked:

1) for machines whose maximum speed of rotation is determined by the fixed frequency of the supply, that the control circuit for the low speed movement only has been energized;

2) for machines supplied from static convertors, that re-levelling speed does not exceed 0.3 m/s.

14.2.1.3 *Inspection operation.* To facilitate inspection and servicing, a readily accessible control station shall be provided on the car roof. This device shall be brought into operation by a switch (inspection operation switch) which shall satisfy the requirements for electric safety devices (**14.1.2**).

This switch, which shall be bi-stable, shall be protected against involuntary operation.

The following conditions shall be satisfied simultaneously:

a) Engagement of the inspection operation shall neutralize:

1) the normal controls, including the operation of any automatic doors;

2) emergency electrical operation (**14.2.1.4**);

3) docking operation (**14.2.1.5**).

The return to normal service of the lift shall only be effected by another operation of the inspection switch.

If the switching devices used for this neutralization are not safety contacts integral with the inspection switch mechanism, precautions shall be taken to prevent all involuntary movement of the car in the event of one of the faults listed in **14.1.1.1** appearing in the circuit.

b) The movement of the car shall be dependent on a constant pressure on a push-button protected against accidental operation and with the direction of movement clearly indicated.

c) The control device shall also incorporate a stopping device in conformity with **14.2.2**.

d) The car speed shall not exceed 0.63 m/s.

e) The limits of normal car travel shall not be overrun.

f) The operation of the lift shall remain dependent on the safety devices.

The control device may also incorporate special switches protected against accidental operation for controlling the mechanism of doors from the car roof.

14.2.1.4 *Emergency electrical operation.* For machines where the manual effort to raise the car with its rated load exceeds 400 N an emergency electrical operation switch in conformity with **14.1.2** shall be installed in the machine room. The machine shall be supplied from the normal mains supply or from the standby supply if there is one.

14.2.1.4.1 Operation of the emergency electrical operation switch shall permit, from the machine room, the control of car movement by constant pressure on buttons protected against accidental operation. The direction of movement shall be clearly indicated.

14.2.1.4.2 After operation of the emergency electrical operation switch, all movement of the car except that controlled by this switch shall be prevented.

14.2.1.4.3 The emergency electrical operation switch may render inoperative by itself or through another electric safety device the electric safety device required in **9.9.11.1** and **9.9.11.2** for the overspeed governor.

14.2.1.4.4 The emergency electrical operation switch may render inoperative by itself or through another electric safety device the following electric devices:

a) those mounted on the safety gear, according to **9.8.8**;

b) those mounted on the buffers, according to **10.4.3.4**;

c) final limit switches, according to **10.5**.

14.2.1.4.5 The emergency electrical operation switch and its push-buttons shall be so placed that the machine can readily be observed when using them.

14.2.1.4.6 The car speed shall not exceed 0.63 m/s.

14.2.1.5 *Docking operation.* In the specific case covered by **7.7.2.2** b), movement of the car is permitted with the landing and car doors open to allow loading or unloading of lifts reserved for authorized and instructed users (General introduction, **0.6.2**), under the following conditions:

a) movement of the car shall only be possible in a zone not exceeding 1.65 m above the corresponding landing level;

b) movement of the car shall be limited by a directional electric safety device in conformity with the requirements of **14.1.2**;

c) the speed of movement shall not exceed 0.3 m/s;

d) the landing door and the car door (if there is one) shall only be opened on the docking side;

e) the zone of movement shall be clearly visible from the docking operation control position;

f) the docking operation shall only become possible after operation of a key operated safety contact, the key of which can only be removed when in position to discontinue the docking operation;

g) the engagement of the key operated safety contact:

1) shall neutralize the effects of the normal controls. If the switching devices used are not safety contacts integral with the key operated contact mechanisms, precautions shall be taken to prevent all involuntary movement of the car in the event of one of the faults listed in **14.1.1.1** appearing in the circuit;

2) shall only allow movement of the car by use of a constant pressure button. The direction of movement shall be clearly indicated;

3) may render inoperative, by itself or through another electric safety device in conformity with **14.1.2**:

the electric safety device of the lock of the landing door concerned;

the electric safety device for proving closure of the landing door concerned;

the electric safety device for proving closure of the car door at the docking entrance;

h) the effects of the docking operation shall be over-ridden by the engagement of the inspection operation;

j) there shall be a stopping device in the car.

14.2.2 *Stopping devices.* The stopping devices shall consist of electric safety devices in conformity with **14.1.2**. They shall be bi-stable and such that a return to service cannot result from an involuntary action.

14.2.2.1 *Cars where all entrances are fitted with imperforate doors.* Stopping devices in the car are prohibited, excepting the case **14.2.1.5** j).

If the doors are power closed, there shall be a device permitting the closing movement to be reversed.

14.2.2.2 *Cars where not all the entrances are fitted with imperforate doors.* The passengers shall have at their disposal, 1 m at the most from the entrances in question, a switch to stop the car and keep it stationary. This switch:

a) shall be either of the bi-stable push-button type or the lever type, with the lever in the down position for stop;

b) shall be clearly identified (**15.2.3.1**).

14.2.2.3 *Other stopping devices.* A device shall be provided for stopping, and maintaining the lift out of service, including the automatically operated doors:

a) on the car roof at 1 m maximum from the entry point for inspection by servicing personnel (this device may be the one located next to the inspection operation control if this is not placed more than 1 m from the access point) (**8.15**);

b) in the pulley room (**6.4.5**);

c) in the pit (**5.7.3.4**).

14.2.3 *Emergency alarm device*

14.2.3.1 In order to call for outside assistance if necessary passengers shall have available in the car an easily recognizable and accessible device for this purpose.

14.2.3.2 The power for this device shall be either from the emergency lighting supply called for in **8.17.3** or from an equivalent supply.

14.2.3.3 This device shall take the form of a bell, intercom system, external telephone or similar device.

NOTE In the case of connection to a public telephone network **14.2.3.2** does not apply.

14.2.3.4 The organization within the building should be such that it can respond effectively without undue delay to these emergency calls.

14.2.3.5 An intercom system, or similar device, powered by the emergency supply referred to in **8.17.3**, shall be installed between the car and the machine room if the lift travel exceeds 30 m.

14.2.4 *Priorities and signals*

14.2.4.1 For lifts with manual doors, a device shall prevent a car leaving a landing for a period of at least 2 seconds after stopping.

14.2.4.2 A user who enters the car shall have at least 2 seconds after the doors have closed, to enable him to press the button of his choice before any external call buttons can become effective.

Exception is made in the case of lifts with car doors, operating on collective control.

14.2.4.3 In the case of collective control, an illuminated signal, which is clearly visible from the landing, shall indicate to the users waiting on this landing the direction of the next movement imposed on the car.

14.2.4.4 For groups of lifts, position indicators on the landings are not recommended. However, it is recommended that the arrival of a car be preceded by an audible signal.

15 Notices and operating instructions

15.1 General provisions. All labels, notices and operating instructions shall be legible and readily understandable (if necessary aided by signs or symbols). They shall be untearable, of durable material, placed in a visible position, and written in the language of the country where the lift is installed (or, if necessary, in several languages).

15.2 In the car

15.2.1 The rated load of the lift in kilogrammes as well as the number of persons shall be displayed.

The number of persons shall be determined by reference to **8.2.4**.

The notice shall be made as follows:

. . . . kg . . PERS.

The minimum height of the characters used for the notice shall be:

a) 10 mm for capital letters and numbers;

b) 7 mm for small letters.

However, for non-commercial vehicle lifts, the minimum height of the characters shall be:

c) 100 mm for capital letters and numbers;

d) 70 mm for small letters.

15.2.2 The name of the vendor and his identification number of the lift shall be displayed.

15.2.3 ***Other information***

15.2.3.1 The control device of the stop switch (where fitted) shall be red in colour and identified by the word "STOP", so placed that there can be no risk of error as to the stop position.

The button (if any) of the alarm switch shall be yellow in colour and identified by the symbol 

The colours red and yellow shall not be used for other buttons. However, these colours may be used for illuminated "call registered" signals.

15.2.3.2 The control devices shall be clearly identified by reference to their function; for this purpose it is recommended to use:

a) for control buttons the markings – 2, – 1, 0, 1, 2, 3, etc . . . ;

b) for the door re-open button, where applicable, the indication 

15.2.4 Instructions to ensure safe usage of the lift shall be placed in the car whenever the need for these is apparent.

These shall at least indicate:

a) in the case of a lift without car doors:

1) that a passenger shall not approach the wall of the well;

2) that a passenger shall not stand in front of or behind the load;

3) that loads shall not be placed close to the wall of the well;

4) that movable loads shall be immobilized so that they remain away from the wall of the well;

b) in the case of a lift with a docking operation, instructions specific to this operation;

c) for lifts with telephones or intercom systems — the instructions for use, if not self-evident;

d) that after using the lift, it is necessary to close manually operated doors and power operated doors where closing is carried out under the continuous control of the users.

15.3 On the car roof. The following information shall be given:

a) the word "STOP" on or near the stopping device, so placed that there can be no risk of error as to the stop position;

b) the words "NORMAL" and "INSPECTION" on or near the inspection operation switch;

c) the direction of motion on or near the inspection buttons.

15.4 Machine and pulley rooms

15.4.1 A notice bearing the following minimum inscription:

"Lift Machine — Danger

Access forbidden to all unauthorized persons"

shall be fixed to the outside of doors or trap-doors giving access to the machines and pulleys.

In the case of trap-doors, a permanently visible notice shall indicate to those using the trap-door:

"Danger of falling — Reclose the trap-door".

15.4.2 Notices shall be provided to permit easy identification of the main switch(es) and the light switches.

If there are several machines in one machine room, the notices shall facilitate the identification of the switches appropriate to each lift.

If, after release of a main switch, some parts remain live (interconnection between lifts, lighting . . . .), a notice shall indicate this.

15.4.3 In the machine room or the interior of the machine enclosure, there shall be detailed instructions to be followed in the event of lift breakdown, particularly concerning the use of the device for manual or electrical emergency movement, and the unlocking key for landing doors.

15.4.3.1 The direction of movement of the car shall be clearly indicated on the machine, close to the hand winding wheel.

If the wheel is not removable, the indication may be on the wheel itself.

15.4.3.2 On or near the emergency electrical operation buttons, there shall be markings to show the corresponding direction of movement.

15.4.4 On or near the stop switch in the pulley room there shall be the word "STOP" so placed that there can be no risk of error as to the stop position.

15.4.5 The maximum permissible load shall be indicated on the lifting beam or hooks (see **6.3.7**).

15.5 On the outside of the well

15.5.1 Near the inspection doors for the well there shall be a notice stating:

"Lift well — Danger

Access forbidden to unauthorized persons

15.5.2 Landing doors with manual opening, if they can be confused with other adjacent doors, shall bear the inscription "LIFT".

15.5.3 Landing doors of lifts, the use of which is solely reserved for authorized and instructed users (General introduction, **0.6.2**), shall bear on the landing side the following inscription:

"Lift forbidden to unauthorized persons".

15.5.4 On goods passenger and non-commercial vehicle lifts the landing doors shall display the rated load.

15.6 On the overspeed governor. A data plate shall be fixed indicating:

a) the name of the manufacturer of the overspeed governor;

b) the type examination sign and its references;

c) the tripping speed for which it has been adjusted.

15.7 On or near the stop switch in the pit there shall be the word "STOP", so placed that there can be no risk of error as to the stop position.

15.8 On the buffers. On the buffers, other than energy accumulation type buffers, there shall be a data plate showing:

a) the name of the manufacturer of the buffer;

b) the type examination sign and its references.

15.9 Landing identification. Sufficiently visible notices or signals shall permit persons in the car to know at which landing the lift has stopped.

15.10 Electrical identification. Contactors, relays, fuses and connection strips for circuits coming into the control panels shall be marked in accordance with the wiring diagram.

In the case of the use of multiple wire connectors, only the connector (and not the wires) needs to be marked.

15.11 Unlocking key for landing doors. The unlocking key shall have a label attached drawing attention to the danger which may be involved in using this key and the need to make sure that the door is locked after it has been closed.

15.12 Alarm device. The bell or device activated during a call for help from the car shall be clearly marked "Lift alarm".

In the case of multiple lifts it shall be possible to identify the car from which the call is being made.

15.13 Locking devices. A data plate shall be fixed indicating:

a) the name of the manufacturer of the locking device;

b) the type examination sign and its references.

15.14 Safety gear. A data plate shall be fixed indicating:

a) the name of the manufacturer of the safety gear;

b) the type examination sign and its references.

16 Examinations; tests; register; servicing

16.1 Examinations and tests

16.1.1 The technical dossier to be supplied when applying for preliminary authorization (N.a, b) shall contain the necessary information to ascertain that the constituent parts are correctly designed and the proposed installation is in conformity with this standard. (N)

This verification can only relate to items, or some of them, which shall form the subject of an examination or test prior to putting the lift in service (see Appendix C).

Appendix C may serve as a basis for those who wish to carry out, or to have carried out, a study of an installation before putting it into effect.

16.1.2 Before going into service, lifts shall form the subject of an examination and tests in order to verify their conformity to this standard.

These examinations and tests shall be carried out, in accordance with Appendix D of this standard, by a person or organization approved by the public authorities (N.b).

16.1.2.1 It may be required in the case of lifts which have not been subject to application for a preliminary authorization, to supply all or some of the technical information and calculations which appear in Appendix C.

16.1.2.2 If type examinations are required, a copy of each relevant type examination certificate, as issued by a body approved for this purpose, shall be provided for:

a) locking devices;

b) landing doors;

c) overspeed governors;

d) safety gear;

e) energy dissipation buffers (or buffers of the energy accumulation type with buffered return movement).

