
Code of Practice
on the Design and Construction
of Builders' Lifts
(2021 Edition)

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PART 0

INTRODUCTION

This Code is issued under section 11 of the Builders' Lifts and Tower Working Platforms (Safety) Ordinance ("the Ordinance"), Chapter 470. This Code, unless the Director of Electrical and Mechanical Services ("the Director") provides otherwise, is applicable to any builder's lift for construction work.

Because of the varying operating conditions on sites and a builder's lift is frequently erected, altered in height of travel and dismantled, this Code for builders' lifts has been drawn up based on the following requirements:

- (a) it is only operated by a competent operator.
- (b) it is maintained and periodically inspected, cleaned, oiled and adjusted by a registered contractor.
- (c) it is checked and inspected by a competent operator daily for its function before commencement of operation.
- (d) it is examined and tested by a registered examiner according to safety requirements of the Ordinance.

A builder's lift is to be used for construction work at a construction site or an existing building. It is mainly intended for the conveyance of builders and materials to different landings.

The lift cage of a builder's lift is constrained against lateral displacement by a guide or guides and moved along its supporting mast which under most circumstances is fixed to an adjoining building or a structure with wall anchorages.

If a registered examiner or registered contractor carries out builder's lift work in accordance with the relevant portions of this Code, he/she shall be deemed to have carried out the work to the satisfaction of the Director. Otherwise, he/she shall, before carrying out the work, submit details of the proposed builder's lift work to the Director and obtain his approval in writing for the proposed work.

PART 1

SCOPE

This Code specifies safety requirements of a builder's lift used for carrying builders and materials at a construction site. This Code applies to a builder's lift defined in the Ordinance.

This Code does not apply to:

- lifts as defined in the Lifts and Escalators Ordinance, Chapter 618¹;
- hoists for transportation of materials as defined in the Construction Sites (Safety) Regulations, Chapter 59I;
- suspended working platforms as defined in the Factories and Industrial Undertakings (Suspended Working Platforms) Regulation, Chapter 59AC;
- mobile elevating working platforms not having a mast construction;
- tower working platforms as defined in the Ordinance.

The objective of this Code is to enhance the reliability and safety of a builder's lift without placing undue limitations on the general design, construction and installation of the builder's lift.

For the design and construction requirement of "Jump Lifts", reference should be made to Part 8 of this Code.

¹ The Lift and Escalator Ordinance, Chapter 618, was launched and superseded the Lifts and Escalators (Safety) Ordinance, Chapter 327, on 17 December 2012.

PART 2

DEFINITIONS

The following definitions are used to indicate precisely the technical terms that are used in the Code in addition to all the interpretations as stipulated in section 2 of the Ordinance. Reference should be made to Figure II.1 in Annex II for the terms provided.

Base Frame

The base frame is a structural part upon which the mast, lift cage and other components are supported.

Buffer

A resilient stop at the end of travel, and comprising a means to braking using fluids, springs, elastomers, or other similar means.

Counterweight Way

The total space within which the counterweight of a builder's lift travels.

Fence

A barrier enclosing an area to prevent access of persons.

Guardrail

Fixed rails used to prevent persons falling from a height.

Guides

Rigid components provided for guiding the direction of travel of the lift cage (and the counterweight when provided).

In Service Condition

An operating condition in which the laden or unladen lift cage can be either travelling or stationary in any position in the liftway.

Jump Lift

A kind of builders' lifts where the lift cages operate in a liftway under construction, and the travelling height is extended by raising the overhead machine platform as the building structure under construction rises.

Landing

Defined stopping level at the building or structure which includes the space required for loading and unloading of the lift cage.

Liftway

The total space within which the lift cage travels.

Mast

A structure used to support and guide the lift cage (and the counterweight when provided).

Mast Section

Individual sections which are joined together to form the mast.

Machine platform

A platform designed and used for supporting the drive machine, controller, etc., of a jump lift and acts as a temporary machine room.

Out of Service Condition

A non-operating condition in which the unladen lift cage is placed in such a position that it is least affected by wind. This is usually at the base enclosure or the lowest landing.

Overspeed Governor

A device which, when the lift cage attains a predetermined speed in either upward or downward direction, causes the lift cage to stop and, if necessary, causes the safety gear, which may be referred to as overspeed safety device in some technical documents or guidelines, to apply.

Pitch Circle

It is the imaginary circle that rolls without slippage with a pitch circle of a mating gear.

Positive Drive

A lift cage that is driven by means of direct coupling to the driving machine, i.e. other than friction drive.

Rated Load

The maximum load that a builder's lift has been designed to carry in service.

Rated Speed

The normal speed at which a lift cage has been designed to operate.

Registered Professional Engineer ("RPE")

A person who has been registered under the Engineers Registration Ordinance, Chapter 409.

Safety Gear

A mechanical device for stopping and maintaining stationary on the guide(s) the lift cage (or the counterweight when provided) in the event of overspeeding of the lift cage (or the counterweight) in the downward direction. It may also be referred to as an overspeed safety device.

