BS 5655-6:2011

BSI Standards Publication

Lifts and service lifts –

Part 6: Code of practice for the selection, installation and location of new lifts

Publishing and copyright information

ISBN 978 0 580 71811 3

ICS 91.140.90

The following BSI references relate to the work on this standard:
Committee reference MHE/4
Draft for comment 11/30229088 DC

Publication history

First published August 1985
Second edition, October 1990
Third edition, November 2002
Fourth (present) edition, November 2011

Amendments issued since publication

Date	Text affected

Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 76, an inside back cover and a back cover.

Foreword

Publishing information

This part of BS 5655 is published by BSI and came into effect on 30 November 2011. It was prepared by Technical Committee MHE/4, *Lifts, hoists and escalators*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 5655 supersedes BS 5655-6:2002, which is withdrawn.

Relationship with other publications

This part of BS 5655 should be read in conjunction with BS 7255, which gives recommendations for safe working on lifts that are additional to the features recommended in this part of BS 5655 and are applicable when installing, examining, inspecting, testing, servicing, repairing, dismantling and demolishing permanent lift installations.

This part of BS 5655 paraphrases many of the requirements specified in all other relevant standards (listed in the bibliography). This indicates what information is to be exchanged between the interested parties and the sequence of events from the preliminary planning stage to the putting into service of the installation.

Lifts selected in accordance with Clause **11** are generally suitable for use by persons with impaired mobility. It might be necessary to specify additional features to suit certain disabilities (details can be found in BS 8300 and BS EN 81-70). Subject to certain limitations, the provision of vertical access for persons with impaired mobility can be achieved by the provision of powered lifting platforms.

Information about this document

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

- the clauses on technology have been updated;
- energy efficiency considerations have been included;
- the annexes have been updated and three new annexes have been included covering traffic control systems, energy efficiency and the principal requirements in the provision of lifts for persons with impaired mobility.

Use of this document

As a code of practice, this part of BS 5655 takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this part of BS 5655 is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

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

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

Contractual and legal considerations

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

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

1 Scope

This part of BS 5655 gives recommendations for the selection, installation and location of new passenger and passenger/goods lifts in the classifications given in Table 1. It also gives recommendations for issues relating to the selection and installation of lifts, such as building design.

This part of BS 5655 is applicable only for the early stages of a project for clients, architects, principal contractors, building owners, building managers, developers, general and specialized engineering consultants, lift contractors and other interested parties.

Table 1 **BS ISO 4190-1 and BS ISO 4190-2 classification of lifts**

Class	Purpose
Class I	Lifts designed for the transport of persons
Class II	Lifts designed mainly for the transport of persons but in which goods may be carried
Class III	Lifts designed for health care purposes, including hospitals and nursing homes
Class IV	Lifts designed for the transport of goods that are generally accompanied by persons
Class VI	Lifts designed to suit buildings with intensive traffic, i.e. lifts with speeds of 2.5 m/s and above

This part of BS 5655 does not give recommendations for existing lift installations.

NOTE Although this part of BS 5655 does not give recommendations for existing installations, it may be used as guidance when making alterations to such installations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476 (all parts), *Fire tests on building materials and structures*

BS 1363-2, *13 A plugs, socket-outlets, adaptors and connection units – Part 2: Specification for 13 A switched and unswitched socket-outlets*

BS 2853, *Specification for the design and testing of steel overhead runway beams*

BS 5606:1990+A1:1998, *Guide to accuracy in building*

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

BS 6440, *Powered vertical lifting platforms having non-enclosed or partially enclosed liftways intended for use by persons with impaired mobility – Specification*

BS 7255, *Code of practice for safe working on lifts*

BS 7375, *Distribution of electricity on construction and demolition sites – Code of practice*

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

BS 8300, *Design of buildings and their approaches to meet the needs of disabled people – Code of practice*

BS 8486-1, *Examination and test of new lifts before putting into service – Specification for means of determining compliance with BS EN 81 – Part 1: Electric lifts*

BS 8486-2, *Examination and test of new lifts before putting into service – Specification for means of determining compliance with BS EN 81 – Part 2: Hydraulic lifts*

BS 9999, *Code of practice for fire safety in the design, management and use of buildings*

BS EN 81 (all parts), *Safety rules for the construction and installation of lifts*

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

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

BS EN 60269 (all parts) [BS 88 (all parts)], *Low-voltage fuses*

BS EN 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

BS ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

BS ISO 3864-3, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for graphical symbols for use in safety signs* [1)]

BS ISO 4190 (all parts), *Lift (Elevator) installation*

BS ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*

3 Terms and definitions

For the purposes of this part of BS 5655 the following terms and definitions apply.

3.1 balancing weight
mass that saves energy

3.2 car
part of a lift that carries passengers and/or other loads

NOTE Referred to as a "carrier" in The Supply of Machinery (Safety) Regulations 2008 [1].

3.3 CDM co-ordinator
person who advises and assists the Client to co-ordinate heath and safety aspects of a notifiable project

NOTE The CDM co-ordinator is also the duty holder under the Construction (Design and Management) (CDM) Regulations 2007 [2].

3.4 client
person who seeks the services of another to carry out a construction project or carries out the project themselves

NOTE The client is also the duty holder under the CDM Regulations 2007 [2].

[1)] In preparation.

3.5 contractor
person (including a client, principal contractor, lift contractor) who carries out or manages construction work

NOTE The contractor is also the duty holder under the CDM Regulations 2007 [2].

3.6 control system
system that controls the manner in which the lift and doors operate

3.7 counterweight
mass that ensures traction

3.8 designer
person (including a client, principal contractor or a lift contractor) who prepares or modifies a design or who arranges or instructs any person to do so

NOTE The designer is also the duty holder under the CDM Regulations 2007 [2].

3.9 entrance
complete landing door assembly, together with its surround

3.10 firefighters lift
lift designated to have additional protection, with controls that enable it to be used under the direct control of the fire brigade in fighting a fire

3.11 fire resistance
ability of a component or construction of a building to satisfy, for a stated period of time, some or all of the appropriate criteria specified in BS 476 (all parts)

3.12 goods/passenger lift
lift intended mainly for the transport of goods, which are generally accompanied by persons

3.13 group of lifts
two or more lifts that are electrically inter-connected

3.14 levelling
operation that improves the accuracy of stopping at landings

3.15 lift contractor
party that is contracted to supply and install the lift(s)

3.16 owner
legal entity having right of possession of a lift and responsibility for its safe working

NOTE The owner is usually the landlord or proprietor of the building in which a lift is situated.

3.17 machinery space
space inside or outside a well where the machinery, as a whole or in parts, is placed

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

3.19 machine-room-less lift
passenger or goods/passenger lift, which does not require a separate machine room and where the machine is generally located in the well and the control panel is integrated into the wall of the well

NOTE A machine-room-less lift is commonly referred to as an MRL lift.

3.20 notified body
body appointed to carry out one or more of the conformity assessment procedures

3.21 observation lift
lift that provides a panoramic outlook

NOTE The well for such a lift can be partially enclosed.

3.22 passenger
person transported by a lift in the car

3.23 principal contractor
person appointed by the client, who carries out or manages construction work

NOTE 1 The principal contractor is also the duty holder under the CDM Regulations 2007 [2].

NOTE 2 The principal contractor is commonly referred to as the "main contractor".

3.24 pulley room
room, not containing a lift machine, in which pulleys are located

NOTE This room can also contain other equipment, such as the overspeed governor(s) and electrical equipment associated with a lift.

3.25 pulley space
space inside or outside a well where pulleys are placed

3.26 putting into service
making available for use a lift that has undergone examinations and tests

3.27 rated load
load which the equipment has been designed to carry

3.28 rated speed
speed at which the equipment has been designed to operate

3.29 re-levelling
operation, after the lift has stopped, to permit the stopping position to be corrected during loading or unloading, if necessary by successive movements

3.30 starts per hour (electric traction lifts)
number of times during 1 h that the drive motor is energized in order for the lift to travel between any two floors in either direction

3.31 starts per hour (hydraulic lifts)
number of times during 1 h that the pump motor is energized in order for the lift to travel between any two floors in the upwards direction

3.32 user
person making use of the services of a lift installation

NOTE A user is not necessarily the same as a passenger.

3.33 well
space in which the car, the counterweight or the balancing weight travels

NOTE This space is normally bounded by the bottom of the pit, the walls and the ceiling of the well.

4 Contract and project guidance

4.1 Exchange of information

NOTE 1 Lifts are classified in BS ISO 4190 (all parts); see Table 1.

Although the rated load can range from 320 kg to 2 500 kg and the rated speed can range from 0.4 m/s to 1.0 m/s for hydraulic lifts and 0.63 m/s to 6.00 m/s for electric traction lifts, the lift contractor should establish the clients requirements at an early stage. If rated loads and/or rated speeds outside these ranges are required, they should be discussed in detail between the lift contractor and the client's representative.

If the projected lift installation is one of the arrangements described, the preliminary plan for the installation, in particular the traffic sizing (see Clause **6**), should be established, and general planning details should be determined by the architect, or any person assuming such function. The details for a lift system installation should be finalized at the earliest possible stage. Before an order is finalized, a detailed investigation should be completed (see **A.1**), after which the client's representative should reach an agreement with the principal contractor.

NOTE 2 Attention is drawn to the requirements of the Lifts Regulations 1997 [3] and the CDM Regulations 2007 [2].

*NOTE 3 A typical checklist for the exchange of information is given in **A.1**.*

4.2 Lift invitation to tender

4.2.1 General

The client's representative should issue an invitation to tender and allow a period of two weeks to six weeks for the lift contractors to tender.

4.2.2 Tender documents

The tender documents should state each particular project's details and include items that are relevant to the lift work of the particular project in accordance with **A.2**. They should also state the standards to which equipment should conform to.

Lifts to be installed in new buildings should conform to BS EN 81-1 and BS EN 81-2.

NOTE 1 Attention is particularly drawn to the Lifts Regulations 1997 [3] with regard to new lifts.

New lifts in existing buildings should conform to BS EN 81-1:1998+A3, **5.7.1** and **5.7.3** and BS EN 81-2:1998+A3, **5.7.1** and **5.7.2**. Where building restrictions, or special types of load, preclude the use of such lifts, additional data should be included in the tender documents as necessary (see **5.9**).

NOTE 2 Attention is drawn to the Lifts Regulations 1997 [3], which require a Design Examination Certificate to be obtained under certain circumstances.

4.2.3 Additional items for tender documents

4.2.3.1 General

The tender documents should indicate if any additional items beyond those specified in BS EN 81-1:1998+A3 and BS EN 81-2:1998+A3 are included, such as the dismantling of an existing lift, vision panels, forced ventilation, landing architrave, level of fire resistance, any special controls, firefighters lifts and designations (see **7.2.3**) and any temporary or beneficial use (see **4.5.4**).

Where applicable, the principal contractor should specify the building construction for the well and machine room, provide notes on possible fixings for guides, etc., and indicate any special installation method for the lift that might be required on system building sites (see **4.5.3**).

NOTE 1 This can necessitate agreement between the principal contractor and the lift contractor before a tender can be submitted.

NOTE 2 Annex B gives guidance regarding interface fixings for steel-framed buildings.

Particular consideration should be given to lifts that are to be installed in adverse conditions, e.g. chemical works, lifts used with power trucks and lifts used in vandal-prone situations (see BS EN 81-71:2005) and similar applications. The necessary measures to be provided to deal with these environments should be specified in the tender documents.

4.2.3.2 Finishes

Finishes should be specified in the tender documents (see also **4.3.5**). The provision of architraves, or finish surrounds for doors, should be the agreed between the lift contractor and the client’s representative.

NOTE A list of possible finishes is given in ***A.2.2****.*

4.2.3.3 Other items

A number of other items are associated with a lift installation, of which some should be provided by the principal contractor and some should be provided by the lift contractor. The limits of responsibility should be understood by all parties and clearly set out in the tender documents, particularly with respect to design and build projects.

NOTE Details of the items typically supplied by the lift contractor are given in ***A.2.3*** *and details of the items typically supplied by the principal contractor are given in* ***A.2.4****.*

4.2.3.4 Inserts

Depending on the construction methods used, inserts for attaching equipment might be required and the builder should have primary responsibility for the supply and installation of inserts. Before a tender is offered, the builder and the lift contractor should agree the exact specification and set it out in the enquiry documents, particularly with respect to dimensions and tolerances (see Annex B).

4.2.3.5 Building contract programme

The tender documents should indicate, as accurately as possible, the building contract programme as it affects the lift contractor, and a mutually acceptable programme should be agreed.

NOTE Attention is drawn to the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 [4] and to local regulations and byelaws with regard to access, storage and cranage facilities.

4.2.4 Pre-construction information

NOTE 1 Attention is drawn to the CDM Regulations 2007, Regulation 17(1) [2], which requires the client to provide the CDM co-ordinator with health and safety information relating to the project.

Pre-construction information should be provided by the client to designers and contractors as part of the bidding process and planning work. It should contain project specific health and safety information to enable the identification of hazards and risks associated with the lift design and construction work; these should include:

a) description of the project;

b) client's considerations and management requirements;

c) environmental restrictions and existing on-site risks;

d) significant design and construction hazards;

e) description of the health and safety file.

NOTE 2 Attention is drawn to the Approved Code of Practice to the CDM Regulations, Appendix 2 [5], which details the pre-construction information required.

4.2.5 Tender submissions

Tender submissions should be returned to the person issuing the invitation to tender, and should include all requested information (see **4.2.2**), additional items (see **4.2.3**) to support the tender bid.

Tender submissions should clearly state all assumptions made and deviations proposed.

Any information regarding the health and safety of any person carrying out the construction work or information that might justify a revision of the construction phase plan should be included. The level of detail of the information should be proportionate to the risks involved in the project.

NOTE Attention is drawn to the Control of Asbestos Regulations 2006, r4(9)(c) [6].

4.3 Acceptance of tender and subsequent procedure

*COMMENTARY ON **4.3***

*The procedure indicated in **4.3.1**, **4.3.2**, **4.3.3**, **4.3.4**, **4.3.5** and **4.3.6** relates to the most common case, where the lift contractor is a contractor under the CDM Regulations 2007 [2].*

4.3.1 Order

The principal contractor, other contractor or client should place an order with the selected lift contractor. If alternative schemes have been offered, the order should clearly indicate which has been accepted.

4.3.2 Lift contractor's programme

At the time of order, the lift contractor's programme for manufacture and installation of the lift should be agreed. The lift contractor's programme should cover each lift separately and should indicate the dates when:

a) the order was placed;

b) the lift site is to be ready for work to start;

c) the provision of lift electricity supplies is needed;

d) the lift should be completed;

e) handover and CE marking is to be done.

The period between order and delivery of materials should fall into two stages:

1) the finalizing of details; and

2) the actual production of the equipment, which is dependent on the first stage.

Within the first stage, other dates should be considered, such as when:

i) all relevant building information is to be available;

ii) the builders' drawings, prepared by the lift contractor, is to be available;

iii) the layout drawings is to be approved;

iv) the finishes are to be finally accepted and approved.

*NOTE For additional information relevant to programming the site work, see **4.4** and **4.5**.*

4.3.3 Drawings

After the order has been placed, the lift contractor should supply drawings that show the builders' work required, the point loadings and machine room layouts, etc., giving minimum dimensions and tolerances. To enable these to be prepared, the client's representative should provide the lift contractor with the relevant detailed building plans.

4.3.4 Approval of drawings

The client's representative should give written approval of the drawings (referred to in **4.5.3**) that are submitted by the lift contractor (after modification, if necessary, and within the limitations of the information provided). At the same time, the client's representative should obtain any additional copies that might be needed for distribution to other concerned parties.

4.3.5 Selection of finishes

Decisions regarding the client's choice of finishes (see **4.2.3.2**), such as architrave finishing, decorative features, decorative finishes, colours, etc., should be communicated by the client's representative to the lift contractor no later than when the drawings are approved.

NOTE 1 Delays in these decisions can adversely affect the completion of the contract.

*NOTE 2 Attention is drawn to the Equality Act 2010 [7]. Also see Clause **11** and **C.3**.*

4.3.6 Electricity supplies to lift

The lift contractor should provide the client's representative with details in the tender return documents of the electrical power supply needed to install the lift.

A permanent power supply (at 400 V $^{+10}_{-5}$ %) should be provided for final commissioning and testing.

If a permanent supply is not available, a temporary supply should be provided that is equivalent to the permanent supply.

NOTE If an electrical supply is not available when needed, this can cause additional works and delays.

4.4 Coordination of site work

4.4.1 Pre-construction and site meetings

On large sites regular meetings should be held to ensure the successful progress of site work and full cooperation between all parties.

Programmes for the construction work (taking place in the part of the building containing the lift) should only be made following consultation between all parties concerned. Critical dimensional tolerances (see **5.2**) should be fully discussed at this stage; correction after wells have been formed can result in time delays.

4.5 Construction phase plan and health and safety file

4.5.1 Construction phase plan

NOTE Attention is drawn to the CDM Regulations 2007, Regulation 23 [2], and Approved Code of Practice to the CDM Regulations, Appendix 3 [5], for details on the construction phase plan.

The principal contractor is responsible for drawing up the construction phase plan, which should be prepared before work commences, has been developed in discussion with the lift contractor and other affected contractors and kept up-to-date as the work progresses. The construction phase plan should include:

a) a description of the work;

b) management of the work;

c) arrangements for controlling significant site risks;

d) management of the health and safety file;

e) details of the lift contractors work for inclusion in this plan. The level of detail of the information should be proportionate to the risks involved in the project.

4.5.2 Health and safety file

NOTE 1 Attention is drawn to the CDM Regulations 2007, Regulation 14 [2], which require the client to appoint a CDM coordinator to produce a health and safety file. The Approved Code of Practice to the CDM Regulations [5] gives further details on the contents of the health and safety file.

The production of the health and safety file should, at least, include the following information:

a) a record or "as built" drawings and plans to be used throughout the construction phase;

b) general details of the construction methods and materials used;

c) details of the equipment and maintenance facilities;

d) maintenance requirements, including cleaning;

e) manuals produced by specialist contractors;

f) details of the location and nature of services, including emergency and fire-fighting systems.

During the construction phase the principal contractor and other contractors should provide all relevant information to the CDM coordinator to enable the file to be reviewed, amended or additions made.

NOTE 2 The health and safety file alerts persons to the risks to be managed during the repair, service, renovation or demolition of the structure and plant after the lift has been put into service.

4.5.3 Preparatory work on site

The lift contractor should make periodic visits to the site before the starting date to check progress on the well construction and discuss relevant matters with the principal contractor. The lift contractor should check that all building work has been carried out in accordance with the agreed dimensions in **5.2**. Immediately before the lift installation is to start, the lift contractor should check that site conditions are fit to permit the installation to proceed.

*NOTE A typical list of preparatory work is given in **A.3**.*

In certain system buildings and buildings of over ten floors, it can be necessary, by prior agreement, to start erection before the top portion of the well has been constructed, in which case the contractor should temporarily deck out and waterproof. This is a special condition that should be included in the pre-tender health and safety plan [see **4.2.4**e) and **4.5.8**] and should be specified at the time of the tender enquiry.

4.5.4 Delivery of material

The lift contractor should advise the principal contractor when equipment is ready for dispatch. The principal contractor, in consultation with the lift contractor, should make arrangements on site to receive and unload the equipment with appropriate hoisting tackle, slings, supports, etc, as near as possible to the well.

4.5.5 Storage and protection

Provision should be made by the principal contractor for storing, protecting and preserving against loss, deterioration or damage, all material on the site.

NOTE Attention is drawn to the adverse effect of damp conditions on electrical equipment, steel wire ropes and guide rails.

Lift equipment should receive a protective coat of paint at the works before dispatch to site. A finishing coat should either be applied on site or applied at the works with retouching carried out on site where necessary. If there is any additional painting to be done due to adverse site conditions and damage to decorative finishes, this should be subject to separate negotiation between the lift contractor and the client.

4.5.6 Services of other trades

Where the lift contractor requires the services of joiners, bricklayers and other trades, due notice should be given to the principal contractor of the work to be done by other trades so that work can be planned accordingly.

4.5.7 Scaffolding, fencing, etc.

Scaffolding, timbers, rollers and similar plant to be used for the unloading and installation of the lift, and also for the proper guarding and close fencing of the well, should be provided, erected and maintained by the principal contractor.

The well should not be used as a means of disposal for rubbish from the upper floors.

The well and machine room should be handed over to the lift contractor complete. Other trades should not be allowed to work in them during the installation of the lift, except by arrangement with the lift contractor and under the provisions of a safe system of work in accordance with BS 7255.

4.5.8 Special installation procedures

Where there is insufficient time for the lift(s) to be installed in the conventional fashion, (i.e. after the well is completely built or with industrialized multi-storey buildings) special procedures should be employed.

*NOTE Methods of construction differ in detail: for example, it could be necessary to use a crane to lower and position lift equipment into the progressively rising top of the well (see **4.5.3**).*

The principal contractor should provide a suitable portable cover for the completed portion of the well in order to protect the lift erectors working below. When the top of the well has been reached, it should be capped immediately with a precast load-bearing floor slab on to which is lowered the pre-assembled machine room equipment. The principal contractor should then complete and weatherproof the machine room as swiftly as possible.

On all such projects the closest cooperation between the principal contractor and the lift contractor should be brought about by regular meetings from an early stage.

4.5.9 Connecting to power supply

The lift contractor should inform the principal contractor of the date the power supply to the lift is needed for installation so that suitable arrangements for connection can be made (see **4.5.6**, **8.3** and **8.4**).

4.5.10 Use of the lift prior to acceptance

Until the lift is put into service, it should not be used by any persons other than those involved in the actual installation of the lift.