16.1.3 Periodical examinations and tests on lifts shall be carried out after they are brought into service (N.a, b) to verify that they are in good condition. These periodical examinations and tests shall be carried out in accordance with Appendix **E.1** of this standard.

Examinations and tests shall be carried out after important modifications or after an accident (N.a, b) to ascertain that lifts continue to conform to this standard. These examinations and tests shall be carried out in accordance with Appendix **E.2** of this standard.

16.2 Register

16.2.1 The basic characteristics of the lift shall be recorded in a register, or file, drawn up at the latest at the time the installation is brought into service. This register or file shall be kept up-to-date and comprise:

a) A technical section giving the date the lift was brought into service, the basic characteristics of the lift, the characteristics of the ropes and/or chains and those of the five parts (**16.1.2.2**) for which a type examination certificate is required, important modifications to the lift, replacement of ropes or important parts, accidents.

The plans of installation in the building and circuit diagrams (using IEC symbols), which may be limited to the circuits for the overall understanding of the safety considerations, shall be attached. The symbols shall be explained by means of a nomenclature.

b) A section where duplicate dated copies of examination and inspection reports are kept, with observations.

16.2.2 This register or file shall, in any case, be available to those in charge of the servicing, and to the person or organization responsible for the periodical examinations and tests. (It is for the national committees to indicate, with reference to their regulations, who is responsible for the register.) (N.b.)

16.3 Servicing. The lift and its accessories shall be maintained in good working order. To this effect, regular servicing of the lift shall be carried out by competent personnel (N.a, b).

Appendix A

Table 4 — Conditions for use of electric safety devices

Types of electric safety devices:

a) safety contacts (**14.1.2.2**);

b) safety circuits (**14.1.2.3**), whatever the type of installation;

c) safety circuits (**14.1.2.3**), authorized in the case of installations requiring special protection against risks of humidity or explosion.

The "X" indicates the type of device authorized. If there are several "X"s, there is a choice of devices.

Clause	Devices checked	Electric safety device		
		a	b	c
5.2.2.2.2	Check on closed position of inspection and emergency doors and inspection traps	X		
5.4.3.2.2	Check on locking of car door	X		X
7.7.3.1	Check on locking of landing doors	X		X
7.7.4	Check on closed position of landing doors	X		X
7.7.6.2	Check on closed position of the panel or panels without locks	X		X
8.9.2	Check on closed position of car door	X		X
8.12.5.2	Check on locking of the emergency trap and the emergency door in car	X		
9.5.3	Check on the abnormal relative extension of a rope or chain	X		
9.6.1 b)	Check on the tension in the compensation ropes	X		
9.6.2	Check on the anti-rebound device	X		
9.8.8	Check on the operation of safety gear	X		
9.9.11.1	Check on the operation of the overspeed governor	X	X	X
9.9.11.2	Check on the release of the overspeed governor	X		
9.9.11.3	Check on the tension in the overspeed governor rope	X		
10.4.3.4	Check on the return to normal extended position of buffers	X		
10.5.2.3 b)	Check on the tension in the device for transmission of the car position (final limit switches)	X		
10.5.3.1 b) 2)	Final limit switches for traction drive lifts	X		
10.6.1	Check for slack rope or slack chain	X		
12.8.4 c)	Check on the tension in the device for transmission of the car position (slowdown checking device)	X		
12.8.5	Check on retardation in the case of reduced stroke buffers	X	X	X
13.4.2, note	Control of main switch	X		
14.2.1.2 a) 2)	Check on levelling and re-levelling	X	X	X
14.2.1.2 a) 3)	Check on the tension in the device for transmission of the car position (levelling and re-levelling)	X		
14.2.1.3	Inspection operation switch	X		
14.2.1.4	Emergency electrical operation switch	X		
14.2.1.5	Docking operation:			
b)	travel limiting device	X	X	X
g) 3)	key operated safety contact position	X		
14.2.2	Stopping devices	X		

Appendix B

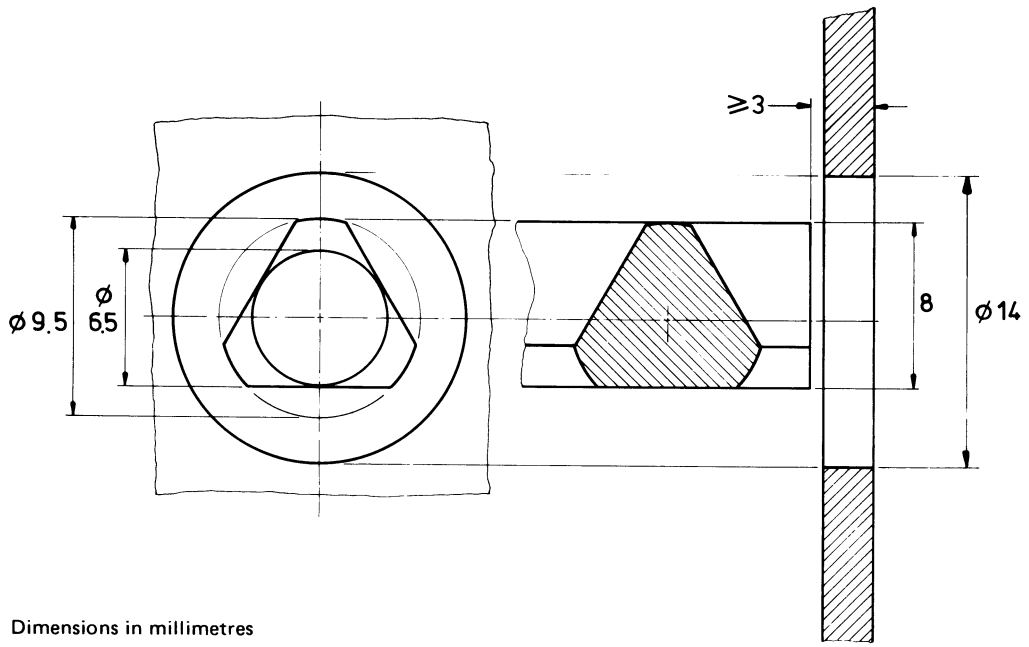


Figure 4 — Unlocking triangle

Appendix C Technical dossier

Ⓝ The technical dossier to be submitted with the application for preliminary authorization (N.a, b) may comprise all or part of the information and documents figuring in the following list.

C.1 General

Names and addresses of the lift maker, the owner and/or the user.

Address of the installation premises.

Type of equipment — rated load — rated speed — number of passengers — category of users (for the countries which allow less severe rules for authorized and instructed users — General introduction, **0.6.2**).

Travel of the lift, number of landings served.

Mass of the car and of the counterweight.

Means of access to the machine room, and to the pulley room, if there is one (**6.2**).

C.2 Technical details and plans

Necessary plans and sections in order to understand the lift installation, including rooms for machines, pulleys and apparatus.

These plans do not have to give details of construction, but they shall contain the necessary particulars to check conformity to this standard, and particularly the following.

Clearances at the top of the well and in the pit (**5.7.1**, **5.7.2**, **5.7.3.3**).

Any accessible spaces which exist below the well (**5.5**).

Access to the pit (**5.7.3.2**).

Guards between lifts if there are more than one in the same well (**5.6**).

Provision for holes for fixings.

Position and principal dimensions of the machine room with the layout of the machine and principal devices.

Dimensions of the traction sheave or the drum. Ventilation holes. Reaction loads on the building and at the bottom of the pit.

Access to the machine room (**6.3.3**).

Position and principal dimensions of the pulley room, if any. Position and dimensions of pulleys. Position of other devices in this room.

Access to the pulley room (**6.4.3**).

Arrangement and principal dimensions of landing doors (**7.3**). It is not necessary to show all the doors if they are identical and if the distances between the floors are indicated.

Arrangement and dimensions of inspection and emergency doors (**5.2.2**).

Dimensions of the car and of its entrances (**8.1**, **8.2**).

Distances from the sill and from the car door to the inner surface of the well wall (**11.2.2**).

Horizontal distance between the closed car and landing doors measured as indicated in **11.2.3**.

Principal characteristics of the suspension — safety factor — ropes (number, diameter, composition, breaking load) — chains (type, composition, pitch, breaking load) — compensation ropes (where provided).

Calculations of the traction and the specific pressure.

Principal characteristics of the overspeed governor rope:

diameter, composition, breaking load, safety factor.

Dimensions and calculation of the guides, condition and dimensions of the rubbing surfaces (drawn, milled, ground).

Dimensions and calculation of energy accumulation type buffers, including their characteristic curve.

C.3 Electric schematic diagrams

Outline electric schematic diagrams of the power circuits and of safety circuits.

These schematic diagrams shall be clear and use IEC symbols.

C.4 Certificates

Copies of type examination certificates, if type examinations are required, for locking devices, landing doors, overspeed governor, safety gear and buffers.

If necessary, copies of certificates for other components (ropes, chains, explosion proof equipment).

Setting up certificate for the safety gear according to the instructions provided by the safety gear manufacturer and calculation of the compression of the springs in the case of progressive safety gear.

Appendix D Examinations and tests before going into service

Before the lift is put into service, the following examinations and tests shall be carried out.

D.1 Examinations

These examinations shall cover in particular the following points:

a) if there has been a preliminary authorization, comparison of the documents submitted on that occasion (Appendix C) with the installation as it has been installed;

b) in all cases, verification that the requirements of this standard are fulfilled;

c) visual examination of the application of the rules of good construction of the components for which this standard has no special requirements;

d) comparison of the details given in the approval certificates for the components for which type examinations are required, with the characteristics of the lift.

D.2 Tests and verifications

These tests and verifications shall cover the following points:

a) Locking devices (**7.7**).

b) Electric safety devices (Appendix A).

c) Suspension elements and their attachments. It shall be verified that their characteristics are those indicated in the register or file [**16.2.1** a)].

d) Braking system (**12.4**). The test shall be carried out whilst the car is descending at rated speed with 125 % of the rated load and interrupting the supply to the motor and the brake.

e) Measurements of current or power and of speed.

f) 1) Measurement of the insulation resistance of the different circuits (**13.1.3**). (For this measurement all the electronic components are to be disconnected.)

2) Verification of the electrical continuity of the connection between the earth terminal of the machine room and the different parts of the lift liable to be made live accidentally.

g) Final limit switches (**10.5**).

h) Checking of the traction (**9.3**).

1) The traction shall be checked by making several stops with the most severe braking compatible with the installation. At each test, complete stoppage of the car shall occur.

The test shall be carried out:

a) ascending, with the car empty, in the upper part of the travel;

b) descending, with the car loaded with 125 % of the rated load, in the lower part of the travel.

2) It will be checked that the empty car cannot be raised, when the counterweight rests on its compressed buffers.

3) In the case (**8.2.3**) of non-commercial vehicle lifts where the rated load has not been calculated in accordance with the requirements of **8.2.1**, the traction shall also be checked statically with 150 % of the rated load.

4) It shall be checked that the balance is as stated by the lift maker.

This check may be made by means of measurements of current combined with:

speed measurements for a.c. motors;

voltage measurements for d.c. motors.

i) Overspeed governor.

1) The tripping speed of the overspeed governor shall be checked in the direction corresponding to the descent of the car (**9.9.1**, **9.9.2**, **9.9.3**).

2) The operation of the stopping control laid down in **9.9.11.1** and **9.9.11.2** shall be checked in both directions of movement.

j) Car safety gear (**9.8**). The energy which the safety gear is capable of absorbing at the moment of engagement will have been verified during the type examination. The aim of the test before going into service is to check the correct mounting, correct setting and the soundness of the complete assembly, comprising car, safety gear, guide rails and their fixing to the building.

The test shall be made while the car is descending, with the brake open, the machine continuing to run until the ropes slip or become slack, and in the following conditions.

1) *Instantaneous safety gear or instantaneous safety gear with buffered effect*. The car shall be loaded with the rated load uniformly distributed and engagement shall be made at the rated speed.

2) *Progressive safety gear*. The car shall be loaded with 125 % of the rated load uniformly distributed and engagement shall be made at a reduced speed (e.g. levelling speed or inspection speed).

However, National regulations may specify a higher testing speed, but not exceeding the rated speed.

In order to facilitate disengagement of the safety gear, it is recommended that the test be carried out opposite a door in order to be able to unload the car.

Specific case. In the case of non-commercial vehicle lifts (**8.2.3**) where the rated load has not been calculated in accordance with the provisions of **8.2.1**, the car shall be loaded with 150 % of the rated load instead of 125 %.

After the test, it shall be ascertained that no deterioration which could adversely affect the normal use of the lift has occurred. In exceptional cases, and if necessary, friction components may be replaced.

k) Counterweight safety gear.

1) The counterweight safety gear activated by an overspeed governor shall be tested in the same conditions as the car safety gear (without any overload in the car);

2) The counterweight safety gear which is not activated by an overspeed governor shall be tested dynamically.

After the test, it shall be ascertained that no deterioration which could adversely affect the normal use of the lift has occurred. In exceptional cases, and if necessary, friction components may be replaced.

l) Buffers (**10.3**, **10.4**).

1) *Energy accumulation type buffers.* The test shall be carried out in the following manner. The car with its rated load shall be placed on the buffer(s), the ropes shall be made slack and it shall be checked that the compression corresponds to that given by the characteristic curve required in Appendix C.

2) *Energy accumulation type buffers with buffered return movement and energy dissipation type buffers.* The test shall be made in the following manner: the car with its rated load or the counter-weight shall be brought into contact with the buffers at the rated speed or at the speed for which the stroke of the buffers has been calculated, in the case of the use of reduced stroke buffers with verification of the retardation (**10.4.3.2**).