Tooth Module

It is equal to the pitch circle diameter of a gear divided by the number of teeth.

Traction Drive

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

Wall Anchorage

A structural member, connected between the mast and an adjacent building or other structure, uses to prevent lateral movement of the mast.

PART 3
TECHNICAL REQUIREMENTS

SECTION A STRUCTURAL DESIGN

1 GENERAL DESIGN CONSIDERATIONS

The design and stability calculations shall conform to the laws and principles of applied mechanics and strength of materials. All components and structural members shall be properly designed and made of sound materials that are free from defects and shall have sufficient strength and specified quality. The construction and reliability of the equipment, in whole or part, shall be appropriate to its intended use, operating environment and design life. Materials used in the fabrication of the builder's lift shall not support combustion and emit toxic gases or fumes upon burning.

Wall anchorages between the mast and the adjacent structure or buildings are considered to be part of the structure of the builder's lift. Structural support and concrete foundation for supporting the base frame are not included in this Code. Such structural support and concrete foundation should be designed and checked by registered professional engineers ("RPE") in structural or other relevant disciplines. Figure II.1 in Annex II illustrates one of the general layouts of a builder's lift with mast attached to an adjacent building by means of wall anchorages.

2 CONSIDERATION OF FORCE AND LOAD COMBINATIONS

2.1 General

The structure as a whole of the builder's lift shall be so designed, calculated and constructed that its strength is sufficient under all conditions, including normal operation, application of safety gear, impact of the lift cage on its buffer, installation and dismantling and adverse weather conditions.

2.2 Forces and load combinations to be considered in design

Any possible combination of the following forces and loads shall be taken into consideration when designing the structure of a builder's lift.

2.2.1 Static loads

Static load includes mast, wall anchorages and other appendages but excludes the lift cage, rated load and parts that travel with the lift cage.

2.2.2 Dynamic loads

Dynamic load includes the loads due to moving components, e.g. dead weight of the unladen lift cage, rated load, trailing cables and machinery that travel with the lift cage.

Dynamic load shall be calculated by multiplying the moving load by an impact factor. This factor shall be $(1.1+0.264V)$ where V is the rated speed in m/s. Other factors may be considered if they can be determined by calculation, measurement or testing.

2.2.3 Rated load on lift cage

The effect of the forces on the cage and mast resulting from the application of the rated load shall be allowed for in one of the two following ways, which reflect the chosen density of loading on the cage floor:

- (a) If $\frac{F}{A \times 0.8} < 4.0 \text{ kN/m}^2$
 where
 F = rated load [kN]
 A = total floor area [m²]

then the rated load shall be assumed to be distributed over a reduced area (A1) which results in a distribution of 4.0 kN/m². The format and the location of this area shall be taken as that which gives the least favourable stress for the mast and also for the cage. One example is shown in Figure II. 2a in Annex II.

- (b) If $\frac{F}{A \times 0.8} \geq 4.0 \text{ kN/m}^2$

then the rated load shall be assumed to be distributed over an area (A2) equivalent to 80% of the total floor area of the cage. The format and the location of this area shall be taken as that which gives the least favourable stress for the mast and also for the cage. One example is shown in Figure II. 2b in Annex II.

Where the uniform distribution of the rated load over the full area of the cage floor is less than 4.0 kN/m², then, for calculation purposes a minimum of 4.0 kN/m² shall be placed over the whole area of the cage floor. See Figure II. 3 in Annex II.

2.2.4 Wind loads

For most complete parts and structures, and individual members used in a builder's lift, the wind load shall be determined by:

$$F = A \times q \times C_f$$

where F is the wind load in N
 q is the dynamic wind pressure in N/m²
 A is the effective frontal area in m²
 C_f is the force coefficient

The wind pressure is given by:

$$q = V_w^2 / 1.6$$

where V_w is design wind speed in m/s

The force coefficient for lift cage shall be 1.2. The factor 1.2 covers both the shape factor and the shielding factor.

To determine the force coefficient, reference shall be made to the Code of

Practice on Wind Effects in Hong Kong – 2019.

In calculating wind loads on the builder's lift, the following three wind conditions shall be taken into account:

(a) In service condition

The minimum value for wind pressure and the corresponding wind speed under in service condition shall be as indicated in Table 1:

Table 1:

Installation	Wind Speed (m/s)	Wind Pressure (N/m ²)
builder's lift in either free standing mode or the mast is secured with wall anchorages	20.0	250

(b) Out of service condition

The wind pressure for out of service condition shall depend on the height above the ground and the location where the builder's lift is installed.

