

Specification for

Lifts, escalators, passenger conveyors and paternosters —

**Part 1: General requirements for
electric, hydraulic and hand-powered
lifts**

UDC 621.876

Co-operating organizations

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Associated Offices' Technical Committee*	Gas Council
Association of Consulting Engineers	Institution of Civil Engineers
Association of Mining Electrical and Mechanical Engineers	Institution of Gas Engineers
Board of Trade	Institution of Heating and Ventilating Engineers
British Chemical Plant Manufacturers' Association	Institution of Mechanical Engineers*
British Compressed Air Society	Institution of Mechanical Engineers (Automobile Division)
British Electrical and Allied Manufacturers' Association*	Institution of Production Engineers
British Gear Manufacturers' Association	Locomotive and Allied Manufacturers' Association of Great Britain
British Internal Combustion Engine Manufacturers' Association	London Transport Board*
British Mechanical Engineering Confederation*	Machine Tool Trades Association
British Pump Manufacturers' Association	Ministry of Defence
British Steel Industry	Ministry of Defence, Army Department
Crown Agents for Oversea Governments and Administrations	Ministry of Power
Department of Employment and Productivity (H.M. Factory Inspectorate)*	Ministry of Public Building and Works*
Electricity Council, the Central Electricity Generating Board and the Area Boards in England and Wales	Ministry of Technology*
Engineering Equipment Users' Association*	Ministry of Technology — National Engineering Laboratory
	Ministry of Transport
	National Coal Board
	National Physical Laboratory (Ministry of Technology)
	Royal Institute of British Architects

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Railways Board	Fire Offices' Committee
Department of Health and Social Security	Greater London Council
Draughtsmen's and Allied Technicians' Association	Institution of Electrical Engineers
Electrical Trades Union	Institution of Municipal Engineers
Engineers Surveyors' Association	Ministry of Housing and Local Government
Federation of Wire Rope Manufacturers of Great Britain	National Association of Lift Makers
	Post office
	Retail Trading Standards Association

This British Standard, having been approved by the Mechanical Engineering Industry Standards Committee, was published under the authority of the Executive Board on 24 February 1970

© BSI 07-1999

First published June 1957
First revision October 1958
Second revision February 1970

The following BSI references relate to the work on this standard:
Committee reference MEE/49
Draft for comment 67/32688

ISBN 580 05606 6

Amendments issued since publication

Amd. No.	Date of issue	Comments
1569	October 1974	
1949	April 1976	
2677	July 1978	
3015	May 1979	
4562	May 1984	
8856	December 1995	Indicated by a sideline in the margin

Contents

	Page
Co-operating organizations	Inside front cover
Foreword	iii
1 General	
1.1 Scope	1
1.2 Factors of safety	1
2 Specific requirements for electric passenger and goods lifts	
2.1 Guides and fixings	1
2.2 Buffers	1
2.3 Top and bottom clearances and runbys	2
2.4 Car frames	3
2.5 Car enclosure	3
2.6 Car and landing entrance construction	4
2.7 Automatic power operation of entrances	5
2.8 Controlled power closing of entrances	6
2.9 Locking devices and switches for car and landing entrances	6
2.10 Emergency devices and openings for cars	7
2.11 Car capacity and loading	7
2.12 Safety-gear	8
2.13 Governors	12
2.14 Suspension	12
2.15 Lift machines	14
2.16 Counterweights	14
2.17 Load plates	15
2.18 Controllers	16
2.19 Operation and operating devices	16
2.20 Suppression of radio and television interference	17
2.21 Terminal stopping and final limit switches	17
2.22 Main switches and wiring	18
3 Specific requirements for electric service lifts	
3.1 Lift cars	18
3.2 Lift machines	19
3.3 Guides	19
3.4 Buffers	19
3.5 Counterweights	19
3.6 Suspension	19
3.7 Safety-gear	19
3.8 Load plates	19
3.9 Landing doors, shutters or gates	19
3.10 Terminal stops	19
3.11 Slack-rope switch	19
3.12 Main switches and wiring	19
3.13 Suppression of radio and television interference	20
4 Firemen's lifts	
4.1 Location	20
4.2 Capacity	20
4.3 Doors	20
4.4 Speed	20
4.5 Fire switch	20

