~~RULES FOR POWER LIFTS~~

NOT EXCEEDING

~~750 WATTS (ONE HORSEPOWER)~~

TITLE:

MECHANICAL INSTALLATIONS FOR ACCESS, DOMESTIC AND SERVICE LIFTS.

AN ACCEPTABLE SOLUTION FOR NZBC D2.

MODIFIED BY NZBC 1991.

JULY 1ST 1992.

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ERRATUM

The formula in paragraph 4.3.3 on page 15 should read:

$$R = W\left(g + \frac{V^2}{2S}\right) \text{ newtons}$$

FOREWORD

Lifts, the motive power of which do not exceed 750 watts (one horsepower) are within the scope of the Boilers, Lifts, and Cranes Act 1950, and under the jurisdiction of the Marine Division of the Ministry of Transport.

By authority of the Boilers and Machinery Exemption Order 1971 (1971/13), dated 1 February 1971 such lifts are exempted from the provisions of sections 10 to 16, and sections 18, 19, 21 and 23, subsection (4) of section 28, and subsection (3) of section 29, of the Act. The Chief Engineer Surveyor, by authority of section 17 (1) of the Act has prescribed requirements relating to such lifts which are contained in the following rules.

The effect of the exemption is that such lifts are not subjected to the usual Departmental routines of design, supervision during construction, testing, certification, and routine six monthly inspection. All other relevant provisions of the Act including those relating to obligations of owners and the formal notification of accidents still apply. It is the owner's responsibility to ensure that all lifts comply with the applicable Marine Division requirements and are maintained and operated in a safe and responsible manner at all times.

The Rules which follow are formulated from the fundamental aspect of basic safety and must therefore be considered as minimum requirements.

These Rules were provisionally circulated in draft form in November 1972. Some comment regarding their application has been brought to our attention. These comments have been considered in compiling this document.

In conclusion I thank all those who have assisted in the preparation of this final document. I feel certain that working within the spirit of this document will be of benefit to all concerned.

J. Critchley
Chief Engineer Surveyor
Wellington

November 1985

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SECTION 1—GENERAL

1.1 SCOPE

These Rules shall apply to the design, construction, maintenance, inspection, testing and operation, ~~of all lifts the motive power of which does not exceed 750 watts (one horsepower).~~ of passenger lifts serving individual private dwellings to which the public does not have access, and to service lifts which are for the carriage of goods only.

1.2 DESIGN

All lifts coming within the scope of these rules shall be ~~designed in accordance with them.~~ The standard and quality of materials, & workmanship ~~and fittings shall be equal to that which is~~ required by the Power Lift Rules ~~1980 for lifts built under full supervision.~~ The manufacturer is responsible for ensuring compliance with these requirements. Further checks shall be undertaken ~~Engineer Surveyors may check such equipment~~ if requested to do so in the interests of safety or where it is evident, suspected, or reported that the standard of such equipment is below the requirements of these rules, or that which is generally considered necessary for safe practice.

1.3 MAINTENANCE

Lifts shall be regularly serviced by competent lift engineers at least once every six months and all repairs, adjustments, and lubrication necessary for safe and efficient operation shall be carried out.

Manufacturers shall supply the lift owner with a complete schedule of electrical and mechanical maintenance and shall state the interval at which such maintenance shall be carried out having regard to the lift service involved.

Owners shall be responsible for the maintenance of these lifts according to the manufacturer's schedule using properly trained staff. It is emphasised that regular maintenance of the lift with its fittings and safety devices is of major importance.

1.4 REGISTER

Each manufacturer shall record in a suitable register (which shall be kept and signed by a person holding a responsible position in the company) the serial number, lift carrying capacity, date and details of installation acceptance tests, design drawing numbers, material particulars, and the name and address of the person or company in whose premises the lift is installed. (Where lifts are imported the importing agent shall assume the duties of the manufacturer).

Every owner shall keep a suitable log book pertaining to the lift listing maintenance carried out with full details of any repairs, and the date, person and company involved. Every entry shall be signed legibly by the person concerned.

Registers and log books are to be available for inspection, ~~if required, by an Engineer Surveyor appointed under the Boilers, Lifts and Cranes Act 1950.~~

1.5 INSPECTION AND TESTS

All lifts which are being erected, re-erected or altered shall be inspected by a competent lift engineer at regular stages of the erection or alteration. The construction shall conform with the requirements of these rules.

The operation of the governor and safety gear, brake, and all other safety devices shall be to the satisfaction of the engineer. Tests of the governor and car safety gear shall be in accordance with rules 11.1 and 11.2. On completion of testing the engineer in charge shall endorse and sign the lift log book to the effect that the requirements of these rules have been met.

The owner shall ensure that routine inspections of the entire lift installation and the safety devices are carried out at intervals not exceeding six months. The safety gear shall be activated under working conditions at least once in every two years. Full details are to be entered in the log book and the report signed by the person carrying out the inspections certifying that the lift is in a safe working condition.

1.6 SPEED LIMITATION

No lift covered by these rules shall run at a speed in excess of 30 metres per minute. Where speeds in excess of this figure are required full details of the lift are to be submitted to the ~~Chief Engineer Surveyor~~ for his consideration.

1.7 CARRYING CAPACITY

The machine, supporting structure, car and all parts and equipment of a lift shall be designed and constructed to safely carry a contract load of not less than 370 kilograms per square metre based on the car floor area.

A conspicuous load plate bearing the contract load in persons, and kilograms shall be fitted in each lift car.

Refer to NZBC F8 Signs.