The design wind pressure,

$$Q_z = Q_{0,z} S_t S_\theta$$

Where

$Q_{0,z}$ = Wind reference pressure at an effective height defined in Table 2 (extracted from the Code of Practice on Wind Effects in Hong Kong - 2019)

S_t = topography factor (refer to Section 3.4 in the Code of Practice on Wind Effects in Hong Kong - 2019)

S_θ = wind directionality factor (refer to Appendix A1 in the Code of Practice on Wind Effects in Hong Kong - 2019)

Table 2:

Effective height Z_e (m)	Wind reference pressure $Q_{0,z}$ (N/m ²)
≤ 2.5	1 590
5	1 770
10	1 980
20	2 210
30	2 360
50	2 560
75	2 730
100	2 860

Effective height Z_e (m)	Wind reference pressure $Q_{o,z}$ (N/m ²)
150	3 050
200	3 200
250	3 310
300	3 410
400	3 570
500	3 700
>500	Seek specialist advice

Other aerodynamic factors should be considered in accordance with the Code of Practice on Wind Effects in Hong Kong – 2019.

(c) Erection and dismantling wind pressure

The minimum design wind pressure during erection or dismantling shall be 100 N/m² which corresponds to a wind speed of 12.5 m/s.

2.2.5 Loading and unloading forces

The lift cage and the mast structure shall be capable of sustaining forces exerted on the lift cage during loading and unloading of the lift cage. These forces include a horizontal force and a vertical force acting at the threshold member at a point which is located at one third of the width of the lift cage gate opening from either side of the uprights. The magnitudes of the horizontal and vertical forces are as follows:

- i. horizontal force = one-fifth of the rated load but not more than 250 kg
- ii. vertical force = half of the rated load or 200 kg whichever is greater, or, for rated load greater than 2 000 kg, calculated from the equation

$$F_V = 400 + 0.3 F$$

where

F_V = vertical force [kg]

F = rated load [kg]

In addition to the above, the rest of the rated load, i.e. rated load minus the vertical force in subsection (ii), shall act vertically in the centre of the lift cage floor as well.

The directions and locations of the above forces shall give the most unfavourable stresses for the lift cage and the mast structure.

2.2.6 Forces due to application of safety gear

Forces due to application of the safety gear at tripping speed shall be taken as the total moving mass multiplied by a dynamic factor of not less than 2.5.

A lower factor, but not less than 1.5, can be used if it can be verified by test under all conditions of loading up to 1.5 times rated load including any inertia effects of the drive system.

2.3 Other considerations

The design of the builder's lift shall allow for a vertical misalignment of at least 0.5° introduced during erection of mast. The loading of the landing gates and landing platforms shall be taken into consideration

2.4 Safety factors

i. The allowable stress of a steel member shall be given by:

$$\sigma_0 = \frac{\sigma_y}{S_y}$$

where σ_0 is allowable stress
 σ_y is yield strength of the material
 S_y is the factor of safety with respect to yield strength of steel

S_y shall not be less than 1.50 in **normal loading cases**², 1.33 in **occasional loading cases**² and 1.25 in **exceptional loading cases**².

ii. The allowable stress of a stressed aluminium member shall be given by:

$$\sigma_0 = \frac{f_y}{S_y} \text{ or } \frac{f_u}{S_u}$$

where σ_0 is allowable stress
 f_y is yield strength of the material
 f_u is tensile strength of the material
 S_y is the factor of safety with respect to yield strength of aluminium
 S_u is the factor of safety with respect to tensile strength of aluminium

S_y shall not be less than 1.70 in **normal loading cases**, 1.55 in **occasional loading cases** and 1.41 in **exceptional loading cases**.

S_u shall not be less than 2.50 in **normal loading cases**, 2.25 in **occasional loading cases** and 2.05 in **exceptional loading cases**.

2.5 Combination of loads and forces

The structure as a whole and each part of the builder's lift including the wall anchorages, and landing gates shall be designed by taking into account the forces calculated from the combination of loads under the following conditions:

² The detailed requirement of loading cases can be referred to EN 12159 Table 7.

- in service condition
- out of service condition
- erection
- dismantling
- alteration of height of travel
- application of safety gear upon over speeding
- striking of buffers
- fatigue loading of structural parts under fluctuating stresses including rack and pinions
- during test and examination
- other possible conditions that the builder's lift may encounter

2.6 Stability of builder's lift

When a builder's lift is in a free standing mode during erection, dismantling, in operation, or out of service condition, the stability of the builder's lift shall be taken into account.

2.6.1 The maximum overturning moments and the corresponding stabilizing moments shall be calculated about the most unfavourable tipping lines.

2.6.2 The calculation shall be made with the builder's lift in the most unfavourable positions with the maximum allowable inclination of the base frame as defined by the manufacturer. All loads and forces, which can act simultaneously shall be taken into account in their most unfavourable combinations. An allowance of 0.5° for inaccuracy in setting up the builder's lift shall be added to the maximum allowable inclination of the base frame.

2.6.3 The following influences shall be taken into account in the calculations:

- i. Distortions due to inaccuracies in the manufacture of the components,
- ii. Play in the connections of the structure,
- iii. Elastic deflections due to effects of forces.

2.6.4 When calculating the stability of a builder's lift, the sum of overturning moments multiplied by the respective overturning factors shall be less than the sum of the stabilizing moments. The overturning factors shall be as in Table 3:

All stabilising forces have the factor = 1.0.