4.6 Procedure following acceptance tests, including inspection and maintenance

*COMMENTARY ON **4.6***

Attention is drawn to LOLER 1998 [4], which require lifts in certain premises to be examined at intervals, e.g. within every period of 6 months, by a person competent to carry out such examinations, who is required to report on a prescribed form. The reports are normally kept in a register by the building owner or occupier. A LOLER test is not normally required at the time of commissioning a new lift.

4.6.1 Acceptance procedure

NOTE 1 Attention is drawn to the Lifts Regulations 1997, Regulation 13 [3], for information on placing of lifts on the market.

The lift should be tested, before being put into service, in accordance with the appropriate part of BS EN 81 (all parts) and with BS 8486-1 and BS 8486-2 as applicable.

The client should accept the lift on completion of these tests and provide a suitable telephone line to connect to a rescue service. Special arrangements (see **4.6.3** and **4.6.4**) should be made if there is to be a period between the lift being put into service and the lift going into normal service.

NOTE 2 It is advisable for the client to arrange insurance cover for the lift.

4.6.2 Maintenance

To ensure the continuance of satisfactory and safe operation, the client (or building occupier) should arrange for the completed lift to receive regular servicing by persons competent to carry out these tasks at such intervals as the type of equipment and intensity of usage demand.

NOTE 1 Such service can be secured under a service contract. It is preferable and normal for the lift contractor to be entrusted with the servicing during the guarantee period of a new lift. The scope of a service contract can be extended to cover intermediate service calls, repairs and replacement of worn parts. Any guarantee provided by the lift contractor is generally conditional upon the lift receiving regular and adequate servicing and covers the free replacement of parts that prove defective through reasons of faulty materials or workmanship during the guarantee period. The guarantee period is typically 12 months and is known as the Defects Liability Period.

All maintenance should take account of the lift contractor's instruction manual supplied with the installation in order to ensure:

a) the application of safe systems of work;

b) all parts are kept in good working order (see BS EN 13015).

Throughout the lifetime of the installation, the owner of the lift should ensure, in the interests of safety and operating efficiency, that:

1) the equipment is not misused;

2) unauthorized persons are not permitted to enter the well or machine rooms.

Cleaning of the well and machine rooms/spaces should only be performed by the lift contractor or by other under the supervision of the lift contractor.

NOTE 2 Attention is drawn to the regulations listed in Annex C.

4.6.3 Lift not in immediate use (caretaker maintenance)

When conditions do not permit a lift to be put into normal service immediately following completion and acceptance, it should be immobilized.

Until the lift is put into normal service, the principal contractor should put in place effective precautions against damage to:

a) finishes;

b) equipment from dampness and builders' debris.

*NOTE A separate service contract is usually made with the lift contractor to pay regular visits during this period to inspect, lubricate and report on the condition of the lift. During the inspection the lift is typically not moved under power. A date is typically agreed with the lift contractor from which the guarantee period (see **4.6.2**, Note 1) commences.*

4.6.4 Temporary use of lifts

If the client intends to permit temporary use of a lift by another party, such as the principal contractor, before putting it into normal service but after the acceptance procedure (see **4.6.1**), then the responsibilities of those concerned should be clearly defined and agreed.

The temporary use of a lift should be decided at the same time that the lift contractor is appointed, taking into account the conditions under which it is likely to take place.

A permanent two-way voice communication system with a rescue service should be available at all times in accordance with BS EN 81-28.

4.6.5 Cleaning

During the acceptance procedures checks should be made of the condition and repair of decorative finishes, before the lift contractor leaves the site, as deterioration of decorative finishes can occur owing to adverse site conditions both before and after completion of the installation.

After any period of caretaker maintenance (or temporary service), the lift should be checked and any further general cleaning down should be carried out before the lift is taken into normal service. The lift contractor should be instructed accordingly to undertake this work and, if any damage has occurred, to repair this at the same time.

During the lifetime of the lift, cleaning of various parts, e.g. the glass in an observation lift, should be carried out when necessary. Cleaning of the well and machine rooms/spaces should only be performed by the lift contractor or by others under the supervision of the lift contractor.

5 Building construction for lift installations in accordance with BS EN 81 (all parts)

*COMMENTARY ON Clause **5***

This clause gives additional recommendations and guidance that builds upon the requirements in BS EN 81 (all parts). The full requirements for building construction for electric and hydraulic lifts are given in the BS EN 81 (all parts). The majority of the details described here have been extracted and paraphrased from those standards.

5.1 General

Where building work (such as fixings, cutting away for switches and making good) is needed, reference should be made to the drawings supplied by the manufacturer of the equipment.

The access route into and through the building for introducing large or heavy components, e.g. hydraulic jack, pre-assembled car and lift machine, etc. should be planned at an early stage.

If, owing to building restrictions, hydraulic jacks cannot be accommodated in a single length, special arrangements can be necessary and the lift contractor should be consulted.

5.2 Dimensional tolerances

5.2.1 General

The architect, or any person assuming such functions, in agreement with the builder, should ensure that either the well dimensions are sufficient for the lift to be installed or add additional tolerances to the target size dimensions for the well.

5.2.2 Well dimensions

COMMENTARY ON 5.2.2

Lifts have to move vertically through a building and the car and landing door equipment have to interconnect so the plumbness of the well and the alignment of the landing openings are of paramount importance. It is therefore important that the well is not built to the usually applied construction industry practices, which allow deviations from the target sizes as both increased and decreased dimensions. It is also important to ensure that the well is built to a high degree of verticality, i.e. plumb. Decreased dimensions are thus not acceptable to the lift industry and allowances need to be made by the architect, builder or structural engineer to accommodate the high degree of verticality needed. Failure to do so can result in significant reworking and serious delays.

During the building construction, the principal contractor should apply the guidance given in BS 5606; in particular see BS 5606:1990+A1, Figure 2, for the specification of target sizes for lift wells.

NOTE 1 BS 5606 is a guide for ensuring accuracy in building construction, which indicates the expected limits of building accuracy for different types of construction.

The plan dimensions of wells should be provided by the lift contractor and define the minimum clear plumb sizes.

When specifying the well structural dimensions to meet the lift contractor's dimensional requirements, the client's representative should take into account the constructional tolerances appropriate to any particular building technique. They should also ensure that the minimum clear plumb sizes specified by the lift contractor are included in the building design and are obtained in the finished work.

The client's representative, in conjunction with the builder, should ensure that dimensions in excess of the recommended minimum plumb dimensions for wells and openings are not greater than the values given in Table 2, beyond which changes to the design might be necessary.

Table 2 **Limits of accuracy of well plumb dimensions (see BS ISO 4190-1:2010)**

Well height	**Limit of accuracy**
Storeys	*K*
<20	+50 mm, –0 mm
>20	+1.0 mm, –0 mm per extra storey up to max. 100 mm

NOTE 2 The dimensional tolerance K shown in Table 2 is a positive value only. Unlike other building tolerances, K cannot have a negative value. If the well is built with a negative value of K, this can require reconstruction of the well in the affected areas or extensive modifications to the lift equipment, if this is possible, resulting in delays.

At the planning stage, the well dimensions should be in accordance with those specified in BS ISO 4190-1 and BS ISO 4190-2, but the dimensions may be increased or decreased at a later stage if necessary to meet the requirements of a specific product.

The structural limits of accuracy pertaining to single and multiple well arrangements should be in accordance with Figure 1. If the net well dimensions W_w (well width) and W_d (well depth) and the nominal structural entrance opening dimensions *C* and *D* are defined by plumb lines, the actual wall should not encroach upon the space bounded by those dimensions. In Figure 1 dimension *K*, which is the limit of accuracy of dimensions W_w and W_d, should not exceed the value given in Table 2 for the relevant well height.

In the case of multiple lifts situated side by side, see Figure 1c), the dimension *K* is not applicable to the space between the plumb wells and its length should be not less than 200 mm for this space in accordance with BS ISO 4190-1 and BS ISO 4190-2.

Figure 1 **Structural limits of accuracy** *(1 of 2)*

Key

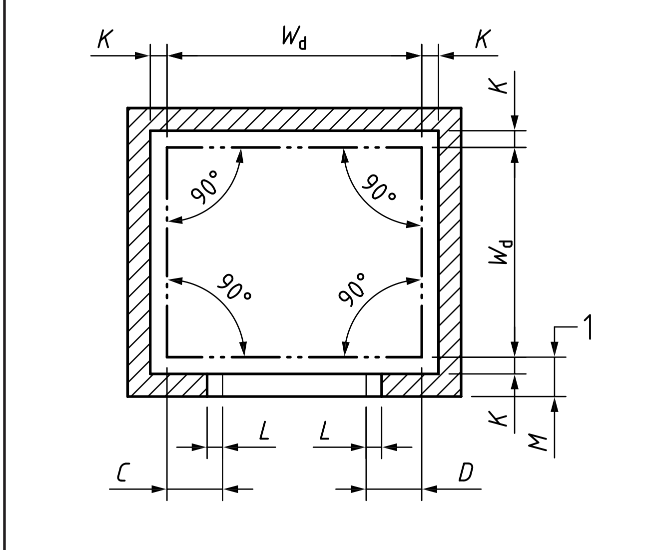
1 Lift contractor's reference line (most prominent point of wall)

2 Minimum rough opening

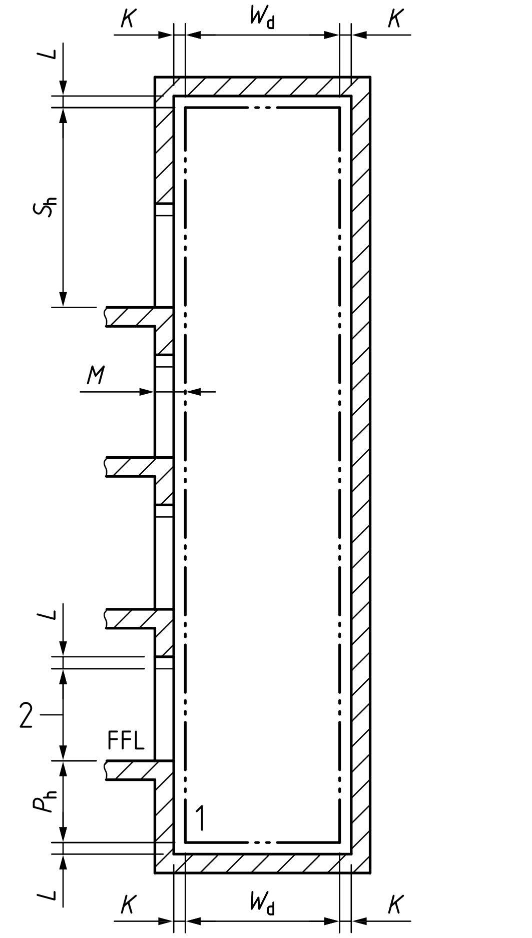
3 (If solid dividing wall, refer to single well installation)

4 (To include section width and tolerance)

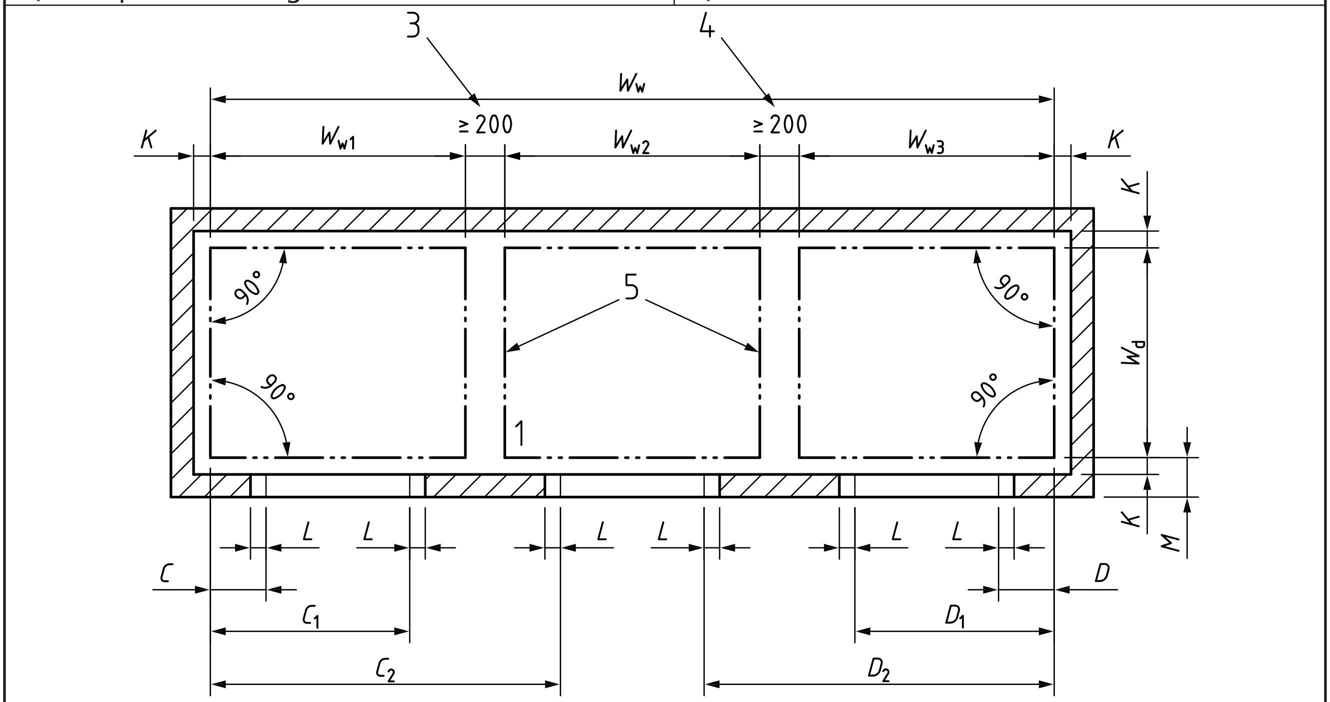
5 Shaft trimmers



a) Well plan for a single lift



b) Side elevation of well



c) Well plan for multiple lifts arranged side by side

5.2.3 Landing door openings

*NOTE 1 Attention is drawn to the Building Regulations 2000, Approved Document M [8], in respect of the provision of clear opening widths (i.e. at least 800 mm for lift doors) and landings (i.e. an unobstructed space of at least 1 500 mm by 1 500 mm). Duties under the Equality Act 2010 [7] can also impose additional requirements (see **C.3**).*

The finished landing openings should be accurate to the size specified by the lift contractor and vertically aligned one above the other for the full travel of the lift.

NOTE 2 When constructing the structural openings in concrete walls to wells, it is often not possible to achieve a degree of accuracy vertically that can allow doors and frames to be inserted in the openings without some form of masking or packing to overcome the inaccuracies.

To achieve a greater degree of accuracy, the building design should be modified so that the nominal landing door opening height is increased from the target finished floor level to each head and the nominal landing door opening to each jamb.

The alignment of the landing face from floor to floor should not vary to a greater extent than can be accommodated by the subsequent front wall finish. The architraves should be set accurately plumb.

NOTE 3 The alignment of the landing face of the front wall of the well is of importance when architraves of fixed dimensions are to be used.

Where architraves are to be supplied by the lift contractor, it should be ensured that:

a) there is a true alignment of the sill line with the landing along the front line of the well, allowing it to serve as the datum-line for the well dimensions;

   NOTE 4 To facilitate accurate alignment of landing sills, it is common practice to provide an independent threshold at each landing, the position of which can be adjusted.

b) the dimension L in Figure 1, which is the limit of accuracy of dimensions C and D, pit depth P_h and headroom S_h, is not greater than 25 mm;

c) the distance from the plumb well to the outer face of the front wall, dimension M in Figure 1, does not vary to an extent greater than can be accommodated by the subsequent front wall finish;

d) the architraves are set plumb;

e) architraves installed in conjunction with multiple wells are laterally aligned to ensure visual acceptance.

To prevent water from draining into the well from cleaning or sprinkler operation, the landing floor should have a slight slope ('fall') away from the lift entrance.

Where architraves are supplied by the principal contractor, each of the finished openings should be accurately plumb above the one below for the full travel of the lift, and the finished openings should all meet the target size.

5.3 Well construction

5.3.1 General

The counterweight, or the balancing weight, of a lift should be in the same well as the car in accordance with BS EN 81-1:1998+A3, **5.1.2**.

5.3.2 Exclusive use of the well

The well should be used exclusively for the lift and should not contain cables or devices, etc., other than for the lift in accordance with BS EN 81-1:1998+A3, **5.8** and BS EN 81-2:1998+A3, **5.8**. If the well contains heating equipment for the well (excluding hot water or steam heating), any control and adjustment devices should be located outside the well.

5.3.3 Ventilation of the well

The client's representative, in conjunction with the builder, should advise the lift contractor of any requirement under statutory regulations to ventilate the well.

NOTE Attention is drawn to the Building Regulations [8] and the local fire authority for further requirements on ventilating wells.

Where the ventilation provided naturally is insufficient, as the result of door operations and through gaps around doors, access traps/doors and other openings into the well such as ductwork, special arrangements should be made.

The well should not be used to provide ventilation for rooms other than those for the service of the lifts.

When the well is ventilated via the machine room or pulley room, through trunking to the outside should be used. The vents should be louvred or otherwise protected to prevent rain, snow, birds, etc. from entering the well after construction is completed.

Where lifts with rated speeds exceeding 2.50 m/s are installed, pressure release vents might need to be provided in order to prevent buffeting, which in the case of a single lift the vent should have an area of not less than 0.3 m^2 and for multiple lifts an additional vent area of 0.1 m^2 should be provided for each additional lift sharing a common well.

5.3.4 Well containing cars or counterweights belonging to several lifts or service lifts

In the lower part of the well a rigid screen should be erected between the moving parts (car, counterweight or balancing weight) of different lifts or service lifts. This partition should extend from a position not more than 0.30 m above the pit floor to a position not less than 2.50 m above the floor of the lowest landing.

If the horizontal distance between the edge of the car roof and the moving part of an adjacent lift or service lift is less than 0.50 m, the partition should be extended through the full height of the well. The width of the partition should be not less than equal to that of the moving part, or part of this, which is to be guarded, plus 0.10 m on each side.

In every instance, the partition should extend through the full height of the well.

Protection in the well should conform to BS EN 81-1:1998+A3, **5.6** and BS EN 81-2:1998+A3, **5.6**.

5.3.5 Well enclosure

Where a well contributes to the prevention of the spread of fire, each well should be totally enclosed by an imperforate wall, floor and ceiling, except for:

a) landing doors;

b) 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 room or pulley room.

The walls, floor and ceiling of the well should be:

1) made of durable materials;

NOTE 1 Attention is drawn to the Building Regulations 2000 [8] and to local regulations and bye-laws in respect of the materials used in the construction of wells.

2) treated to prevent the creation of dust;

3) of sufficient mechanical strength.

Where glass is used for any part of the well enclosure, it should be laminated.

NOTE 2 The use of toughened glass is not acceptable.

Where a well does not contribute to the prevention of the spread of fire, e.g. observation lifts (see Annex D), it does not need to be totally enclosed and should conform to BS EN 81-1:1998+A3 or BS EN 81-2:1998+A3.

As far as is practicable, the inner surfaces of a well enclosure facing any car entrance should form a smooth continuous flush surface without projections or recesses. Where any projections or recesses cannot be made flush and they project more than 200 mm, they should be bevelled to an angle of 75° from the horizontal above and below the projection by means of metal plates, concrete or other similar non-combustible material. Where practicable, all other inner surfaces of the well enclosure should form a continuous flush surface without projections or recesses.

Permanent electric lighting should be available in the well for each lift, allowing it to be lit during repairs or servicing, even when all doors are closed. The lighting should be controlled from the well and the machine room. This lighting should comprise one lamp positioned not more than 0.5 m from the highest and lowest points in the well with intermediate lamp(s) (see BS EN 81-1:1998+A3, **5.9** and BS EN 81-2:1998+A3, **5.9**). The average level of illumination should be not less than 50 lux, measured 1.00 m above the plane of the car roof and pit floor.

5.3.6 Load reactions on the building structure

The building structure should be able to support any or all the loads that might be applied by:

a) the machine (while stationary and running);

b) the guides in normal operation and during safety gear operation (in either a downward or an upward direction);

c) the operation of the buffers;

d) the operation of the anti-rebound device; or

e) off-centring the load in the car.

Lifts should be not located in stairwells, as special arrangements need to be made to fix the guides, fit support beams, ensure appropriate ride quality and provide continuous enclosures, etc.

To assist the early planning, the guidance of the lift contractor or client's representative should be sought on the load imposed by the lift on the building structure.

5.3.7 Fire resistance

*COMMENTARY ON **5.5.7***

Attention is drawn to the Building Regulations 2000 [8]. Tests for the various fire resistance ratings referred to in Table 3 are those given in BS EN 81-58:2003. Unlike other fire-resistant doors in a building, lift doors are not thermally insulated. Automatic or self-closing lift doors are not smoke-proof or smoke-tight, particularly in the case of sliding doors.

Table 3 **Examples of fire resistance of lift entrances**

Type of doors	Fire resistance of the well enclosure f_r	Fire resistance of the lift entrance
Automatically closed doors	f_r <1 h	= 30 min
	1 h ≤f_r ≤2 h	= 1 h
Manually closed doors	f_r ≤30 min	= 30 min
	30 min ≤f_r ≤1 h	= 1 h

Construction materials should be used that do not give off toxic fumes and smoke in the case of a fire. A fire officer/adviser should be consulted to determine the degree of fire resistance needed for the well structure and landing entrances.

When entrances having access to the well require fire resistance, the degree of fire resistance should be not less than:

a) half that of the enclosure where the lift doors close automatically;

b) that of the enclosure where the lifts doors are manually closed.