After the test, it shall be ascertained that no deterioration which could adversely affect the normal use of the lift has occurred.

m) Alarm device (**14.2.3**).

Appendix E Periodical examinations and tests. Examinations and tests after an important modification or after an accident

E.1 Periodical examinations and tests

If the national regulations prescribe periodical examinations and tests (N.a, b), these may not be more stringent than those required before the lift was put into service.

These periodical tests shall not, through their repetition, cause excessive wear or impose stresses likely to reduce the safety of the lift. This is the case in particular of the test on components such as the safety gear and the buffers. If tests on these components are made, they shall be carried out with empty car and at a reduced speed. The capacity of these components has been verified during the type examination. Furthermore their correct assembly and operation have been verified in the tests made before going into service. The person appointed to make the periodical test shall assure himself that these components (which do not operate in normal service) are always in an operating condition.

The examinations and the tests may bear on:

- the locking devices;
- the ropes or chains;
- the mechanical brake. If the braking components are such that in the case of failure of one of them the other is not sufficient to retard the car, a detailed examination shall be made of the hubs, spindles and linkages to ensure that there is no wear, corrosion, or dirt accumulation affecting their satisfactory operation;
- the overspeed governor;
- the safety gear tested with empty car and at reduced speed;
- the buffers tested with empty car and at reduced speed;
- the alarm device.

A duplicate copy of the report shall be attached to the register or file in the part covered by **16.2.1** b).

E.2 Examinations and tests after an important modification or after an accident (N.a, b)

The important modifications and accidents shall be recorded in the technical part of the register or file covered in **16.2.1** a).

In particular, the following are considered as important modifications.

Change:

- of the rated speed;
- of the rated load;
- of the mass of the car;
- of the travel;
- of the type of locking devices (the replacement of a locking device by a device of the same type is not considered as an important modification).

Change or replacement:

- of the control system;
- of guides or the type of guide;
- of the type of door (or the addition of one or more landing or car doors);
- of the machine or the traction sheave;
- of the overspeed governor;
- of the buffers;
- of the safety gear.

If the national regulations prescribe examinations and tests after an important modification or after an accident, the documents relating to the modification and the necessary details shall be submitted to the person or organization responsible for the examinations and tests. Such person or organization will decide on the advisability of carrying out tests on the modified or replaced components.

These tests will, at the most, be those required for the original components before the lift was brought into service.

Appendix F Test procedures for type examination

F.0 Introduction

F.0.1 *General provisions*

F.0.1.1 The application of the approval procedures figuring in the following clauses may not be dissociated from the text of this standard itself. In particular, all components being certified shall conform to the requirements of this standard and to the rules of good construction.

F.0.1.2 For the purposes of this standard it is assumed that the laboratory undertakes both the testing and the certification as an approved body. In certain countries the test laboratory and the body approved for the issue of type examination certificates may be separate. In these cases the administrative procedures may differ from those described in this appendix.

F.0.1.3 The application for type examination shall be made by the manufacturer of the component or his authorized representative and shall be addressed to one of the test laboratories appearing on the list drawn up by the national authorities (N.b).

F.0.1.4 The despatch of samples for examination shall be made by agreement between the laboratory and the applicant.

F.0.1.5 The applicant may attend the tests.

F.0.1.6 If the laboratory entrusted with the complete examination of one of the components requiring the supply of a type examination certificate has not available appropriate means for certain tests or examinations, it may under its responsibility have these made by other laboratories.

F.0.1.7 The precision of the instruments shall allow, unless particularly specified, measurements to be made within the following tolerances:

a) ± 1 % masses, forces, distances, times, speeds;

b) ± 2 % accelerations, retardations;

c) ± 5 % voltages, currents;

d) ± 5 °C temperatures.

F.0.2 Model form of type examination certificate. The examination certificate shall contain the information shown on page 54.

F.1 Landing door locking devices

F.1.1 *General provisions*

F.1.1.1 *Field of application.* These procedures are applicable to locking devices for lift landing doors. It is understood that each component taking part in the locking of landing doors and in the checking of the locking forms part of the locking device.

F.1.1.2 *Object and extent of the test.* The locking device shall be submitted to a test procedure to verify that insofar as construction and operation are concerned, it conforms to the requirements imposed by this standard.

It shall be checked in particular that the mechanical and electrical components of the device are of adequate size and that in the course of time the device does not lose its effectiveness, particularly through wear.

If the locking device is needed to satisfy particular requirements (waterproof, dust proof or explosion proof construction) the applicant shall specify this so that supplementary tests under appropriate criteria may be made.

The test described in this clause relates to locking devices of current design. In the case of construction presenting special characteristics or characteristics not provided for in this clause, modified tests may be carried out.

F.1.1.3 *Documents to be submitted.* The following documents shall be attached to the application for a type test.

MODEL TYPE-EXAMINATION CERTIFICATE

Name of the approved body . . . .

. . . .

. . . .

Type-examination certificate . . . .

. . . .

. . . .

. . . .

Type-examination No . . . .

1. Category, type and make or trade name . . . .
2. Manufacturer's name and address . . . .

   . . . .

   . . . .
3. Name and address of certificate holder . . . .

   . . . .

   . . . .
4. Date of submission for type-examination . . . .
5. Certificate issued on the basis of the following requirement . . . .

   . . . .
6. Test laboratory . . . .
7. Date and number of laboratory report . . . .
8. Date of type-examination . . . .
9. The following documents, bearing the type-examination number shown above, are annexed to this certificate . . . .

   . . . .
10. Any additional information . . . .

   . . . .

   . . . .

Place . . . .

(Date)

. . . .

(Signature)

F.1.1.3.1 *Schematic arrangement drawing with description of operation.* This drawing shall show clearly all the details relating to the operation and the safety of the locking device, including:

a) the operation of the device in normal service showing the effective engagement of the locking elements and the point at which the electrical safety device operates;

b) the operation of the device for mechanical checking of the locking position if this device exists;

c) the control and operation of the emergency unlocking device.

F.1.1.3.2 *Assembly drawing with key.* This drawing shall show all the parts which are important to the operation of the locking device, in particular those required to conform to requirements of this standard. A key shall indicate the list of principal parts, the type of materials used, and the characteristics of the fixing elements.

F.1.1.3.3 *The type (a.c. and/or d.c.) and the rated voltage and rated current.*

F.1.1.4 *Test samples.* Two samples, at least, of the locking device shall be provided, one for the test, the other to remain in the laboratory to allow comparisons to be made later if necessary.

If the test is carried out on a prototype, it shall be repeated later on a production model.

If the test of the locking device is only possible when the device is mounted in the corresponding door (for example, sliding doors with several panels or hinged doors with several panels) the device shall be mounted on a complete door in working order. However, the door dimensions may be reduced by comparison with a production model, on condition that this does not falsify the test results.

F.1.2 ***Examinations and tests***

F.1.2.1 *Examination of operation.* This examination has the aim of verifying that the mechanical and electrical components of the locking device are operating correctly with respect to safety, and in conformity with the requirements of this standard, and that the device is in conformity with the particulars provided in the application.

In particular it shall be verified that:

F.1.2.1.1 That there is at least 7 mm engagement of the locking elements before the electric safety device operates (**7.7.3.1.1**).

F.1.2.1.2 That it is not possible from positions normally accessible to persons to operate the lift with a door open or unlocked, after one single action, not forming part of the normal operation (**7.7.5.1**).

F.1.2.2 *Mechanical tests.* These tests have the purpose of verifying the strength of the mechanical locking components and the electrical components.

The sample of the locking device in its normal operating position is controlled by the devices normally used to operate it.

The sample shall be lubricated in accordance with the requirements of the manufacturer of the locking device.

When there are several possible means of control and positions of operation, the endurance test shall be made in the arrangement which seems the most unfavourable from the point of view of the forces on the components.

The number of complete cycles of operation and the travel of the locking components shall be registered by mechanical or electrical counters.

Examples

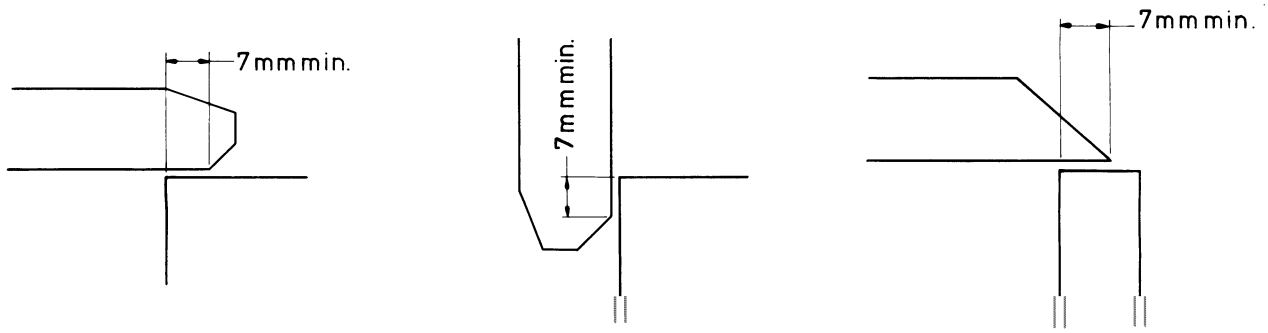


Figure 5

F.1.2.2.1 *Endurance test*

F.1.2.2.1.1 The locking device shall be submitted to 1 000 000 complete cycles (± 1 %) (one cycle comprises one forward and return movement over the full travel possible in both directions).

The driving of the device shall be smooth, without shocks, and at a rate of 60 cycles per minute (± 10 %).

During the endurance test the electrical contact of the lock shall *close* a resistive circuit under the rated voltage and at a current value double that of the rated current.

F.1.2.2.1.2 If the locking device is provided with a mechanical checking device for the locking pin or the position of the locking element, this decice shall be submitted to an endurance test of 100 000 cycles (± 1 %).

The driving of the device shall be smooth, without shocks, and at a rate of 60 cycles per minute (± 10 %).

F.1.2.2.2 *Static test.* For locking devices intended for hinged doors, a test shall be made consisting of the application over a total period of 300 seconds of a static force increasing progressively to a value of 3 000 N.

This force shall be applied in the opening direction of the door and in a position corresponding as far as possible to that which may be applied when a user attempts to open the door. The force applied shall be 1 000 N in the case of a locking device intended for sliding doors.

F.1.2.2.3 *Dynamic test.* The locking device, in the locked position, shall be submitted to a shock test in the opening direction of the door.

The shock shall correspond to the impact of a rigid mass of 4 kg falling in free fall from a height of 0.5 m.

F.1.2.3 *Criteria for the mechanical tests.* After the endurance test (**F.1.2.2.1**), the static test (**F.1.2.2.2**) and the dynamic test (**F.1.2.2.3**) there shall not be any wear, deformation or breakage which could adversely affect safety.

F.1.2.4 *Electrical test*

F.1.2.4.1 *Endurance test of contacts.* This test is included in the endurance test laid down in **F.1.2.2.1.1**.

F.1.2.4.2 *Test of ability to break circuit.* This test is to be carried out after the endurance test. It shall check that the ability to break a live circuit is sufficient. This test shall be made in accordance with the procedure in CENELEC HD 419 (IEC 158-1, mod) and CENELEC HD 420 (IEC 337-1, mod), the values of current and rated voltage serving as a basis for the tests shall be those indicated by the manufacturer of the device.

If there is nothing specified, the rated values shall be as follows:

a) alternating current 220 V, 2 A;
b) direct current 180 V, 2 A.

In the absence of an indication to the contrary, the capacity to break circuit shall be examined for both a.c. and d.c. conditions.

The tests shall be carried out with the locking device in the working position. If several positions are possible, the test shall be made in the position which the laboratory judges to be the most unfavourable.

The sample tested shall be provided with covers and electric wiring as used in normal service.

F.1.2.4.2.1 A.C. locking devices shall open and close 50 times, at normal speed, and at intervals of 5 to 10 s, an electric circuit under a voltage equal to 110 % of the rated voltage. The contact shall remain closed for at least 0.5 seconds.

The circuit shall comprise a choke and a resistance in series. Its power factor shall be 0.7 ± 0.05 and the test current shall be 11 times the rated current indicated by the manufacturer of the device.

F.1.2.4.2.2 D.C. locking devices shall open and close 20 times, at normal speed, and at intervals of 5 to 10 s, an electric circuit under a voltage equal to 110 % of the rated voltage. The contact shall remain cloded for at least 0.5 seconds.

The circuit shall comprise a choke and a resistance in series having values such that the current reaches 95 % of the steady-state value of the test current in 300 ms.

The test current shall be 110 % of the rated current indicated by the manufacturer of the device.

F.1.2.4.2.3 The tests are considered as satisfactory if no tracking or arcing is produced and if no deterioration occurs which could adversely affect safety.

F.1.2.4.3 *Test for resistance to leakage currents.* This test shall be made in accordance with the procedure in CENELEC HD 214 S2 (IEC 112). The electrodes shall be connected to a source providing an a.c. voltage which is practically sinusoidal at 175 V, 50 Hz.

F.1.2.4.4 *Examination of creep distances and air gaps*. The leakage paths and air gaps shall be in accordance with **14.1.2.2.2** and **14.1.2.2.3** of this standard and the check on their effectiveness shall be made in accordance with the procedure in the standard being prepared by IEC sub-committee 28A (at present Appendix B of IEC Publication 158-1).

F.1.2.4.5 *Examination of the requirements appropriate to safety contacts and their accessibility* (**14.1.2.2**). This examination shall be made taking account of the mounting position and the layout of the locking device, as appropriate.