Table 3:

Overturning Moment Created by	Overturning Factor
static loads	1.1
dynamic loads	1.5
wind loads	1.2
errors of erection	1.0

2.7 Design details of steel structure

The design of steel structures shall require a general stress analysis, including buckling and crippling, and fatigue stress analysis. If metals other than steel, e.g. aluminum alloys or other materials are used for structural components, the design shall comply with recognized international standards.

2.8 Fatigue calculation

A fatigue stress analysis shall be made for all load bearing components and joints which are critical to fatigue, such as shafts and gearing. This analysis shall take into account the degree of stress fluctuation and the number of stress cycles, which can be a multiple of the number of load cycles.

To determine the number of stress cycles, the manufacturer shall take the following into account:

- 80 000 movements with 50 % of the rated load in the cage;
- 80 000 movements with empty cage;
- For the calculation of the drives a travel length of 20.0 m for each movement (acceleration from rest to rated speed – travel at rated speed – deceleration to full stop) shall be taken into account.

For each component the least favourable combination of upwards and downwards movements shall be taken into account.

NOTE The number of movements for a passenger lift is based on 1.6×10^5 – intermittent duty (e.g. 10 years, 40 weeks per year, 40 hours per week, 10 movements per hour).

2.9 Builder's lift support conditions

The ground or foundations, temporary supporting structure and fixing for builders' lifts should be of sufficient strength to withstand the maximum load imposed under in service and out of service conditions without failure, or settlements or deflection which may endanger the stability or safety of the machinery. The temporary support of the builder's lift, the assessment of maximum loads and the design of foundations, supporting structures and ancillary details should be designed by an RPE in structural or other relevant disciplines. Particular care should be taken to ensure that the imposed load is not underestimated and also a careful assessment of probable wind pressures should be made, taking into account the degree of exposure of the site and any other special factors. Manufacturers' data relating to the dead weight of the builder's lift and the dynamic forces which can occur during operation of the builder's lift should always be obtained.

Under in-service conditions, the loads imposed on the supports of builders' lifts are usually due to the combined effects of:

- i. the dead weight of the builder's lift
- ii. the dead weight of the load
- iii. dynamic forces caused by movements of the lift cage, counterweight, wire ropes, cables and the load during operation including loading and unloading; and

- iv. wind loading, resulting from operation in wind speeds up to maximum permitted for in service conditions, acting in any direction on the builder's lift and load.

When out of service, the loads on the builder's lift stand or support are imposed by the dead weight of the builder's lift combined with the wind load, acting in any direction, due to maximum wind pressures anticipated on the particular site as specified in the Code of Practice on Wind Effects in Hong Kong 2019 or even higher. Particular care should be taken to estimate loads arising during operation for which data should be obtained from the builder's lift. A safety margin should be allowed for unpredictable effects.

The overall stability and safety of a builder's lift should be carefully checked and particularly when the builder's lift must operate close to excavations or embankments, or on bridge decks, or partially completed building frames or other structural supports. The analysis of the forces imposed by a builder's lift on its support is a vitally important matter which should always be checked by an RPE in structural or other relevant disciplines. The vertical and horizontal forces imposed are not uniformly distributed, their magnitudes may be much greater than the load causing them and will vary according to the movement of the lift cage and direction and speed of the wind. On tall builders' lifts, wind forces will have a considerable influence on the strength requirements of the supports and foundations and the greatest care is necessary in the setting-up and fixing of any holding-down devices, temporary connections or anchorages.

SECTION B: LIFT CAGE

1 BASIC REQUIREMENTS

Every lift cage shall consist fundamentally of a frame and be completely enclosed by walls, floor and roof. The only permissible openings are:

- (a) lift cage gate for normal access of passengers
- (b) emergency trapdoor or emergency door

The assembly shall be able to withstand the forces which will be applied in normal operation, during impact on buffers and emergency application of safety gear. No movable extensions shall be allowed on the lift cage unless these have been specifically designed by the manufacturer.

- 1.1 Each passenger shall be considered to weigh 80 kg. For determining the maximum number of passengers allowed in the lift cage, the maximum number shall not be greater than the rated load in kg divided by 80 kg and a cage floor area of 0.2 m² per person shall be used. The maximum number of passengers allowed in the lift cage shall include the competent operator.
- 1.2 The design of the builder's lift shall take into consideration that loads may be distributed either unsymmetrically or non-uniformly on the lift cage floor. The lift cage structure shall be calculated according to **Section A 2**.
- 1.3 The direction of movement of the lift cage shall be restricted by guides. The following means shall be provided during its travel to prevent derailment or jamming of the lift cage on the guides:
 - an effective device shall be provided to retain the lift cage to the guide in the event of failure of the guide shoes, blocks or rollers.
 - an effective mechanical means to prevent the lift cage from coming off the guides during operation, erection and dismantling.
- 1.4 The interior clear height of the lift cage shall be not less than 2.0 m.
- 1.5 When two lift cages are supported on the same mast, they shall be considered as two separate builders' lifts.
- 1.6 The rated speed of the lift cage shall be not more than 2.0 m/s in the vertical direction.
- 1.7 Suitable non-destructive tests to prove the integrity of the lift cage shall be conducted at intervals not more than 5 years or according to the manufacturer's recommendation, whichever is shorter.