NOTE 1 Examples are given in Table 3.

The client's representative, in conjunction with the builder, should advise the lift contractor of any requirements where landing doors and frames are to have a fire resistance in excess of 2 h.

NOTE 2 This protection, which is not supplied by the lift manufacturer, might be in the form of a roller shutter with a fusible link.

If entrances to wells need to be smoke-tight, auxiliary protective means should be provided in addition to the doors normally provided by the lift contractor.

A firefighters lift should be installed in accordance with BS EN 81-72:2003, Clause **5**; this affects the lift, the routing of its power supply cables to the control equipment and its building environment, etc.

5.3.8 Entrances

Access to the car, provided by entrances in the well enclosure, should not be in the path of the counterweight.

Lift entrances that open out into an area exposed to the weather should be suitably protected by canopies, sloped landing levels and weatherproof controls.

5.3.9 Inspection doors, emergency doors and inspection traps

Inspection doors, emergency doors and inspection traps to the well should be provided only for the evacuation of passengers or to provide access for servicing.

Where the well extends for some distance without a landing door, a means of evacuating passengers should be provided.

NOTE This can be as either intermediate emergency doors at intervals not exceeding 11 m or adjacent cars fitted with an emergency door.

The lift contractor should provide any details needed to suit the conditions of a particular building and lift installation to the principal contractor at the earliest possible time.

Inspection doors should have a height of not less than 1.40 m and a width of not less than 0.60 m. Emergency doors should have a height of not less than 1.80 m and a width of not less than 0.35 m. Inspection traps should have a height of not less than 0.50 m and a width of not less than 0.50 m.

The fire resistance of each inspection door, emergency door or inspection trap should be not less than those recommended in **5.3.7** for the enclosure.

Inspection doors, emergency doors and inspection traps should not open towards the interior of the well.

Inspection doors, emergency doors and inspection traps should be provided with a key-operated lock, capable of being closed and locked without a key. The lock should not include a device to retain the bolt in a retracted position. The key should be the same key as for the landing door release. It should have a label attached to it, detailing essential precautions to be taken when using the key.

It should be possible to open inspection doors, emergency doors and inspection traps from inside the well without a key, even when locked. However, operation of the lift should always be dependent upon the closed condition of these doors and traps.

Inspection doors, emergency doors and inspection traps should be imperforate and should conform to the same recommendations for mechanical strength as the landing doors in BS EN 81-1:1998+A3, **7.2.3** and BS EN 81-2:1998+A3, **7.2.3**.

A permanent safety sign and warning notice should be displayed on the outside of all inspection doors, emergency doors and inspection traps in accordance with Annex E.

5.3.10 Lift pits

The lower part of the well should consist of a pit, the bottom of which should be smooth and approximately level, except for any buffer and guide bases and water drainage devices. The pit should remain impervious to the infiltration of water, following the building-in of guide fixings, buffers, any grids, etc.

If there is an access door to the pit, other than the landing doors, it should be in accordance with **5.3.9**. Such a door should always be provided if the pit depth exceeds 2.50 m. To permit authorized personnel to descend safely into the pit and in the absence of any other access, another permanent means should be provided that is easily accessible from the landing door and does not project into the clear running space of the lift equipment.

Wells should, where ever possible, not be situated above a space accessible to people.

If accessible spaces exist underneath the car or counterweight, the counterweight should be fitted with a safety gear. Where this is not possible, the base of the pit should be designed for an imposed load of not less than 5 000 N/m^2, and:

a) there should be a solid pier extending down to solid ground; or

b) there should be an alternative means to support the loads imposed; or

c) the counterweight should be equipped with safety gears.

With direct-acting hydraulic lifts, jacks under the car should have lined boreholes. The borehole should be watertight, should have a limit of accuracy within 25 mm of plumb in 3 000 mm and should have its centreline within ±10 mm, measured at pit floor. The liner should be watertight and non-rusting in order to protect the cylinder from corrosion.

NOTE A borehole is normally made during the building construction and the work is normally carried out by a specialist contractor.

Details of the diameter and depth required are supplied by the lift contractor, who should also give details of the ram and cylinder lengths to be handled on site.

5.4 Machinery spaces and pulley rooms

5.4.1 General

NOTE 1 This subclause applies to conventional machine rooms or pulley rooms and enclosures outside the well. If control panels are to be installed in the pulley room, it is considered as another machine room. See ***5.5*** *for machine-room-less lift applications.*

Machine rooms or pulley rooms, or enclosures, should not be used for purposes other than lifts, should not contain cables or devices other than for the lift, and should not provide means of access to other parts of the building.

NOTE 2 These rooms may, however, contain:

a) machines for service lifts or escalators;

b) equipment for ventilating, heating or air conditioning of these rooms, excluding hot water or steam heating;

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.

When the function of the building requires it (e.g. dwellings, hotels, hospitals, schools or libraries), the walls, floors and ceilings of machine rooms and pulley rooms should substantially absorb the sounds associated with the operation of the lifts.

5.4.2 Construction

NOTE 1 Attention is drawn to the fire resistance requirements for machine rooms and pulley rooms given in the relevant building regulations. Attention is also drawn to the need to take precautions to minimize the spread of fire from the machine rooms and pulley rooms into the well or from the machine rooms or pulley rooms to adjacent parts of the building.

Machine rooms and pulley rooms should be constructed to withstand the loads and forces to which they are normally subjected. Only durable materials that are known to create little or no dust should be used.

Machine rooms and pulley rooms should be considered as plant space. The conditions in machine rooms and pulley rooms should be such as to enable reliable operation of electrical switchgear and rotating machinery, and should allow maintenance to be carried out when necessary.

NOTE 2 The use of large areas of glass windows in walls can give rise to large solar energy gains in machine rooms and pulley rooms.

When large glass walled areas are used, ventilation and/or cooling should be provided for all equipment. In particular, areas of stagnant air should be avoided. Controller equipment should be located away from areas that are subject to direct sunlight for long periods.

Before lift machinery can be installed, the machine room and pulley room should be weather proof and all walls, ceiling and floor should be sealed or painted to stop dust circulation, which otherwise could damage rotating machinery and cause failure of electrical control equipment. If ventilation louvres are provided, they should be designed and sited in accordance with **5.7**.

Additional features for firefighters lifts, where required, should be in accordance with BS EN 81-72:2003.

5.4.3 Other openings

It is important that the number of holes and other penetrations through the slab and machine room/pulley room floor should be reduced to a minimum. Their dimensions should be as small as possible while ensuring that safe clearances from moving parts are maintained.

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

5.4.4 Machine room and pulley room floors

Machine room and pulley room floors should be:

a) able to bear the weight of the heaviest unit of the lift machinery;

b) constructed from non-slip materials;

c) at one level.

When there are a number of levels, differing by more than 0.50 m, stairways or steps and guard rails should be provided.

5.4.5 Space and maintenance provisions

Machine room and pulley room dimensions should allow easy and safe access for:

a) personnel to any part of the equipment;

b) equipment to be removed.

One or more steel beams, or other suitable supports, should be permanently positioned at a high level in the machine room (and pulley room if appropriate) so as to accommodate the lifting apparatus and permit the hoisting, installation and possible replacement of heavy equipment. Prior to the installation of lift machinery, the principal contractor should install, test and clearly mark these beams or supports with the safe working load, which should be determined in accordance with BS 2853. The certificate of test should be placed in the health and safety file (see **4.5**).

Machinery in machine rooms and pulley rooms should be protected, as far as possible, from dust, harmful fumes, humidity or other adverse environmental pollution. Stale air from other parts of the building should not be exhausted into a machine room or pulley room. Machine rooms and pulley rooms should be soundly constructed, weatherproof and dry, with provision for permanent ventilation of not less than 1% of the horizontal section of the well per lift. Where possible, ventilation should be to the outside of the building.

The heating and ventilation of machine rooms and pulley rooms should be done in accordance with **5.8**.

The dimensions of the machine room should conform to BS ISO 4190-1 and BS ISO 4190-2, where possible. The working space should be determined by risk assessment as adequate to prevent injury. Machine rooms should conform to BS EN 81-1:1998+A3, **6.3.2** and BS EN 81-2:1998+A3, **6.3.2** and Table 4.

Table 4 **Machine room clearances**

Area	Clearance (min. value)		
	Depth	**Width**	**Height**
	mm	mm	mm
In front of the controllers	≥700	either 500 or the full width of the cabinet or panel, whichever is the greater	—
Behind the controllers: [A]			
• where access to the back is only for purposes not requiring the controller to be energized, other than at extra low voltage, or where appropriate precautions have been taken in accordance with a risk assessment;	500	as for front	—
• when unrestricted access to the rear of a controller is required;	900	as for front	—
• when the rear of the controllers are situated back-to-back.	1 350	—	—
Clear horizontal area for servicing and inspecting moving parts, where necessary	500	600	—
Width of passageways to all the foregoing	—	500	—
Clear height above the highest point of the machine (including rotating parts) and above pulleys (excluding diverters mounted immediately under the lift machine)	—	—	300 [B]
Clear height from the floor of the main movement/working area [C]	—	—	2 000 [D]
Clear height in pulley rooms:			
• without controllers located within;	—	—	1 500
• with controllers located within.	—	—	2 000

[A] Where controllers have permanent enclosures that do not require access to the back, clear space at back is not required.

[B] This value may be reduced in areas not containing moving parts.

[C] In practice this is increased to accommodate lifting equipment.

[D] This value may be reduced to 1 800 mm for movement areas.

Where risk assessment shows that more space than the minimum given in Table 4 is required for safety, the dimensions should be increased.

The dimensions of the pulley rooms should be sufficient to provide easy and safe access to all the equipment for servicing personnel and should have a height under the roof of not less than 1.50 m. A clear space of not less than 0.30 m high should be provided above all pulleys, except in the case of double wrap or deflection pulleys.

Permanent electric lighting should be installed in machine rooms and pulley rooms to provide an average illumination of not less than 200 lux in machine rooms and not less than 100 lux in pulley rooms at floor level, particularly around machinery and controllers. Light switches should be positioned adjacent to personnel access points. Switches to operate the well lighting should also be available in the machine room. All the lighting should be independent of the power supply to the lift machine.

At least one independent switched socket outlet, equipped with residual current device protection, should also be provided in each machine room and pulley room, supplied from circuits that are totally independent of the lift supplies. Each switched socket outlet should provide a current of not less than 13 A.

5.4.6 Access to machine rooms and pulley rooms

Access from the public way to the interior of the rooms containing machines, their associated equipment and pulleys, should be clear of tripping hazards and projections and free from obstacles. There should be no need to pass through private accommodation. The access route should be well illuminated.

The routes to machine rooms and pulley rooms and access points should have headroom of not less than 1.80 m. The height of sills and ledges in front of the entrance should not be greater than 0.40 m.

Access for personnel to machine rooms or pulley rooms should, wherever possible, be entirely by stairways. When it is not possible to install stairs, a ladder should be provided and:

a) should not be liable to slip or turn over;

b) when in position, the ladder should form an angle between 65° and 75° with the horizontal, unless it is fixed and its height is less than 1.5 m;

c) the ladder should be used exclusively for this purpose and should always be kept available in the vicinity with the necessary provisions made for that purpose;

d) one or more handholds should be provided within easy reach at the top end of the ladder.

Doors giving access to machine rooms and pulley rooms should not open inwards and should be secure against unauthorized access. Key-operated locks should be fitted that can be opened without a key from the inside of the machine room. Doors for personnel access should have the following clear dimensions:

1) width of not less than 0.6 m;

2) height into main machine room or controller room of not less than 1.80 m;

3) height into pulley rooms of not less than 1.40 m.

When necessary, dimensions should be increased to provide access for equipment.

A permanent safety sign and warning notice, as described in Annex E, should be displayed on the outside of machine room and pulley room doors.

Trap doors for personnel access should:

i) provide a clear passage of not less than 800 mm by 800 mm;

ii) when closed, be flush with the finished floor and capable of safely supporting the mass of two people equating to 2 000 N (200 kg) on an area of 200 mm by 200 mm at any point;

iii) be counterbalanced and open upwards, unless associated with retractable ladders;

iv) be provided with hinges that cannot be unhooked;

v) be fitted with key-operated locks that can be opened without a key from inside the room.

Precautions should be taken to prevent the fall of people or materials when trap doors are in the open position.

Trap doors for equipment access should:

- when closed, be flush with the finished floor;
- be lockable only from inside the machine room or pulley room;
- be soundly constructed, since they might be required temporarily to support heavy machinery.

5.4.7 Machine supports

Machines, pulleys, overspeed governors and similar units should be supported and held to prevent any unit from becoming loose or displaced. Supporting beams should be of steel or reinforced concrete. When calculating the size of beams and their supports, the total load on the beams should be taken as the mass of all fixed apparatus supported by the beams, plus twice the mass of those parts of the lift that have vertical motion (including the rated load). The deflection of the beams, when carrying the calculated load, should not be greater than 1/1 500 of the lesser of the distances across the well and the distance between supports. The datum for deflection should be taken as a straight line between the beam supports on the well walls. For the purposes of calculation, these beams should be deemed to be simply supported.

In the case of hydraulic lifts, owing to the varying configurations, the loads on the building structure can vary; the lift contractor should be consulted.

5.4.8 Machine-room-less lifts

*COMMENTARY ON **5.4.8***

Conventionally, electric traction lifts have their machine room above, to the side of or below the well. Hydraulic lifts have their machine rooms (or pump rooms) adjacent to the well, or nearby. It is possible to have a machine-room-less electric traction or hydraulic lift. Guided chain lifts follow the provision for conventional electric traction lifts. Rack and pinion, and screw lifts can require a machinery space or cubicle nearby. The absence of a machine room allows architects greater design freedom, e.g. simpler roof lines. Principal contractors are able to benefit from a controlled, streamlined installation process and less interference with other trades.

Electric traction and hydraulic lifts should be installed in accordance with BS EN 81-1:1998+A3 and BS EN 81-2:1998+A3.

The dimensions required for safe working spaces inside the well, etc. should be specified by the lift contractor.

As access to the well is required from the landings and the adjacent passageways, additional unobstructed, well-illuminated space in the building should be provided.

Where control facilities for the lift are located at landings, additional unobstructed space should be provided.

NOTE The well dimensions might not follow those published in BS ISO 4190-1 or BS ISO 4190-2.

5.5 Quiet operation

*COMMENTARY ON **5.5***

No lift installation can be silent in operation and the intensity of noise depends on particular circumstances.

The location of lifts should be such as to cause minimum disturbance. Dwelling spaces and especially bedrooms should not be sited adjacent to machine rooms. Beams and structural members associated with the lift installation should not penetrate into such areas; similar considerations might apply to office buildings and other quiet areas. Building design has the greatest role to play in noise reduction and the design of the building structure should take account of this.

To attenuate airborne vibrations particular attention should be paid to providing the necessary:

a) degree of isolation of lift equipment from the building structure and the lift interior;

b) acoustic insulation cover within the lift and within the living areas surrounding the lift.

The treatment of apertures, through which hydraulic fluid pipes pass, should also be given particular attention.

No lift specification should include a requirement that the lift is to operate "silently to the satisfaction of the client's representative". If the client's representative requires the principal contractor to ensure that the lift operates to the customer's specific acoustic requirements, such a request should be the subject of joint consultation between all parties concerned and should not be passed on as if it were solely the responsibility of the lift contractor. The client's representative should check the operation of the lift contractor's equipment in as near similar conditions as possible to those that might be present in the final installation.

NOTE However, lift equipment that operates perfectly satisfactorily in one building might not do so in another building under a different structural design.

It is not possible to be specific about what noise levels are generally acceptable as they depend on the circumstances of the installation; where there is doubt specialist advice should be sought.

5.6 Location of machine rooms

For electric traction lifts, the machine room should be located immediately over the well wherever this is possible without restricting the headroom, S_h (see Figure 1). Alternative machine positions for electric traction lifts should be considered only under special circumstances, such as headroom restrictions imposed by the planning authority for lifts serving the top floor.

For hydraulic lifts the machine room, containing the pumping unit and controller, should be located adjacent to the well at the lowest level served. If this is not practicable it may be located at a distance from the well, but where this distance is greater than 10 m, there should be detailed discussions between the client's representative and the lift contractor.

The specific position, type and anticipated loading of lifting supports should be detailed on the drawings prepared by the lift contractor, taking account of equipment access, changes of level in the machine room and final equipment location.

The contour of the machine room should not be finalized until the client's representative, in conjunction with the lift contractor, is satisfied that it would meet the needs of the lift that is ultimately to be accommodated.

5.7 Heating and ventilation of machine rooms and pulley rooms

All machine rooms and pulley rooms should be provided with ventilation to dissipate the heat generated by the lift equipment. The ventilation should provide reasonable working conditions for maintenance personnel and should maintain temperatures that ensure the stability of lift operations, as agreed with the lift contractor. If the lift machine room is located where temperatures could drop below 5 °C, heating should be provided to avoid frost and condensation and to maintain stability of operation. Ventilation louvers should be designed and sited to prevent rain, snow, birds, etc. from entering the machine or pulley room.

Machine rooms for electric traction lifts accommodating single and double installations in a temperate climate should be served by a high and low louvred convection ventilation arrangement. For groups of three or more lifts in one machine room, there should be increased ventilation and forced cooling can be required, the design of which should prevent local hot spots. The lift contractor should be consulted to ascertain the heat output of a complete installation.

NOTE Generally, goods lifts operate at a lower rating in terms of starts per hour and heat output.

Where machine rooms for hydraulic lifts are located at the lowest level served, ventilation might be difficult and particular attention should be given to the means of heat dissipation. In certain cases forced cooling and/or oil coolers may be used, as hydraulic lifts utilize oil as the active fluid and viscosity is an important factor for the optimum performance of the lift.

If the building has an integrated heating and ventilating system that is likely to shut down, building designers should take into account the possible need for standby heating and ventilating equipment.

5.8 Special environments

Lift equipment conforming to BS EN 81 (all parts) is suitable for use inside normal residential, commercial and industrial buildings, but where unusual environments are likely to be encountered, e.g. observation lifts (see Annex D), specialist advice should be sought at the earliest possible stage. Special mechanical protection and/or electrical enclosures might be necessary to meet special situations, which should be fully considered at the time of enquiry (see Clause **4**). The following should be considered as special environments:

a) specific locations, e.g. railway stations;

b) special duties, e.g. hospital theatre lifts;

c) exposure to weather, e.g. car parks;

d) low temperatures, e.g. cold stores;

e) high temperatures, e.g. boiler plants;

f) hosing-down, e.g. for hygiene or decontamination in hospitals;

g) corrosive atmospheres, e.g. chemical works;

h) dusty atmospheres, e.g. boiler plants, flour mills;

i) explosive atmospheres, e.g. gas plants;

j) vandal-prone installations (see BS EN 81-71);

k) extreme levels in humidity.

The installation of equipment in hazardous areas should be avoided owing to the increased complications involved.

5.9 Reduced headroom and pit dimensions

NOTE 1 Where new lifts are installed in an existing building, that the building construction might be such that the headroom and pit depth requirements of BS EN 81-1 and BS EN 81-2 cannot be provided.

Building designers faced with this problem should first establish that alternative means cannot be provided, such as not serving the bottom or top landings in order to maintain the necessary refuge spaces.

NOTE 2 Further advice from specialist bodies might need to be obtained.

Where the situation is intractable a derogation should be sought by the client, under the Lifts Regulations 1997 [3], from the Department of Business, Innovation and Skills [2)] before any work is commenced. Once this has been issued, safe working and operation should be in accordance with BS EN 81-21.

6 Lift traffic planning

6.1 General

NOTE BS ISO 4190-1 and BS ISO 4190-2 give a globally agreed range of standardized rated loads and rated speeds, as shown in Table 1, to meet different vertical transportation needs and also provide the type of and size of entrance, the shape of car, etc.

In a new building, these standard layouts should be selected as they simplify planning and execution, offer the shortest delivery times and should ensure a satisfactory installation.

6.2 Lift speed in relation to travel

The time to travel from the main entrance floor to the highest served floor should be as shown in Table 4, where possible. For broad guidance, reference should be made to Table 5, where the lift travel limits shown are based upon current general practice.

Table 5 **Total time to travel between terminal floors in different buildings**

Building usage	**Transit time** s
Large offices, hotels, etc.	20
Small offices, hotels, etc.	30
Hospitals, nursing/residential homes, etc.	24
Residential buildings	20 to 30
Factories, warehouses, shops, etc.	24 to 40

2) Guidance can be obtained from the Department of Business, Innovation and Skills document URN09/1479, dated November 2009.

Table 6 **Typical lift dynamics**

Lift travel m	Rated speed m/s
<20	<1.00
20	1.00
32	1.60
50	2.50
63	3.00
100	5.00
120	6.00
>120	>6.00

NOTE Goods lifts generally operate at lower rated speeds than passenger lifts over the same distance, principally because traffic conditions are less demanding and more time is needed for loading and unloading goods. The levelling accuracy of goods lifts can also be an additional factor.

Where a lift is required to be a firefighters lift, the minimum rated speed should be in accordance with BS EN 81-72. The rated speed should be such that the lift can run its full travel between the Fire Service Access Level (FSAL) to the highest served floor in not more than 60 s.

The rated speed should be higher for lifts serving express zones in a building.

6.3 Number of lifts and capacity for passenger service

The number of passenger lifts that should be installed in a given building, and their capacities, depend on the following characteristics, including:

a) the number of floors to be served by the lift;

b) the pitch of the floors;

c) the population of each floor to be served;

d) the maximum peak demand, which can be unidirectional, as in the up-peak or down-peak periods, or multidirectional.