F.1.3 ***Tests particular to certain types of locking devices***

F.1.3.1 *Locking device for horizontally or vertically sliding doors with several panels.* The devices providing direct mechanical linkage between panels according to **7.7.6.1** or indirect mechanical linkage according to **7.7.6.2** are considered as forming part of the locking device.

These devices shall be submitted in a reasonable manner to the tests mentioned in **F.1.2**. The number of cycles per minute in such endurance tests shall be suited to the dimensions of the construction.

F.1.3.2 *Flap type locking device for hinged door*

F.1.3.2.1 If this device is provided with an electric safety device required to check the possible deformation of the flap and if, after the static test envisaged in **F.1.2.2.2** there are any doubts on the strength of the device, the load shall be increased progressively until, following a permanent deformation of the flap, the safety device begins to open. The other components of the locking device or of the landing door shall not be damaged nor deformed by the load applied.

F.1.3.2.2 If, after the static test, the dimensions and construction leave no doubt as to its strength, it is not necessary to proceed to the endurance test on the flap.

F.1.4 ***Type examination certificate***

F.1.4.1 The certificate shall be drawn up in triplicate:

a) two copies for the applicant;

b) one copy for the laboratory.

F.1.4.2 The certificate shall indicate:

a) information according to **F.0.2**;

b) type and application of locking device;

c) the type (a.c. and/or d.c.) and values of rated voltage and rated current.

F.2 Landing doors (N.a.)

NOTE The study of a new test procedure and the choice of new criteria has been entrusted to a group at the European level, comprising, in particular, representatives of services for protection against fire in buildings and representatives of fire testing laboratories.

F.2.1 General provisions. These instructions have the object of defining test methods and of establishing criteria appropriate to lift landing doors, taking account of the factors peculiar to them and in particular the following:

a) that they shall, after installation, satisfy the requirements of this standard (clause **7**);

b) that the well will be constructed to comply with the requirements of this standard (clause **5**);

c) that it is the landing side only of the door which is likely to be directly exposed to fire;

d) that the doors are normally closed and locked and that in any case doors on different levels cannot be opened simultaneously.

F.2.2 ***Equipment***

F.2.2.1 *Furnace.* It shall be capable of subjecting the "landing" side of the sample to the heating conditions specified in ISO 834.

It shall be checked that the temperatures remain within the limits fixed by ISO 834.

Means shall be provided for maintaining the pressure conditions specified in **F.2.5.1**.

F.2.2.2 *Canopy.* A canopy of the shape and size shown in Figure 7 shall be used such that its underside is 500 mm (± 1 %) from the top edge of the opening for the door assembly in the test wall. The canopy shall be constructed of a steel frame and asbestos insulation board 20 mm (± 5 %) thick (density approximately 600 kg/m^3) on the top and the sides.

The canopy shall bear against the face of the wall containing the specimen door; all gaps between the wall and the canopy shall be sealed. Six thermocouples each consisting of wires having a diameter not exceeding 1 mm shall be used with the hot junctions located in conformity with Figure 9.

Porcelain tubes of a diameter not exceeding 8 mm shall be used where the thermocouples pass through the canopy. The hot junctions of the thermocouples shall be located 25 mm (± 5 %) below the lower surface of the top canopy with the porcelain tubes projecting not more than 10 mm (± 10 %) below this surface. The holes for the porcelain tubes shall be on an axis parallel to the front face of the canopy.

F.2.3 ***Test sample***

F.2.3.1 *Dimensions.* The test sample shall be a full size one.

F.2.3.1.1 The approval granted is valid automatically for door assemblies (**F.2.3.2**) with dimensions less than those of the door assemblies tested and for those with larger dimensions within the following limits:

a) width + 15 %;

b) height + 10 %.

F.2.3.1.2 In the case of door assemblies whose dimensions are greater than those of the furnace, the test sample shall be the largest possible compatible with the furnace.

On the basis of the test results and the construction of the door, the responsible authority will judge whether approval can be given to the full size door.

F.2.3.2 *Construction.* The test shall be carried out on a complete door assembly as will be used in the lift. This assembly shall comprise one or more panels, their frame and attachments to the main structure, the transom (if any), one or other fixed parts outside the frame (see note at the end of this clause), joints and joint covers, insulation elements (thermal or acoustic), means of suspension of the panels, closure, locking or unlocking, or operation (latch, handle and plate), the maximum electrical wiring to be used in normal application.

Metallic coatings need not be tested. Non-metallic coatings on the exposed face need not be tested if their thickness does not exceed 3 mm.

F.2.4 *Test procedure.* The test sample shall be exposed on its landing face to the conditions of heat specified in ISO 834.

The measurements and observations indicated below in **F.2.5** shall be carried out in the course of the test. The test shall be stopped when the criteria listed in **F.2.6** are satisfied or at a different stage of the test by prior agreement between the applicant and the laboratory.

F.2.5 ***Measurements and observations***

F.2.5.1 *Pressure of the furnace.* The static pressure in the furnace shall be measured, for example by using the static pressure probe detailed in Figure 8. The measurements of the static pressure shall be made at a minimum of three positions located along a vertical axis on one side of and close to the door assembly in line with the top and bottom edges of the clear opening and at one third of the height from the sill level as shown in Figure 7. The pressure shall be controlled so that a positive pressure is maintained over the upper two thirds of the door.

The maximum pressure at the top of the door shall be maintained as near as possible to 10 Pa.

F.2.5.2 *Temperature under the canopy.* The temperature of the gases below the canopy shall be measured by means of six thermocouples having bare junctions arranged and fixed as shown in Figure 7 and Figure 9. All necessary provisions shall be made to limit, in the proximity of the canopy, any turbulence liable to upset the results.

F.2.5.3 *Radiation from the non-exposed face*

F.2.5.3.1 *Measuring instrument*

a) The measurement of the radiation shall be carried out using a measuring instrument, without a lens, with a measuring angle of about 180°.

b) The measuring surface may not exceed 5 cm^2. The measuring instrument shall be kept at the ambient temperature by cooling it with water.

c) The temperature of the body of the instrument shall be equal to the ambient temperature ± 5 °C, with a minimum of 5 °C and a maximum of 30 °C.

d) The electrical conductors used for the various wiring shall be made from the same metal in order to avoid an unwanted thermocouple effect.

e) The instrument shall be provided with a calibration graph drawn up in W/cm^2 of radiation absorbed.

f) The coefficient of absorption shall be known and expressed as a percentage.

g) The instrument shall be calibrated regularly.

h) No objects shall be brought into contact with the radiation-sensitive surface, which shall be protected when not in use.

i) The radiation measurement shall be continuous.

j) The speed at which the recording sheet advances shall be known accurately and shall be at least 10 mm/min.

F.2.5.3.2 *Installation of the radiation measuring instrument.* The instrument shall be installed with its receiving surface parallel to the test piece and located at right angles to the centre of the lift entrance at a distance equal to half the diagonal of the entrance.

This distance is measured at right angles to the active surface of the instrument and the furthermost door panel.

F.2.5.3.3 *Radiation measurement*. The value of the radiation intensity at a distance of 1 m is calculated from the radiation intensity measured using the following formula:

$$W_1 = \frac{100}{a} \times F \times W_Z$$

where

W_1 is the radiation intensity at a distance of 1 m (W/cm^2);

a is the coefficient of absorption of the appliance (%);

W_Z is the radiation intensity measured at a distance equal to half the diagonal (W/cm^2);

F is a conversion factor derived from the graph in Figure 6.

In this graph, L represents the ratio between the smallest and largest dimensions of the entrance and Z the length of the diagonal (m).

F.2.6 *Criteria of performance*. Landing doors (and equivalent assemblies) shall satisfy the following criteria during a test of at least . . . minutes[12)].

F.2.6.1 *Integrity*

F.2.6.1.1 *Initial lack of integrity*. The average temperature of the six thermocouples of the canopy shall not exceed the initial temperature by more than . . . °C[12)] and no single thermocouple shall exceed it by more than . .°C[12)].

F.2.6.1.2 *Damage*. The door shall not have been damaged and its constituent parts shall continue to carry out the function of protection against falls into the well. The mechanical locking of the door shall be maintained. After the test, the door shall resist a force of 300 N applied horizontally at any point on the metal surfaces, this force being more or less perpendicular to the exposed face and distributed uniformly over a surface area of 5 cm^2 in the form of a circle or square.

F.2.6.2 *Insulation*

Radiation from the non-exposed face of the sample door. The average radiation received by the apparatus at a distance of 1 m from the non-exposed face shall never exceed . . . W/cm^2 [12)] during the test.

F.2.7 ***Certificate***

F.2.7.1 The certificate shall be drawn up in triplicate:

a) two copies for the applicant;

b) one copy for the laboratory.

F.2.7.2 The certificate shall indicate:

a) the name of the doormaker;

b) the type of door and its designation, if there is one;

c) the mark of the laboratory and the test number;

d) the dimensions of the door, details of its construction, materials employed, clearances and gaps between panels and frame;

e) the method of fixing the element tested to the walls of the well;

f) a description of glazing, if there is any;

g) description of electrical wiring incorporated in the door assembly being tested;

h) the results of the tests;

i) any other indication on the performance of the sample in the course of the test;

j) the type of instruments used to measure the radiation.

Note to F.2.3.2

The following are considered to form part of the door assembly:

a) the transom up to a maximum height corresponding to the height of free passage of the landing door plus 0.3 m[13)];

b) the side parts up to a maximum width $l_{max.}$ of:

1) sliding doors with central opening with several door panels:

$$l_{max.} = E + \frac{2E}{n_v} + 0.2 \text{ m}^{13)}$$

2) sliding doors with side opening with one or several door panel(s):

$$l_{max} = E + \frac{E}{n_v} + 0.4 \text{ m}^{13)}$$

where

E is the width of clear opening of the door (m);

n_v is the total number of panels of the door.

[12)] Under consideration.

[13)] It is good practice to consider that the material or the elements for closing the gap between the door itself and the structural opening of the building within a limit of 50 mm around the door should have the same fire resistance as the door itself to allow for building tolerances.

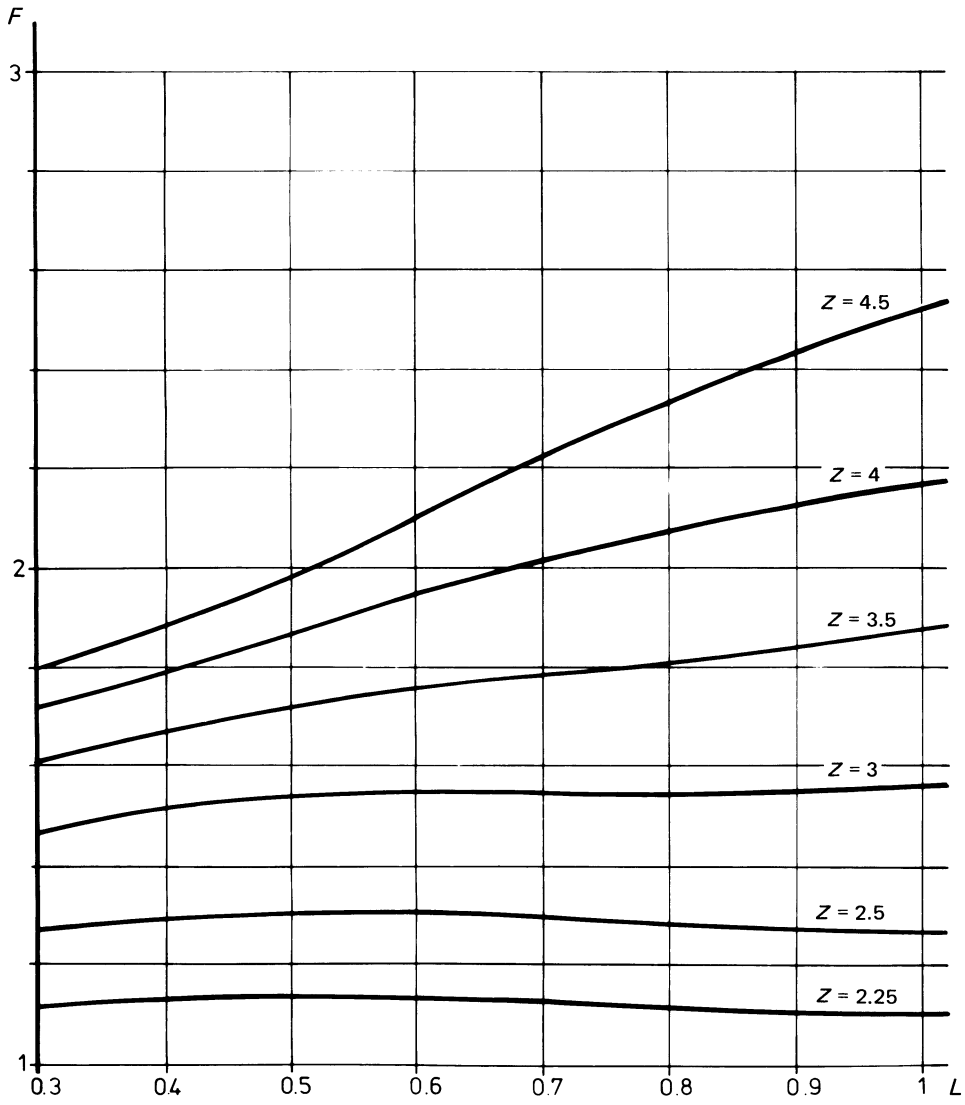


Figure 6 — Graph giving radiation conversion factor *F* (F.2.5.3.3)