2 LIFT CAGE FLOOR

- 2.1 The lift cage floor shall be slip resistant and be provided with means to drain off water.
- 2.2 The lift cage floor shall be designed to resist without permanent deflection a static load of 150 kg or 25% of rated load, whichever is the greater, but in no case more than 300 kg, applied on the least favourable square of 0.01 m².
- 2.3 The lift cage floor shall not be deflected by more than 3 mm under the rated load.

3 LIFT CAGE WALLS

- 3.1 The lift cage shall have walls on all sides. The walls shall extend from the floor to the roof.

The walls shall as regards perforation meet the requirements in ISO 13857:2019 Table 4, but the openings shall not allow the passage of a 25 mm sphere.

Any hazardous projection shall be marked according to ISO 3864-1.

- 3.2 The strength of the lift cage wall shall conform to **Section E 4**.
- 3.3 In the case of perforated walls, no material shall be attached to the walls which may increase the dead load on the lift cage.

4 LIFT CAGE ROOF

- 4.1 A solid roof shall be provided for every lift cage. Opening on the roof for conveying long material shall not be allowed.
- 4.2 If the lift cage roof is used as a working platform for erection, dismantling, maintenance, inspection or is provided with an emergency trapdoor for egress of passengers, it shall be slip resistant and protected with guardrail having sufficient strength and appropriate dimensions.

The upper guardrail shall be at a height between 1 000 mm and 1 150 mm above the lift cage roof, an intermediate rail at half the height of top rail and a toeboard not less than 200 mm high shall be provided. The guardrail shall not be placed on the car cage roof and within 200 mm (horizontally) away from the edge of the lift cage roof.

- 4.3 The lift cage roof shall have sufficient strength and shall be able to load of 120 kg on any area of 0.01 m². The lift cage roof shall also be able to withstand a loading of at least 300 kg evenly applied on an area of 1.0 m² at any position without causing permanent deformation.

If the lift cage roof is provided with a storage drum for storage of surplus wire for subsequent alteration of height of travel, the strength of lift cage roof shall also be able to sustain without plastic deformation a load equal to 125% of the dead weight of the storage drum plus the weight of wire rope that can be wound on the storage drum.

- 4.4 In no circumstances shall the lift cage roof be used as a working platform or for conveyance or support of persons other than for the designated purposes such as inspection, servicing, erection, dismantling or maintenance of the builder's lift carried out by the authorized personnel or for emergency escape from the lift cage.
- 4.5 The lift cage roof shall not be used for the storage or transportation of materials other than the storage of surplus wire rope for suspension of the lift cage or counterweight. Surplus wire rope used for alteration of height of travel of the builder's lift shall be wound on the storage drum securely fixed on the cage roof. See also **Section F 3.9**.

5 LIFT CAGE GATE

- 5.1 The lift cage gate and its frame shall be designed and constructed with sound material in such a way that it will not become deformed in the course of time. The use of glass (even armoured) or transparent polymeric material, is only permitted for the vision panel. If perforated gate panels are used, they shall meet the requirements in ISO 13857:2019 Table 4. But the openings shall not allow the passage of a 25 mm sphere.
- 5.2 The clear height and width of the lift cage gate opening shall not be less than 2.0 m and 0.6 m respectively. The lift cage gate shall cover the full opening.
- 5.3 When solid lift cage gate is used, it shall be provided with a vision panel using transparent material of sufficient strength. This vision panel shall be at eye level and have an area of at least 250 cm² and shall be shatter resistant.
- 5.4 The lift cage gate shall be fitted with an electrically and mechanically operated locking device. It shall not be possible to start or run the lift cage unless all lift cage gates are closed and locked. If a lift cage has more than one lift cage gate, each lift cage gate shall have its independent electrically and mechanically operated locking device.
- 5.5 The cage gates shall be capable of withstanding a force of 300 N applied normally at any position without permanent deformation and without the gates being sprung from their guides. The elastic deformation shall not be more than 30 mm. The 300 N thrust shall be applied by a rigid square or round flat face of 5 000 mm².
- 5.6 The horizontal distance between the lift cage threshold and the landing threshold shall not be more than 50 mm during loading and unloading when

the lift cage is at that particular landing.

- 5.7 The electrically and mechanically operated locking device of the lift cage gate shall be suitably protected against interference by unauthorized persons.
- 5.8 The threshold member shall be able to sustain loading and unloading forces.