NOTE 1 All calculations on the traffic handling capabilities of lifts are dependent on a number of factors that vary according to the design of the lift and the assumptions made on passenger actions. The results of such calculations can be safely used to compare different options and the different installations offered, provided the same set of factors are used for all cases.

NOTE 2 Traffic specialists and lift contractors can use different methods of calculation and simulation thus making the comparison of results difficult.

NOTE 3 Where a lift is specifically installed for the use of persons with impaired mobility, the car and landing call dwell times may be extended to 5.0 s and this could have a significant impact on the performance of a lift.

6.4 Preliminary lift planning

6.4.1 General

The following method should be used as general guidance on preliminary lift planning for offices, although its principles can be used for other types of buildings. A lift installation for office buildings should be designed to enable the building to be populated at a given rate and the three main factors to be considered are:

a) the building population or the number of people who require lift service;

b) the lift handling capacity or quantity of service (the maximum arrival rate required by the population);

c) the average passenger waiting time or the quality of service required (often represented by the average lift interval).

6.4.2 Population

The building population for the office building to be served should be obtained from the client together with any increases in population likely to occur in the future. If a definite population figure is unobtainable, an assessment should be made from the usable area and probable population density as shown in Table 7, column 2, which gives guidance for a number of different building types.

Table 7 **Estimation of population, arrival rate and interval**

Building type	Population estimate	Arrival rate	Arrival interval
		%	s
Hotel	1.5 – 1.9 people per room	10 – 15	30 – 50
Flats	1.5 – 1.9 people per bedroom	5 – 7	40 – 90 [A)]
Hospital	3.0 people per bedspace [B)]	8 – 10	30 – 50
School	0.8 m^2 – 1.2 m^2 net area per pupil	15 – 25	30 – 50
Office (multiple tenancy)	10 m^2 – 12 m^2 net area per person	12 – 15	25 – 30

[A)] In blocks of flats, the average interval might be increased to 90 s on economic grounds, but this is not desirable.

[B)] Excluding patient.

NOTE The usable area is less than the rentable area (sometimes called the net internal area) and this area is less than the gross internal area (between the walls) and the gross external area (the footprint). BOMA Z65.1: Method for Measuring Floor Area in Office Buildings [9] gives guidance for US buildings, which experience indicates can be employed in the UK. BOMA Z65.1 [9] gives the rentable area as from 90% to 95% of the gross area and the usable area as from 75% to 80% of the gross area.

If no indication of the probable population density is possible (e.g. a speculative development), a population in the region of 10 – 12 m^2 per person for general office buildings should be assumed.

In many office buildings it is unlikely that the total possible population are present on any day, the total building population should be reduced by 10% to 20% to account for:

a) people working at home;

b) people away on holiday;

c) people away sick;

d) people away on company business;

e) vacant posts;

f) hot desking.

6.4.3 Arrival rate

The arrival rate of passengers should be obtained from the client and expressed as a percentage of a building's total population. The estimation of the arrival rate should take into account a number of factors including:

a) the purpose of the building (commercial, institutional, residential);

b) the location of nearby bulk transport facilities;

c) whether the building is in the heart of the city or in the suburbs;

d) the starting and finishing habits of the building population, i.e. unified or flexitime working;

e) the type of tenancy, i.e. single or multi-tenanted;

f) the prestige of the building.

If a definite arrival rate figure is not available, an assessment should be made from the building type as shown in Table 7, column 3.

If no information is available on the flow rate to be expected, 12% should be assumed for speculative buildings, or buildings where flexitime might be practiced.

6.4.4 Average interval

The average interval can only be accurately calculated for the morning up peak traffic condition. The average interval is expressed in seconds and should be calculated by taking the round trip time of one car and dividing it by the number of cars interconnected in the common group system, see Annex F. Typical target values for average intervals should be taken from Table 7, column 4.

For office buildings, the average interval should be specified by the client not to exceed a certain value.

6.4.5 Quality of service for office buildings

NOTE 1 The average interval can be used to reflect the quality of service required in an office building.

Where the client specifies the quality of service required, an appropriate value for the average interval should be selected from Table 8.

Table 8 **Expected quality of service in office buildings**

Interval s	**Quality of service**
≤20	Excellent
25	Very good
30	Good
40	Below average
≥50	Unsatisfactory

For office buildings, the following numbers of lifts should give an above average, average and below average quality of service:

a) one lift for every three floors (for above average quality of service);

b) one lift for every four floors (for average quality of service);

c) one lift for every five floors (for below average quality of service).

NOTE 2 Actual passenger waiting time is the real indicator of quality of service, but there is no simple means of calculation. Simulation methods are available, from manufacturers and others, that might give more accurate information.

6.4.6 Grouping of passenger lifts in offices

*COMMENTARY ON **6.4.6***

The location of lifts throughout a building does not save potential passengers' waiting time. Some passengers' walking time is saved, but this is more than offset by the increase in the average passenger waiting time for lift service. Furthermore, passengers tend to be far more impatient when standing still and doing nothing, when waiting for a lift to respond to their call for service, than when they are actively engaged in walking to the lift lobby.

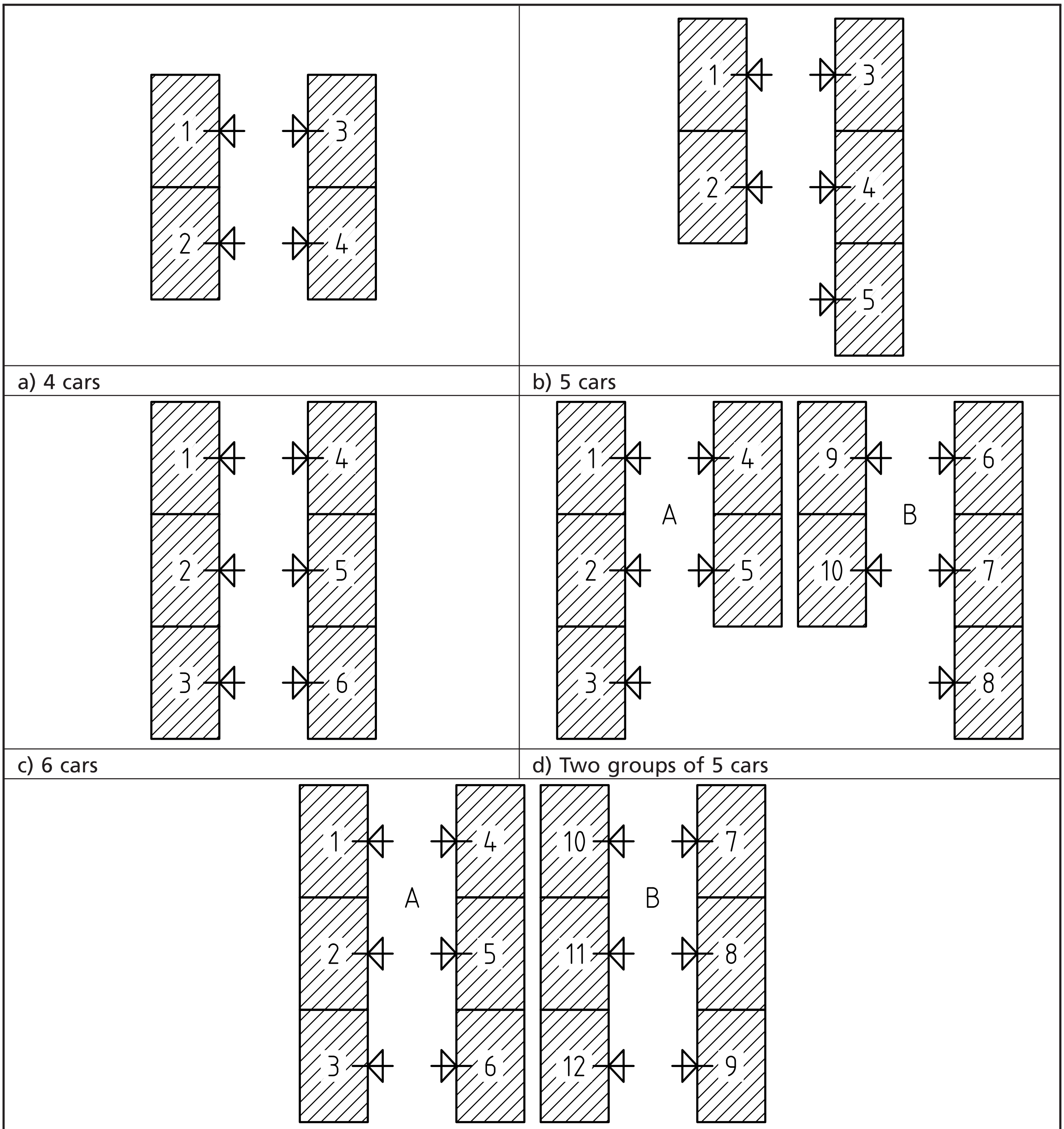
The grouping of lifts should be planned for efficient passenger movement in order to ensure that the performance figures given in any calculations can be realised and that the vertical transport system operates effectively.

All lifts should be placed together, and not spread around the building, in accordance with the groupings shown in Figure 2.

The handling capacity of each lift in a group of lifts should be carefully considered and where possible the handling capacity should be identical.

Except under very special circumstances, each lift should have a capacity of not less than 1 000 kg. The minimum landing depth should conform to BS ISO 4190-1 and BS ISO 4190-2.

Figure 2 **Grouping of lifts** *(1 of 2)*



a) 4 cars

b) 5 cars

c) 6 cars

d) Two groups of 5 cars

e) Two groups of 6 cars

Key

A Low rise

B High rise

6.5 Performance data and calculations

The number and sizes of lifts finally selected should provide a performance capable of dealing with the anticipated flow rate determined in **6.4.3**.

Traffic calculations, which cover a lift or lifts serving all floors, should be calculated in accordance with Annex F.

NOTE 1 Examples of traffic calculations are given in Annex G.

To achieve higher efficiency, buildings consisting of more than 18 floors should be split into high rise and low rise groups of lifts.

*NOTE 2 An interconnected collective control system (see Clause **7** and Annex H) with an automatic highest call reversal feature improves the efficiency of an installation.*

Where the calculations give different combinations of the number of lifts, rated speeds and rated capacitites, the final selection should be made according to the quality of service required.

As the calculations make no allowance for serving basement floors, a time penalty of 15 s to 30 s should be added to the *RTT* for every basement floor served during the peak period; this ensures the correct selection is made.

In many of the above instances specialist advice should be sought.

7 Traffic control systems

7.1 Selection of traffic control systems

The traffic control systems should be selected from one of the following types:

a) non-collective control (see **H.1**);

b) collective control (see **H.2**, **H.3**, **H.4**, **H.5** and **H.6**);

c) group traffic supervisory control (see **H.7**);

d) hall call allocation (destination) supervisory control (see **H.8**).

NOTE A description of these different types of traffic control systems is given in Annex H.

A full collective control system should be installed when interfloor traffic is expected during upward and downward travel; it can be used with a single lift or in group collective lifts (see **H.6**).

Before selection the advantages and disadvantages of a hall call allocation system should be discussed with the intended supplier.

When selecting the traffic control system for the installation, the following features of the control system should be specified by the client at the tender stage (see **4.2**):

1) preferential services (see **7.2.1**);

2) door operations (see **7.2.2**);

3) any other features (see **7.2.3**).

7.2 Features of control systems

7.2.1 Preferential services

NOTE 1 When a preferential service is in operation for a particular lift, this might reduce the normal service provided by that lift or group of lifts to all other passengers.

If a special personal service or a house service is required, a car preference service should be provided. When this service is required, for whatever purpose, it should be specified by the client at the tender stage (see **4.2**) as car preference service. The transfer from normal passenger control to car preference service should be by a key-operated switch in the car.

NOTE 2 The operation is then from the car only and the doors remain open until a car call is registered for a floor destination. In the case of a single lift this means that landing calls cannot be registered.

When the special operation is completed, the key should be removed to restore the control to normal service.

If a special service where one lift in a group needs to operate separately is required, an independent service should be provided. The transfer from normal passenger control to independent service should be by a key-operated switch.

NOTE 3 The control is then from an independent set of landing control stations for that particular car, which responds in a full-collective manner.

A hospital service should be provided for lifts required to carry beds and stretchers, where there should be a car preference switch so that an attendant can have complete control of the car. When this service is required it should be specified by the client at the tender stage (see **4.2**) as car preference service.

NOTE 4 See Health Technical Manual 08-02: Lifts [10] for further details on specialist services.

The transfer from normal passenger control to car preference service should be by a key-operated switch in the car.

NOTE 5 Priority service gives a special service for individuals and has many forms ranging from key-operated switches or swipe cards at specific landings, to the complete segregation of one lift out of a group of lifts.

A fire-fighters' service should be provided on designated lifts in accordance with BS EN 81-72 and BS 9999 for the use of the emergency services.

An evacuation service should be provided on designated lifts in accordance with BS 9999 to enable the evacuation of persons with impaired mobility.

7.2.2 Door operations

Lifts fitted with manually operated doors (without closers) should incorporate a "door open" alarm to draw attention to a car or landing door that has been left open.

When a lift that is fitted with automatic power-operated doors arrives at a landing, the doors should automatically open and then close after a timed interval (known as the door dwell time). It should be possible to overrule or reduce this time interval by the operation of a car call pushbutton or a "door close" pushbutton. A "door open" pushbutton should be provided in the car to reverse the closing motion of the doors or to hold them open.

Wherever practicable, non-contact passenger detectors should be installed on the car doors to detect the presence of a passenger on the threshold and halt, or reverse, the movement of the doors.

NOTE 1 Where passenger detectors are fitted they can be used to automatically reduce the door dwell time (differential door timing), as the passenger detection system might greatly reduce the risk of the doors striking a passenger or closing until the threshold is clear.

The operation of doors should ensure the safety of passengers passing through the lift entrances and should conform to BS EN 81-1:1998+A3, **8.7** and BS EN 81-2:1998+A3, **8.7**.

NOTE 2 Attention is particularly drawn to the requirements concerning the maximum values for kinetic energy generated and closing force.

A lift should be fitted with controlled power-operated doors for use when there are conditions that particularly affect the safety of passengers or damage to motor vehicles or fork lift trucks. The closing of such doors should be possible only by continuous pressure on pushbuttons in the car or on landings.

Vision panels should only be installed in doors for lifts with manually operated car and landing doors.

7.2.3 Other features

When a lift is designated to be used as a firefighters lift, its controls should conform to BS EN 81-72:2003, **5.11**. In particular, in the event of a fire in a building, all lifts that are not in a firefighting well should return to the appropriate access level, in accordance with BS EN 81-73, in order to facilitate the escape of any passengers who are travelling in them at that time. They should then be immobilized.

The purpose of every pushbutton and indicator should be clearly understood by all passengers. To achieve this, the use and presentation of all pushbuttons and indicators should be as specified in BS EN 81-70 and BS ISO 4190-5.

*NOTE See also Clause **12** and **A.3**.*

8 Electrical installation

8.1 Main supply

The electrical installation and appliances should conform to BS EN 81-1 and BS EN 81-2.

To enable the electrical contractor to determine the size of the mains isolating switch, the lift contractor should declare the following on a schedule:

- values of full load current;
- starting (acceleration) current and its duration;
- maximum permissible voltage drop;
- any other relevant details.

Where an installation has more than one lift supplied from a common feeder, a diversity factor should be applied to the cable size (see Table 9 for examples). Where there are more than four lifts, the lift contractor should be consulted.

Table 9 **Examples of diversity factors**

Number of lifts	Diversity factor
1	1.0
2	1.0
3	0.9
4	0.8

Mains isolating switches at the intake point and in the machine room (which are provided by the electrical contractor) should be in accordance with BS EN 60947-3. They should accept either high rupture capability (HRC) fuses conforming to BS EN 60269 (all parts) or an equivalent miniature circuit breaker (MCB). The lift contractor should identify the size and type of fuses to be fitted in the mains isolation switch in the machine room. In order for the lift contractor to specify these fuses correctly, the electrical contractor should state the prospective short circuit current at the inlet to the machine room.

NOTE The supply cable to the mains isolating switches for the lift installation and lift lighting circuits may be routed through the well.

The electrical installation up to the inlet terminal of the machine room isolating switches is not part of the lift installation and should conform to BS 7671.

Overcurrent protection for individual lift machines and switching control circuits should be provided by the lift contractor, either on the lift controller or by a circuit breaker. It should be noted that the following are not supplied by the lift contractor.

a) The lift circuit from the intake room should be separate from other building services. In addition:
   1) where a lift within a group is designated as a firefighters lift, this should be in accordance with BS EN 81-72;
   2) where the installation consists of a single lift, and its supply is fused both in the lift machine room and at the inlet distribution board, the cable size and fuse ratings on the supply side of the machine room mains isolating switch should be selected to take account of the fact that overload current protection is provided by the lift contractor within the lift installation;
   3) on groups of interconnected lifts, it should be possible to switch off an individual lift without affecting the supervisory control of the remainder;
   4) each and every lift in an installation should have its own individual fused mains isolating switch that is lockable in the off position;
   5) no form of no-volt trip mechanism should be included anywhere in a lift power supply.
b) The supply to the car, machinery space/pulley space, machine room/pulley room and well lighting should be from a circuit separate from the lift power supply, or taken from a point on the supply side of the mains isolating switch and controlled by a fused switch in the machine room in accordance with BS EN81-1:1998+A3, **13.6** and BS EN81-2:1998+A3, **13.6**. For multiple lifts with a common machine room, a separate fused switch should be provided for the lighting supply to each car.
c) The supply to the socket outlets in the machinery space/pulley space, machine room/pulley room and well should be from a circuit separate from the lift power supply, or taken from a point on the supply side of the mains isolating switch and controlled by a fused switch in the machine room in accordance with BS EN 81-1:1998+A3, **13.6** and BS EN 81-2:1998+A3, **13.6**.

8.2 Machine room, machinery space, pulley room, well and pit

*COMMENTARY ON **8.2***

*Further information on well enclosures can be found in **5.3.5** and on space in **5.4.5**.*

8.2.1 General

The circuits for the lighting and power supplies in the machine room, well and pit should be in accordance with BS 7671.

NOTE Although these circuits are associated with the lift installation, they do not constitute part of the lift installation as defined in BS EN 81-1 and BS EN 81-2.

8.2.2 Machine room, machinery space and pulley room

Lighting in machine rooms and machinery spaces should give a level of illumination of not less than 200 lux at floor level and should conform to BS EN 81-1:1998+A3, **6.3.6** and BS EN 81-2:1998+A3, **6.3.6**. Lighting in pulley rooms should conform to BS EN 81-1:1998+A3, **6.4.7** and BS EN 81-2:1998+A3, **6.4.7**.

There should be a lighting switch adjacent to every entrance to the room.

In every room containing lift equipment, there should be no less than one 13 A socket outlets conforming to BS 1363-2.

8.2.3 Well

Lighting in the well should conform to BS EN 81-1:1998+A3, **5.9** and BS EN 81-2:1998+A3, **5.9** and should be controlled by a switch within the machine room. Multi-way switching should be used in conjunction with additional switches in the well (see also **5.3.5**).

8.2.4 Pit

There should be no less than one 13 A socket outlet conforming to BS 1363-2 in the pit. Socket outlets in the pit should also conform to BS EN 81-1:1998+A3, **5.7.3.4** and BS EN 81-2:1998+A3, **5.7.3.4**.

8.3 Permanent and temporary supplies

A permanent or temporary electrical supply should be available in the machine room and inside the well during installation for both lighting and socket outlets for power tools. Socket outlets should be located in the well at intervals of not greater than 7 m. The temporary supply should be 110 V a.c., centre tapped to earth and conforming to BS 7375. If the lift contractor needs a 3-phase supply to operate a materials handling hoist, the capacity of this supply should be specified by the lift contractor.

The permanent electrical supply to the lift should be connected in sufficient time to permit the running adjustments and tests that are necessary before lift completion can be carried out. If there is likely to be a delay in the connection of the main supply, a temporary supply with the same characteristics as the permanent supply should be provided to operate the lifts. Where stand-by supply operation is required (see **8.4**), the stand-by supply should be made available during lift testing at a time to be agreed between the lift contractor and the client, in order to fully test the stand-by supply operation as a whole.

8.4 Stand-by supply

Where a lift installation has to be supplied from a stand-by generator during interruptions to the normal power supply, the level of performance of the lifts, or reduction in lift service, should be agreed between the lift contractor and the client. The lift contractor should then indicate the capacity of power supply necessary to achieve this level of performance, and the level of regenerated energy that the lift installation can be expected to give, which the stand-by supply might need to absorb during such periods. Where appropriate, the lift contractor should specify the amount of harmonic distortion to be expected in the lift supply circuits in relation to both voltage and current and the acceptable voltage drop during lift starting.

Unless there is an uninterruptible stand-by (UPS) supply generator of sufficient capacity to drive the lift system with the same performance as the permanent power supply, there should be a break after failure or restoration of the main supply of sufficient duration to enable the lift control system to reset and enter or leave its stand-by supply mode. The actual duration of this break should be agreed between the lift contractor and the client.

NOTE The changeover control equipment is not provided by the lift contractor.

A signal, in a form to be agreed between the lift contractor and the client, should be provided to indicate whether the supply is from the permanent supply or from the stand-by generator. Where there is insufficient capacity provided by the stand-by supply to operate the lift system as a whole, those lifts which are to be taken out of service should initially return to a nominated floor to release passengers, in sequence, at the rated speed or a reduced speed.

Where there are several lifts or groups of lifts with separate machine rooms, the lift contractor should specify the number and sizes of electrical conductors running between machine rooms for stand-by supply mode control purposes.