SECTION 2—DEFINITIONS

2.1 CAR BOTTOM CLEARANCE

The distance between the lowest part of the underside of the lift car (excluding equipment around the perimeter of the car such as guide shoes, safety gear, toe guards, etc.) and the pit floor when the car is standing on fully compressed buffers.

2.2 CAR BOTTOM RUNBY

The distance the lift car can travel beyond the level of the lower terminal floor until the buffers are fully compressed.

2.3 CAR DOOR

The door of the lift car ordinarily used for entrance and exit.

2.4 CAR SWITCH CONTROL

A form of control wherein the movement of the car is directly and solely under the control of a person in the car by means of a switch.

2.5 CAR TOP CLEARANCE

The distance between the ~~topmost part or projection (whichever is the higher)~~ of the lift car and the first point of obstruction when the car is standing at floor level at the upper terminal landing.

2.6 CAR TOP RUNBY

The distance the lift car can travel beyond the upper terminal floor ~~until~~ the counterweight ~~has~~ landed on fully compressed buffers.

2.7 COUNTERWEIGHT BOTTOM RUNBY

The distance the counterweight can travel from its normal position when the lift car floor is level with the top floor landing to its position on fully compressed buffers.

2.8 COUNTERWEIGHT TOP CLEARANCE

The distance between the topmost point of the counterweight or its attachments and the nearest point of obstruction with the counterweight at its normal position when the lift car floor is level with the bottom floor landing.

2.9 COUNTERWEIGHT TOP RUNBY

The distance the counterweight can travel from its normal position when the lift car floor is level with the bottom floor landing to its position when the lift car is on fully compressed buffers.

2.10 CONTRACT LOAD

The maximum load the lift is designed to carry.

2.11 DRUM DRIVE

A drive in which the ropes are secured to and wind on a drum.

2.12 ELECTRIC LIFT

A lift in which the motion of the car is obtained through an electric motor coupled to the winding element.

2.13 ENCLOSURE

The guarding structure around a lift well.

2.14 ENCLOSURE DOOR

A door in an enclosure.

2.15 HYDRAULIC LIFT

A lift in which the motion of the car is obtained through the action of a liquid under pressure acting on a piston or ram.

2.16 LIFT

An appliance the motive power of which does not exceed 750 watts (one horsepower), used for raising and lowering persons or goods by means of a car the movement of which in a vertical or approximately vertical direction is maintained by guides; and includes the supports, well, enclosures, car, and the whole of the mechanical and electrical apparatus required in connection with the operation and safety of a lift.

2.17 LIFT CAR

The load-carrying unit and includes the car platform, frame and enclosures.

2.18 PASSENGER-GOODS LIFT

A lift designed to carry passengers and/or goods.

2.19 PUSH BUTTON AUTOMATIC CONTROL

A form of control by buttons in the car and at the landings, the momentary pressing of which will cause the car to start and automatically stop at the floor corresponding to the button pressed.

2.20 SERVICE LIFT

A lift, the car of which has a floor area not exceeding one square metre and a height not exceeding 1.25 metres designed to carry goods only, and which is operated solely from the landings.

2.21 TRACTION DRIVE

A drive in which the sheave is so grooved as to impart its motion to the ropes by friction.

SECTION 3—MACHINES, MACHINERY SPACES, OVERHEAD BEAMS AND THEIR SUPPORTS

3.1 MACHINES

(a) Lift machines shall be of sound and proven construction built by reputable manufacturers of lift equipment. They shall not be hung from the overhead supporting beams.

(b) Electric lift machines shall be equipped with brakes applied automatically by mechanical means when the operating device is at the "stop" position or power is cut off from the motor from any cause. No brake shall be released in normal operation unless power is supplied to the lift motor.

(c) Machines driven by multi-vee belts shall not have less than three belts. Provision shall be made for adjustment of the belt tension.

NOTE: No chains or friction gearing, i.e., gearing dependent upon the friction between faces of adjacent pulleys, friction clutch mechanisms, or belts, shall be used for connecting the main driving gear to the sheave or drum.

(d) The factor of safety of lift machines, and the pins, shafting and attachments of suspension rope sheaves and pulleys, based on the ultimate strength of the material and the static load imposed thereon, shall be not less than:

8 for steel;

10 for cast iron, cast steel or other materials.

(e) The dimensions of keys and keyways shall be in accordance with British Standard No. 46, Part 1. Set screws or pins shall not be used for transmitting power, or for connections subject to tension.

(f) Gears are to be designed and manufactured to British Standard No. 436.

(g) Adequate provision shall be made for lubrication of the machine parts. If the overhead diverter sheave bearings are not easily accessible from the top of the lift car for the purpose of inspection and lubrication, then a suitable permanent steel ladder shall be provided.

3.2 MACHINERY SPACES

(a) The winding machine mechanism and all parts of the equipment of a lift, other than those which must necessarily be placed elsewhere to effectively perform their functions, shall be housed in an adequately constructed machinery space. This space shall afford permanent protection against all weather with provision for adequate permanent ventilation. Fittings which can be closed shall not be regarded as permanent means of ventilation.

(b) The floors of machinery spaces shall be capable of sustaining the weight of the heaviest unit of the lift machinery together with any superimposed loads.

(c) A beam shall be provided for lifting machine parts, the beam being permanently fixed and adequately supported. The dimensions of the machinery space shall be such that free and safe access is provided to all parts of the machinery for the purposes of inspection, maintenance and dismantling. The clearance provided between the highest point of the lift machinery and the underside of the lifting beams shall not be less than 1.25 metres.

(d) Machinery spaces shall be provided with at least one permanently fitted light socket which shall be controlled by a switch located in a suitable position outside the machinery space. One 3-pin socket shall also be provided.