	Page
4.6 Electricity supply	20
5 Specific requirements for hydraulic lifts	
5.1 Guides and fixings	20
5.2 Buffers	20
5.3 Top and bottom clearances and runbys	20
5.4 Car frames	21
5.5 Car enclosure	21
5.6 Car and landing entrance construction	21
5.7 Automatic power operation of entrances	21
5.8 Controlled power closing of entrances	21
5.9 Locking devices and switches	21
5.10 Emergency devices and openings for cars	21
5.11 Car capacity and loading	21
5.12 Safety-gear	21
5.13 Ram stops	22
5.14 Suspension	22
5.15 Hoisting machinery	22
5.16 Counterweights	24
5.17 Load plates	24
5.18 Control and controllers	24
5.19 Main circuit breaker or main switch, and wiring	24
5.20 Terminal stopping switches	24
6 Specific requirements for hand-powered lifts	
6.1 General	24
6.2 Lift cars	24
6.3 Lift machines	24
6.4 Guides	25
6.5 Buffers	25
6.6 Counterweights	25
6.7 Suspension	25
6.8 Hauling rope	25
6.9 Brakes and sustaining devices	25
6.10 Safety-gear	25
6.11 Load plates	25
6.12 Landing doors	25
Figure 1a — Contract load for passenger lifts in relation to net inside floor area (metric units)	8
Figure 1b — Contract load for passenger lifts in relation to net inside floor area (metric units)	9
Figure 1c — Contract load for passenger lifts in relation to net inside floor area (imperial units)	9
Figure 1d — Contract load for passenger lifts in relation to net inside floor area (imperial units)	10
Figure 2 — Net inside floor areas for passenger lifts	10
Table 1 — Governor tripping speeds and stopping distances	11
Table 2 — Minimum diameters of drums, pulleys and sheaves	13

Foreword

This standard makes reference to the following British Standard:

BS 476, *Fire tests on building materials and structures*.

BS 476-7, *Surface spread of flame tests for materials*.

This British Standard, prepared under the authority of the Mechanical Engineering Industry Standards Committee, is a revision of and supersedes the previous edition of BS 2655, which was entitled “*Electric lifts*”.

The new title reflects the extension of the scope of this British Standard. Amendments to Parts 2 and 3 have been published and implement the change in title. The revised Part 1 and additional new parts are being published separately and, together with Parts 2 and 3, are as follows:

Part 1: General requirements for electric, hydraulic and hand-powered lifts.

This part is basically a revision of the 1958 edition of BS 2655-1¹⁾, without the building requirements and list of definitions, and extended to cover engineering and safety requirements for new hydraulic and hand-powered lifts as well as for new electric lifts.

Part 2: Single-speed polyphase induction motors for driving lifts.

This part covers the type of electric motor specially designed for driving lifts. It should be used in conjunction with BS 2613²⁾ and gives additional requirements, including the class of lift rating and special limits of temperature rise.

Part 3: Arrangements of standard electric lifts.

This part gives standard dimensions for lift wells and machine rooms in relation to lift capacity and platform sizes, for seven classes of lifts.

Part 4: General requirements for escalators and passenger conveyors.

This part specifies engineering and safety requirements for escalators and passenger conveyors. The latter may be described as machines in which the passenger carrying surface remains parallel to the direction of motion and is uninterrupted.

Part 5: General requirements for paternosters.

This part specifies engineering and safety requirements for paternosters, which may be described as machines where series of cars are continuously running in closed loops and are characterized by the car floors remaining substantially horizontal when the direction of motion is reversed at the extremities of car travel.

Part 6: Building construction requirements.

This part specifies structural and fire resistance requirements for the equipment covered by Parts 1, 4 and 5.

Part 7: Testing and inspection.

This part specifies tests, examination and certification of new and modified equipment covered by Parts 1, 4 and 5.

Part 8: Modernization or reconstruction of lifts, escalators and paternosters.

This part specifies engineering and safety requirements.