These forces include a horizontal force and a vertical force acting at one third of the width of the lift cage gate opening from either side of the uprights. The magnitudes of the horizontal and vertical forces are as follows:

- i. horizontal force = one-fifth of the rated load but not more than 250 kg.
 ii. vertical force = half of the rated load or 200 kg whichever is greater, or, for rated load greater than 2 000 kg, calculated from the equation

$$F_v = 400 + 0.3 F$$

where F_v = vertical force [kg]
 F = rated load [kg]

The directions and locations of the above forces shall give the most unfavourable stresses for the threshold member.

- 5.9 For power operated horizontally sliding cage gates, they shall comply with Section E Part 1 Clause 5.3.6.2.2.1 or 5.3.6.2.2.2 of the Code of Practice on the Design and Construction of Lifts and Escalators 2019 Edition issued by the Electrical and Mechanical Services Department ("EMSD").
- 5.10 For power operated vertically sliding cage gates, they shall comply with Section E Part 1 Clause 5.3.6.2.2.3 of the Code of Practice on the Design and Construction of Lifts and Escalators 2019 Edition issued by EMSD.
- 5.11 In the case of a lift cage gate with hinged joints at bottom edge, the lift cage gate shall not be used as a gangway for loading and unloading of passengers and/or materials.
- 5.12 If sliding lift cage gates are used, they shall comply with **Section E 2.2**.
- 5.13 Any clearances around the edges of each lift cage gate or between lift cage gate sections shall conform to ISO 13857:2019 Table 4 except for under the gate where the clearance shall not be greater than 35 mm.

6 EMERGENCY EXIT

- 6.1 It shall be possible in an emergency situation for the passengers and the competent operator to escape from the lift cage. This is fulfilled if the lift cage is provided with an emergency opening either as a door in the lift cage wall or as a trapdoor in the lift cage roof.

- 6.2 The emergency door in the lift cage wall shall have a width and a height of at least 400 mm and 1 400 mm respectively. It shall open towards the inside of the lift cage or be a sliding type.
- 6.3 The emergency trapdoor in the lift cage roof shall have a width and a length of at least 400 mm and 600 mm. It shall not open inwards nor project outside the edge of the lift cage when it is opened. A ladder shall be provided inside the lift cage giving access to the emergency trapdoor if an emergency trapdoor is provided.
- 6.4 A safety switch shall be provided to interrupt the control circuit and prevent the movement of the lift cage if the emergency door or trapdoor is not properly closed and locked. It shall not be possible to override this switch from inside the lift cage. The restoration of a builder's lift to service shall only be possible after deliberate relocking of the emergency trapdoor and emergency door.

(Note: Provision may be made to short circuit this switch specifically for the purposes of inspection and erection when the lift cage control is transferred to the lift cage roof. In the interests of safety this provision should not be used to facilitate the carriage of long materials.)

- 6.5 The emergency trapdoors and emergency doors shall be provided with a means for manual locking. They shall be opened from outside the lift cage without a key and from inside the lift cage with a removable key. The key shall be kept by the competent operator inside the lift cage at all times during operation of the builder's lift.

7 LIGHTING INSIDE LIFT CAGE

At all times when the builder's lift is in service, it shall be provided with electric lighting that can provide a light intensity of at least 50 lux at floor level and at the controls. A switch shall be provided inside the lift cage to switch on and off the lighting.

SECTION C: BASE FRAME, MAST AND GUIDE, WALL ANCHORAGE

1 BASE FRAME

- 1.1 The base frame shall be able to sustain any loading during normal operation, erection, dismantling and out of service condition. The base frame shall transfer the loading to the support or foundation effectively. Springs, elastomers, pneumatic or cushion tyres shall not be used for transferring the loading to the support or foundation.
- 1.2 When adjustable means are provided to transfer the load into the ground, the feet must be free to pivot in all planes to an angle of at least 15 degrees from the horizontal in order to prevent bending stresses in the structure. If the foot does not pivot, the worst resulting bending stress must be taken into account.
- 1.3 The plumb of the mast shall be adjusted with suitable pads, liners or other devices. The base frame shall be adjusted to the horizontal position.
- 1.4 Allowance shall be made so as not to exert a ground pressure exceeding the allowable stress of the foundation or support. The loading on foundation or support should be checked by an RPE in structural or other relevant disciplines.

2 MAST AND GUIDE

- 2.1 The lift cage and the counterweight if provided shall each be guided by at least two rigid guides throughout the travel. The guides can be part of the mast. Flexible elements such as wire ropes or chains shall not be used as guides. The strength of the guides, their attachments and joints shall be sufficient to withstand the forces imposed due to the operation of the safety gear and deflections due to uneven loading of the lift cage.
- 2.2 The lift cage and any part of the mast shall not deflect by more than ± 50 mm relative to the landings provided that no collision can occur, when in service.
- 2.3 Guides or masts shall be so designed that they are able to sustain all loads. Horizontal forces acting transverse to the guides shall be considered when calculating the lateral rigidity of the guides and their fastenings. Joints between individual mast sections and guide sections shall be effective to transfer the loads, maintain the alignment and resist loosening.
- 2.4 The mast sections shall be provided with a means of identification. Means shall be provided to prevent the use of inappropriate mast sections in installation.
- 2.5 Protective measures shall be provided to prevent excessive corrosion of the structural members of the mast sections, in particular the inner surfaces. The figure of minimum allowable thickness of the structural members of the mast shall be provided by the manufacturer.