(e) Safe and convenient access to the machinery space shall be provided. If the entrance to the machinery space is more than 1.5 metres above the adjacent floor or roof surface, safe access shall be provided by means of an inclined ladder or stairs. Where the differences in level is 1.5 metres or less, ladders may be vertical.

Inclined ladders or stairs shall have a substantial handrail fixed at a convenient height on the outer stringer. Platform and landings shall be provided with handrails at least one metre high. Where the entrance door to a machine room opens outwards a landing having a length not less than the width of the door plus 0.75 metres and not less than 0.75 metres wide shall be provided. The minimum door size shall be 1.5 x 0.75 metres. Vertical ladders shall be fixed at least 150 mm clear of any wall, beam or obstruction and shall extend at least to the landing level. The ladder stringers shall be extended or suitable handgrips provided for a height of at least 1.125 metres above the landing level.

Where the access to a machinery space is through a manhole in the floor or ceiling the manhole shall be of such size as to provide a minimum clear dimension of 0.75 metres in all directions. All manholes in machinery space floors shall be enclosed on three sides by a handrail at least 0.75 metres high with a toe board or equivalent protection.

(f) A machinery space shall not be used for purposes other than those connected with the operation of the lift or the installation of other permanent equipment. No material of any description shall be stored in a machinery space with the exception of material used for maintenance purposes which may be kept in a steel cabinet not exceeding 1 x 0.75 x 0.25 metres fitted with an efficient catch. The cabinet must be installed as far as practicable away from the lift well. Means are to be taken to deny access to machinery spaces to all but authorised personnel. The owner of the lift is responsible for ensuring this provision is carried out. The owner shall also be

displaying an appropriate sign – refer NZBC FP Signs.

responsible for ~~having the following notice exhibited in a prominent position adjacent to the entrance:~~

~~"DANGER—ENTRY OF UNAUTHORISED PERSONS PROHIBITED"~~

(g) Exposed gears, belts and other moving parts of machines shall be guarded so as to afford adequate protection to all persons who may be in the vicinity.

3.3 OVERHEAD BEAMS AND THEIR SUPPORTS

(a) The equivalent static load on the overhead beams and their supporting structure shall be assumed to be equal to twice the maximum rope loads obtained when the lift is stationary, plus all other loads imposed on the beams and supporting structure.

(b) Beams directly supporting machines or sheaves over which lifting ropes or governor ropes pass shall be of steel or reinforced concrete. Beams are to be landed on to a solid bearing surface or checked into supporting structures, i.e., not attached by grouted bolts in shear.

(c) Beams supporting the beams which carry the machine or sheaves shall be of steel or reinforced concrete.

(d) The factor of safety for the overhead beams and supporting structure based on the ultimate strength of the materials and the load assumed in (a) shall not be less than 5 for steel and 7 for reinforced concrete.

(e) When concrete beams are used a certificate shall be provided by a registered civil or structural engineer stating:

(i) The design of the beams is adequate to withstand all loads likely to be imposed upon them using a factor of safety of 7.

(ii) All work has been undertaken in accordance with the design.

(iii) The completed work is considered acceptable and satisfactory in every respect.

The certificate shall be retained in the owner's records.

(f) The deflection of steel overhead beams shall not exceed

$\frac{1}{1500}$ of the span of the beams.

SECTION 4—CLEARANCES, RUNBYS, BUFFERS, STOPS, AND PITS

Rule 4.1.1 Add the following words:

This clear height shall be provided over a minimum clear area of 900 mm x 600 mm except that where the available height is greater than 750 mm, this may be reduced to 600 mm x 600 mm.

It is acceptable for an obstruction, such as a ram or buffer, to impinge on the minimum clear area provided there is a horizontal clearance of at least 450 mm on three sides of the obstruction.

earance

arance shall be such that when the car rests on the ed buffers the distances between the lowest part of car (guide shoes or rollers, safety gear, toe guards around the perimeter of the car excluded) and the ll be at least 600 mm.

nce for Lifts with Counterweights

The top clearance shall not be less than the sum of the following dimensions:

(a) the bottom counterweight runby,
(b) 1.5 times the stroke of the counterweight buffer,
(c) the greater of the following two dimensions:
  (i) 600 mm ~~above the car roof,~~
  (ii) 75 mm ~~above~~ the projection of any parts of the car or its equipment above the car roof.

Plus

4.1.3 Car Top Clearance for Lifts Without Counterweights

The top clearance of lifts without counterweights shall not be less than either of the following:

(a) ~~0.75 metres from the car top,~~ car top runby plus 0·75 meters.
(b) the projection of any part of the car or its equipment above the car top plus 150 mm.

top runby

4.1.4 Counterweight Top Clearance

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

(a) the bottom car runby,
(b) 1.5 times the stroke of the car buffer,
(c) 150 mm.

Rule 4.1.5 Minimum area at top of lift car for the safety of maintenance personnel:

The clear height required by Rule 4.1.2 or 4.1.3 shall be provided over a minimum clear area of 900 mm x 600 mm except that where the available height is greater than 750 mm, this may be reduced to 600 mm x 600 mm.

4.2 RUNBYS

4.2.1 Minimum Bottom Runby for Cars

The minimum bottom runby or distance between car or counterweight buffer plate and the compressed buffer shall be:

Lift speed

(a) Up to and including 8 metres per minute . . . . . 75 mm. <= ·13 m/sec
(b) Over 8 metres/min. and up to and including 16 metres/min. . . . . 150 mm. { > ·13 m/sec <= ·26 m/sec
(c) Over 16 metres/min. and up to and including 30 metres/min. . . . . 225 mm. > ·26 m/sec.