Part 9: Definitions.

This part gives definitions of terms used in the remainder of the standard.

Part 10: General requirements for guarding.

This part specifies requirements for the guarding of moving parts and protection against hazards from electrical equipment. It relates to equipment covered in Parts 1, 4 and 5.

¹⁾ BS 2655, “Electric lifts”, Part 1, “General requirements”.

²⁾ BS 2613, “The electrical performance of rotating electrical machinery”.

CP 407:1972, *British Standard Code of Practice for electric, hydraulic and hand-powered lifts*.

The code gives general information and guidance for planning, purchasing, installation and maintenance of passenger, goods and service lifts.

In case of difficulty in classifying any equipment in accordance with the headings of Parts 1, 4 and 5, reference should be made to the relevant definitions in Part 9.

The British Standard covering lifts, in its main provisions, has been in use for nearly 20 years and embodies the main principles of good practice, with particular reference to safety. It is widely used in the lift manufacturing industry in this country as a basis for design and there is thus economic advantage to the user in specifying that his lift is to be in accordance with the standard.

Throughout this standard the metric and imperial systems are used together, but it is important that each contract shall use either the imperial system throughout or the metric system throughout. A mixture of the two may lead to complications. The following points should be noted.

- 1) Whereas it has been customary for those countries using the imperial system to rate one person as weighing 150 lb, those countries using the metric system rate one person as weighing 75 kg, i.e. a 10.2 % increase. Both these ratings have been retained in this standard for their respective systems.
- 2) The relationship of contract load to effective car area has been retained irrespective of the system used. Therefore, for a given car size, although the contract load will be the same in imperial or metric units, there may be a relatively small variation in the "number of persons" specified on the load plate. This will be in the direction of less persons for the metric system.
- 3) In the matter of customary usage for designating speeds the imperial and metric systems are very close, since $100 \text{ ft/min} = 0.508 \text{ m/s}$ and $1.00 \text{ m/s} = 196.85 \text{ ft/min}$. British equipment has naturally been designed to suit speeds given in rounded imperial units. When rounded metric units are used in contracts a variation of 1.6 % therefore occurs when checking the speed in service in the metric system. This particularly applies for systems driven by a.c. motors. This very small difference will apply to governor tripping speeds as well as car speeds.
- 4) Generally, units have been converted from imperial to the metric system and then rounded off by increasing or reducing after taking into account the practical problems involved and current Continental practice.

This Part 1 applies to the engineering and safety requirements for electrically, hydraulically or hand-powered new lifts for passengers, goods and service. For hand-powered lifts the standard is restricted to goods lifts, hoists and service lifts. Though basically a revision of the 1958 edition of BS 2655-1³⁾, it incorporates the following broad changes:

- 1) The definitions and test requirements, as well as all structural requirements, now appear under separate cover (see above).
- 2) Information on hydraulically and hand-powered lifts is now included.
- 3) The requirements for safety-gears, buffers and clearances have been extensively revised.

³⁾ BS 2655, "Electric lifts", Part 1, "General requirements".

4) In certain circumstances fire resistance requirements for lift cars are now specified and car and landing openings must now be provided with doors, not gates, for all lifts other than service lifts. Because of the implications of this change, for the purpose of this standard the requirements, which exclude the use of close-picket collapsible gates for certain cars intended for the carriage of goods only, will become mandatory after a period of five years from the date of publication of this revision of the standard (see **2.6.1**). Emergency openings in lift cars must now be provided only in the roof and be openable only from the outside. Emergency stop switches for passenger operation are now not permitted.

5) The requirements for car doors and landing doors have now been combined in three clauses dealing respectively with construction, automatic closing and power controlled closing. Car closing force and kinetic energy limitations are now specified.

6) Limiting stress requirements for springs are now introduced.

7) Lift car suspension requirements now cater for the use of steel plate link chains.

8) A control station is now required on top of all lift cars which are capable of carrying persons.

9) The requirements for firemen's lifts are revised and incorporated in the body of the standard.

10) The minimum contract load requirements for goods lifts have been changed.

11) Counterweights shall not be used on drum drive machines.