In addition, any special requirements with regard to segregation should be specified by the lift contractor. Where there are remote indicators associated with the lift system giving, for example, information concerning lift position, due regard should be given to the power supply requirements of these and whether this is to be derived from the stand-by supply.

8.5 Supplies to firefighters lifts

Firefighters lifts should have a primary and a secondary source of electrical supply as in accordance with BS EN 81-72. Both sources should be sufficient to run the firefighters lift at the rated load and speed. The supplies should be fire rated at least to the level of protection equal to that given to the lift by its structure.

NOTE Attention is drawn to the requirements of local fire authorities regarding fire ratings.

8.6 Communications

Where a lift installation, including its external indicators and emergency communications, requires external data and/or signal/communication links, the number, sizes and types of these should be specified by the lift contractor. Where special links, e.g. fibre optic data links, are to be used, the lift contractor should also specify the required terminations.

The positioning of external indicators and alarm bells should be indicated by the client in the tender documents (see **4.2**).

8.7 Terminations

All wiring and cables other than those recommended in **8.1** and **8.2**, of whatever types, which run outside the machine room, well and pit, but are associated with the lift installation, should be installed by the electrical contractor to the specification of the lift contractor.

The lift contractor should provide a schedule of all such cables/wiring with appropriate instructions as to any special precautions required in respect of terminations, limit on length of run, screening and/or segregation. Unless otherwise agreed between the lift contractor and the electrical contractor, such wiring should be terminated in appropriate terminal boxes within the machine room or well. The position of such boxes should be shown on installation drawings, but should be finally agreed with the lift contractor's site representative. The markings of terminals within such terminal boxes should be specified by the lift contractor.

8.8 Markings

All switches, controls and terminal boxes associated with the lift installation should be clearly and indelibly marked with their function and the equipment and/or lift to which they relate. All switches should also have their off position clearly and indelibly marked and should be of a type that the on and off condition is clear and unambiguous. All main isolators for lifts should be capable of being locked off in the open position with the use of a padlock or equivalent.

8.9 Emergency alarm devices

An emergency alarm device as specified in BS EN 81-1 and BS EN 81-2 should be provided in the car.

NOTE BS EN 81-28 also specifies requirements for emergency alarm devices.

The lift contractor should fit the cabinet in the car and provide the wiring from the car to a terminal box adjacent to the well. All telephone lines should be ordered and provided by the client and should be available to the lift contractor prior to the testing of the lift.

8.10 Electromagnetic compatibility

Lift electrical installations should be in accordance with BS EN 12015 and BS EN 12016.

9 Lift installation

9.1 General

9.1.1 Controller technology

Where safety contacts are replaced by solid state switching, they should be type tested and a certificate should be available and included in the Technical File in accordance with BS EN 81-1:1998+A3, Annex F and BS EN 81-2:1998+A3, Annex F.

The control programme used in programmable electronic systems (PESSRAL) should not be corrupted or destroyed whenever the electrical supply is disconnected in accordance with BS EN 81-1:1998+A3, **14.1.2.6** and BS EN 81-2:1998+A3, **14.1.2.6**.

Insulation tests should be restricted to power and safety circuits.

9.1.2 Levelling and re-levelling

*NOTE 1 Levelling accuracy is determined by the type of drive system used (see **9.2**).*

The degree of levelling accuracy should be the same for all loading conditions of the lift. Where greater levelling accuracy is needed, advice should be sought regarding the additional equipment required.

NOTE 2 A greater levelling accuracy can increase costs.

Re-levelling should be used only when it is otherwise impossible to maintain the levelling accuracy within the normally expected tolerances (given in BS EN 81-70, **5.3.3**), e.g. on long travel lifts during loading and unloading or to compensate for creep on hydraulic lifts.

9.1.3 Safe rescue of passengers trapped in a lift

NOTE Attention is drawn to the Lifts Regulations 1997 [3], which require persons having control of a lift (owners, landlords, tenants, etc.) to make provision to respond effectively to emergency calls without delay.

Rescue procedures should be in accordance with BS 7255.

For electric traction lifts, the location and accessibility of the handwinding wheel and brake release mechanism should allow safe operation. A means of easily determining that a lift is in the door-unlocking zone should be provided by means of rope markings, buzzers or other devices, which can operate when the electrical supply is switched off. Where the force required to move the handwheel is greater than 400 N, a means of electrical emergency operation should be provided in accordance with BS EN 81-1:1998+A3, **12.5**.

On hydraulic lifts, a manually operated lowering valve should be provided, together with a means of easily determining that a lift is in the door-unlocking zone by means of buzzers or other devices, which can operate when the electrical supply is switched off. A pressure gauge should be provided to indicate the status of the hydraulic system. A handpump should also be provided in order to move the lift in the upward direction.

Manufacturers' instructions and other instructions regarding rescue procedures should be displayed in the machine rooms.

9.1.4 Car extension for stretchers

Recesses and extensions can be provided to permit the transport of stretchers, etc., and the area made available for this should be included in the calculation of the available car area related to rated load.

9.1.5 Lift duty

Lifts have to meet different traffic demands and the lift drive system should be capable of meeting these demands.

NOTE Demand is measured in starts per hour. For electric traction lifts the commonly available drive motor starts per hour are 90, 120, 150 and 180, the latter being considered intensive duty. For hydraulic lifts where pump motor starts are only required for upward travel (gravity is used for downward travel) the commonly available pump motor starts per hour are 15, 45 and 60.

9.1.6 Lift entrance operation

NOTE 1 Door configuration, size and operating speed play a major part in meeting the service to be provided by the lift.

Passenger lifts should be provided with (horizontal) power-operated car doors, which couple to the landing doors to provide simultaneous opening and closing. The doors should only open when the lift is in a door unlocking zone. Any aid to improved traffic handling, including pre-opening of the doors, should only occur as the lift enters the unlocking zone and approaches the landing.

Automatic doors should close after the lift has emptied for safety reasons and to facilitate the quick movement of the lift to another floor to meet demand.

Goods lifts should be fitted with manual (horizontal) doors where longer loading and unloading times are to be accommodated. Where power operation is employed the doors should be closed by operating a pushbutton.

NOTE 2 Goods lifts can also be fitted with vertical sliding panels and these are usually power-operated.

9.1.7 Car suspension

Cars on electric traction lifts and on indirect drive hydraulic lifts should be suspended by ropes. Satisfactory performance and service life depend on a number of factors, which should be taken into account when unusual requirements are specified by architects and developers; these include:

- the number of pulleys the rope passes over;
- the number of reverse bends it encounters;
- the fleet angle on and off pulleys and sheaves.

Whenever possible, the position for the machine room of an electric traction lift should be above the well. If the machine room is at the side or below the well, the number of reverse bends and multiplying pulleys should be minimized in order to reduce rope wear.

These factors should also be considered for roping systems for hydraulic lifts.

NOTE Chain suspension may be used instead of ropes for both electric and hydraulic drive systems. Chain suspensions are noisier in use than a conventional rope-suspended lift.

9.1.8 Emergency unlocking of landing doors

An emergency unlocking key should be available, allowing the opening of the landing doors. This key should only be given to a responsible person who has been instructed in its use.

NOTE See BS EN 81-71 for further details if a lift is considered to be in an environment where it is likely to be subjected to interference or vandalism.

9.2 Drive systems

9.2.1 Electric traction lifts

*COMMENTARY ON **9.2.1***

Electric traction lifts operate on the principle of an electric motor turning a sheave directly or through a speed-reducing gear. Ropes are placed over the sheave with the car suspended on one side and a balancing counterweight on the other. Traction between the rope and the sheave is achieved by the ropes running in a groove.

Electric lifts can deal with most passenger and goods requirements.

For applications requiring rated speeds from 0.63 m/s to 6.00 m/s (and above) and rated loads from 320 kg to 2 500 kg (and above) for a wide range of travel distances, electric traction lifts should be considered.

Electric traction lifts should conform to BS EN 81-1:1998+A3 and the well and other dimensions should conform to BS ISO 4190-1 and BS ISO 4190-2.

The drive system should be selected to meet the client's specification of rated speed, duty, levelling accuracy and comfort in accordance with Table 10.

Table 10 **Drive system selection to meet levelling accuracy and comfort criteria for electric traction lifts**

Duty	**Drive**	**Levelling accuracy (*la*)** mm	**Comfort**
Rated speed <0.5 m/s Duty <90 starts per h	Single speed a.c.	25 <*la* <40	Poor
Rated speed <1.0 m/s Duty <150 starts per h	Two-speed a.c.	10 <*la* <20	Good
Rated speed <1.0 m/s Duty <150 starts per h	VVVF open loop control	5 <*la* <10	Excellent
Rated speed <1.0 m/s A) Duty <180 starts per h	Variable speed a.c. or d.c.	<10	Very good
Rated speed <1.0 m/s B) Duty <180 starts per h	VVVF with digital velocity feedback	5 <*la* <10	Excellent

A) Typically units are geared for speeds up to 1.6 m/s and gearless for above 2.5 m/s.

B) For higher speeds and for higher quality systems, digitally encoded positional and velocity feedback should be used.

NOTE Currently the most commonly supplied modern drive systems are the variable-voltage, variable-frequency a.c. drives, known as VVVF (or V3F). Here the incoming electrical supply at 50 Hz is first rectified to provide a d.c. supply. This d.c. supply is then inverted by a solid state controller to provide a variable-voltage, variable-frequency supply to the drive motor.

The motor should be matched to the output characteristics of the inverter to ensure quiet operation, exact velocity and acceleration profiles, precise performance times and good ride quality.

9.2.2 Hydraulic lifts

*COMMENTARY ON **9.2.2***

Hydraulic lifts are complementary to the conventional electric traction lift. They operate on the principle of using fluid (generally oil) under pressure for transmission and raising the car by means of a jack or jacks. Downward travel is achieved under gravity.

There are two types of hydraulic lift:

a) direct acting, with two variations:

1) jack(s) under the car, for which a lined borehole is required;

2) jack(s) at the side of the car located in the well, for which no bore hole or a reduced depth bore hole is required;

b) indirect acting, where one or two jacks are located in the well with a suspension system (ropes or chains) connected to the car.

Hydraulic lifts are suitable for goods lifts, vehicle lifts, hospital and bed lifts and for passenger lifts up to 1.0 m/s.

For applications where the rated speeds from 0.30 m/s to 1.00 m/s and rated loads from 320 kg to 2 500 kg (and above) and travel distances are not greater than 18 m, hydraulic lifts should be considered.

Hydraulic lifts should conform to BS EN 81-2:1998+A3 and the well and other dimensions should conform to BS ISO 4190-1 and BS ISO 4190-2.

The drive system should be selected to meet the client's specification of rated speed, duty, levelling accuracy and comfort in accordance with Table 11.

Table 11 **Drive system selection to meet levelling accuracy and comfort criteria for hydraulic lifts**

Duty	**Drive**	**Levelling accuracy (*la*)** mm	**Comfort**
Rated speed <0.30 m/s Duty <15 starts per h	No control of acceleration or levelling speeds	<25	Poor
Rated speed <0.60 m/s Duty <45 starts per h	Simple control of acceleration or levelling speeds [A)]	6 <*la* <12	Good
Rated speed <1.0 m/s Duty <60 starts per h	Flow control of acceleration or levelling speeds [B)]	<6	Excellent

[A)] Single speed flow control.

[B)] VVVF flow control.

Where heavy duty is expected, the installation of oil coolers and external ventilation of the machine room should be considered. In these circumstances the lift contractor should be consulted for guidance at the time of tender (see **4.2.2.1**).

9.2.3 Guided chain lifts

*COMMENTARY ON **9.2.3***

Guided chain lifts are an indirect drive system, where the car is suspended by chains instead of ropes. Typically guided chain lifts have the machinery located in the top or bottom of the well, with the control cabinet sited anywhere near the lift. For this reason a conventional machine room is not always necessary and a machinery space might be provided instead. Balancing weights may be employed, as with conventional lifts. The safety gear and overspeed governor are normally contained in one unit.

Where, for constructional purposes, it is not possible to accommodate sheaves or pulleys of adequate diameter, chain suspension should be used.

This lift type should be used as a low-speed, short-travel lift, as chain speeds are restricted to 0.63 m/s with travels of less than 25 m. The rated loads, well and other dimensions should conform to BS ISO 4190-1 and BS ISO 4190-2.

9.2.4 Rack and pinion lifts

*COMMENTARY ON **9.2.4***

Rack and pinion lifts are a direct drive system. The drive unit comprises a continuous length of machine-cut rack bolted to a rigid mast and engaging with a pinion or pinions held in permanent mesh. The motive power can be electric, hydraulic, petrol or diesel units. The vertical loads occurring are applied via the rack to the mast. Balancing weights may be employed, as with conventional lifts. The safety gear and overspeed governor are normally contained in the same unit as the rack and pinion assembly. As the drive unit is carried on the car frame a conventional machine room is not always necessary and a machinery space near to the lift might be provided instead to accommodate the control equipment.

The application of rack and pinion lifts in the construction industry as passenger hoists is not considered here.

Rack and pinion lifts should be installed in special situations such as communication towers, underground power stations, smoke stacks, where periodic use is expected, and where the lift is required to follow a contour such as on exploration platforms and unique architectural designs.

Rack and pinion lifts should have rated speeds not greater than 1.50 m/s and rated loads in the range 200 kg to 2 000 kg. Where noise is a problem, the rated speed should be less than 0.3 m/s.

NOTE See DD 222 for the design of rack and pinion lifts.

9.2.5 Screw lifts

*COMMENTARY ON **9.2.5***

Screw lifts can be direct acting, where the drive mechanism is directly connected to the car frame or sling, or indirect acting, where the drive mechanism is connected to the car frame or sling by a suspension means, such as ropes or chains. A balancing weight may also be employed.

Screw lifts mainly have the machinery on the car frame and a machinery space near to the lift should be provided to accommodate the control equipment.

Screw lifts should be installed for use in very short travel situations, e.g. platform lifts for goods and use by persons with impaired mobility.

Screw lifts should have rated speeds not greater than 0.5 m/s. The rated load depends on drive type:

a) for lifts with a balancing weight the rated loads should not be greater than 1 000 kg;

b) for indirect acting screw lifts, rated loads should not be greater than 375 kg.

10 Energy efficiency

Lifts should be installed to meet energy saving criteria required by Building Research Establishment's Environmental Assessment Method (BREEAM).

NOTE 1 Two BREEAM credits are available in the overall energy classification of a building by the provision of energy efficient lifts.

To meet the BREEAM requirements, drives should be variable-voltage, variable-frequency, regenerative drives.

Lift car lighting should be of a low energy type and should decrease to a lower level of energy consumption after a period of inactivity in excess of 5 min in accordance with ISO/DIS 25745-1:2008. The lighting should be restored to the normal level as the result of:

- the lift starting to move;
- the doors opening;
- a destination pushbutton being operated;
- any other pushbutton on the car operating panel (COP) being operated.

Lift controllers should be placed in standby mode after 5 min of inactivity in accordance with ISO/DIS 25745-1:2008. In practice only the basic control should remain in operation.

NOTE 2 Annex I indicates measures that can be taken to reduce energy consumption.

11 Accessibility to lifts for persons, including persons with impaired mobility

*COMMENTARY ON **11***

The Building Regulations 2000, Approved Document M [8] provides information on door opening widths and landing spaces, and with regard to the positioning of the control panels and pushbuttons in lifts designated as accessible lifts.

*The Lifts Regulations 1997 [3] (see **C.1**) and the Equality Act 2010 [7] (see **C.3**) provide information on access and controls for people with disability.*

BS 8300 gives recommendations for the design of buildings and their approaches to meet the needs of people with disability.

BS EN 81-70 provides information on lifts provided for persons with impaired mobility, see Annex J.

When selecting a lift for use by people with disability, the following should be taken into account:

a) the specific needs of the individuals for whom the lift is to be provided; and

b) the circumstances of the building in which the lift is to be installed.

In particular, where there is a requirement for wheelchair transportation, an assessment should be made to determine the types of wheelchairs to be carried, in order to ensure a lifting solution with a correct rated load and suitable platform dimensions is selected.

When a new lift is being installed in an existing building, reasonable provision should be made for people with disability where practicable.

Means of escape for people with disability should conform to BS 8300 and BS 9999.

When choosing finishes, the purchaser should take into account the necessity for access by persons with impaired mobility. Any finishes applied, e.g. handrails, mirror, etc., should not hinder or prevent access by people with disability. The use and presentation of all pushbuttons and indicators should conform to BS EN 81-70 and BS ISO 4190-5.

Where a lift is specifically installed for the use of people with disability, the car and landing call dwell times should be extended to 5.0 s and this might have a significant impact on the performance of a lift.

Subject to certain limitations, the provision of vertical access for people, including people with disability, can be provided by specific types of lifts, which should be in accordance with the relevant British Standards, e.g.:

a) powered stair lifts should be in accordance with BS EN 81-40;

b) powered domestic lifts with partially enclosed cars and no lift well enclosures should be in accordance with BS 5900;

c) powered vertical lifting platforms having non-enclosed or partially enclosed liftways should be in accordance with BS 6440;

d) fully enclosed lifting platforms should be in accordance with BS EN 81-41.

Annex A (normative) Examples of checklists for tender documents

A.1 Exchange of information

The client's representative and the lift contractor should agree the following typical information (see **4.1**) at the earliest possible stage:

- customer's identification of lift;
- the number, capacity, speed and disposition of the lifts necessary to give lift service in the projected building;
- the special requirements of local authorities and other requirements set out in the planning permit;
- the provision of safe and convenient access to the machine room, where provided;
- the loads that the lift imposes on the building structure, the holes to be left in the machine room floor and the cut-outs for wall boxes for pushbuttons and signals;
- the necessity for and type of isolation to minimize the transmission of vibration and noise to other parts of the building;
- machine room heating and ventilation;
- the need for the builder to maintain accuracy of building in relation to dimensions, vertical alignment and agreed tolerances (see **5.2**);
- the time required for preparation and approval of relevant details and drawings for the manufacture and installation of the lift equipment;
- the requirements for fixing guide brackets to the building structure;
- the time at which electric power might be needed before completion of the lift contract;
- the requirements for electrical supply, feeders, associated switchgear, etc.;
- the requirements for scaffolding in the well and protection of the well prior to and during installation and testing of equipment;
- delivery and storage of equipment;
- the means of escape in the event of fire or other emergency.

A.2 Lift invitation to tender

A.2.1 General

The following is a non-exhaustive list of the basic information that should be provided to the lift contractor in the tender documents (see **4.2.2**):

- customer's identification of lift;
- installation arrangement (see BS ISO 4190-1 or BS ISO 4190-2);
- rated load and speed (see **6.2** and **6.3**);
- lift travel and floor-to-floor heights;
- net lettable floor area and population per floor;
- location and designation of levels served;
- arrangement of a multiple lift installation (see **6.4.6**);
- electricity supply (including emergency power supply): voltage, frequency, capacity, tolerance, etc. (see Clause **8**);
- lift drive system and duty cycle (see **9.2**);

- ride quality;
- control system and indicators (see Clause **7**);
- additional items (see **4.2.2**);
- facilities for access by persons with impaired mobility (see Clause **11**, **C.3**, BS 8300 and BS EN 81-70);

  NOTE 1 Attention is drawn to the Equality Act 2010 [7] and to the Building Regulations 2000, Approved Document M [8].
- firefighters lifts (see BS EN 81-72);
- fire detection systems to be used;
- finishes (see **4.2.3**);
- vandal-resistant requirements (see BS EN 81-71);
- inclusions and exclusions (see **4.2.4**);
- building contract programme (see **4.2.6**);
- pre-tender health and safety plan;
- building construction method (see **4.2.2**);
- capacity and availability of cranage facilities;
- lift priority recall (see BS EN 81-72).

NOTE 2 This list covers the basic data the lift contractor needs and is non-exhaustive.

A.2.2 Finishes

Finishes that should be considered (see **4.2.3.2**) for the tender documents include:

- car enclosures;
- car ceilings;
- car floors;
- car light fittings;
- car trims (including decoration, mirrors, handrails, tip-up seats, etc);
- car and landing doors and sills;
- landing architraves, door frames;
- pushbutton and indicator fittings in the car and at the landings.

A.2.3 Other items to be supplied by the lift contractor

If any of the following items are to be included in the tender documents, they should be supplied by the lift contractor (see **4.2.3**):

- guide brackets;
- buffers and metal stools for the buffers (where applicable);
- pit screen for counterweight;
- machine and pulley subframes;
- sound and vibration isolation for the machine, where required;
- sill support member (with toe guard and/or fascias) for all except general-purpose goods lifts;
- interlocks for access, inspection and emergency doors;

- power supply for emergency lighting and alarm signals;
- electrical wiring and cables for the lift, terminating in the main switch furnished by the client;
- alarm pushbutton and bell or other intercommunication system (which may be limited to that part of the system contained within the well);
- lifting tackle and small electric tools for use during the actual installation;
- services of personnel to install, wire and test;
- test instruments and weights.