4.2.2 Maximum bottom runby

The maximum bottom runby shall not exceed:

(a) 600 mm for cars

(b) 900 mm for counterweights.

4.2.3 Car Top Runby (Lifts with Counterweights)

The car top runby shall be equal to the counterweight bottom runby.

4.2.4 Counterweight Top Runby

The counterweight top runby shall be equal to the car bottom runby.

4.3 BUFFERS AND STOPS FOR CARS AND COUNTERWEIGHTS

4.3.1 Buffers

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

(a) Spring buffers shall be used for all lifts with a speed in excess of ~~20~~ .3m/sec metres per min. ~~.3m/sec~~.

(b) For lifts having a speed of 20 metres per min. or less buffers of timber or rubber may be used.

4.3.2 Spring Buffers

The minimum stroke of a spring buffer shall be 40 mm. Twice the static load to be supported by the buffer shall not fully compress it but three times this load shall fully compress it.

4.3.3 Calculation of Buffer Loads

The average reaction force exerted by a buffer on its supports is given by:

$$R = M \left(g + \frac{V^2}{2S}\right) \text{ newtons}$$

Where M = ~~weight~~ mass of car plus rated load in kilograms. (kg)

V = speed of car in metres/second at impact (~~115% contract speed~~). 115 times the rated speed.

S = buffer stroke in metres. (m)

g = 9.81 m/s²

For the purposes of design of the buffer supports the maximum reaction force shall be taken as twice the average value (R) for spring buffers.

4.4 PITS

(a) Every lift shall ~~extend to~~ be founded on solid earth ~~except when the floor of the pit has adequate strength to withstand without failure the impact of the car with maximum load when it is descending at the rated speed, or at governor tripping speeds where a governor is fitted, and the pit is arranged so that the counterweight will land on solid earth or an abutment constructed on solid earth. Where lift pits are constructed with false floors a certificate signed by a registered civil or structural engineer shall be provided stating the construction of the floor is adequate to withstand any load that could be imposed upon it through the action of the lift.~~ unless the pit floor is specifically designed. The pit shall extend over the entire area of lift

(b) Every pit shall be constructed so as to remain dry and the floor shall be substantially level.

(c) (i) Where two or more lifts work in a combined lift well a mesh or similar type screen shall completely separate individual lift working spaces.

(ii) Where lift machinery is installed at the bottom working level of the lift a mesh or similar type screen, shall separate the lift pit and the machinery space.

(d) Where the depth of a pit, measured from the lower terminal landing exceeds one metre, and where no other means of access exists, a ladder shall be fixed permanently within reach of the lower enclosure door.

(e) Where access to a pit is by means of a door in the wall of the pit, the door shall be provided with an electric interlock so arranged that the door must be closed and electric contact made independently by bolting the door before the lift can be operated. The door shall be provided with a lock and key to prevent the entry of unauthorised persons.

(f) For all lifts except service lifts the pit shall be fitted with a 3-pin socket. The socket shall be located inside the lift well in a position easily accessible from the point of entry into the pit.

(g) All lift pits shall be provided with a permanent electric light fitting with its control switch adjacent to the point of entry. Light bulbs shall be protected by a wire cage.

SECTION 5—LIFTWELL ENCLOSURES

5.1 ENCLOSURE OF LIFTWELLS

(a) Liftwells shall be fully enclosed and shall be constructed of approved materials and be otherwise in accordance with the requirements of these rules and the bylaws of the appropriate local authorities.

(b) Where fire resistant construction is not required, lift well enclosures may be constructed of wire mesh, grille or other open work. The well enclosure shall also cover the full travel of the counterweight.

(c) The clearance between a car and liftwell enclosure shall not be less than 25 mm, nor shall it exceed 125 mm on the entrance side of the car except when the doors are installed wholly within the liftwell, in which case the maximum distance shall not exceed 190 mm, provided that the clearance between the car floor casing and the landing threshold shall not be less than 15 mm or more than 40 mm.

(d) The clearance between the counterweight and the enclosure shall be not less than 25 mm.

(e) The clearance between the car and the counterweight of a lift, or between the car or the counterweight and any ropes that normally move, or conductor cables, shall be not less than 40 mm.

(f) Where grille work or a similar type of construction is used for liftwell enclosures the interspaces shall comply with the following requirements:

(i) Where any moving part of a lift is 75 mm or less from the inside of the enclosure the interspaces shall not be greater than 10 mm

(ii) Where the distance is more than 75 mm the interspaces shall be not greater than 40 mm.

(g) Every projection extending inwards from the general surface of the wall of a liftwell and which faces a car entrance shall be bevelled on the underside. The angles of such bevels to the horizontal shall be not less than 60 degrees and preferably 75 degrees. The bevelled surfaces may be integral with the enclosure wall, as in a concrete wall, or may be rigid metal plates, or wood faced with sheet metal at least 3 mm thick.

5.2 PIPING, ETC., IN LIFTWELLS

Piping, conduit or other equipment not forming part of the lift installation shall not be installed in a liftwell, lift pit, or machinery space.

SECTION 6—SUSPENSION, SHEAVES, DRUMS AND PULLEYS

6.1 METHODS OF SUSPENSION

Lift car suspension shall be by means of round strand steel wire ropes, or by means of steel plate link chains.