This Part of this standard is rendered obsolescent concurrently with the publication of BS 5655 "*Lifts and service lifts*" — Part 1:1979 "*Safety rules for the construction and installation of electric lifts*" — Part 2:1988 "*Safety rules for the construction and installation of hydraulic lifts*" — Part 3:1989 "*Specification for electric service lifts*" and Part 14:1995 "*Specification for hand-powered service lifts and platform hoists*".

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

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to vi, pages 1 to 26, an inside back cover and a back cover.

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

1 General

1.1 Scope

This Part of this British Standard applies to electric, hydraulic and hand-powered passenger lifts, goods lifts and service lifts suspended by ropes or chains or supported by direct acting ram and employing a guided lift car installed in a situation where the structural requirements of Part 6 are carried out.

The requirements for passenger and goods lifts are combined in this standard, on the basis that goods lifts are capable of carrying persons and should thus be subject to the same safety requirements applicable to lifts intended for passenger operation.

The requirements for hand-powered lifts apply only to goods lifts, hoists and service lifts.

The standard does not apply to lifting platforms and road vehicle lifting machines having a vertical travel not exceeding 2.00 m or 6 ft 6 in, amusement devices, skip hoists, builders' hoists, conveyors or similar apparatus used for raising, piling or tiering.

1.2 Factors of safety

Unless stated otherwise in this Part of the standard, there shall be a factor of safety of not less than 5 for all parts of the lift.

EXCEPTION. This does not include the conventional type of compression, tension, torsion or leaf spring, which substantially maintains original form and does not include any reverse stresses during its working stroke.

2 Specific requirements for electric passenger and goods lifts

This section is rendered obsolescent under the conditions stated in the foreword (see Amendment No. 5).

2.1 Guides and fixings

2.1.1 Rigid guides shall be used for guiding lift cars and counterweights through their travel.

2.1.2 Guides shall be of sufficient length to prevent any of the car or counterweight shoes from running off the guides, irrespective of whether or not there are any gaps beyond the upper or lower end of the guides and the nearest obstruction, such as the pit floor or the top of the well.

2.1.3 Guides shall be of steel except where the nature of the processes carried on in the building renders such material unsuitable. For goods lifts having a contract speed exceeding 0.50 m/s (100 ft/min) and for all passenger lifts, the guides shall have working surfaces that are bright, smooth and straight.

2.1.4 Guides shall be so jointed and fixed to their brackets that they do not deflect by more than 3.0 mm or $\frac{1}{8}$ in under normal operation.

2.1.5 Guides of "T" section shall be held to their fastenings by through bolts or by clips of such design that any rotary movement of the clip will not release the guide.

2.1.6 Guide brackets shall be fixed to walls, metal inserts or stairstringers by bolts, or bolted to the building or structure steel work. Wood or fibre blocks or plugs shall not be used for securing guide brackets. Any shims shall be of metal. Suitably designed guide brackets may be built into the load bearing walls.

2.1.7 Guides and their fixings shall withstand the application of the safety-gear without permanent deformation when stopping a fully laden car or the counterweight.

2.2 Buffers

2.2.1 Installation. Buffers shall be installed under all cars and counterweights in accordance with the following requirements:

- 1) Buffers of timber or rubber shall not be used with lifts having a contract speed exceeding 0.40 m/s (75 ft/min) or where there is an accessible space below the pit.
- 2) Spring buffers shall not be used with lifts having a contract speed exceeding 1.00 m/s (200 ft/min).
- 3) Oil buffers shall be used with lifts having a contract speed exceeding 1.00 m/s (200 ft/min).

EXCEPTION. Where a buffer type safety-gear is used (see 2.12.5) the buffer under the car can be of the timber or rubber type.

2.2.2 Oil buffers. The minimum total stroke of an oil buffer shall be based on an average retardation of 9.81 m/s^2 (32.2 ft/s^2), based on 115 % contract speed.

The maximum rate of retardation of oil buffers based on 115 % contract speed shall be 24.5 m/s^2 (80.5 ft/s^2), excluding any transient decelerations having a duration not exceeding 0.04 seconds.