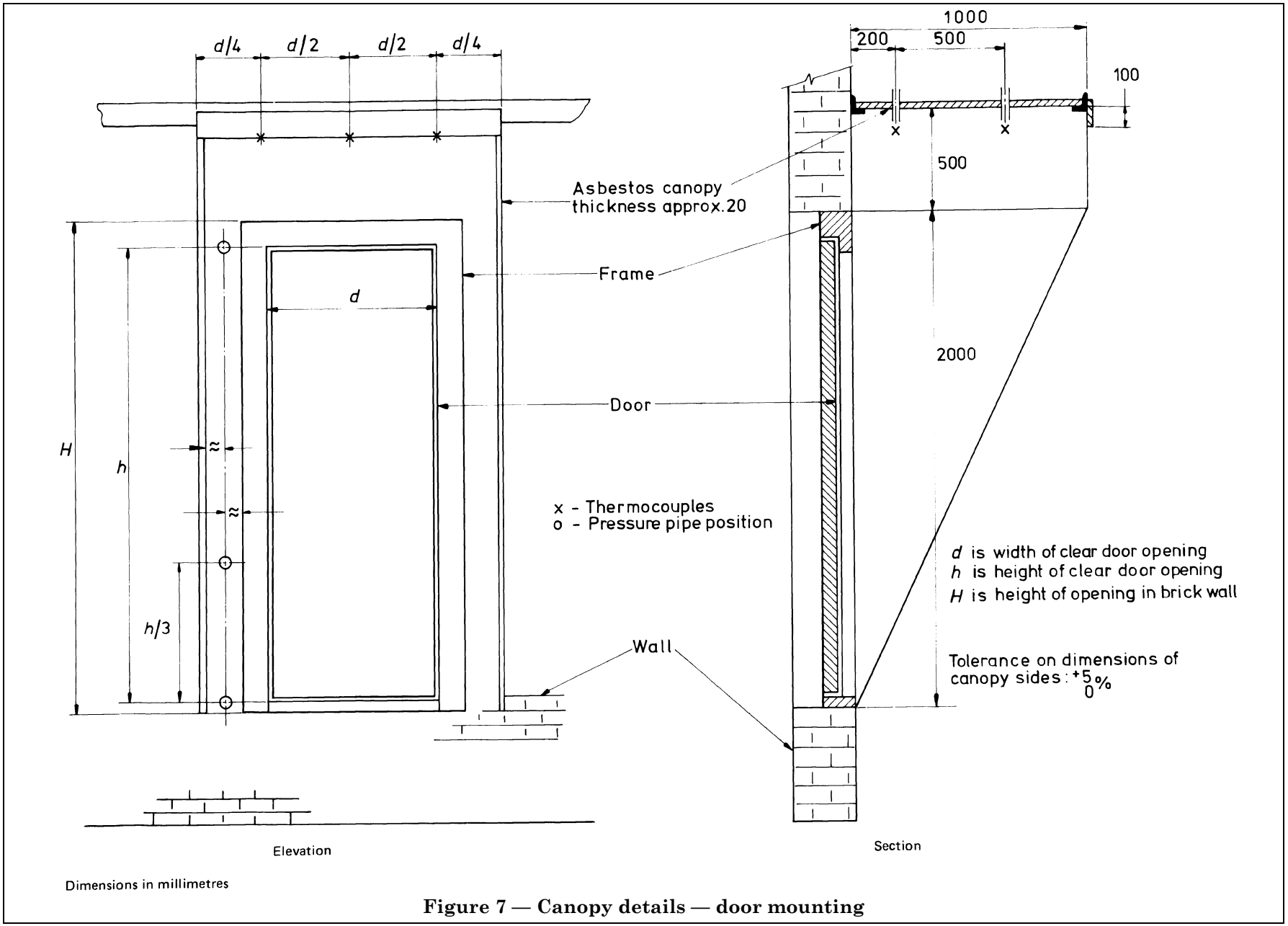


Figure 7 — Canopy details — door mounting

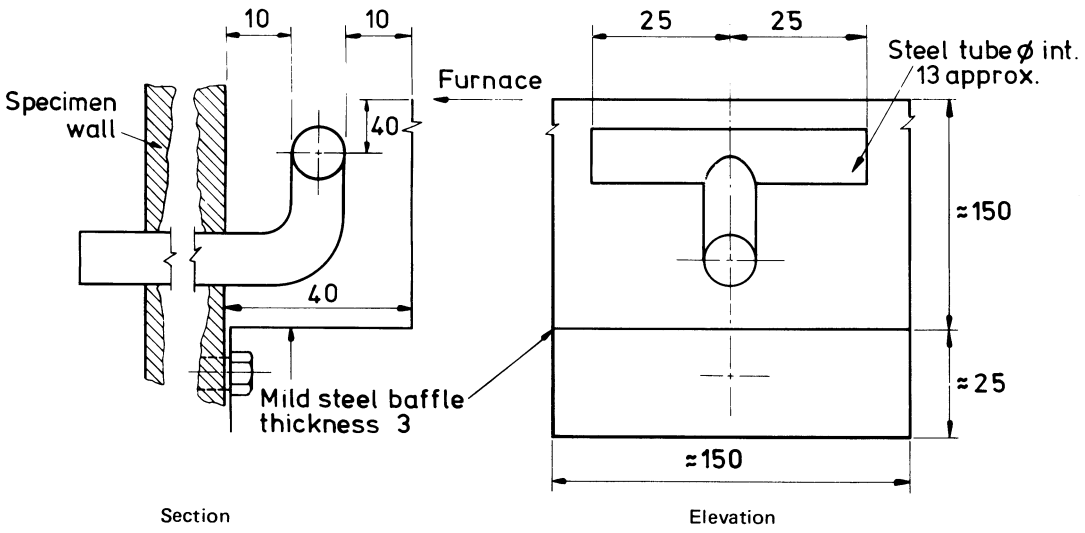
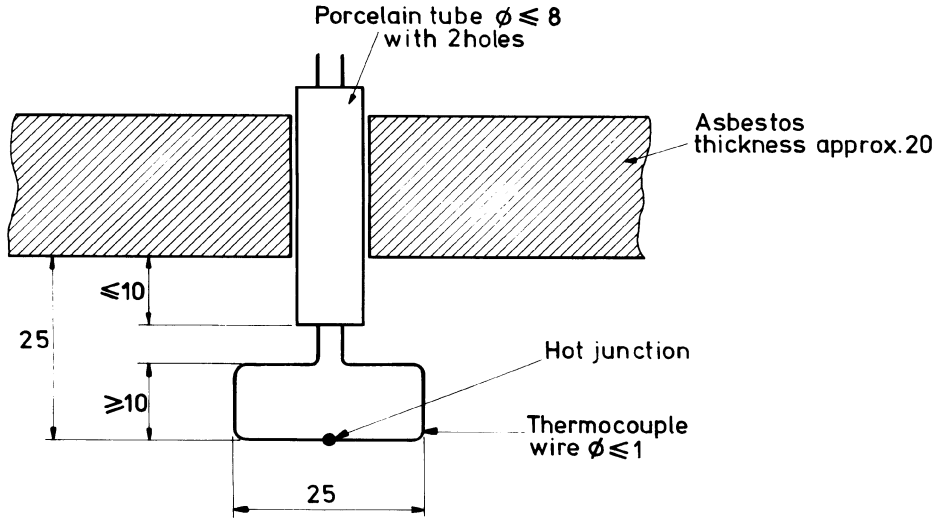
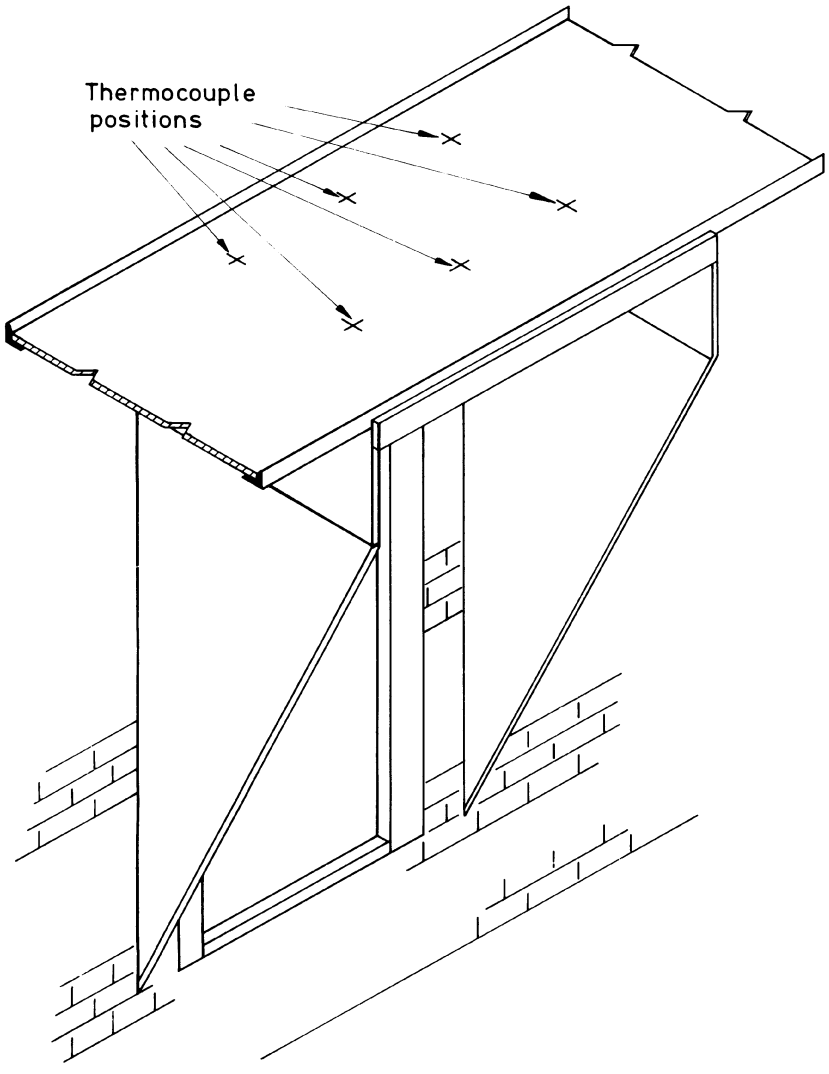


Figure 8 — Static pressure probe



Canopy thermocouple detail



Dimensions in millimetres

Figure 9 — Isometric view of canopy

F.3 Safety gear

F.3.1 General provisions. The applicant shall state the range of use provided, i.e.:

minimum and maximum total masses;

maximum rated speed and maximum tripping speed.

Detailed information shall be provided on the materials used, the type of guides and their surface condition (drawn, milled, ground).

The following documents are to be attached to the application:

a) detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components;

b) in the case of progressive safety gear, also a load diagram relating to elastic parts.

At the request of the laboratory these documents may be required in triplicate. The laboratory may likewise call for supplementary information which may be necessary to it for the examination and test.

F.3.2 ***Instantaneous safety gear***

F.3.2.1 *Test samples.* The laboratory shall be provided with two gripping assemblies with wedges or clamps and two lengths of guide rail.

The arrangement and the fixing details for the samples shall be determined by the laboratory in accordance with the equipment that it uses.

If the same gripping assemblies can be used with different types of guide, a new test shall not be required if the thickness of the guides, the width of the grip needed for the safety gear and the surface state (drawn, milled, ground) are the same.

F.3.2.2 *Test*

F.3.2.2.1 *Method of test.* The test shall be made using a press or similar device which moves without abrupt speed change. Measurements shall be made of:

a) the distance travelled as a function of the force;

b) the deformation of the safety gear block as a function of the force or as a function of the distance travelled.

F.3.2.2.2 *Test procedure.* The guide shall be moved through the safety gear.

Reference marks shall be traced onto the blocks in order to be able to measure their deformation.

a) The distance travelled shall be recorded as a function of the force.

b) After the test:

1) The hardness of the block and the gripping elements shall be compared with the original values quoted by the applicant.

Other analyses may be carried out in special cases.

2) If there is no fracture, deformations and other changes shall be examined (for example, cracks, deformations or wear of the jaws, appearance of the rubbed surfaces).

3) If necessary, photographs shall be taken of the block, the gripping elements and the guide for evidence of deformations or fractures.

F.3.2.3 *Documents*

F.3.2.3.1 Two charts shall be drawn up:

a) the first shall show the distance travelled as a function of the force;

b) the other shall show the deformation of the block. It shall be done in such a way that it can be related to the first chart.

F.3.2.3.2 The capacity of the safety gear shall be established by integration of the area of the distance-force chart.

The area of the chart to be taken into consideration shall be:

a) the total area if there is no permanent deformation;

b) if permanent deformation or rupture has occurred, either:

1) the area up to the value at which the elastic limit has been reached, or

2) the area up to the value corresponding to the maximum force.

F.3.2.4 *Determination of the total permissible mass*

F.3.2.4.1 *Energy absorbed by the safety gear*. The following symbols are used:

$(P + Q)_1$ = total permissible mass (kg) (definition of P and Q, see clause **4**);

v_1 = tripping speed of overspeed governor (m/s);

g_n = standard acceleration of free fall (m/s^2);

K, K_1, K_2 = energy absorbed by one safety gear block (J) (calculated in accordance with the chart)

A distance of free fall, calculated with reference to the maximum tripping speed of the overspeed governor fixed in **9.9.1** shall be adopted.

The distance of free fall shall be taken as:

$$h = \frac{v_1^2}{2g_n} + 0.10 + 0.03 \quad \text{(m)}$$

where

0.10 m corresponds to the distance travelled during the response time;

0.03 m corresponds to the travel during take-up of clearance between the gripping elements and the guides.