6.1.1 Rope Suspension

(a) All steel rope shall conform to the requirements of BS 329 "Steel Wire Ropes for Electric Lifts" and a certificate shall be furnished for each size of rope used showing—
(i) the name and address of the makers,
(ii) diameter of rope,
(iii) number of strands,
(iv) number of wires of each strand,
(v) quality of material,
(vi) grade of material,
(vii) lay of rope, and
(viii) breaking load of rope.
Each certificate shall also bear a statement, signed by the rope maker, to the effect that the manufacture of the rope complies fully with BS 329.

(b) The factor of safety for car and counterweight ropes based on maximum static loads shall be not less than 12.

(c) The minimum diameter of ropes for cars and counterweights shall be 10 mm and the minimum number of ropes for cars and counterweights shall be two for drum drive and hydraulic types and three for all other types. Each rope shall be independently connected and shall be identical in diameter, construction and quality.

(d) All ropes anchored to a winding drum shall have not less than one turn on the winding drum when the car or counterweight has reached the extreme limit of its runby. The anchorage of the rope shall be effected by passing the rope through a hole in the drum and effectively clamping it.

(e) The car and counterweight ends of ropes shall be fastened by spliced eyes or by tapered sockets, or by bulldog grips. If the spliced eye is used a metal thimble shall be placed within the eye and the splice made with at least three tucks of the whole strand of the rope and two tucks with one-half of the wire cut out of each strand made under and over against the lay of the rope. The eye shall be drawn tightly around the thimble, the strands drawn tight after each tuck and the tucks smoothly laid. After the last tuck is made each strand shall be cut off not closer than 7 mm from the tuck and beaten down flush. If a tapered socket is used the dimensions, material and method of socketing shall conform with the current BS 463 "Sockets for Wire Ropes". Where bulldog grips are used for securing ends of hoisting ropes the grips, with respect to materials,

proportions and dimensions, shall conform with the current BS 462. Not less than three grips applied in the correct manner shall be the minimum number used to secure any wire rope.

Fig. 6.1.1 (a). Correct method of fitting bull dog grips

Fig. 6.1.1 (b). Incorrect method of fitting bull dog grips

Bulldog grips shall be fitted to wire rope as shown in Figure 6.1.1 (a) and not as shown in Figure 6.1.1 (b). The bridge of the grip shall be fitted on the working part of the rope and the U bolt on the rope tail or dead end of the rope. Grips shall not alternate in position on the rope.

(f) No car or counterweight rope shall be repaired by splicing.

(g) A traction-drive lift shall be provided with means to adjust the lengths of ropes to equalise the load on the individual suspension rope. The suspension ropes of all lifts shall be fitted wih rope equalising devices.

(h) Eyebolts for the suspension of cars and counterweights, and for the anchorage of the standing ends of car and counterweight ropes where two to one roping is employed, shall be solid forged and of the form and dimensions specified in BS 4278 "Eyebolts for lifting purposes".

(i) If one rope should require renewing all other ropes shall be renewed at the same time.

6.1.2 Chain Suspension

Chains used for lift car suspension shall be steel plate link chains and shall be bushed solid bearing pin construction, incorporating rollers. Chains shall not be used where lift travel exceeds 12 metres. The factor of safety shall not be less than 12. Connecting links shall have a strength at least equal to that of the chain to which they are attached. Not less than two chains independent of one another shall be used for suspension. Chains shall be so installed that any one chain lies in one plane

throughout its length. Chains, or sections of chains, showing signs of wear shall be replaced. In the event of the breakage or excessive stretch in one or more suspension chains, a switch shall open to cause the motor-control and brake-control to be opened.

6.2 SHEAVES, DRUMS, AND PULLEYS

(a) The diameter of sheaves, drums and pulleys for hoisting or counterweight ropes of 6 x 19 (fibre core); 6 x 19 (Seale); 6 x 25 (fibre); 8 x 19 (fibre); 8 x 19 (Seale); 8 x 25 (fibre) and shall in no case be less than those obtained from the following table.

6 x 19 fibre	13C or 41D
6 x 19 Seale	15C or 47D
6 x 25 fibre	13C or 41D
8 x 19 fibre	13C or 41D
8 x 19 Seale	13C or 41D
8 x 25 fibre	13C or 41D

Where D = diameter of rope
C = circumference of rope.

(b) All drums, sheaves and pulleys shall have flanges extending one rope diameter beyond the centre of the rope, or at least to the level of the surface of the rope when close-fitting guards are provided.

(c) The sheave rims of traction sheaves shall be of sufficient thickness to permit re-machining of worn rope grooves. The rope shall not be permitted to bed on the bottom of the groove.

(d) Drums. The rope groove shall be a circular arc having a radius 5% larger than the nominal radius of the rope. The grooves on the drum shall be pitched so that there is clearance between neighbouring turns of rope on the drum and also clearance between the part of the rope leading on to or leaving the drum and the adjacent coil. The clearance between neighbouring turns of rope shall not be less than 1.5 mm for ropes up to and including 13.0 mm diameter, or 2.5 mm for ropes above 13 mm diameter. Allowance shall be made for lead angle of the rope on to the drum.

(e) Chainwheels. Chain pulleys shall not be used. Chainwheels shall be of cast iron or steel and shall have machine cut teeth. They shall have a minimum of 25 teeth and the minimum engagement of chain when passing over a chainwheel shall be 6 teeth. For all chainwheels means shall be provided to prevent the chain from leaving the chainwheel or riding over the teeth.

(f) Shafts and axles. Pulleys or sprockets and their shafts shall be so supported and retained as to prevent them from becoming displaced.

(g) Keys and keyways. Keys shall be secured against movement and shall conform to the requirements of BS 4235.