Where there is an accessible space below the pit, the total stroke and the specified maximum rate of retardation shall relate to the maximum permitted governor tripping speed (see 2.13.2) instead of 115 % contract speed.

Means shall be provided for ascertaining that there is a correct amount of oil in the buffer and the construction shall ensure that any oil displaced during the operation is contained within the buffer.

Each buffer shall be permanently and legibly marked to indicate the type and quantity of oil to be used within the buffer.

Oil buffers shall be self-resetting.

When lift speeds are 5.00 m/s (1 000 ft/min) or more, the buffer stroke can be reduced to not less than 50 % of the above required stroke provided positive means are used to reduce the speed of the car and counterweight to that suitable for the reduced buffer stroke before the buffer is struck.

When a reduced stroke buffer is used, the positive means of reducing car or counterweight speed shall operate independently of the normal terminal stopping device, should this device fail to slow down the car at the terminal as intended, and shall provide a retardation not in excess of 9.81 m/s² or 32.2 ft/s² without applying the car safety-gear.

EXCEPTION. In an installation with “lock down” compensating rope idler tension pulleys, the buffers must be designed to decelerate the entire moving system and the buffer supports should be designed accordingly.

2.2.3 Spring buffers. The spring buffers shall be of helical form or otherwise designed to have a spring rate which is constant throughout the full compression. The minimum stroke of a spring buffer shall be as follows:

Lift speed		Stroke	
m/s	ft/min	mm	in
Up to 0.50	Up to 100	40	1 ½
0.51 – 0.75	101 – 150	65	2 ½
0.76 – 1.00	151 – 200	100	4

Twice the static load to be supported by the buffer shall not fully compress it, but three times this load shall fully compress it.

EXCEPTION. When there is an accessible space below the pit bottom the spring buffers shall be so designed that they will not be fully compressed when struck by the loaded car or by the counterweight at safety-gear operating speeds.

2.2.4 Calculation of buffer loads. For the purpose of design of the buffer supports the maximum reaction force shall be taken as

For car buffers	For counterweight buffers
4 times (the weight of the unladen car plus contract load).	4 times the weight of the counterweight.

EXCEPTION. For systems with lock down compensator pulleys the factor of 4 may need to be increased.

2.3 Top and bottom clearances and runbys

2.3.1 Car bottom clearance. The car bottom clearance shall be such that when the car rests on the completely compressed buffers the distance between the underside of the car (guide shoes or rollers, safety gear, toe guards and other equipment round the perimeter of the car excluded) and the bottom of the pit shall be at least 600 mm or 24 in.

2.3.2 Bottom runby for lifts with counterweights. The minimum bottom runby or distance between car or counterweight buffer plate and the uncompressed buffer shall be:

- 1) for oil buffers, 150 mm or 6 in,
- 2) for spring buffers:
 - with generator field control, 150 mm or 6 in;
 - with a.c. or rheostatic control —

Speed		Runby	
m/s	ft/min	mm	in
0.15	25	75	3
0.25	50	150	6
0.50	100	230	9
1.00	200	300	12

2.3.3 Bottom runby for lifts without counterweights. The bottom runby of lifts without counterweights shall not be less than the following:

- 1) 75 mm or 3 in for rated speed not exceeding 0.15 m/s or 25 ft/min,
- 2) 150 mm or 6 in for rated speeds exceeding 0.15 m/s or 25 ft/min.

2.3.4 Maximum bottom runby. The maximum bottom runby shall not exceed:

- 1) for cars, 600 mm or 24 in,
- 2) for counterweights, 900 mm or 36 in.

2.3.5 Car top clearance for lifts with counterweights. The top clearance shall not be less than the sum of the following dimensions:

- 1) the bottom counterweight runby,
- 2) the stroke of the counterweight buffer,
- 3) the greater of the following two dimensions:
 - a. 600 mm or 24 in above the car roof,
 - b. 75 mm or 3 in above the projection of any part of the car or its equipment above the car roof, and
- 4) one half the counterweight buffer stroke.