A.2.4 Other items to be supplied by the principal contractor

If any of the following items are to be included in the tender documents, they should be supplied by the principal contractor (see **4.2.3.3**):

- builders' work, such as forming the well, pit and machine room, which should be in accordance with Clause **6**;
- building in of wall inserts, cutting away, making good and site painting;
- forming the machine room floor, including any reinforcement necessary for load bearing;
- supplying or fixing lifting beams in machine room, including proof testing, certifying and marking;
- supplying or fixing of structural steelwork for machine and buffer supports;
- provision of safe and adequate access to the machine room and well;
- supplying or fixing of steel surrounds for vertical bi-parting sliding doors;
- supplying or fixing of sill support members (with toe guards) for general-purpose goods lifts;
- carrying out any necessary tanking, lining or reinforcement of the pit;
- supplying or fixing of dividing beams for multiple wells and inter-well screens;
- supplying or fixing of access doors to machine room, pit and pulley room, emergency doors and inspection doors and their locks;
- guarding of openings and other measures necessary to ensure the safety and convenience of personnel within the building;
- provision of temporary protection (over and above the additional protective skin) of finished lift equipment on landings, surrounds, surfaces, finishes and access routes and if necessary in the car;
- supplying or fixing of scaffolding, planks and ladders;
- off-loading and storage in a protected area of lift materials and equipment delivered by the principal contractor;
- painting of site steelwork supplied by other parties;
- supplying or installation of any electrical wiring external to the well and machine room;
- supplying or installation of working lights, temporary and permanent electricity supplies, etc. (see **4.3.6**, **5.3.5** and **8.3**);
- providing a three-phase electrical supply for a mobile platform or hoist fitted in the well, if required;
- providing messrooms, sanitary accommodation and welfare facilities for personnel;

- boring the hole and provision of the liner (where required) for the jack on hydraulic lifts;
- provision of cranage facilities;
- supplying and fixing of permanent access ladders, steps and guard rails;
- cleaning, renewing or replacing lift equipment damaged by dust produced from such processes as dry grinding of mosaic and other building work;
- provision of permanent ventilation or other arrangements to ensure a machine room temperature between 5 °C and 40 °C for electric traction lifts and between 15 °C and 35 °C for hydraulic lifts in operation prior to testing;
- provision of reinforcement of pavements and floors, making suitable access and trucking, cranage and unskilled labour for handling equipment to its final position;
- provision of calculations with respect to the building, or the obtaining of any necessary permissions and the issue of relevant notices;
- carrying out any role specified in the CDM Regulations 2007 [2] other than that of "contractor";
- provision of telephone utility services.

NOTE The principal contractor is also generally responsible for meeting extra costs due to surveyor's fees or special requirements of government departments, local authorities, insurance companies, consultants, other bodies or officials.

A.3 Coordination of site work

Preparatory work on site (see **4.5.3**) can include:

- making the pit dry and watertight, including tanking if necessary, and clearing it of rubbish;
- making the well complete and watertight and equipping it with lighting (permanent if possible);
- making the machine room complete and watertight, with full lighting, clearing it of rubbish, dust-proofing it (see **5.4.2**) and securing access against unauthorized entry, including temporary warning notices and lock, with a key available exclusively to authorized personnel;
- completing preparation for lift fixings in the pit, well and machine room, including the accurate placing of built-in wall inserts if these are used, and the thorough cleaning out of the associated slots;
- final grouting or fixing in position of steel work items (e.g. well trimmers and machine beams) after checking for correct position by the lift contractor;
- putting the scaffolding in position, as agreed with the lift contractor;
- completing entrance preparations, including preparations for door frames, architraves, push button boxes and indicators. In many cases progress can be facilitated by omitting the front walls of the well at some floors, until the car, doors, etc., are installed;
- establishing the datum-line (in elevation) at each floor to enable the lift contractor to set metal sills and frames in relation to finished floor levels;
- planning the dimensions in accordance with **5.2**.

Annex B (informative) Interface fixings for steel-framed buildings

B.1 Guide rail fixings

In considering the options, it is important to take account of the criteria that might influence the resultant acceptability of the lift installation to the building occupants when the lifts are in service.

By the nature of the product, a lift is required to travel vertically through a building via a well (hoistway), which might be individual to each and every lift, or in the case of a group of lifts, a lift might occupy a multiple well.

Lift guide rails need to be attached at regular intervals to the building, in order to achieve the appropriate stiffness; and in the case of steel-framed buildings, particular consideration needs to be given to how this could be achieved.

The lift guidance system is of necessity a sliding (or rolling) system and noise transmission can emanate from the installation. Lifts fixed into reinforced concrete structures are less noisy from the transmission point of view.

Modern steel-framed buildings tend to be more “lively” than those of the older “stiffer” type of construction, with a natural frequency range of 8 Hz to 15 Hz, to which humans are very sensitive. For this reason the lift industry prefers not to fix guide rails directly to the steel frame. Fixing directly to steel carries the risk of noise and vibration being transmitted throughout the building, and the alleviation of this risk is outside the control of the lift contractor.

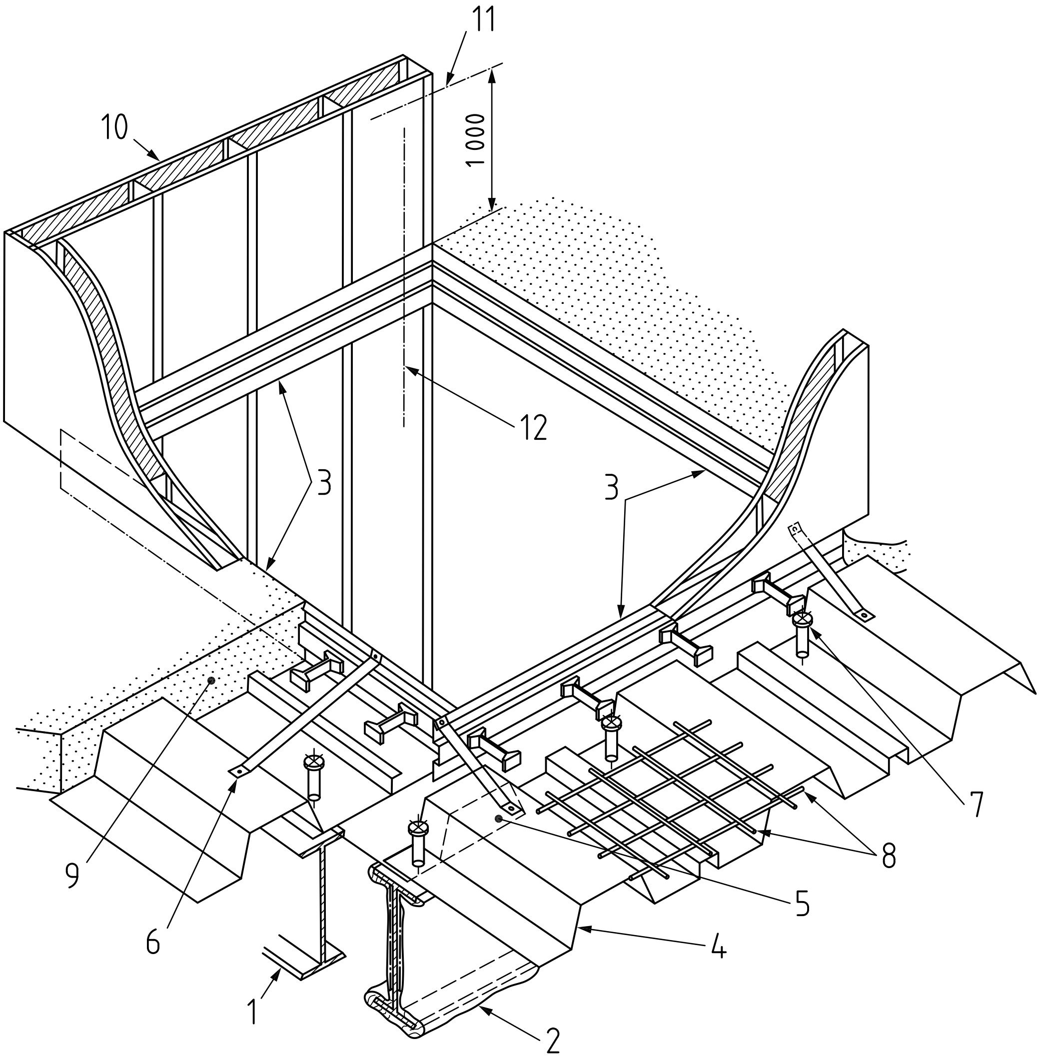
The preferred guide rail fixing method is to use a continuous composite ring of inserts around the well opening in the floor slab, to introduce damping, which can be achieved by the use of concrete. Most floors within a building are usually of concrete construction, of which, for this method of cast-in fixing, the normal strength is 34.475 N/mm^2 and the thickness is 130 mm.

Large floor spans might need intermediate steelwork to provide a suitable guide bracket spacing.

If the concrete is “lightweight”, i.e. less than 130 mm thick, the edge of the slab can be thickened or a composite edge trim can be used, incorporating an insert and additional reinforcement to give the equivalent strength required. Examples of this type of installation are shown in Figure B.1 and Figure B.2.

Figure B.1 **Well construction** *(1 of 2)*

Dimensions in mm

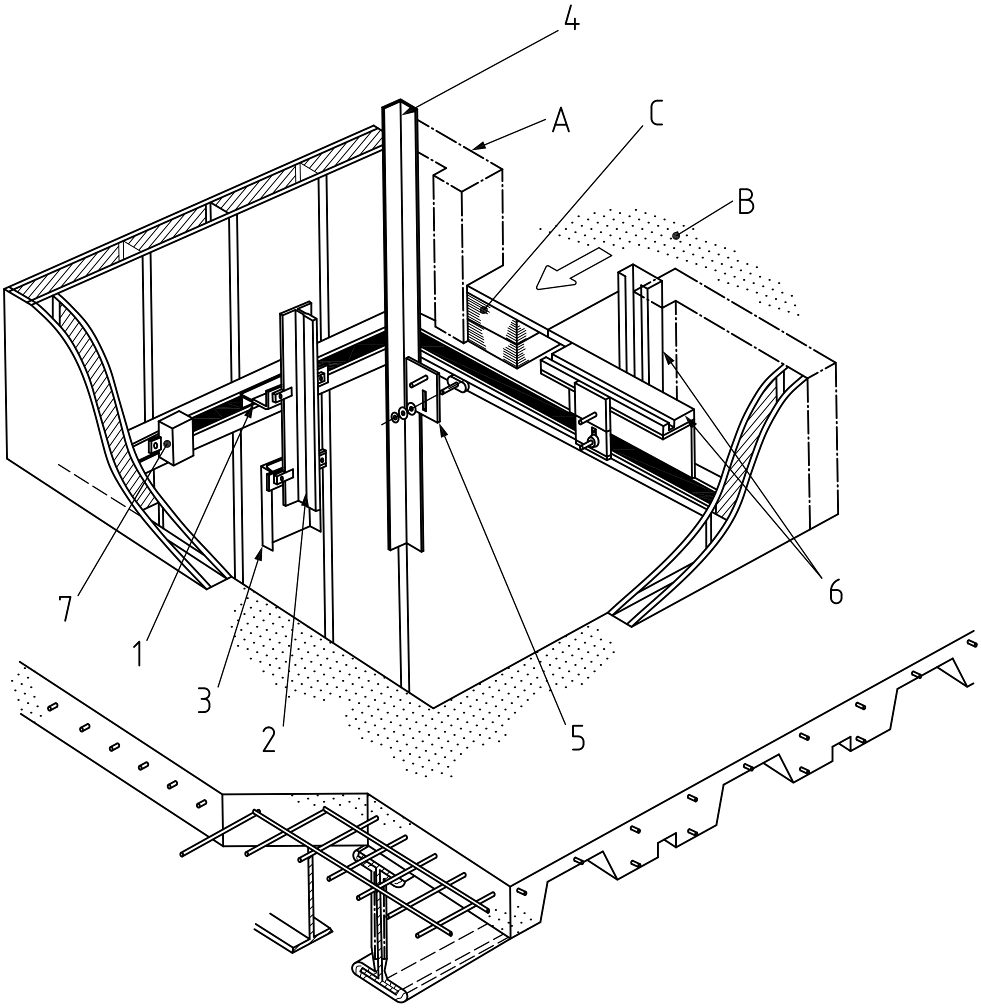


Key

1	Primary steel beams around well	7	Shear studs (electrically welded studs that penetrate decking and edge trim, making a structural connection to floor steel for concrete slab)
2	Fire protection (sprayed, boarded or jacketed)	8	Reinforcement (mesh with edge bars)
3	Composite edge trim (incorporates full insert with welded on studs. Hot dip galvanized. Note the cleaning out of the insert if required should be undertaken by others)	9	Concrete (pumped, normal light aggregate incorporating round grained pea gravel)
4	Metal decking (galvanized corrugated steel)	10	Dry lined stud walls on sides and rear of well only, for protection (front wall constructed after lift entrance installed)
5	Void stops (expanded polystyrene)	11	Meter mark [1 000 mm above all finished floor levels (FFLs) by site engineer]
6	Metal stays (to maintain straightness and squareness of edge trim during pouring of concrete)	12	Vertical datum (lines at one floor, marked close to the entrance inside the well so that the lift door, floor and ceiling patterns can be positioned in line)

The benefits of using composite inserts in the floor slab are:

Figure B.2 **Typical installation of lift equipment** *(1 of 2)*



Key

Lift industry

1 Lift guide brackets (attached to composite trim with "T" bolt. Guides fixed with clips that allow for building compression)

2 Lift guides

3 Guide backing (secondary clip-on backing to increase guide stiffness at taller floors)

4 Entrance "H" frames [typically comprising vertical angles, fixed to composite trim with clips to allow for building compression, with an angle (or "C" channel) horizontally clipped at header height for top door fixings]

5 Sill adapter plates (allows use of standard sills at higher level to suit computer flooring)

6 Lift door frames and sills (fixed to items 4 and 5)

7 Ancillary equipment (flex hangers, lighting, cable trays etc. fixed to composite trim using "T" bolts or insert nuts)

Other trades (Front wall and floor construction after installation of entrances)

A Dry lined front wall (attached to lift entrance frame or fire trim to give fire rated connection. Holes to be cut and lined with studs for indicators and pushes. Back boxes to be fixed into holes)

B Floor tiles (to be profiled to fit butt up against door sill and wall. Floor jacks to be positioned close to sill)

C Fire barrier (floor void to be closed with rockwool batts or similar at the edge of the well)

- simplified construction;
- no interference with firespray;
- no site welding necessary;
- known supply of materials;
- greater flexibility related to tolerance;
- independent pre-planning of steel frames;
- accord with fast-track installation methods.

B.2 Wall linings

In a typical installation, wall linings are arranged to fit to the edge of floor slabs, in order to obviate the necessity of additional screening or ramping to projecting floor slabs. The maximum projection of ledges or beams is 200 mm, before ramping is considered necessary.

In order to provide a smooth surface on the inside of the well, internal cross bracing is always suitably enclosed.

The interface fixings for the lift landing furniture are always discussed and resolved with the lift contractor.

B.3 Schedule of supplied items

Table B.1 shows a typical schedule of supplied items.

NOTE The list of items shown in Table B.1 is not exhaustive and the customer's specification and contract documents need to be checked.

Table B.1 **Schedules of supplied items**

Supplier	Item
Steelwork contractor	All primary framing members around the perimeter of the well at all levels, including framing rings at the head of the well for pulleys, etc.
	All well trimmer steels.
	Lifting beams at the head of the well and/or the machine room, together with all attachments and supports.
	Machine supporting steelwork and deflector pulley steels for machine below applications.
	Any intermediate steelwork between floors for guide rail fixing purposes.
	Chequer plate decking for suspended pit/pulley room floors.
	Horizontal landing door fixing support members.
Lift contractor	Internal vertical framing for the purpose of retaining landing doors.
	Supporting members for machine above applications, including fabricated steel piers when concrete piers are unavailable.
	Buffer blocking for spring/hydraulic buffers, when concrete piers are unavailable.
	Support members for landing door sills.
	Secondary pulley steels for gear below and other non-standard applications.
Floor slab contractor	Composite edge trims incorporating inserts.
Others	Dividing screens.
	Void screens [A].
	Fire stopping at landing thresholds [A].

[A] These items can be supplied by the lift contractor, if specified at the time of tender.

Annex C (informative) Relevant statutory regulations

C.1 Summary of the Health and Safety at Work etc. Act 1974

Persons concerned with lifts have duties under the Health and Safety at Work etc. Act 1974 [11], which include the following.

a) Employers have a duty to ensure, so far as is reasonably practicable, the health and safety of their employees while at work. This includes:
   - the provision of plant and systems of work that are safe and without risk to health;
   - the means to safely use and handle articles and substances;
   - all necessary information, instruction, training and supervision;
   - a safe means of access and egress;
   - a safe working environment.

b) Employers, the self-employed and employees have a duty to conduct their undertakings in such a way as to ensure, so far as is reasonably practicable, that all persons who might be affected by the work activity are not exposed to risks to their health and safety.

c) Manufacturers, suppliers etc. of articles for use at work have a duty to ensure, so far as is reasonably practicable, that the articles are so designed and constructed that they are safe and without risk to health when they are being set, used, cleaned or maintained.

d) Erectors and installers of articles for use at work have a duty to ensure, so far as is reasonably practicable, that nothing about the way articles are erected or installed is unsafe or a risk to health.

e) Persons concerned with premises have a duty to persons other than employees who use non-domestic premises made available to them as a place of work. It is the duty of the person who controls the premises to take such measures as it is reasonable for them to take to ensure, so far as is reasonably practicable, that the premises, the means of access and egress to and from the premises, and any plant of substance in the premises, are safe and without risk to health.

C.2 Summary of the Management of Health and Safety at Work Regulations 1999

The Management of Health and Safety at Work Regulations 1999 [13] implement the requirements of Framework Directive 89/391/EEC [14].

They include a requirement (Regulation 3) for every employer and self-employed person to make a suitable and sufficient assessment of the risks to health and safety of themselves and others arising out of, or in connection with, the conduct of the undertaking. The Regulations require the significant findings of the assessment to be recorded. The purpose of the assessment is to identify and quantify the risk. Employers are required to implement preventative and protective measures to eliminate risk, and to put in place effective control measures to address residual risks and hazards.

The Regulations also include requirements for training, health and safety assistance, information for employees, and a requirement to put in place such arrangements as are appropriate for the effective planning, organization, control, monitoring and review of the preventative and protective measures necessary.

C.3 Summary of the Equality Act 2010

From 1 October 2010, the Equality Act replaced most of the Disability Discrimination Act (DDA) 1995 [15]. However, the Disability Equality Duty in the DDA [15] continues to apply [3)].

The Equality Act 2010 has been enacted with the desire to reduce socio-economic inequalities, discrimination and harassment related to protected personal characteristics such as age; disability; gender reassignment; marriage and civil partnership; pregnancy and maternity; race; religion or belief; sex; sexual orientation.

Service providers have a duty to consider the use of premises by people with mobility, visual, hearing, speech and dexterity impairments as well as those with learning difficulties and mental health disabilities.

Businesses and service providers have a duty to make "reasonable adjustments" to the physical features of their premises in order to remove or overcome barriers to provide "access for all". "Reasonable adjustments" take account of: practicality; financial and other costs; disruption; resources available; availability of financial assistance.

C.4 Summary of other relevant statutory provisions

COMMENTARY ON ***C.4***

This list is not intended to be exhaustive and does not attempt to indicate which regulations are applicable in any given circumstance. The regulations are listed alphabetically and not by relative importance.

C.4.1 Construction (Design and Management) Regulations 2007

The CDM Regulations 2007 [2] places duties on the client, the CDM coordinator, designers, the Principal Contractor and contractors (e.g. lift contractors) to coordinate and manage the health and safety aspects of a construction project with the aim to control and reduce the risks involved.

C.4.2 Control of Asbestos at Work Regulations 1987

The Control of Asbestos at Work Regulations 1987 [6] require employers to prevent the exposure of employees to asbestos, or if this is not reasonably practicable, to control such exposure to the lowest possible level. Before any work with asbestos is carried out, the Regulations require employers to make an assessment of the likely exposure of employees to asbestos dust, which can include a description of the precautions that are taken to control dust release and to protect workers and others who might be affected by that work.

C.4.3 Control of Substances Hazardous to Health Regulations 1994

The Control of Substances Hazardous to Health Regulations 1994 [16] set out a framework of action for employers and self-employed persons to follow, which aims to protect the health of all people who might be exposed to hazardous substances at work.

This includes:

- carrying out a risk assessment;
- identifying and implementing control measures;
- ensuring that control measures are used;
- ensuring that employees are properly informed, trained and supervised.

3) This can be viewed at www.equalityhumanrights.com.

Hazardous substances include chemicals, dust, gases and fumes. Asbestos is excluded from the Control of Substances Hazardous to Health Regulations 1994 [16] as it is covered by separate regulations (see **C.4.2**).

C.4.4 Electricity at Work Regulations 1989

The Electricity at Work Regulations 1989 [17] set out requirements for all electrical systems used at work, including construction, integrity, maintenance and isolation. They apply to employers and self-employed persons.

C.4.5 Electromagnetic Compatibility Regulations 1992

NOTE Generic standards that support the Electromagnetic Compatibility Regulations 1992 [18] are BS EN 61000-6-1 for residential, commercial and light industry and BS EN 61000-6-2 for industrial environments. Industry standards for lifts are BS EN 12015 and BS EN 12016.

The Electromagnetic Compatibility Regulations 1992 [18] deal with the two elements of electromagnetic compatibility, i.e. emission and immunity.

The emission requirements aim to ensure a level of electromagnetic emission that causes minimal disturbance to other equipment.

The immunity requirements aim to ensure a level of electromagnetic immunity that allows minimal disturbance to other equipment.

C.4.6 Electrical Equipment (Safety) Regulations 1994

The Electrical Equipment (Safety) Regulations 1994 [19] implement the requirements of composite Directive 93/68/EEC [20] and cover the supply of electrical equipment, which, when properly installed, does not endanger persons, domestic animals or property and provides safe operation of the equipment by users free from electric shock. Low voltage is defined as 50 V a.c. to 100 V a.c. or 75 V d.c. to 1 500 V d.c.