SECTION 7—CAR CONSTRUCTION

7.1 CAR CONSTRUCTION

(a) Lift cars shall be of sound construction. The bow, side members, safety gear bearers and platform frames shall be of steel. The car sides may be of timber or metal or other approved material. If grille or other openwork is used, the car enclosure, where it extends more than 2 metres above the floor level, shall reject a ball 50 mm diameter, and where less than 2 metres above the floor shall reject a ball 10 mm diameter. The sides of lift cars shall extend from floor to roof.

(b) Every lift car shall be provided with a roof which shall cover the whole area of the car and shall be such as to safely support the weight of a man. The roof shall be provided with a panel capable of being opened only from outside the car. The panel shall be of such size as to permit easy ingress and egress. Glass shall not be used in the construction of a car roof.

(c) No glass shall be used in lift cars except to cover certificates, lighting fixtures, and appliances necessary for the operation of the car, and as a vision panel in the car door. No pieces of glass, unless wired or otherwise shatter-proof, shall exceed 930 cm^2 in area. Glassware used in lighting fixtures larger than 250 mm diameter shall be of wired glass or surrounded by a wire guard of a mesh that will reject a ball 10 mm diameter.

(d) (i) The cars of all lifts shall be provided with electric light. The light shall be placed so that when the car is at a landing, that portion of the landing immediately opposite the car entrance shall be effectively illuminated. In the case of automatic lifts, the control of the light shall be such that it may be switched off only by an authorised person, and the lamp shall be guarded and locked to prevent its removal.

(ii) Emergency lighting shall be provided for all lift cars by means of a battery secured to the top of the car. Operation shall be by means of a suitable solenoid.

(e) The upper sections or roof of all lift cars shall be provided with openings, which may be adjustable, for ventilation purposes.

(f) The factor of safety (for static loading) in the car bow, safety gear bearers, members in platform, side members, and their connections to the bow and platform, shall be not less than 6.

(g) No lift car shall have more than two entrances.

(h) (i) Where in a lift with more than one car entrance there is a liftwell with a blank wall opposite the entrance of the car when the car is at a landing, the clearance between the car floor nosing and the blank wall shall not exceed 40 mm.

(ii) If at such a landing or landings mentioned in (a) above, the distance between the car floor nosing and the well would exceed 40 mm, a projecting face shall be built on the well opposite so that the clearance shall not exceed 40 mm.

(i) Floating floors are not permitted.

SECTION 8—CAR AND LANDING DOORS, CONTROLS AND INTERLOCKS

8.1 LANDING DOORS

(a) Landing openings in liftwell enclosures shall be protected by sliding doors, combination sliding and swinging doors or by swinging doors.

(b) The doors shall be of good quality materials and shall withstand a force of 344 newtons applied at right angles at any point without permanent deformation and without being sprung from their guides.

(c) Enclosure doors when fully open shall leave no portions of the liftwell unprotected at the sides of the car and when closed shall guard the full width and height of the landing opening.

(d) Enclosure doors shall have a minimum height of 2 metres.

(e) Where enclosure doors of fire resisting type or smoke-stops are required by the building bylaws of the local authority concerned, construction of the doors shall comply with the bylaws, except that nothing therein shall relieve the owner, contractor, or other responsible person from complying with these rules. Where doors of either of the above types are not required the doors may be of wire mesh, grille or other open work, the interspaces of which shall reject a ball of 50 mm in diameter. Doors of openwork type shall not be power-operated.

(f) Manually operated doors of the solid horizontally sliding type for lifts with automatic and semi-automatic operation shall be provided with a vision panel, except at landings where a hall position indicator is provided. [redacted] enclosure doors [redacted] be provided with a vision panel. The panel shall be of wired or otherwise shatter-proof clear glass not less than 160 square centimetres nor more than 930 square centimetres in area through which a view of the car may be conveniently obtained from the landings.

(g) The distance between the liftwell side of the enclosure doors opposite the car entrance and the liftwell edge of the landing thresholds shall not exceed 60 mm in pushbutton automatic control lifts, and 100 mm in other lifts. If the enclosure door consists of two or more sections, the distances specified above shall be measured from the section of the door nearest to the edge of the landing sill.

8.2 CAR DOORS

(a) Doors of sound construction shall be fitted at each entrance to lift cars. Each door when closed shall guard the full opening and shall be provided with an electric contact so arranged that the car door must be closed before the lift can be operated.

(b) Sliding doors shall be guided top and bottom, and if of the openwork type shall be so constructed that the interspaces shall reject a ball of 50 mm in diameter when the door is closed.

(c) In the case of a lift equipped with a car levelling device, the car gate or doors may be opened during the period of inching provided the car landings are equipped with approved toe guards.
(d) Car doors shall have a minimum height of 2 metres.
(e) Collapsible car doors may be closed under power. Collapsible car doors may be partially opened under power, provided that power operations shall not exceed a distance of 250 mm and positive means shall be employed to prevent automatic opening beyond a distance of 300 mm. Full opening of the doors shall be manual.
(f) Solid car doors of lifts with solid enclosure doors in which vision panels are required by rule 8.1 (f) shall be provided with a panel through which a view of the interior of the car can be conveniently obtained from the landings. [illegible]el shall be of wired or otherwise shatter-proof clear glass, and shall not be less than 160 square centimetres nor more than 930 square centimetres in area.
(g) Lattice gates shall not be used.