- 2.6 Attachments of driving elements (e.g. rack) to the guide/mast shall ensure that the driving element is kept in correct position so that the stipulated loads can be transferred to the mast and loosening shall only be possible by an intentional action.
- 2.7 Each individual mast section shall have a serial number as a unique identification by the manufacturer. The serial number is used for identification of the mast section for non-destructive tests and diagnoses if necessary. The contractor shall provide and inform EMSD of the details of mast section identification numbers before the first installation, alteration, replacement, and discard.
- 2.8 Suitable non-destructive tests to prove the integrity of the mast sections shall be conducted at intervals not more than 5 years or according to the manufacturer's recommendation, whichever is shorter.

3 WALL ANCHORAGE

- 3.1 The wall anchorages shall be able to withstand all loads generated under normal operation, erection, dismantling, addition of mast sections and out of service condition.
- 3.2 The wall anchorages shall be adjustable in length to cater for variation in distance between the mast and the adjoining building or structure.
- 3.3 The magnitude of the load exerted by the wall anchorages on the adjoining structure or building shall be provided by the manufacturer. The strength of fixing bolts and sockets and the mounting on the building side should be checked by an RPE in structural or other relevant disciplines.
- 3.4 The maximum and minimum distances between two consecutive wall anchorages shall be given by the manufacturer. The length of the overhang of the mast above the highest wall anchorage shall also be provided.
- 3.5 If the separation between the mast and the adjoining building is very large, any extension or cantilever constructed from the adjoining building used to connect to the wall anchorages should be designed and checked by an RPE in structural or other relevant disciplines. No extensions or cantilevers shall be allowed to be directly connected to the mast except via properly designed wall anchorages.

SECTION D: BUFFER, OVERRUN, COUNTERWEIGHT, LIFTING EQUIPMENT

1 BUFFER

- 1.1 Buffers shall be placed at the bottom limit of travel for lift cages and counterweights if provided.
- 1.2 The average deceleration of the lift cage during action of the buffers shall not exceed 1 g (where g is the gravitational acceleration which is equal to 9.81 m/s²) with no peak exceeding 2.5 g for more than 0.04 sec.

Buffers shall be designed in such a way that the above is met when the lift cage with rated load:

- (a) travels at a speed equal to the rated speed plus 0.2 m/s or
- (b) travels at a speed equal to the rated speed plus 0.4 m/s for:
 - (1) non rack and pinion drive systems, or
 - (2) a rack and pinion drive system with a single brake, or
 - (3) for a cage that is disengaged from the drive machinery.
- 1.3 If the buffers travel with the lift cage or counterweight if provided, they shall strike against a pedestal at least 0.5 m high at the end of the travel.
- 1.4 For traction driven builders' lifts, energy accumulation type buffers may only be used if the rated speed of the lift cage does not exceed 1.0 m/s. Energy dissipation type buffers may be used for any rated speed of the lift cage.
- 1.5 Hydraulic buffers shall be constructed so that the fluid level may be easily checked. An electric safety switch shall be provided to check whether the buffers have been returned to their extended position after operation. The normal operation of the lift cage shall depend on the return of the buffers to their normal extended position after operation.
- 1.6 The characteristics of the buffer used shall be considered when calculating the buffer force.

2 OVERRUN

- 2.1 The builder's lift shall operate the final limit switch before striking the buffers.
- 2.2 In all cases, the minimum distance between the lowest landing and the bottom final limit switch shall be such that the latter is not operated during normal operation.
- 2.3 The overrun of the lift cage at the top end of mast or liftway, i.e. the vertical distance the lift cage may travel after actuation of the final limit switch and

before meeting any obstruction to its normal travel or upper guide rollers reaching the end of the guides, shall be not less than:

- (a) 0.15 m for rack and pinion drive lift cage;
- (b) 0.5 m for traction drive lift cage or rack and pinion drive lift with a counterweight weighting not more than the empty cage;
- (c) 2 m for any lift with a counterweight heavier than the empty cage.

When the lift cage travels at a rated speed (V) greater than 0.85 m/s, the overrun of the above shall be increased by $0.1V^2$ m where V is in m/s.

When the cage has travelled through the upper overrun the free distance above the lift shall be at least 1.8 m (0.3 m if the cage roof is not designed to be accessible). In addition, any components or equipment associated with the cage which projects above the cage shall have a free distance above them of not less than 0.3 m.