C.4.7 Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)

LOLER 1998 [4] give effect to Directive 89/655/EEC [21] on the health and safety requirements for the use of work equipment by persons at work as amended by Council Directive 95/63/EC [22].

Lifting operations mean an operation concerned with the lifting or lowering of a load. Lifting equipment means work equipment for lifting or lowering loads and includes its attachments for anchoring, fixing or supporting it. An accessory for lifting means work equipment for attaching loads to machinery for lifting. Work equipment means any machinery, appliance, tool or installation for use at work. Load includes a person and LOLER [4] include passenger lifts.

The LOLER [4] require that a thorough examination be carried out every six months (or as determined by risk assessment) by a competent person and a report issued. The report has to notify any defect, which in the opinion of the competent person could be, or become, a danger to persons. Where there is a serious risk of personnel injury a report has to be sent as soon as reasonably practicable to the relevant enforcing authority (HSE or Local Authority).

C.4.8 Lifts Regulations 1997

The Lift Regulations 1997 [3] implement Directive 95/16/EC [23] (the Lift Directive) in order to meet the Essential Health and Safety Requirements (EHSRs) defined in the Directive. The Regulations contain fifteen complex Schedules setting out the arrangements. The most important of these is Schedule 1, which sets out the EHSRs relating to the design and construction of lifts and safety components. Among the definitions included are: lift, harmonized standard, installer, safe, placing on the market, EHSRs, responsible person. "Putting into service" is not specifically defined.

The Lifts Regulations 1997 [3] require new lift installations to conform to the EHSRs laid down in Schedule 1. These requirements apply to the entire lift installation including the building fabric and supporting building services. Compliant installations carry a CE mark in the lift car, which denotes that either (a) the entire installation conforms in full to harmonized standards or to a pre-approved "model" standard, or (b) the installation meets the minimum essential health and safety requirements approved by a Notified Body. These are known as the "routes to conformity". The most common routes to conformity are the installation of "model" lifts and lift installations meeting harmonized standards.

For installations where conformity is to be obtained other than by installing in accordance with harmonized standards, it is necessary to seek the specific requirements for the lift installation's environment. This is defined in the model lift's technical documentation, or otherwise approved by a Notified Body. The harmonized standards that are deemed to satisfy the EHSRs are BS EN 81 (all parts).

The Lift Regulations 1997 [3] do not apply to lifts installed and put into service before 1 July 1999 or to a number of specialist lifts listed in Schedule 14.

C.4.9 Provision and Use of Work Equipment Regulations 1998

The Provision and Use of Work Equipment Regulations 1998 [24] require risks to people's health and safety, from equipment they use at work, to be prevented or controlled by ensuring that the equipment is:

- suitable for use;
- maintained in a safe condition;
- and inspected in certain circumstances.

"Work equipment" covers all equipment used by an employee or a self-employed person at work and includes tools, static and mobile machinery, installations and lift equipment.

C.4.10 Personal Protective Equipment Regulations 2002

The Personal Protective Equipment Regulations 2002 [25] implement the requirements of Personal Protective Equipment Directive 89/656/EEC (as amended) [26].

Personal protective equipment means:

> "All equipment designed to be worn or held by a person at work to protect against one or more risks, and any addition or accessory designed to meet this objective."

Personal protective equipment includes:

- helmets;
- eye protection;
- ear protection;
- safety footwear;
- gloves;
- safety harness;
- protective clothing;
- high visibility clothing.

Employers are required to provide suitable personal protective equipment to each of their employees who might be exposed to risk.

Personal protective equipment is to be used as a last resort after all measures to prevent or control risks at source are exhausted.

The Regulations cover suitability, compatibility, maintenance, replacement, information, loss, defect, etc.

C.4.11 Supply of Machinery (Safety) Regulations 2007

The Supply of Machinery (Safety) Regulations 2008 [1] implement the requirements of Machinery Directive 2006/42/EC [27] and apply to escalators and specific vertical transportation equipment not appropriate to be regulated by the Lifts Regulations 1997 [3], e.g. some domestic lifts and lifting platforms.

C.4.12 Workplace (Health, Safety and Welfare) Regulations 1992

The Workplace (Health, Safety and Welfare) Regulations 1992 [28] implement the requirements of Workplace Directive 89/654/EEC [29] and aim to ensure that workplaces meet minimum standards of health, safety and welfare.

C.5 Other statutory provisions

In addition to the statutory provisions listed in **C.1, C.2, C.3** and **C.4**, the following statutory provisions are examples of those that can be applicable to the construction, installation, service and use of lifts:

- Building Regulations 2000 and subsequent amendments [8];
- Construction (Head Protection) Regulations 1989 [30];
- Construction (Health, Safety and Welfare) Regulations 1996 [12];
- Fire Precautions Act 1971 [31];
- Fire Precautions (Workplace) Regulations 1997 [32];
- Health and Safety (First Aid) Regulations 1981 [33];
- Health and Safety (Safety Signs and Signals) Regulations 1996 [34];
- Manual Handling Operations Regulations 1992 [35];
- Noise at Work Regulations 1989 [36].

Annex D (informative) Observation lifts

D.1 General

Observation lifts are increasingly being installed in modern buildings and this annex provides guidance on the use and installation of these lifts. It is essential that observation lifts be no less safe than those constructed in accordance with BS EN 81 (all parts).

D.2 Description

An observation lift is a passenger lift in which the car has large transparent panels whereby the passengers can have a panoramic outlook. The car travels through a well that either is mainly open or incorporates large transparent panels. The car and its surroundings provide a notable visual feature of the building.

An observation lift can be individually styled to suit the architectural treatment of the building and can often result in both aesthetic and technical difficulties.

The car of an observation lift comprises two distinct areas: the entry area adjacent to the car entrance and the viewing area located at the rear of the car. It is important that the ratio of viewing area to entry area is not too great, otherwise the balancing of the car becomes difficult and the passenger loading time is increased owing to any reduction of car door width.

Observation lifts can be installed inside or outside new buildings or existing buildings as part of major modernization schemes. Observation lifts installed on the outside of buildings require special additional features to combat climatic conditions.

Observation lifts can be either rope-suspended or hydraulic in operation. The choice is largely limited by the duty cycle, the travel height and the architectural treatment of the installation. Observation lifts do not usually require a high rated speed since passengers frequently wish to linger in the car to admire the outlook, provided that this does not seriously affect traffic flow.

D.3 Features requiring particular attention

D.3.1 Car

For car enclosures:

a) appropriate changes have to be made to the car sling;

b) switches, wiring and other car-mounted equipment have to be concealed;

c) in some cases, the outside surfaces of the car door and the car front need special treatment (e.g. smooth appearance, decorative painting, etc.) when they are visible from the lift lobby.

D.3.2 Well equipment

Equipment conventionally contained within the well (e.g. guide brackets, switches, well wiring and travelling cables) is typically concealed. The only technical features that need to remain prominently visible to the public are the lifting ropes or the hydraulic ram (if direct acting) and compensating ropes (if fitted).

D.3.3 Landing doors

Special treatment (e.g. smooth appearance, decorative painting, etc.) is needed for landing doors, their locks, frames, fascia panels, etc., on the front wall of the well, which might be in full public view.

D.3.4 Exposed surfaces and components

The exposed surfaces of the landing doors and their fitments and the entire car exterior need smooth, easily cleaned, durable and corrosion-resisting surfaces in all visible areas, e.g. corrosion-resisting steel or enamel finish.

D.4 Glazing principles

The chief novelty of observation lifts is the use of large transparent viewing panels; it is therefore important for all concerned to fully understand glazing techniques. Transparent panels in cars need to be designed and installed as non-load-bearing, non-structural elements. Their frame or surround has to be capable of withstanding all horizontal forces, including those imposed by users, without significant deformation. The properties and usage of transparent panels are given in BS EN 81-1 and BS EN 81-2.

In cars having large arc curved transparent panels without glazing bars, special measures are usually taken to ensure structural stability of the car top so that compressive vertical loads are not imposed on the panels, especially under emergency stop conditions or when maintenance personnel are working on the car top. In installations exposed to brilliant sunshine, solar control laminated glass can be used for the transparent panels, for the comfort of passengers. A glass manufacturer is usually consulted as early as possible during the design stages. If it is decided not to use glass panels, it is essential for the alternative material to have self-extinguishing properties.

Glass mirror panels are frequently used for vertical decorative facings of both the inside and outside of the car, see BS EN 81-1:1998+A3, **8.3.2.2** to **8.3.2.4** and BS EN 81-2:1998+A3, **8.3.2.2** to **8.3.2.4**.

Glass is typically laminated at all points accessible to persons and details on this are given in BS EN 81-1:1998+A3, **5.3.1.2** and **8.3.2.2** to **8.3.2.4** and to BS EN 81-2:1998+A3, **5.3.1.2** and **8.3.2.2** to **8.3.2.4**.

D.5 Technical considerations

D.5.1 Treatment of car top

The top and bottom cappings are strong, yet reasonably light and simple to remove and replace, and designed so that their decorative finish is not marred by handling or by seepage of moisture or excess lubricant.

Top cappings are generally not intended to bear the weight of maintenance personnel. It is sometimes necessary for the top capping to be constructed in several portions so that at least one portion can be removed or hinged back readily to provide access for regular maintenance and inspection or for rapid emergency access to the car top. It is necessary for maintenance personnel to be able to work and travel safely on the car top and attend to items requiring regular attention. This maintenance activity includes the cleaning of parts of the well visible to the public, e.g. landing doors and surrounds, and might be carried out by a specialist contractor, who is under the supervision of the lift maintenance contractor.

D.5.2 Pit and bottom landing enclosure

It is essential that a well enclosure be provided to protect users and the public (see **5.3.5**). This is frequently achieved by the provision of glass panels to match the general decor. The provision of this enclosure is usually an item of builders' work.

D.6 Outdoor installations

All components exposed to the weather are to be suitably treated and protected.

Frost and ice are the greatest obstacle to the use of general-duty outdoor observation lifts. Where such conditions are frequently met, observation lifts are typically not installed. If freezing conditions are infrequently encountered, the lift is not to be used while those conditions prevail.

Strong winds can be another reason for slowing down or temporarily interrupting the service provided by an outdoor observation lift. The installation of such a lift in a region or location that is prone to gusting or high wind speeds is best avoided, unless the lift can be installed in a sheltered position on the outside wall of the building. It is sometimes advisable to consult data on wind speeds at various locations in the British Isles.

Moderate rain and heat are generally no obstacle to the safe operation of properly designed and installed equipment. Dust- and sand-laden winds, which can be seasonal in nature and could lead to excessive wear and heavy maintenance costs, are further problems that need to be considered before deciding to install an outdoor lift.

It is essential that there be other lifts operating within the building that can provide continuity of service in the event of outdoor lifts being taken out of service due to extreme climatic conditions.

Annex E (normative) Safety signs and warning notices

Safety signs and warning notices should be provided on, or adjacent to, doors or traps giving access to the well, machinery spaces/pulley spaces and machine rooms/pulley rooms and wherever recommended or required. The wording of these notices should be in accordance with BS EN 81-1:1998+A3, Clause **15** and BS EN 81-2:1998+A3, Clause **15**.

NOTE 1 Attention is drawn to the Health and Safety (Safety Signs and Signals) Regulations 1996 [34], which require employers to provide specific safety signs whenever there is a risk that has not been avoided or controlled by other means, e.g. by engineering controls.

NOTE 2 Typical examples of safety signs and warning notices are given in BS 7255, where the safety signs conform to BS ISO 7010.

The shape and colour of each safety sign should conform to BS ISO 3864-1 and the design of the graphical symbols should conform to BS ISO 3864-3. The diameter or height of safety signs should be not less than 120 mm. All safety signs and notices shall be indelible, legible and readily understandable (if necessary aided by signs or symbols).

Annex F (normative) Typical traffic calculation method

COMMENTARY ON Annex F

This is a simplified method. Refer to CIBSE Guide D 2010, Section 3 [37], for more complex calculations and where additional references can be found. Examples of traffic calculations are given in Annex G.

F.1 Formulae

The *RTT* in seconds (s), of a single lift during up-peak traffic can be calculated using Equation F.1:

$$RTT = 2H\frac{d_f}{v} + (s+1)\left[t_c + t_f(1) + t_o - \frac{d_f}{v}\right] + 2Pt_p \qquad \text{(F.1)}$$

where:

- H is the average highest reversal floor;
- d_f is the average interfloor height in metres (m);
- v is the rated speed in metres per seconds (m/s);
- S is the average probable number of stops;
- t_c is the door closing time in seconds (s);
- t_f (1) is the single floor flight time in seconds (s);
- t_o is the door opening time in seconds (s);
- P is the average number of passengers in the car;
- t_p is the average passenger transfer time in seconds (s).

NOTE 1 Average values for H and S can be obtained from Table F.1, which assumes equal floor populations. These tables are calculated for H and S for buildings with 5 to 24 floors (N) served above the main terminal using the rated car capacities (CC) in BS ISO 4190 (all parts). The rated car capacity is given by the formula in BS EN 81-1:1998+A3, ***8.2.3****a) or BS EN 81-2:1998+A3,* ***8.2.3****a), as appropriate. The average value for P shown in parentheses is assumed to be 80% of the rated capacity.*

NOTE 2 The term $t_c + t_f(1) + t_o$ can better be expressed as a performance time (T), which is the time from the instant when the doors start to close to the time when they are open to 800 mm at the next adjacent floor. Typical performance times for a floor height of 3.3 m are 8.0 s for an excellent system, 10.0 s for an average system and 12.0 s for a poor system. The lift contractor can provide these figures.

NOTE 3 The t_p can only be estimated. Typical values are 0.8 s for a very busy office building to 2.0 s for a residential care home. An average passenger transfer time of 1.2 s can be assumed.

Table F.1 **Values of *H* and *S* for rated capacities: 6 people to 33 people**

No. of floors, *N*	**Values of *H* and *S***															
	CC = 6 (*P* = 4.8)		*CC* = 8 (*P* = 6.4)		*CC* = 10 (*P* = 8.0)		*CC* = 13 (*P* = 10.4)		*CC* = 16 (*P* = 12.8)		*CC* = 21 (*P* = 16.8)		*CC* = 26 (*P* = 20.8)		*CC* = 33 (*P* = 26.4)	
	H	*S*	*H*	*S*	*H*	*S*	*H*	*S*	*H*	*S*	*H*	*S*	*H*	*S*	*H*	*S*
5	4.6	3.3	4.7	3.8	4.8	4.2	4.9	4.5	4.9	4.7	5.0	4.9	5.0	5.0	5.0	5.0
6	5.4	3.5	5.6	4.1	5.7	4.6	5.8	5.1	5.9	5.4	6.0	5.7	6.0	5.9	6.0	6.0
7	6.2	3.7	6.5	4.4	6.6	5.0	6.8	5.6	6.8	6.0	6.9	6.5	7.0	6.7	7.0	6.9
8	7.1	3.8	7.4	4.6	7.5	5.3	7.7	6.0	7.8	6.6	7.9	7.2	7.9	7.5	8.0	7.8
9	7.9	3.9	8.2	4.8	8.4	5.5	8.6	6.4	8.7	7.0	8.8	7.8	8.9	8.2	9.0	8.6
10	8.7	4.0	9.1	4.9	9.3	5.7	9.5	6.7	9.7	7.4	9.8	8.3	9.9	8.9	9.9	9.4
11	9.6	4.0	10.0	5.0	10.2	5.9	10.5	6.9	10.6	7.8	10.8	8.8	10.8	9.5	10.9	10.1
12	10.4	4.1	10.8	5.1	11.1	6.0	11.4	7.1	11.5	8.1	11.7	9.2	11.8	10.0	11.9	10.8
13	11.2	4.1	11.7	5.2	12.0	6.1	12.3	7.3	12.5	8.3	12.7	9.6	12.8	10.5	12.9	11.4
14	12.1	4.2	12.6	5.3	12.9	6.3	13.2	7.5	13.4	8.6	13.6	10.0	13.7	11.0	13.8	12.0
15	12.9	4.2	13.4	5.4	13.8	6.4	14.1	7.7	14.3	8.8	14.6	10.3	14.7	11.4	14.8	12.6
16	13.7	4.3	14.3	5.4	14.7	6.5	15.0	7.8	15.3	9.0	15.5	10.6	15.7	11.8	15.8	13.1
17	14.5	4.3	15.3	5.5	15.6	6.5	16.0	8.0	16.2	9.2	16.5	10.9	16.6	12.2	16.8	13.6
18	15.4	4.3	16.0	5.5	16.6	6.6	16.9	8.1	17.1	9.3	17.4	11.1	17.6	12.5	17.7	14.0
19	16.2	4.3	16.9	5.6	17.4	6.7	17.8	8.2	18.1	9.5	18.4	11.3	18.5	12.8	18.7	14.4
20	17.0	4.4	17.8	5.6	18.2	6.7	18.7	8.3	19.0	9.6	19.3	11.6	19.5	13.1	19.7	14.8
21	17.9	4.4	18.6	5.6	19.1	6.8	19.6	8.4	19.9	9.8	20.3	11.7	20.5	13.4	20.6	15.2
22	18.7	4.4	19.5	5.7	20.0	6.8	20.5	8.4	20.9	9.9	21.2	11.9	21.4	13.6	21.6	15.6
23	19.5	4.4	20.4	5.7	20.9	6.9	21.4	8.5	21.8	10.0	22.1	12.1	22.4	13.9	22.6	15.9
24	20.3	4.4	21.2	5.7	21.8	6.9	22.4	8.6	22.7	10.1	23.1	12.3	23.3	14.1	23.5	16.2

The up-peak interval (*INT*), in s, of a group of (*L*) lifts can be calculated using Equation F.2:

$$INT = \frac{RTT}{L} \quad \text{(F.2)}$$

The up-peak handling capacity (*HC*), in persons per 5 min, of a group of *L* cars can be calculated using Equation F.3:

$$HC = \frac{300PL}{RTT} = \frac{300P}{INT} \quad \text{(F.3)}$$

The percentage (%*POP*) of the total daily population (*POP*) above the main terminal floor that can be served during up-peak traffic can be calculated using equation F.4:

$$\%POP = \frac{HC}{POP} \times 100 \quad \text{(F.4)}$$

Annex G (informative) Examples of traffic calculations

G.1 Determination of car size

NOTE Definitions of symbols are given in Annex F.

If the *HC* and *INT* of a target system are known, they can be used to estimate the rated CC required. For example, if the required interval is 30 s and the required handling capacity is 100 persons per 5 min, the rated car capacity can be calculated as follows:

Given data:

Required interval:	30 s
Required handling capacity:	100 people per 5 min

Calculation:

Number of trips in 5 min period:	300/30 = 10
Number of people in the lift per trip:	100/10 = 10
Rated CC is:	10/0.8 = 12.5

The nearest standard car size conforming to BS ISO 4190 (all parts) has a rated car capacity of 13 persons, so *P* is 13 persons × 80%, i.e. 10.4 persons.

NOTE For statistical reasons, when sizing a lift system, each car is assumed to fill to an average of 80% capacity on each trip.

G.2 Calculation of lift performance from known data

The building referred to in **G.1** has 10 floors, at an interfloor distance of 3.3 m. The rated speed is 1.6 m/s (see Table 5) and the performance time is 10.0 s (obtained from the lift contractor).

Given data:

Required interval:	30 s
Required handling capacity:	100 people per 5 min
Number of floors to be served:	10
Rated capacity:	13 persons

Rated speed:	1.6 m/s
Performance time:	10.0 s

Derived data:

P = 10.4 (13 people × 80%, see **G.1**, Note)

H = 9.5 (from Table F.1)

S = 6.7 (from Table F.1)

t_p = 1.2 s (assumed)

Calculation:

The *RTT*, in s, calculated from equation F.1, would be:

$$RTT = 2 \times 95 \times \frac{3.3}{1.6} + (9.5 + 1)\left(10 - \frac{3.3}{1.6}\right) + 2 \times 10.4 \times 1.2$$
$$= 39.1 + 83.4 + 25.9$$
$$= 148.4$$

The required interval is 30 s. As there can only be an integer number of lifts, it is necessary to divide the round trip time of 148.4 s by an integer number to achieve an interval close to 30 s. Select five lifts, then calculate the *INT*, in s, using equation F.2:

INT = 148.4/5 = 29.7

The up-peak *HC*, in persons per 5 min, calculated from equation F.3, would be:

HC = 109

NOTE 1 This is a little larger than required.

The provision of five 13-person lifts would be satisfactory.

NOTE 2 Specialist advice can be taken before any final schemes are established.

G.3 Calculation of lift performance from estimated data

NOTE 1 This is an example of one solution for this particular set of data. There might be other solutions that might require specialist advice.

An office building has eight floors above ground, each with a 3.3 m interfloor distance and 1 526 m² gross area.

Given data:

Number of floors to be served:	8
Gross floor area:	1 526 m²
Interfloor distance:	3.3 m

Assumed data:

Interval:	30 s (see Table 6)
Floor density:	one person per 12 m² (see Table 6)
Gross to usable ratio:	80% (see **6.4.2**)
Attendance ratio:	90% (see **6.4.2**)
Peak arrival rate:	12% (see Table 6)
Rated speed:	1.6 m/s (see Table 5)
Performance time:	8.0 s

Passenger transfer time: 1.2 s

NOTE 2 Total travel distance:= 8 floors × 3.3 m = 26.4 m.

Derived data:

Usable area per floor: 1 526 m^2 × 80% = 1 221 m^2

Total possible population: 1 221 × (8/12) = 814 persons

Total daily population: 814 persons × 90% = 740 persons

Required handling capacity: 740 persons × 12% = 89 persons per 5 min

Calculation:

Number of trips in 5 min: 300/30 = 10

Average car occupancy: 89/10 = 8.9 persons

Rated car capacity: 8.9/0.8 = 11.1 persons

NOTE 3 The nearest standard car size from BS ISO 4190-1 has a rated car capacity of 13 persons, so P is 13 persons × 80%, i.e. 10.4 persons.