8.3 LANDING DOOR CONTROL

Each enclosure door of a lift shall be interlocked with the control to ensure that:
(a) the lift car cannot be started unless every enclosure door is closed and locked;
(b) in the event of an enclosure door being open, the lift will come to rest;
(c) in the case of a car switch controlled lift, an enclosure door may normally be unlocked and opened only from the car, except that provision shall be made that the door at one landing may be opened from the outside by a special key, provided the car is opposite that landing;
(d) in the case of an automatic lift, an enclosure door at a landing may be unlocked and opened from either the car or landing only when the car is stationary and within 230 mm of the landing;
(e) in the case of automatic lifts with a self-levelling device and manually operated enclosure doors, the enclosure door at a landing may be unlocked and opened from either the car or the landing only when the car is under the control of the self-levelling device and is within 230 mm of the landing;
(f) in the case of automatic lifts with power operated enclosure doors, the enclosure doors during normal operation shall not open until the car is within a distance of 380 mm of the landing;
(g) provision shall be made for the opening of at least the terminal landing doors with the use of a special key by an authorised person, irrespective of the position of the lift car, for emergency and maintenance purposes.

NOTE: Attention is drawn to the fact that devices employing locks and contacts of a type in which the interlocking contact is made when the door is closed and the locking of the door takes place subsequently are not true interlocks and are not permitted under these rules.

Suitable toe guards shall be fitted to the landings and the car of all lifts with self-levelling devices.

8.4 LANDING DOOR INTERLOCKS

(a) Landing door locks shall be of such a type and so fitted that an unauthorised person cannot manipulate the lock and open the door when the lift car is away from the landing.

(b) Landing-door or landing-gate contacts shall be designed so that they are positively opened by the locking bar, or by a lever or other device attached to, and operated by, the door or gate.

(c) The functioning of a landing-door or landing-gate electric contact to prevent the movement of the car shall not be dependent solely on the action of a spring or springs, nor solely upon gravity, nor shall it be dependent on the closing of an electric contact. If springs are used they shall be in compression. The interruption of the electric circuit shall stop the car.

(d) Interlock contacts shall be on the positive side of the circuit.

SECTION 9—COUNTERWEIGHTS AND GUIDES

9.1 COUNTERWEIGHTS

(a) Counterweights shall be run in guides and all stress bearing parts shall be of steel. For the purpose of determining these stresses the equivalent static loading due to the counterweight shall be assumed to be twice their actual weight. A factor of safety of not less than 5 shall be used.

(b) The sections of sectional type counterweights shall be secured by at least two tie-rods passing through holes in all sections and having locknuts at each end, or the sections may be contained in a rigid steel frame and adequately secured.

(c) Counterweights shall be guarded by means of a rigid screen extending from a position 0.3 metre above the lift pit floor to a position at least 2 metres above the lift pit floor.

9.2 GUIDES

(a) Guides may be made of steel or suitable timber. (Oregon or Douglas Fir).

(b) ~~The guides shall be sufficient for the loads imposed upon them and shall be securely fastened to suitable supports.~~ All joints shall be tongued and grooved or dowelled and the working faces of the finished guides shall form a continuous smooth surface.

(c) For the purposes of determining car guide deflections and stresses due to the thrust exerted by the guide shoes, the lift car shall be considered as suspended by its rope or ropes, in any position of travel, with the contract load evenly distributed over any half of the area of the car platform; such area being bounded on the one side by a line passing through the centre of the car platform.

(d) Should the gross weight of the empty car exceed that of the contract load, then the contract load for the purposes of subrule (c) above shall be taken as one half of the total of the gross weight of the empty car and the contract load.

(e) The guide shoe thrusts caused by the car being loaded and unloaded shall also be considered, but only for those positions occupied by the guide shoes when the car is approximately level with a landing platform.

(f) For the purposes of determining the deflection and stresses of guides during an earthquake, the loaded car or counterweight shall be assumed to be suspended in any position of travel and acted upon by a continuous horizontal acceleration (in any direction) of not less than 0.24 g.

NOTE: Car and counterweight guide shoe spacing distance should be greater than the guide rail fixing distance.

(g) For cars and counterweights provided with safety gear and having steel guides, the maximum distance between points of substantial

support, regarding each span of the guides as a simple beam supported at each end shall not exceed the lesser of the following:
(i) 180 times the least radius of gyration of the section employed.
(ii) That distance which could result in either a deflection of 6 mm allowing a modulus of elasticity of 208 x 10^3 MPa or a stress of 125 MPa with car and counterweight loaded as defined in subrules (c) to (f) inclusive.

(h) For cars and counterweights with safety gear and having timber guides the maximum distance between the points of substantial support shall not exceed the lesser of the following:
(i) 110 times the least radius of gyration of the section employed.
(ii) That distance which would result in either a deflection of 6 mm allowing a modulus of elasticity of 10.3 x 10^3 MPa or an extreme fibre stress of 9 MPa with the car and counterweight loaded as defined in subrules (c) to (f) inclusive.

(i) For counterweights without safety gear where the two guides are secured one to the other midway between points of substantial support, the distance between points of substantial support may be increased to 270 times the least radius of gyration for steel guides and 165 times the least radius of gyration for wooden guides, provided the maximum deflection and stress in the guides due to the horizontal force defined in subrule (f) do not exceed those specified in subrules (g) and (h) for the material used.

(j) The terminal points of guides shall be at points of substantial support.

SECTION 10—ELECTRICAL INSTALLATIONS; CONTROL AND SAFETY DEVICES

10.1 ELECTRICAL INSTALLATIONS

All wiring, power supply, circuit breakers, conduits, trailing cables and earthings shall conform with the requirements of the current edition of the Electrical Wiring Regulations.