The total energy the safety gear is capable of absorbing:

$$2K = (P + Q)_1 \times g_n \times h$$

from which:

$$(P + Q)_1 = \frac{2K}{g_n \times h}$$

F.3.2.4.2 *Total permissible mass*

a) If the elastic limit has not been exceeded:

2 is taken as the safety coefficient. The total permissible mass (kg) will be:

$$(P + Q)_1 = \frac{K}{g_n \times h}$$

K is calculated by the integration of the area defined in **F.3.2.3.2** a).

b) If the elastic limit has been exceeded:

two calculations shall be made taking the one which is the more favourable to the applicant.

1) Calculate K_1 by the integration of the area defined in **F.3.2.3.2** b) 1).

2 is adopted as the safety coefficient and this will give the total permissible mass (kg) as:

$$(P + Q)_1 = \frac{K_1}{g_n \times h}$$

2) K_2 is calculated by the integration of the area defined in **F.3.2.3.2** b) 2). **3.5** is adopted as the safety coefficient, and this will give the total permissible mass (kg) as:

$$(P + Q)_1 = \frac{2K_2}{3.5 \times g_n \times h}$$

F.3.2.5 *Checking the deformation of the block and of the guide.* If too great a deformation of the gripping elements in the block or the guide might cause difficulty in disengaging the safety gear, the total permissible mass shall be reduced.

F.3.3 ***Progressive safety gear***

F.3.3.1 *Statement and test sample*

F.3.3.1.1 The applicant shall state for what mass (kg) and tripping speed (m/s) of the overspeed governor the test is to be carried out. If the safety gear has to be certified for various masses, he shall specify them and indicate in addition whether adjustment is by stages or continuous.

NOTE The applicant shall choose the suspended mass (kg) by dividing the anticipated braking force (N) by 16 to aim at an average deceleration of 0.6 g_n.

F.3.3.1.2 A complete safety gear assembly mounted on a cross-piece, with the dimensions fixed by the laboratory, together with the number of brake shoes necessary for all the tests shall be placed at the disposal of the laboratory. The number of sets of brake shoes necessary for all the tests shall be attached. For the type of guide used, the length specified by the laboratory shall also be supplied.

F.3.3.2 *Test*

F.3.3.2.1 *Method of test.* The test shall be carried out in free fall. Direct or indirect measurements shall be made of:

a) the total height of the fall;

b) the braking distance on the guides;

c) the sliding distance of the overspeed governor rope, or that of the device used in its place;

d) the total travel of the elements forming the spring.

Measurements a) and b) shall be recorded as a function of the time. The following shall be determined:

e) the average braking force;

f) the greatest instantaneous braking force;

g) the smallest instantaneous braking force.

F.3.3.2.2 *Test procedure*

F.3.3.2.2.1 *Safety gear certified for a single total mass.* The laboratory, shall carry out four tests with the total mass $(P + Q)_1$. Between each test the friction parts shall be allowed to return to their normal temperature.

During the tests several sets of friction parts may be used. However, one set of parts shall be capable of:

a) three tests, if the rated speed does not exceed 4 m/s;

b) two tests, if the rated speed exceeds 4 m/s.

The height of free fall shall be calculated to correspond to the maximum tripping speed of the overspeed governor for which the safety gear may be used.

The engagement of the safety gear shall be achieved by a means allowing the tripping speed to be fixed precisely.

NOTE For example, a rope may be used, the slack of which shall be carefully calculated, fixed to a sleeve which can slide with friction over a fixed smooth rope. The friction effort shall be the same as the effort applied to the operating rope by the governor attached to this safety gear.

F.3.3.2.2.2 *Safety gear certified for different total masses.* Adjustment in stages or continuous adjustment. A series of tests shall be carried out for the maximum value applied for and a series for the minimum value. The applicant shall supply a formula, or a chart, showing the variation of the braking force as a function of a given parameter.

The laboratory shall verify by suitable means (in the absence of anything better, by a third series of tests for an intermediary point) the validity of the proposed formula.

F.3.3.2.3 *Determination of the braking force of the safety gear*

F.3.3.2.3.1 *Safety gear certified for a single total mass.* The braking force of which the safety gear is capable for the given adjustment and the type of guide is taken as equal to the average of the average braking forces determined during the tests. Each test shall be made on an unused section of guide.

A check shall be made that the average values determined during the tests lie within a range of ± 25 % in relation to the value of the braking force defined above.

NOTE Tests have shown that the coefficient of friction could be considerably reduced if several successive tests were carried out on the same area of a machined guide. This is attributed to a modification in the surface condition during successive safety gear operations.

It is accepted that, on an installation, an inadvertent operation of the safety gear would have every chance of occurring at an unused spot.

It is necessary to consider that if, by chance, this were not the case, the braking force would have a lower value until an unused portion of guide surface was reached. Hence, greater sliding then normal.

This is a further reason for not permitting any adjustment causing too small a retardation at the beginning.

F.3.3.2.3.2 *Safety gear certified for different total masses.* Adjustment in stages or continuous adjustment.

The braking force of which the safety gear is capable shall be calculated as laid down in **F.3.3.2.3.1** for the maximum and minimum values applied for.

F.3.3.2.4 *Checking after the tests*

a) The hardness of the block and the gripping elements shall be compared with the original values submitted by the applicant. Other analyses may be made in special cases.

b) The deformations and modifications (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbing surfaces) shall be checked.

c) If necessary, the safety gear assembly, the gripping elements and the guides shall be photographed in order to reveal deformations or fractures.

F.3.3.3 *Calculation of the permissible total mass*

F.3.3.3.1 *Safety gear certified for a single total mass.* The permissible total mass is:

$$(P + Q)_1 \quad (\text{kg}) = \frac{\text{Braking force (F.3.3.2.3) (N)}}{16}$$

F.3.3.3.2 *Safety gear certified for different total masses*

F.3.3.3.2.1 *Adjustment in stages.* The permissible total mass shall be calculated for each adjustment as laid down in **F.3.3.3.1**.

F.3.3.3.2.2 *Continuous adjustment.* The permissible total mass shall be calculated as laid down in **F.3.3.3.1** for the maximum and minimum values applied for and in accordance with the formula proposed for the intermediate adjustments.

F.3.3.4 *Possible modification to the adjustments.* If, during the tests, the values found differ by more than 20 % from those expected by the applicant, other tests may be made with his agreement, after modification of the adjustments if necessary.

NOTE If the braking force is clearly greater than that allowed for by the applicant, the total mass used during the test would be clearly smaller than that which one would be led to authorize by calculation **F.3.3.3.1** and consequently the test would not allow the conclusion that the safety gear is able to dissipate the required energy with the total mass resulting from the calculation.

F.3.4 ***Comments***

a)

1) When it is applied to a given lift, the total mass stated by the installer shall not exceed the total permissible mass for the safety gear (for instantaneous safety gear or instantaneous safety gear with buffered effect), and the adjustment considered.

2) In the case of progressive safety gear, the total mass stated may differ from the permissible total mass defined in **F.3.3.3** by ± 7.5 %. It is accepted in these conditions that the requirements of **9.8.4** are met on the installation, notwithstanding the usual tolerances on the thickness of the guides, the surface conditions, etc.

b) To evaluate the validity of welded parts, reference shall be made to standards on this subject.

c) A check shall be made that the possible travel of the gripping elements is sufficient under the most unfavourable conditions (accumulation of manufacturing tolerances).

d) The friction parts shall be suitably retained so that it can be certain that they will be in place at the moment of operation.

e) In the case of a progressive type safety gear, it shall be checked that the travel of the components forming the spring is sufficient.

F.3.5 ***Type examination certificate***

F.3.5.1 The certificate shall be drawn up in triplicate:

a) two copies for the applicant;

b) one copy for the laboratory.

F.3.5.2 The certificate shall indicate:

a) information according to **F.0.2**;

b) type and application of safety gear;

c) the limits of the permissible total masses [see **F.3.4** a)];

d) the tripping speed of the overspeed governor;

e) the type of guide;

f) the permissible thickness of the guide blade;

g) the minimum width of the gripping areas;

and, for progressive safety gear only:

h) the surface condition of the guides;

i) the state of lubrication of the guides. If they are lubricated, the category and specification of the lubricant.

F.4 Overspeed governors

F.4.1 General provisions. The applicant shall indicate to the laboratory:

a) the type (or the types) of safety gear which will be operated by the governor;

b) the maximum and minimum rated speeds of lifts for which the governor may be used;

c) the anticipated value of the tensile force produced in the rope by the overspeed governor when tripped.

The following documents are to be attached to the application: detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components.

At the request of the laboratory these documents may be required in triplicate.

The laboratory may likewise call for supplementary information which may be necessary to it for the examination and test.

F.4.2 ***Check on the characteristics of the governor***

F.4.2.1 *Test samples.* There shall be submitted to the laboratory:

a) one overspeed governor;

b) one rope of the type used for the overspeed governor and in the normal condition in which it should be installed; the length to be supplied is fixed by the laboratory;

c) a tensioning pulley assembly of the type used for the overspeed governor.

F.4.2.2 *Test*

F.4.2.2.1 *Method of test.* The following shall be checked:

a) the speed of tripping;

b) the operation of the electric safety device called for in **9.9.11.1** causing the machine to stop, if this device is mounted on the overspeed governor;

c) the operation of the electric safety device called for in **9.9.11.2** preventing all movement of the lift when the overspeed governor is tripped;

d) the adherence of the rope in the overspeed governor pulley or the tensile force produced in the rope by the overspeed governor when tripped.

F.4.2.2.2 *Test procedure.* At least 20 tests shall be made in the speed range for tripping corresponding to the range of rated speeds of the lift, indicated in **F.4.1.2** b) above.

NOTE 1 The tests may be made by the laboratory in the component manufacturers works.

NOTE 2 The majority of tests shall be made at the extreme values of the range.

NOTE 3 The acceleration to reach the tripping speed of the overspeed governor shall be as low as possible, in order to eliminate the effects of inertia.

F.4.2.2.3 *Interpretation of the test results*

F.4.2.2.3.1 In the course of 20 tests the tripping speeds shall lie within the limits called for in **9.9.1**.

NOTE If the limits laid down are exceeded, an adjustment may be made by the manufacturer of the component and 20 new tests carried out.

F.4.2.2.3.2 In the course of the 20 tests the operation of the devices for which the test is required in **F.4.2.2.1** b) and **F.4.2.2.1** c) above shall occur within the limits laid down in **9.9.11.1** and **9.9.11.2**.

F.4.2.2.3.3 The tensile force in the rope produced by the overspeed governor when tripped shall be at least 300 N. or any higher value which is specified by the applicant.

NOTE 1 Unless otherwise requested by the manufacturer of the device and specified in the test report, the arc of engagement shall be 180°.

NOTE 2 In the case of a device which operates by gripping the rope it shall be checked that there is no permanent deformation of the rope.

F.4.3 ***Type examination certificate***

F.4.3.1 The certificate shall be drawn up in triplicate:

a) two copies for the applicant;

b) one copy for the laboratory.

F.4.3.2 The certificate shall indicate:

a) information according to **F.0.2**;

b) type and application of overspeed governor;

c) the maximum and minimum rated speeds of the lift for which the overspeed governor may be used;

d) the diameter of the rope to be used and its construction;

e) in the case of an overspeed governor with traction pulley, the minimum tensioning force;

f) the tensile force in the rope which can be produced by the overspeed governor when tripped.

F.5 Energy accumulation type buffers with buffered return movement and energy dissipation buffers

F.5.1 General provisions. The applicant shall state the range of use provided (maximum impact speed, minimum and maximum total masses). The following are to be attached to the application:

a) Detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components.

In the case of hydraulic buffers, the graduation (openings for the passage of the liquid), in particular, shall be shown as a function of the stroke of the buffer.

b) Specifications for the liquid used.

At the request of the laboratory these documents may be required in triplicate.

The laboratory may likewise call for supplementary information which may be necessary to it for the examination and test.

F.5.2 Samples to be submitted. There shall be submitted to the laboratory:

a) one buffer;

b) in the case of hydraulic buffers, the necessary liquid sent separately.

F.5.3 *Test*

F.5.3.1 *Energy accumulation type buffers with buffered return movement*

F.5.3.1.1 *Test procedure*

F.5.3.1.1.1 The mass necessary to compress the spring completely shall be determined, for example, with the aid of weights loaded on to the buffer.

C_r = mass needed to compress the spring completely (kg)

F_1 = total compression of the spring (m)

The buffer may only be used:

a) for rated speeds $v \leqslant \sqrt{\frac{F_1}{0.135}}$ (see **10.4.2.1**)

but $v \leqslant 1.6$ m/s (see **10.3.4**)

b) for total masses between

1) maximum $\frac{C_r}{2.5}$

2) minimum $\frac{C_r}{4}$

F.5.3.1.1.2 The buffer shall be tested with the aid of weights corresponding to the maximum and minimum total masses falling in free fall from a height above the released buffer equal to $0.5F_1 = 0.067\ v^2$.

The speed shall be recorded from the moment of impact on the buffer and throughout the test. At no time shall the rising speed of the weights (during return) exceed 1 m/s.

F.5.3.1.2 *Equipment to be used.* The equipment shall satisfy the following conditions.

F.5.3.1.2.1 *Weights falling in free fall.* The weights shall correspond, to within ± 1 %, to the minimum and maximum total masses. They shall be guided vertically with the minimum of friction possible.

F.5.3.1.2.2 *Recording equipment.* The recording equipment shall be capable of detecting signals which vary at a time of 0.01 s.