EXCEPTION. 4) may be omitted if provision is made to prevent the jump of the car at counterweight-buffer engagement.

2.3.6 Car top clearance for lifts without counterweights. The car top clearance of lifts without counterweights shall not be less than either of the following:

- 1) 0.75 m or 2 ft 6 ins from the car roof,
- 2) The projection of any part of the car or its equipment above the car roof + 150 mm or 6 in.

2.3.7 Counterweight top clearance. The counterweight top clearance shall not be less than the sum of the following dimensions:

- 1) the bottom car runby,
- 2) the stroke of the car buffer,
- 3) 150 mm or 6 in, and
- 4) one half of the car buffer stroke.

EXCEPTION. 4) may be omitted if provision is made to prevent the jump of the counterweight at car-buffer engagement.

2.3.8 Guide gaps. Where gaps are arranged beyond the upper or lower ends of the guides the top and bottom clearances for car and counterweight shall be checked to ensure that, if car or counterweight actually travels the distance of the top or bottom clearances as calculated above, the requirements of 2.1.2 for length of guides are still valid.

2.4 Car frames

Every passenger and goods car body shall be carried in a steel car frame sufficiently rigid to withstand the operation of the safety-gear without permanent deformation of the car frame.

The deflection of the members carrying the platform shall not exceed 1/1 000 of their span under static conditions with the contract load evenly distributed over the platform.

At least four renewable guide shoes, or guide shoes with renewable linings, or sets of guide rollers shall be provided, two at the top and two at the bottom of the car frame.

2.5 Car enclosure

2.5.1 Lift cars, excluding linings, shall be constructed of non-combustible materials.

EXCEPTION. Slow burning materials may be used if all outside surfaces facing into the lift well of such material forming part of the car enclosure and platform are covered with sheet steel not less than 0.50 mm or 0.018 in. All lining surfaces within the car enclosure shall have a surface spread of flame not inferior to Class 2 of BS 476-7⁴⁾.

2.5.2 Lift cars shall be provided with roofs, car enclosures and doors. Enclosures of passenger lift cars and of goods lift cars intended to carry persons shall not be less than 2.000 m (6 ft 6 in) in height, with no openwork panels, except ventilating panels, within a height of 1.800 m (6 ft) from the car floor. The diameter or width of any opening in a panel shall not exceed 13 mm (½ in) unless a baffle is provided on the outer side of the panel. The aperture in any open work in the car roof of a goods lift shall reject a 25 mm (1 in) diameter rod.

2.5.3 The car enclosure shall withstand without permanent deformation a thrust of 340 N (35 kgf) or 75 lbf which is applied normally at any part by a rigid square flat face of 50 mm or 2 in side, whose edges are rounded to a radius of 4.0 mm or ⅛ in. The car enclosure shall be so secured to the car floor and car frame that it cannot work loose or become displaced in ordinary service.

2.5.4 Where the lift car has walls, roof and doors without openings, provision shall be made for adequate ventilation.

2.5.5 Any glass used for, or in conjunction with, the car enclosure shall be of the safety type.

2.5.6 The car platform shall be provided with an apron 750 mm minimum deep extending across the full width under the car entrance to prevent an object being trapped between the underside of the car platform and the landing threshold, and to afford greater safety when passengers are being released from the car, when the car is not at landing level. The apron shall conform to the requirements of 2.5.3.

2.5.7 Car platforms shall be of framed construction. Platforms for passenger cars shall be designed on the basis of contract load, this being evenly distributed. Platforms for goods cars shall be designed to suit the particular conditions of loading. The minimum factors of safety shall be 5 for steel and 8 for timber.

2.5.8 The lift car shall be adequately illuminated by a minimum of two electric lamps during the whole time the lift is available for use.

NOTE This requirement is made in the interests of safety. It is recommended that the car light switch, if provided, be so located that it is accessible only to authorized persons.

2.5.9 A 3 pin socket outlet shall be fitted on top of the lift car. A permanent light, suitably protected and separately switched, shall also be fitted on top of the lift car.

⁴⁾ BS 476, "Fire tests on building materials and structures", Part 7, "Surface spread of flame tests for materials".