NOTE: Where in a lift having a direct current hoisting motor a rectifier is installed to convert A.C. electrical energy to D.C., the lift machine shall be re-tested after installation of the rectifier to ensure that the brakes are applied automatically and effectively whenever the operating device is at the "stop" position or when for any reason power is cut off from the motor of the lift machine. Means shall be provided to protect the installation from the effects of phase failure or phase reversal of the supply current.

10.2 CAR CONTROL DEVICES

(a) Electric lifts shall not be controlled by hand ropes.

(b) The car control buttons in push button automatic control lifts shall be placed in sequence of the landings served. The markings of the buttons shall correspond with the names or numbers of the landings served. An emergency stop button shall be provided and shall be clearly and distinctly marked and shall be placed in close proximity to the control buttons. There shall be provided a non-intereference device, time element or some other device such as will afford a person in an automatic lift car a reasonable opportunity of opening the doors on the car coming to rest and before it can be called away.

NOTE: An emergency stop button is not required to be fitted in a lift car having solid doors, provided a key operated stop switch is fitted.

(c) A separate over riding emergency control shall be fitted on top of the car for maintenance and inspection purposes.

10.3 TERMINAL STOPPING DEVICES

(a) Every electric lift shall be provided with upper and lower normal stopping devices in accordance with rule 10.4.

(b) Every electric lift shall be provided with upper and lower final stopping devices in accordance with rule 10.5.

(c) The normal and final terminal stopping devices shall not control the same switches on the controller.

(d) All normal and final terminal stopping switches shall be of substantial and proven construction.

(e) The contacts of all terminal stopping devices shall be opened positively and mechanically by the movement of the lift car.

(f) Normal and final terminal stopping switches shall be held in the open position when the lift car is at the limit of its runby.

10.4 NORMAL TERMINAL STOPPING DEVICES

(a) Normal terminal stopping devices shall be arranged to stop the lift car automatically from any speed attained in normal operation within the limits of top and bottom runby independently of the operating devices, the final terminal stopping device, and the buffers.

(b) Every lift having a drum machine shall have normal terminal stopping devices operated by the movement of the car and fixed either in the liftwell or on the lift car.

(c) Every lift having a traction machine shall have normal terminal stopping devices operated by the movement of the lift car and fixed either in the liftwell or on the lift car or in the machinery space.

(d) When normal terminal stopping devices are situated in the machinery space they shall be mounted on and operated by a stopping device mechanically connected to and driven by the lift car without dependence upon friction as a driving means. An automatic safety switch shall be provided which will stop the machine should the tape, chain, rope or other similar device mechanically connecting the stopping device fail.

NOTE: When the floor controller or selector of an automatically operated lift is driven in accordance with this requirement, the floor-stopping contacts for each terminal floor may serve as normal terminal floor-stopping devices.

10.5 FINAL TERMINAL STOPPING DEVICES

(a) Final terminal stopping devices shall be arranged to stop the lift car within the top and bottom runby independently of the operating device and normal terminal stopping devices.

(b) Final terminal stopping devices shall be arranged to operate with the lift car as close to the terminal floors as practicable without interfering with the normal operation of the lift.

(c) Every lift having a traction machine shall have final terminal stopping devices operated by the movement of the lift car.

(d) Every lift having a drum machine shall have two final terminal stopping devices, one being operated by the machine and the other by the movement of the lift car.

10.6 SLACK ROPE SWITCH

Every electric drum-drive lift shall be provided with a "slack rope" device which will automatically cut off the power and stop the lift machine if the car lifting ropes become slack from any cause.

10.7 EMERGENCY SWITCH

Every electric traction-drive lift shall be provided with a device which in the event of the car safety gear operating from any cause will automatically cut off the power and stop the lift machine.

10.8 EMERGENCY SIGNAL

All lifts shall be provided with an emergency signalling device operative from inside the car and audible in a suitable position outside the liftwell. The device, and the button in the lift, shall be marked:

"LIFT EMERGENCY SIGNAL"

The device shall be operated by a battery capable of sounding the emergency signal at full volume for a continuous period of not less than two hours.

SECTION 11—GOVERNORS AND SAFETY GEAR

11.1 GOVERNORS

(a) Speed governors shall be so constructed, adjusted and maintained as to cause the operation of the car safety gear at a speed not greater than 40 percent and not less than 15 percent above the rated speed of the lift.

(b) The governor rope shall not be damaged or permanently deformed by the operation of the governor.

(c) The linear mechanical tripping speed of the governor shall be stamped on the governor or on a brass plate permanently attached thereto.

(d) The governor of every new lift, or new governor and safety gear of an existing lift, shall be tested with the contract load in the car before it is passed for service. The test shall be carried out by obtaining the necessary slack rope to cause the gear to function.

11.2 SAFETY GEAR

(a) Safety gear shall be provided on the cars of all electric and indirectly operated roped hydraulic lifts. The gear shall be applied mechanically and shall be located beneath the car platform. It shall be automatic in action and shall be such that it will bring the car with its maximum load to rest and securely hold it in position should the hoisting ropes break or become detached, or, in the case of lifts fitted with speed governing devices, should the lift attain a predetermined excess speed.

NOTE: Safety gear shall not be fitted to direct acting hydraulic lifts.

(b) In lifts whose travel exceeds 5.5 metres, provision shall be made for the operation of the safety gear by a speed governor.

(c) Instantaneous safety gear, with cams made of cast or wrought steel, shall be fitted to the cars of lifts. Upon failure of the hoisting ropes such safety gear shall apply instantly and independently of the speed action of the governor. This may be accomplished by the use of a governor and a governor rigging having a sufficiently high value of inertia to apply the safety gear in the event of a free drop or by means of a fly rope between the safety gear and counterweight, or an equivalent device.