F.5.3.1.2.3 *Measurement of speed.* The speed shall be recorded with a tolerance of ± 1 %.

F.5.3.1.3 *Ambient temperature.* The ambient temperature shall lie between + 15 °C and + 25 °C.

F.5.3.1.4 *Mounting of the buffer.* The buffer shall be placed and fixed in the same manner as in normal service.

F.5.3.1.5 *Checking of the condition of the buffer after tests.* After two tests with the maximum mass, no part of the buffer shall show any permanent deformation or be damaged. Its condition shall guarantee normal operation.

F.5.3.2 *Energy dissipation buffers*

F.5.3.2.1 *Test procedure.* The buffer shall be tested with the aid of weights, corresponding to the minimum and maximum total masses, falling in free fall to reach at the moment of impact the maximum speed called for.

The speed shall be recorded at least from the moment of impact of the weights. The acceleration and the retardation shall be determined as a function of time throughout the movement of the weights.

NOTE This procedure relates to hydraulic buffers; for other types proceed by analogy.

F.5.3.2.2 *Equipment to be used.* The equipment shall satisfy the following conditions.

F.5.3.2.2.1 *Weights falling in free fall.* The weights shall correspond, to within ± 1 %, to the maximum and minimum total masses. They shall be guided vertically with the minimum of friction possible.

F.5.3.2.2.2 *Recording equipment.* The recording equipment shall be able to detect signals which vary in a time of 0.01 s. The measuring chain, including the recording device for the recording of measured values as a function of time, shall be designed with a system frequency of at least 1 000 Hz.

F.5.3.2.2.3 *Measurement of speed.* The speed shall be recorded from the moment of impact of the weights on the buffer or throughout the travel of the weights, with a tolerance of ± 1 %.

F.5.3.2.2.4 *Measurement of the retardation.* The device for measurement, if any, shall be placed as near as possible to axis of the buffer. The tolerance on the measurement is ± 2 %.

F.5.3.2.2.5 *Measurement of time.* Time pulses of a duration of 0.01 s shall be recorded. The tolerance on the measurement is ± 1 %.

F.5.3.2.3 *Ambient temperature.* The ambient temperature shall lie between + 15 °C and + 25 °C.

The temperature of the liquid shall be measured with a tolerance of ± 5 °C.

F.5.3.2.4 *Mounting of the buffer.* The buffer shall be placed and fixed in the same manner as in normal service.

F.5.3.2.5 *Filling of the buffer.* The buffer shall be filled up to the mark indicated following the instructions of the component manufacturer.

F.5.3.2.6 *Checks*

F.5.3.2.6.1 *Checking of retardation.* The height of free fall of the weights shall be chosen in such a way that the speed at the moment of impact corresponds to the maximum impact speed stipulated in the application.

The retardation shall conform to the requirements of **10.4.3.3** of this standard.

A first test shall be made with maximum mass with a check on the retardation.

A second test shall be made with minimum mass with a check on the retardation.

F.5.3.2.6.2 *Checking of the return of the buffer to the normal position.* After each test the buffer shall be held in the completely compressed position for 5 min. The buffer shall then be freed to permit its return to its normal extended position.

When the buffer is of a type with spring or gravity return, the position of complete return shall be reached in a maximum period of 120 s.

Before proceeding to another retardation test there shall be a delay of 30 min to permit the liquid to return to the tank and for bubbles of air to escape.

F.5.3.2.6.3 *Checking of the liquid losses.* The level of liquid shall be checked after having made the two retardation tests required in **F.5.3.2.6.1**, and after an interval of 30 min the level of liquid shall again be sufficient to ensure normal operation of the buffer.

F.5.3.2.6.4 *Checking of the condition of the buffer after tests.* After the two retardation tests required in **F.5.3.2.6.1** no part of the buffer shall show any permanent deformation or be damaged.

F.5.3.2.7 *Procedure in the case where the requirements of the test are not satisfied for the total masses appearing in the application.* When the test results are not satisfactory with the minimum and maximum total masses appearing in the application, the laboratory may, in agreement with the applicant, establish the acceptable limits.

F.5.4 ***Type examination certificate***

F.5.4.1 The certificate shall be drawn up in triplicate:

a) two copies for the applicant;

b) one copy for the laboratory.

F.5.4.2 The certificate shall indicate:

a) information according to **F.0.2**;

b) type and application of buffer;

c) the maximum impact speed;

d) the maximum total mass;

e) the minimum total mass;

f) the specification of the liquid and its temperature at the time of the test in the case of hydraulic buffers.

Appendix G Recommendations for fire protection (N.a, b)

G.1 Justification

The construction rules in relation to protection against fire vary from country to country.

Unfortunately, these rules have not yet been standardized either on the international level or even on the European level.

Although, at first sight, they do not seem to affect the construction of the lifts, they do, however, have a direct influence on:

a) the choice of landing doors;

b) the design and operation of electrical control systems.

It is necessary, therefore to draw the attention to those with local responsibility for laying down constructional criteria to the "lift combinations" corresponding to each of the structural arrangements, between which the choice appears to be restricted at the present time (see **7.2.2.3**).

G.2 General

G.2.1 The operation of a lift becomes uncertain if the temperature exceeds:

a) 40 °C in the machine or pulley room if the control equipment cubicles are located there;

b) 70 °C on the outer side of the landing doors or in the pulley room.

G.2.2 The operations described later on take these criteria into account and assume that devices will be installed to detect these increases in temperature or, in other cases, more generally the beginning of a fire. No responsibility for the detection should fall on the installer of the lifts, the signal should be sent to terminals in the machine room by others.

The signal shall have the following characteristics:

a) 100 V;

b) 1 A;

c) duration: a minimum of 10 s.

Smoke detectors shall, because of their sensitivity, never be associated with the operation of lifts.

G.2.3 Following certain accidents, some countries have tended to prohibit the use of lifts in all cases when a fire, wherever it may be, breaks out in a building.

This does not seem realistic and these accidents would not have been possible if the volume of the building had been partitioned reasonably and if precautions similar to those proposed below had been taken.

It seems useful to consider:

a) that it may not be desirable to interrupt the activities of a whole "tower" because of a localized fire;

b) that to cause the whole population of a tower to use the emergency staircases at every alert may lead to panic and bottle-necks preventing the rapid evacuation of the floors which are particularly threatened and interfere with the action of the firemen;

c) that it is necessary to consider the evacuation of the handicapped, or the old, especially when all the floors are not accessible by firemen's ladders.

Furthermore, the use of the lifts can only be allowed under the supervision of a person responsible for the safety services in the building.

G.3 Operations associated with the usual structural arrangements

G.3.1 The examples of structural arrangements considered are those which appear in Figure 2.

G.3.2 In all cases, upon detection of a temperature of 70 °C on the outer surface of the landing doors or 40 °C in the machine room, the lifts will be brought to the evacuation level to allow any passengers to leave. The re-opening devices will be made inoperative, except for the button in the car and any device to limit the force to 150 N. (See **7.5.2.1.1.1** and **8.7.2.1.1.1**).

G.3.3 Special precautions shall be taken to avoid practically all possibilities of fire at the evacuation level (absence or limiting of combustible materials).

G.3.4 This clause does not concern "firemen's lifts" which are dealt with in **G.4**.

G.3.5 ***Specific operations depending on the structural arrangement considered***

G.3.5.1 *Arrangement (1) (Figure 2)*

The wells form an air duct.

The landings are not isolated by fire-resisting doors.

In this case, the operation covered in **G.3.2** will also be activated by the detection of a fire anywhere in the building.

The lifts may not be used to evacuate the building.

G.3.5.2 *Arrangement (2) (Figure 2)*

The wells form an air duct.

However, the landings are isolated by means of "fire-resisting" doors.

G.3.5.2.1 On detection of a fire in a compartment other than that formed by the wells and their landings:

a) the "fire-resisting" doors of the corresponding storeys will close automatically if they are not normally in the closed position;

b) any despatch signals to send the lifts to these storeys will be cancelled and the corresponding buttons in the car made inoperative;

c) the occupants of the threatened storeys shall use the emergency staircases. The corresponding landing call buttons will be made inoperative.

G.3.5.2.2 If the evacuation of the building is decided by the body responsible for the safety services in the building, and if the lifts can be used for this purpose, the information shall be transmitted to the machine room in the form of a signal (**G.2.2**).

Then, according to local requirements:

a) either the lifts will be returned to the evacuation level and will be able to be used only when under the control of a responsible member of the safety services who has a special key, or

b) only the landing call buttons corresponding to the direction of evacuation and the car button corresponding to the evacuation level will remain operative.

Clearly, **G.3.2** still applies.

G.3.5.3 *Arrangement (3) (Figure 2).* This is a variation of arrangement (2).

People taken by surprise on the landing served by the lifts will also be able to use the emergency staircase in the case where the operation of the lifts has to be interrupted.

G.3.5.4 *Arrangement (4) (Figure 2)*

The lift wells form an air duct.

The lift doors are supplemented by additional "fire-resisting" doors.

This arrangement is a specific case of arrangement (2). Consequently, the operations specified in **G.3.5.2** apply, but

a) either the landing button boxes and signals shall be protected by "fire-resisting" doors, or

b) all the circuits leading to these boxes and signals shall be so designed that the operation of the lift is not compromised if they are affected by the fire.

It should be noted that arrangement (2) is preferable to arrangement (4), as in the latter case 70 °C will be reached quickly on the front of the landing doors and the lifts will have to be immobilized.

G.3.5.5 *Arrangements (5), (6), (7), (8) (Figure 2)*

The wells do not form an air duct because another shaft (for example, a free stair well) exists in parallel.

The landings are not isolated by "fire-resisting" doors.

In these cases, the operations specified in **G.3.5.1** are applicable.

In the case of arrangement (7) (lift adjoining a building), it shall be noted that if the well is completely closed by fire-resisting materials, it is necessary to consider that this is a case of (1), (2), (3) or (4), according to the arrangement of the landings and the "fire-resisting" doors.

If the external enclosure panels of the wells are made from materials which disintegrate under high temperatures without feeding the fire (e.g. thin glass,) it is possible, subject to the favourable opinion of the local authorities, to consider that this is the same as case (7) with the open well.

G.3.5.6 *Arrangement (9) (Figure 2)*

The wells do not form an air inlet because another shaft (e.g. a free staircase) exists in parallel.

The lifts, stairs and landings are housed together in the same protective cell.

In these cases the operations laid down in **G.3.5.2** are applicable.

G.4 "Firemen's lifts". Attention is drawn to the fact that, like other lifts, "firemen's lifts" cannot operate safely if the machine room, the pulley room, if any, or the landing doors are exposed to temperatures exceeding the limits indicated in **G.2.1**. The same applies if the landing doors and the landings are sprinkled with water. It is only possible by judicious arrangement of the building to avoid, in most cases, exposing these lifts to unacceptably high temperatures and to avoid having the water used to fight the fire flowing into the lift wells.

It appears that arrangement (9) or, even better, arrangement (3), are most suitable for a "firemen's lift", as, even if after the firemen have used the lift the temperatures at some point exceed the limits permitted for the operation of the lift, the firemen could still use the stairs.

The operations corresponding to arrangements (3) and (9) are applicable, but, in addition, a switch reserved for the fire service and intended for the priority calling of the lift shall be provided on the landing of the evacuation level close to the landing door. This switch shall be placed in a box, the front of which is glazed and bears the inscription "fire service". It ensures the priority recall of the car which, after its arrival at the evacuation level, shall operate without responding to "landing" calls. Having arrived at the specified level, it remains with its door open until a fresh despatch signal is registered in the car.

The rated load, the rated speed and the dimensions are fixed in local regulations. Current practice indicates that the available car area shall be not less than 1.4 m^2, that the rated load shall be at least 630 kg, that the speed shall be chosen so that the complete travel time does not exceed 60 s and that the width of free entry is a minimum of 0.8 m. It is necessary either for the "firemen's lift" to serve the evacuation level and all the levels or for several "firemen's lifts" (selected from different lift groups) to serve this evacuation level and some of the other levels so that all the "firemen's lifts" together allow access to all the levels of all the building divisions.

G.5 Automatic devices for protection against fire. The installation of "sprinklers" or any other such device in the lift wells (**5.8**) shall be prohibited. Nor would they be justified as the wells contain only very little combustible material. The wells themselves should be made from incombustible materials and have the fire resistance laid down in the local regulations.

On the other hand, in the machine room, automatic devices for fire fighting may be permitted in the following conditions (**6.1.2.3**):

a) they are provided for fires of electrical origin;

b) they have a high nominal operating temperature.

G.6 Ventilation — pressurization

In **5.2.3** and **6.3.5** of this standard it is indicated that the well and the machine room shall be ventilated. It is specified that the stale air coming from locations outside the lifts cannot be evacuated through the machine rooms, but, apart from that, the greatest latitude is left to the local rules governing the construction of buildings.

Unfortunately, opposing theories are put forward by different fire service organizations, some insisting for example on the need to evacuate through the machine room any gases and smoke which could enter the well, others recommending that the whole of the "cell" which contains the lifts which one wishes to keep operating should be kept at a high pressure.

Whatever the solution chosen, it is necessary to ensure that a large difference in pressure cannot occur between the well and the landing, as then the automatic operation of the sliding landing doors could no longer be guaranteed.

G.7 Normal supply — standby supply

G.7.1 This standard does not lay down that there should be an emergency supply and says nothing on what this emergency supply should be if there is one.