P = 10.4

H = 7.7 (from Table F.1)

S = 6.0 (from Table F.1)

The *RTT*, in s, calculated from Equation F.1, would be:

$$RTT = 2 \times 7.7 \times \frac{3.3}{1.6} + (6.0 + 1.0)\left(8.0 - \frac{3.3}{1.6}\right) + 2 \times 10.4 \times 1.2$$
$$= 98.3$$

The up-peak *INT*, in s, calculated from Equation F.2 and assuming three lifts, would be:

$INT = 98.3/3 = 32.8$

The up-peak *HC*, in persons per 5 min, calculated from Equation F.3, would be:

$HC = 300 \times 10.4/32.8 = 95.1$

The percentage (%*POP*) of the total daily population (*POP*) above the main terminal floor that can be served during up-peak, calculated from Equation F.4, would be:

$\%POP = 95.1 \times 100/740 = 12.9$

NOTE 4 A handling capacity of 95.1 persons per 5 min can be provided by three 13-person cars. This is more than the required handling capacity of 89 persons per 5 min (see derived data). However, the interval is longer at 32.8 s than the required interval of 30 s (see assumed data). In practice, the cars would fill to less than 10.4 persons per trip, when the round trip time and interval would shorten, until the handling capacity of the lifts equalled the passenger arrival rate.

Annex H (informative) Description of traffic control systems

H.1 Non-collective control or automatic pushbutton

Non-collective control is the simplest type of automatic traffic control system, where the car answers a landing call only if it is available, i.e. the car is stationary, with its landing door(s) closed, and it is able to carry the passengers to their destination. A single call pushbutton is provided at each landing and only one landing call can be accepted by the controller at any time. The registration of a car call prevents any landing calls from being registered. Simple timing devices give passengers priority to register their car calls and leave the car without haste.

This type of traffic control is particularly suitable for small residential buildings with light passenger traffic serving up to four floors, and for goods lifts. To reduce user frustration, a "lift busy" indicator can be fitted at each landing.

H.2 Collective control

Collective control is a generic term for those methods of automatic operation where all landing and car calls are registered by pressing pushbuttons in the car and at lift landings. The lift answers the calls by the car stopping in floor sequence at each lift landing for which calls have been registered, irrespective of the order in which the calls have been made and until all calls have had attention.

Collective control of any form is usually not suitable for goods lifts.

H.3 Non-directional collective control

A non-directional control system has a single pushbutton at each landing, however, this means a passenger cannot register the desired direction of travel. This type of traffic control could be used for small residential buildings with light passenger traffic and for goods lifts.

H.4 Down-collective or up-distributive, down-collective control

With this control, landing calls can be registered by pressing the single call pushbutton provided on each landing, whether or not the car is available. If the car is free or descending, it can answer the landing calls from the highest landing and then the other calls in succession as it approaches the main floor. Calls registered from the car are answered in a logical sequence according to the direction of travel. Calls made at the main terminal result in a car arriving to take passengers to the upper floors, after they have registered car calls.

A down-collective control can be used when there is normally no passenger traffic between floors (i.e. passengers make use of the lift from the main terminal floor to a required upper floor or vice versa) and when there are no levels to be served below the main terminal floor.

This traffic control system can be used with a single lift or group-collective lifts (see **H.6**).

When one or more levels below the main floor level need to be served, the control is so arranged that the lift operates as down-collective for the levels above the main floor and up-collective for the levels below the main floor.

H.5 Full-collective

A full-collective control requires two call pushbuttons on each intermediate landing, one for ascent and one for descent so that the passenger can indicate the direction of travel (one single pushbutton is provided at the terminal landings). Registered landing and car calls are answered in a logical sequence according to the direction of travel of the car.

H.6 Group-collective

Groups of two, or three or more cars are frequently interconnected and collectively controlled. One pushbutton station is needed at each landing and the call system is common to all lifts in the group. The pushbutton arrangements are the same as those described in **H.5**. Extra pushbutton stations may be specified for architectural balance, as in the case of a three-car group.

Each landing call is automatically allocated to the best-placed car, often the nearest car. The traffic control system is designed to space the cars (provide a constant headway) and to give an even service. When a car reaches the highest requested floor, its direction of travel can be reversed when it starts its next trip.

One or more cars can be made to return to a designated floor. Automatic bypassing of landing calls, when a car is fully loaded, is an essential feature. Any car under inspection or taken out of service is isolated from the group while the other cars continue to provide service to all floors.

When three-car groups serve seven or eight floors and above, some form of automatic group supervisory control (see **H.7**) is generally necessary in order to provide efficient passenger handling.

H.7 Group traffic supervisory control

A group of passenger lifts serving a heavy traffic demand requires a traffic supervisory control system to coordinate the operation of individual lifts that are all on collective control and are interconnected.

The group traffic supervisory control system regulates the dispatching of individual cars and provides service to all floors as different traffic conditions arise, minimizing such unproductive factors as idle cars, uneven service and excessive waiting time. The system should respond automatically to changing traffic conditions such as up-peaks and down-peaks, balanced interfloor traffic, light traffic and two-way lunchtime traffic. The system can also provide other specialized features (see **8.2**).

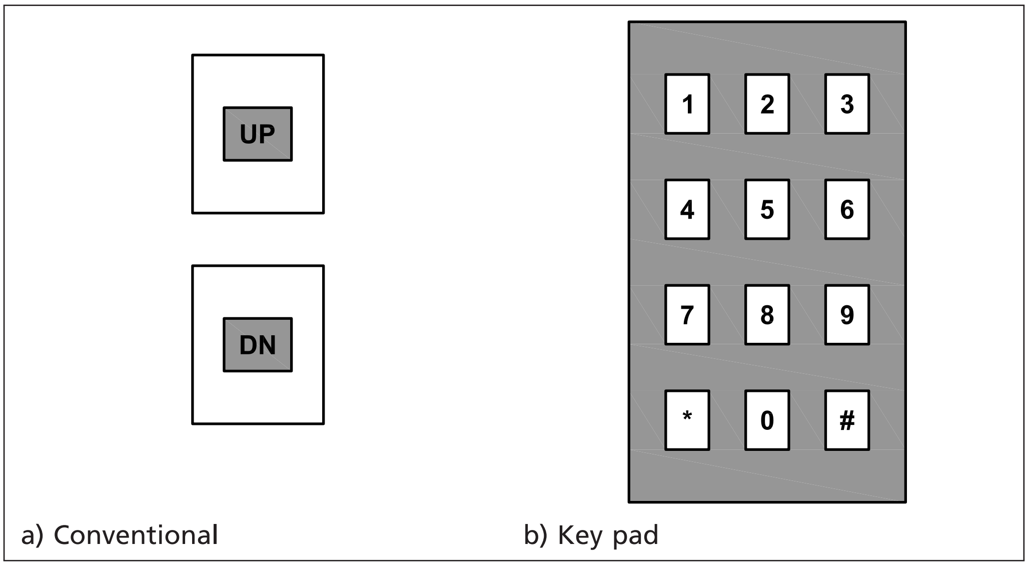
Where there is intensive traffic, sophisticated automatic traffic supervisory control algorithms are required in order to utilize efficiently the capability of the lifts. Many traffic control algorithms are available, including estimated time of arrival, artificial intelligence, neural networks, dynamic sectoring, etc. Since development in this field is continuing, specialist advice is necessary for details of the various systems available.

The pushbutton arrangements are usually the same as those described in **H.5**. However, some modern systems provide a destination call capability. Here a call station is provided with a button for all the landings served on all or some landings. This enables a passenger to register a call for their destination floor and to give more information than their intended direction of travel. These systems are not suitable for certain public buildings.

H.8 Hall call allocation control

Hall call allocation (HCA) control (sometimes known as destination control) requires the replacement of the conventional up/down buttons by a panel of passenger destination buttons at each landing (see Figure H.1). This allows the control system to track every passenger from landing call registration through to their destination.

Figure H.1 **Illustration of hall allocation landing registration panel**



The basic system works by the algorithm allocating each new passenger call, as it is registered, to each car in turn and evaluating the cost of each allocation. The allocation giving the lowest cost is then adopted. Suitable cost functions are, for example, passenger average waiting time, passenger average journey time or a combination of both. Thus during up peak passengers can be grouped to common destinations, as there are large numbers of them. The individual waiting time might increase, the travel time might decrease and there could be an overall reduction in journey time.

During down peak there is little advantage as the destination floor is known and during reasonable levels of balanced interfloor traffic there is little advantage as most landing calls and car calls are not co-incident.

The HCA system is often used to boost an under lifted building during the up peak period, but it does not significantly change the performance during other traffic conditions.

Annex I (informative) Considerations for energy efficient lift design

Table I.1 lists actions that can be applied to most lifts, which can substantially lower the energy consumption of the unit.

Table I.1 **Considerations for energy efficient lift design** *(1 of 3)*

Action	**New equipment**
Equipment design	
Drive type: traction/hydraulic	Traction almost always produces significant energy savings
Drive type: hydraulic	If hydraulic drives are selected, use counterbalancing or energy accumulation systems
Drive type: technology	Select an energy efficient drive for the lift and consider regeneration systems, e.g. VVVF
Starting current	Use soft start technologies
Geared/gearless	Gearless is preferred over geared machine
Machine position	Select top drive in preference to bottom or side drive
Roping	Select 1:1 roping, where possible

Table I.1 **Considerations for energy efficient lift design** *(2 of 3)*

Action	New equipment
Door system	Select door system that does not rely on stalled motor to keep doors closed
Guide shoes	Use roller guide shoes for both car and counterweight in preference to slipper or swivel guide shoes
Guide rail fixings	Ensure guide rails are stiff and do not flex
Guide rail plumbness	Ensure guide rails are plumb and fixed at the shortest spacing
Counter balancing	Select the lowest possible (safest) counterbalancing ratio Use a high average to peak torque ratio motor
Counter-weight balance	Optimize in accordance with building traffic pattern
Car balance	Ensure the car is balanced against the guide shoes
Air resistance	For high speed lifts ensure lift cars present low air resistance
Rope diameter	Select as large a diameter rope as possible to reduce levelling operations due to rope stretch
D/d ratio	Select the lowest possible sheave and pulley diameters to reduce inertial effects
Brake	Ensure the brake is not energized when the lift is stationary
Tank heaters/coolers	Automatic control to minimum temperature required
Lift well heaters	Automatic control to minimum temperature required
Hydraulic oil cooler	Where up starts is greater than 40 per h install an oil cooler
Oil cooler location	Install oil coolers outside the machine room and recover waste heat
Operation	
Lift traffic strategy	Review the traffic patterns and select the lift control strategy to minimize the number of journeys
Parking feature	Consider omitting the parking feature
Automatic shut down	Initiate standby after lift idle for five minutes
Car lights	Turn off when on standby
Car fan/HVAC	Turn off when on standby
Car fan	Ensure any car fans only operate when car temperature is greater than 25 °C
Machine room temperature	Provide automatic temperature control
Waste heat	Recover waste heat from lift motor rooms if the lifts are used intensely
Machine room energy loss	Provide sufficient insulation
Lift well vent (where provided)	Automate opening on fire only
Maintenance	
Routine maintenance	Ensure proper, thorough and regular maintenance is carried out
Adjustments	Ensure all critical parameters are adjusted during maintenance
Drive profile	Set up the acceleration/deceleration profile to the lowest acceptable values
Levelling/creep	Set up levelling/creep distance to be as small as possible
Motor blowers	Ensure any motor blowers are switched to operate on demand
Machine room heating	Ensure any machine room heating (including tank heaters) does not operate until the temperature drops below 6 °C
Machine room heating	Ensure machine room cooling/ventilation does not operate until temperature is greater than operating conditions
Guide rail lubrication	Ensure guide rails are adequately lubricated
Top of car light	Turn off when mechanic leaves
Lights lift well	Turn off when mechanic leaves

Table I.1 **Considerations for energy efficient lift design** *(3 of 3)*

Action	New equipment
Tie down	Ensure compensation/tie down systems are properly adjusted
Handling capacity	
Select rated speed	Select the lowest rated speed commensurate with traffic design criteria
Select appropriate rated speed	Select lift speeds that are appropriate to the task, e.g. slower speeds for goods lifts
Select rated load	Select smallest rated load commensurate with traffic design criteria
Select number of lifts	Select the smallest number of lifts commensurate with traffic design criteria
Location of lifts	Locate lifts together to minimize the number of journeys
Location of lifts	Locate lifts in the most appropriate positions, i.e. locate stairs before lifts
Location of population served	Ensure symbiotic activities are located together, e.g. sales/marketing, personnel/training
Motion dynamics	Select the lowest values for acceleration/deceleration and jerk commensurate with traffic design criteria

Annex J (informative) Summary of the principal requirements of BS EN 81-70 in the provision of lifts for persons with impaired mobility

This annex provides a short summary of the principal requirements of BS EN 81-70 when applied to BS EN 81-1 and BS EN 81-2.

BS EN 81-70 provides requirements for lifts, constructed to BS EN 81 (all parts), relating to the design and positioning of fittings, controls and indicating equipment as well as the use of materials to maximize contrasts between controls and doors and the surrounds. The primary aim is to ensure that the design does not obstruct or impede the use of the lift by people with impaired mobility and to enable the unassisted use of lifts by all people including those with disabilities.

a) The landing area is required to be free of obstacles and sufficiently large to allow the free movement of persons, wheelchairs and accompanying persons, when entering or leaving the lift car with landing call push buttons positioned 900 mm to 1100 mm above the floor level.

b) The lift is required to be able to provide a stopping accuracy of ±10 mm and a levelling accuracy of ±20 mm.

c) Automatic doors are required to be not less than 800 mm clear width and protected with full height non-contact, infra-red (or similar) safety edges.

d) The door operation is required to allow suitable dwell times for passengers who might have restricted mobility, to reach and enter the lift and have an adjustable dwell time of between 2 s and 20 s.

NOTE 1 Extended dwell times can have a significant effect on the traffic performance of a lift system.

e) Control features such as advanced door opening are required to be avoided in hospitals and nursing homes or other environments where wheelchairs or trolleys etc. could be inconvenienced by the momentary presentation of a ledge as the doors open when approaching the floor level.

f) The lift car platform area is required to be large enough to meet the requirements of all persons. Special considerations might need to be made to accommodate some types of electrically driven wheelchairs.

g) Light colours are recommended inside the car to reduce the claustrophobic effects of small lifts and to optimise light levels within the car.

h) Colour is required to be used to provide clear demarcation between the floor of the car and the landing entrance for users with visual impairment.

i) Functional, easily cleaned surface finishes are recommended, together with a half-height mirror that creates an impression of increased car size and enables passengers to see behind them.

NOTE 2 Full height mirrors can be confusing for visually impaired passengers and a clear band of not less than 300 mm between the bottom of a mirror and the floor is needed to decrease this.

j) A handrail along one side of the lift.

k) Large, easily operated car push buttons placed at between 900 mm and 1 200 mm (1 100 mm preferred) above the lift car floor level, and not less than 400 mm from the front or rear wall.

l) The provision of a tip-up seat improves comfort for the elderly and infirm.

m) All push buttons are required to be provided with tactile, and possibly also Braille, markings, either on or adjacent to the buttons.

NOTE 3 Since many visually impaired people are unable to read Braille it is recommended that Braille markings should only be used in addition to tactile markings.

n) Voice synthesized announcements, of sufficient sound level to overcome background noise, is required to be included to announce door actions (opening and closing) as well as the floor level and direction of travel as the lift arrives at a landing. Emergency signals received from a fire alarm or building management system can also be announced by the voice synthesiser.

o) The inclusion of inductive loops in conjunction with the voice synthesiser and emergency communication unit can assist passengers who use hearing aids.

p) In environments where lifts might be used by elderly or infirm passengers such as nursing homes, the use of an additional alarm push button (not connected to the lift rescue service) mounted at a low level is needed. This enables access to the alarm facility for passengers that might have fallen or collapsed in the lift car.

Bibliography

Standards publications

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

BS 6262 (all parts), *Glazing for buildings*

BS EN 13015, *Maintenance for lifts and escalators – Rules for maintenance instructions*

BS EN 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*

BS EN 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

Other publications

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

[2] GREAT BRITAIN. The Construction (Design and Management) Regulations 2007. London: The Stationery Office.

[3] GREAT BRITAIN. The Lifts Regulations 1997. London: The Stationery Office, 1998.

[4] GREAT BRITAIN. The Lifting Operations and Lifting Equipment Regulations 1998. London: The Stationery Office, 1998.

[5] HEALTH AND SAFETY EXECUTIVE. *Approved Code of Practice to the CDM Regulations 2007*. London, HSE Books.

[6] GREAT BRITAIN. The Control of Asbestos at Work Regulations 2006. London: The Stationery Office, 2006.

[7] GREAT BRITAIN. Equality Act 2010. London: The Stationery Office.

[8] GREAT BRITAIN. The Building Regulations 2000: Approved document M: Access to and use of buildings. London: The Stationery Office, 2004.

[9] ANSI. BOMA Z65.1-1996: Method for measuring floor area in office buildings (revision and redesignation of ANSI Z65.1-1980). USA.

[10] GREAT BRITAIN. Health Technical Memorandum 08-02: Lifts. Department of Health Gateway Review, Estates and Facilities Division, 2010.

[11] GREAT BRITAIN. The Health and Safety at Work, etc. Act 1974 (as amended). London: The Stationery Office.

[12] GREAT BRITAIN. The Construction (Health, Safety and Welfare) Regulations 1996. London: The Stationery Office, 1996.

[13] GREAT BRITAIN. The Management of Health and Safety at Work Regulations 1999. London: The Stationery Office, 2000.

[14] EUROPEAN COMMUNITIES. 89/391/EEC. Council Directive of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work. Luxembourg: Office for Official Publications of the European Communities, 1989.

[15] GREAT BRITAIN. The Disability Discrimination Act 1995. London: The Stationary Office.

[16] GREAT BRITAIN. The Control of Substances Hazardous to Health Regulations 1994 (as amended). London: The Stationery Office.

[17] GREAT BRITAIN. The Electricity at Work Regulations 1989. London: The Stationery Office.

[18] GREAT BRITAIN. The Electromagnetic Compatibility Regulations 1992. London: The Stationery Office.

[19] GREAT BRITAIN. The Electrical Equipment (Safety) Regulations 1994. London: The Stationery Office, 1995.

[20] EUROPEAN COMMUNITIES. 93/68/EEC. Council Directive of 22 July 1993 amending Directives 87/404/EEC (simple pressure vessels), 88/378/EEC (safety of toys), 89/106/EEC (construction products), 89/336/EEC (electromagnetic compatibility), 89/392/EEC (machinery), 89/686/EEC (personal protective equipment), 90/384/EEC (non-automatic weighing instruments), 90/385/EEC (active implantable medicinal devices), 90/396/EEC (appliances burning gaseous fuels), 91/263/EEC (telecommunications terminal equipment), 92/42/EEC (new hot-water boilers fired with liquid or gaseous fuels) and 73/23/EEC (electrical equipment designed for use within certain voltage limits). Luxembourg: Office for Official Publications of the European Communities, 1993.

[21] EUROPEAN COMMUNITIES. 89/655/EEC. European Parliament and Council Directive of 30 November 1989 concerning the minimum safety and health requirements for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC). Luxembourg: Office for Official Publications of the European Communities, 1989.

[22] EUROPEAN COMMUNITIES. 95/63/EC. European Parliament and Council Directive of 5 December 1995 concerning the minimum safety and health requirements for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC). Luxembourg: Office for Official Publications of the European Communities, 1995.

[23] EUROPEAN COMMUNITIES. 95/16/EC. European Parliament and Council Directive of 29 June 1995 on the approximation of the laws of the Member States relating to lifts. Luxembourg: Office for Official Publications of the European Communities, 1995.

[24] GREAT BRITAIN. The Provision and Use of Work Equipment Regulations 1998. London: The Stationery Office.

[25] GREAT BRITAIN. The Personal Protective Equipment at Work Regulations 1992. London: The Stationery Office.

[26] EUROPEAN COMMUNITIES. 89/656/EEC. Council Directive of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace (third individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC). Luxembourg: Office for Official Publications of the European Communities, 1989.

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

[28] GREAT BRITAIN. The Workplace (Health, Safety and Welfare) Regulations 1992. London: The Stationery Office.

[29] EUROPEAN COMMUNITIES. 89/654/EEC. Council Directive of 30 November 1989 concerning the minimum safety and health

requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC). Luxembourg: Office for Official Publications of the European Communities, 1989.

[30] GREAT BRITAIN. The Construction (Head Protection) Regulations 1989. London: The Stationery Office.

[31] GREAT BRITAIN. The Fire Precautions Act 1971. London: The Stationery Office.

[32] GREAT BRITAIN. The Fire Precautions (Workplace) Regulations 1997. London: The Stationery Office.

[33] GREAT BRITAIN. The Health and Safety (First Aid) Regulations 1981. London: The Stationery Office.

[34] GREAT BRITAIN. The Health and Safety (Safety Signs and Signals) Regulations 1996. London: The Stationery Office.

[35] GREAT BRITAIN. The Manual Handling Operations Regulations 1992. London: The Stationery Office.

[36] GREAT BRITAIN. The Noise at Work Regulations 1989. London: The Stationery Office.

[37] CHARTERED INSTITUTION OF BUILDING SERVICES ENGINEERS. Transportation systems in building. Guide D. London: The Chartered Institution of Building Services Engineers, 2010.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.

...making excellence a habit.™