It is, however, probable that those responsible for the national fire services will wish, even in the case of the failure of the normal power supply, the following to be ensured:

a) minimum lighting;

b) ventilation, extraction of smoke or pressurization;

c) maintenance of the pressure in the fire ducts;

d) maintenance in service of the "firemen's lifts";

e) maintenance in service of all or some of the lifts and recall to the evacuation level of the lifts which are not maintained in service;

f) the alarm device.

It is recommended above all that the normal rising mains to the lift machine room should be protected against the action of fire.

G.7.2 If two external sources of supply are available, the second may, if necessary, be considered as the "standby supply".

If there is a standby supply:

a) it seems wise for the cables bringing the standby current to the machines to be clearly separated from those bringing the normal current;

b) it is necessary for the regenerative power which the lifts are capable of producing to be able to be absorbed;

c) it seems that the available power should, at the minimum, be able to ensure the operation of all the "firemen's lifts" and, either in succession or at the same time, that of the other lifts according to the solution chosen, this, of course, in addition to the lighting, the pumps and the ventilators.

G.8 Electrical operations on the standby supply in the case of fire

The possibilities of choice should be limited to one of the two following solutions:

a) automatic transfer to the standby supply and maintaining the "firemen's lifts" in operation, and automatic recall in succession of the other lifts to the evacuation level;

b) automatic transfer to the standby supply and maintaining the "firemen's lifts" in operation, automatic recall in succession of the other lifts to the evacuation level and return to service of the selected lifts.

G.9 Signalling — instructions

Adequate instructions should be provided *in the car* and *on each landing*, according to the arrangements chosen.

In addition, an external telephone system should allow supplementary instructions to be given to the passengers in the car and, if necessary, on the landings.

National appendix U Editorial errors in EN 81-1:1985

A number of errors in EN 81-1, which forms the basis of this British Standard have been noted. These errors, which are listed below, have been brought to the attention of the Secretariat of the relevant CEN Technical Committee.

a) *Clause* **3** *Definitions*. In line 2 of the definition of safety gear "drive" should be read as "device".

b) *Clause* **5.2.2.2.2**. In paragraph 2, line 4 "drive" should be read as "device".

c) *Clause* **10.6.1** *Drum drive lifts*. In the title and line 1 "Drum drive lifts" should be read as "Positive drive lifts".

d) *Clause* **13.2.2.3**. In line 2 the cross-reference to "**14.1.2.2.2**" should be read as "**14.1.2.2.3**".

e) *Clause* **13.6.2**. Paragraph 2, line 2 should be read as "either of type 2P + PE, 250 V, supplied directly".

f) *Clause* **14.2.1.4**. In line 2 "electric device" should be read as "electric safety device".

g) *Clause* **F.1.2.2.1.2**. In line 3 "decice" should be read as "device".

h) *Clause* **F.1.2.4.2.2**. In line 4 "cloded" should be read as "closed".

i) *Clause* **F.4.2.2.2**. In line 3 the cross-reference to **F.4.1.2** b) "should be read as **F.4.1** b)".

j) *Clause* **F.5.3.1.1.1** a). In line 1 the cross-reference to "**10.4.2.1**" should be read as "**10.4.1.1**".

k) *Clause* **F.5.3.1.2.2**. In line 2 "at" should be read as "in".

l) *Clause* **F.5.3.2.2.4**. In line 3 "axis" should be read as "the axis".

National appendix V National variations

V.1 Introduction

This national appendix provides, for Part 1 of EN 81, details of specific national variations that are permitted by **0.1.4** of the general introduction to EN 81 and which have been notified to EEC Commission and other member states.

The numbering i), ii), etc. is used in those subclauses of **V.3** where the textual reference covers more than one marginal encircled N mark.

V.2 General. Specific legislative requirements for "lifts and hoists" are embodied in the Factories Act, 1961 (Sections 22, 23, 25) and the Offices, Shops and Railway Premises (Hoists and Lifts) Regulations, 1968; these requirements are concerned primarily with the safety of persons making use of, or travelling in, lifts in the course of their employment in the particular premises. Unless otherwise stated, these requirements cover the national variations in **V.3**. Similar requirements apply to lifts in other types of premises covered by the Health and Safety at Work etc. Act, 1974.

V.3 Specific national variations

V.3.1 *Clause **0.6.2** i) and ii).* Allowance is not made in UK legislation for "authorized and instructed users". Any reference in this standard (EN 81-1) to "authorized and instructed users" is to be disregarded together with any requirements specifically associated with such users. In the UK it is considered that there shall be only one standard of safety for lifts.

V.3.2 *Clause **0.8.1.3***. Periodic thorough examinations only (**E.1** of Appendix E) are a statutory requirement in the UK under the legislation stated in **V.2**.

V.3.3 ***Clause 1.*** (Page *4*).

i) No national variation.

ii) No national variation.

NATIONAL NOTE 1 It is a statutory requirement in the UK that a safe place of work is always to be provided for nondomestic employees.

NATIONAL NOTE 2 Safety rules for powered home-lifts for the specific use of disabled persons in private residences are given in BS 5900.

iii) For new lifts installed in existing buildings and for important modifications, the conditions for implementation of this standard are given in BS 5655-11[14)].

V.3.4 *Clause **5.2.1** Specific case.* No national variation.

V.3.5 *Clause **5.2.2.3***. No national variation except the addition of the words "and fire resistance" after "mechanical strength" (to comply with Building Regulations).

V.3.6 *Clause **5.2.3.*** No national variation, except that different requirements for ventilating wells are included in Building Regulations and when the well is ventilated via the machine or pulley rooms, through trunking is to be used in accordance with the current UK practice.

V.3.7 *Clause **5.3** a).* These materials shall meet the requirements of the Building Regulations.

[14)] In preparation.

V.3.8 *Clause **5.6.1**.* In the second paragraph delete "above the floor of the pit" and substitute "above the lowest landing served" (National Committee requirement for safety).

NATIONAL NOTE Current UK practice requires that where a single lift is in its own well, its counterweight shall be guarded by means of a rigid screen extending from a position 0.3 m above the lift pit floor to a position at least 2.5 m above the lift pit floor (see BS 5655-6).

V.3.9 *Clause **6.1.2.2**.* Delete "1.8 m high" and substitute "2.14 m high" to comply with legislation stated in **V.2**.

V.3.10 *Clause **6.1.2.3*** b). No national variation.

V.3.11 *Clause **6.2.1**.* In the last paragraph, delete "1.8 m" and substitute "2.14 m" to comply with legislation stated in **V.2**.

V.3.12 *Clause **6.2.2**.* No national variation.

V.3.13 *Clause **6.3.1.3**.* No national variation.

V.3.14 *Clause **6.3.2.1** a).* The clear space in front of the panels or cabinets shall be 0.9 m by the full width of the panel or cabinet by 2.14 m high (in accordance with Electricity Regulations of 1908 and 1944).

V.3.15 *Clause **6.3.2.2**.* Delete "1.8 m" and substitute "2.14 m" to comply with legislation stated in **V.2**.

V.3.16 *Clause **6.3.3.1**.* No national variation.

V.3.17 *Clause **6.3.5.1**.* No national variation.

V.3.18 *Clause **6.4.2.2**.* No national variation.

V.3.19 *Clause **6.4.3.1**.* No national variation.

V.3.20 *Clause **7.2.2**.* In the absence of general international agreement on test methods the requirements for landing doors in the UK are stated in the Building Regulations.

V.3.21 *Clause **7.7.2.2** Specific case b).* This specific case is not legally permissible in the UK; the requirements shall be disregarded (see **V.3.1**).

V.3.22 *Clause **8.5.2**.* The entire text of **8.5.2** (and consequently of **11.3**) shall be disregarded; doorless cars are deprecated in current UK practice and are not acceptable in the UK as new installations.

V.3.23 *Clause **13.1.1.4**.* For information concerning CENELEC harmonization documents and equivalent British Standards see **W.2** of National appendix W.

V.3.24 *Clause **14.1.1.1** j).* No national variation.

V.3.25 *Clause **16.1.1**.* Not applicable to this British Standard. There is no current UK legislation requiring such a dossier.

V.3.26 *Clause **16.1.2**.* There are no such approved persons or organizations in the UK. Arrangements for examination and testing are normally agreed between lift contractor and customer (refer to BS 5655-10).

V.3.27 *Clause **16.1.3** i) and ii).* No national variation.

V.3.28 *Clause **16.2.2**.* There are no UK regulations requiring such a register. The National Committee recommends that a register should be lodged with the person(s) designated as immediately responsible for the lift by legislation relating to the particular circumstances.

V.3.29 *Clause **16.3**.* No national variation.

V.3.30 *Appendix C.* The entire appendix shall be disregarded; it is not applicable to this British Standard as there is no current UK legislation requiring such a dossier.

V.3.31 *Appendix D, **D.2** j) 2).* At present there are no requirements for testing safety gears, which comply with the standard, at higher speeds.

V.3.32 *Appendix E, **E.1**.* No national variation.

V.3.33 *Appendix E, **E.2**.* No national variation.

V.3.34 *Appendix F, **F.0.1.3**.* At present there are no officially approved test laboratories in the UK. A list of approved laboratories will be announced before the EEC Directive becomes effective.

V.3.35 *Appendix F, **F.2**.* The entire clause shall be disregarded; in the absence of general international agreement on test methods the requirements of the Building Regulations should apply.

V.3.36 *Appendix G.* In the absence of a national document agreed by UK fire experts, the National Committee recommends that Appendix G should be followed. Draft requirements are in preparation.

National appendix W Corresponding British Standards for International Standards and for CENELEC harmonization documents referred to

W.1 International Standards

Clause **2** of EN 81-1 lists a number of international standards that are referred to in the text of the standard. The only available corresponding British Standard is as follows:

International Standard	Corresponding British Standard
IEC 158(1970) Part 1	BS 5424 *Specification for control gear for voltages up to and including 1 000 V a.c. and 1 200 V d.c.* Part 1:1977 *Contactors* (Identical)

At present there are no corresponding British Standards for the following remaining International Standards to which reference is also made:

ISO 834:1975; this ISO standard did not receive UK approval. It is referred to in **F.2** of EN 81-1 but this clause is the subject of national variation **V.3.35** in National appendix V.

ISO 2532:1974; this ISO standard has received UK approval.

W.2 CENELEC harmonization documents

Clause **2** of EN 81-1 also lists a number of CENELEC harmonization documents that are referred to in the text of the standard. The available British Standards which include the requirements of these documents are as follows:

Harmonization document	British Standard
HD 21.S2	BS 6004 *Specification for PVC-insulated cables (non-armoured) for electric power and lighting and* BS 6500 *Specification for insulated flexible cords and cables*
HD 22.S2	BS 6007 *Specification for rubber-insulated cables for electric power and lighting and* BS 6500 *Specification for insulated flexible cords and cables*
HD 214.S2	BS 5901 *Method of test for determining the comparative and proof tracking indices of insulating materials under moist conditions* (also ≡ IEC 122)
HD 359 and HD 360	BS 6977 *Specification for insulated flexible cables for lifts and other flexible connections*
HD 419	BS 5424 *Specification for control gear for voltages up to and including 1 000 V a.c. and 1 200 V d.c.* Part 1. *Contactors* (also ≡ IEC 158-1 and -1A)
HD 420	BS 4794 *Specification for control switches (switching devices, including contactor relays, for control and auxiliary circuits, for voltages up to and including 1 000 V a.c. and 1 200 V d.c.)* Part 1. *General requirements* (also ≡ IEC 337-1 etc.)

At present there are no corresponding British Standards for harmonization documents HD 384.4.41 and HD 364-3:1977, to which reference is also made. HD 364-3:1977 has however received UK approval and similar information may be obtained by reference to BS 5490 “Specification for degrees of protection provided by enclosures”.

NOTE Copies of the above harmonization documents are obtainable from the BSI Sales Department.

National appendix X National alphabetical index

In this index references are to clause and appendix numbers. Any references found to have an encircled N against them in the text should be read in conjunction with the corresponding subclause of **V.3** in National appendix V.

[15] See **V.3.1** of National appendix V.

[16] See **V.3.1** of National appendix V.

National appendix Y
National committees responsible for this British Standard

The United Kingdom participation in the preparation of this European Standard was entrusted by the Mechanical Handling Standards Committee (MHE/-) to Technical Committee MHE/4 upon which the following bodies were represented:

Associated Offices Technical Committee
Association of County Councils
British Broadcasting Corporation
British Electrical and Allied Manufacturers Association (BEAMA)
British Lift Association
British Railways Board
British Retailers' Association
Bureau of Engineer Surveyors
Chartered Institution of Building Services
Consumer Standards Advisory Committee of BSI
Department of Health and Social Security
Department of the Environment (Building Research Establishment)
Department of the Environment (PSA)
Department of Trade and Industry (Mechanical and Electrical Engineering Division)
Department of Transport
Electrical, Electronic, Telecommunications and Plumbing Union
Engineer Surveyors Section of ASTMS
Federation of Wire Rope Manufacturers of Great Britain
Health and Safety Executive
Independent Engineering Insurers Committee
Institution of Mechanical Engineers
Institution of Production Engineers
London Regional Transport
Mechanical Handling Engineers Association
National Association of Lift Makers
Post Office
Royal Association for Disability and Rehabilitation
Scottish Development Department

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Publications referred to

This standard makes reference to the following publications, in addition to those listed in National appendix W

BS 5655, *Lifts and service lifts.*

BS 5655-6, *Code of practice for selection and installation*[17)].

BS 5655-10, *Specification for testing and inspection of electric and hydraulic lifts*[17)].

BS 5655-11, *Specification for modernization or reconstruction*[17)].

BS 5900, *Specification for powered homelifts*[17)].

[17)] Referred to in National appendix V

BS 5655-1: 1986
EN 81-1:1985

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

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