3 COUNTERWEIGHT

If a counterweight is provided for the lift cage, the following requirements shall be complied with:

- 3.1 The lift cage shall not be used as a counterweight to counterbalance another lift cage.
- 3.2 If the counterweight incorporates filler weights, one of the following measures shall be considered to prevent their displacement:
 - (a) the filler weights shall be retained within a rigid frame, the filler materials shall be homogeneous inside the retainer and shall be properly maintained and protected against damage and falling out; or
 - (b) if the rated speed of the lift cage is not greater than 1 m/s, metallic fillers shall be restrained by a minimum of two tie rods.
- 3.3 To prevent the displacement of counterweights from their guides, the guides shall be equipped with a permanent anti-disengagement device in addition to rollers or shoes. Counterweights shall be at least guided near the top and bottom parts of the counterweight frame.
- 3.4 An indelible notice shall be displayed stating the total weight of the counterweights required and each individual filler shall have its own weight marked on it.
- 3.5 The counterweight shall be equipped with a safety gear if there is an accessible space underneath the counterweight way.
- 3.6 When the cage rests on the fully compressed buffers, the free distance above the counterweight shall be at least 0.3 m.

4 LIFTING EQUIPMENT

- 4.1 Any lifting equipment integrated with the builder's lift shall be designed and constructed not to impose loads on the structure of the builder's lift for which it has not been designed for. If the lifting equipment is power driven and designed to raise mast sections from the ground, means shall be provided to ensure that the lift cage cannot be operated simultaneously.
- 4.2 The lifting equipment shall only be used for installation or lifting of masts for alteration of height of travel of the builder's lift.
- 4.3 The lifting capacity of each lifting equipment shall not exceed 300 kg. There shall be only one lifting equipment for each lift cage.
- 4.4 The lifting equipment shall be thoroughly tested and examined by a registered examiner before it is put into service. Further test shall be required following substantial repairs or alteration, or at intervals not more than 6 months.
- 4.5 For the testing and examination of the lifting equipment, the structural, electrical and mechanical parts of the lifting equipment shall be inspected and thoroughly examined. Overload tests shall be conducted with 125% of rated load of the lifting equipment. The safe working load of the lifting wire rope shall not be greater than 20% of the minimum breaking strength of the wire rope.
- 4.6 The lifting equipment and the lifting gear shall be clearly marked with their safe working loads in both Chinese and English and shall not be overloaded, except by a registered examiner for the purposes of the test.
- 4.7 The lifting equipment shall be operated by a person who has attained the age of 18 and undergone training and is competent in the operation of the lifting equipment.
- 4.8 Routine maintenance of the lifting equipment shall be carried out at intervals not exceeding 7 days. Systematic maintenance, repairs and renewals shall be carried out and recorded.
- 4.9 No lifting appliances, other than the lifting equipment integrated with the builder's lift and used exclusively for its erection, dismantling or lifting of masts, which exert loading on the builder's lift, shall be allowed to be attached to any part of the builder's lift, unless they have been designed for the purpose.
- 4.10 The lifting equipment, including the hook and wire rope when not in use, shall be securely stowed.

SECTION E: LIFTWAY ENCLOSURE AND LANDING GATES

1 LIFTWAY ENCLOSURE

Every builder's lift shall be provided with a base enclosure and liftway enclosure. At every loading and unloading point of passengers and/or materials, a landing gate shall be provided. These shall prevent persons or objects from being struck by any part of the moving lift cage, counterweight and their appendages, and from falling off the liftway.

1.1 Base enclosure

1.1.1 The base enclosure shall have walls on four sides with a height of at least 2.0 m and shall conform to **Section E 4** and ISO 13857:2019 Table 1 and Table 2. If perforated walls are used, they shall conform to ISO 13857:2019 Table 4. The walls shall be constructed and protected to withstand atmospheric conditions to which they are exposed.

1.1.2 When the gate of the base enclosure is used as a landing gate and also used for access of service people to the inside of the base enclosure, this gate shall be capable of being opened from the inside of the base enclosure.

If a special gate is provided for access of service people to the inside of the base enclosure for maintenance purposes, this gate shall be provided with a key operated lock. It shall be capable of being opened from inside without a key even when locked. The gate shall be provided with an electric safety switch to prevent movement of the lift cage if the gate is not properly closed and locked. The strength of the gate shall be designed according to **Section E 4**. The locking device shall be designed according to **Section E 6**.

1.1.3 When lift work is required to be carried out inside the base enclosure with the lift cage stopped at high level, there shall be a clear height of at least 1.8 m. A means shall be provided to support the lift cage (a metal prop or equivalent). The means shall be capable of sustaining the stipulated load with a factor of safety of not less than 4. This means shall have an electrical interlock so that the lift cage cannot be driven when the prop is installed. The clearance shall extend under the whole floor area of the lift cage. It shall be possible to erect and dismantle the means without any person working underneath the lift cage.

1.1.4 The base enclosure shall have a floor of sufficient strength to support service people working inside the base enclosure. The floor shall be clean, tidy, non-slippery and provided with drains to prevent accumulation of water.

1.2 Liftway enclosure at all levels

1.2.1 If the safety separation between any point of access (other than the landing gate opening to the liftway) and any adjacent moving part of the builder's lift is less than 1.0 m, a liftway enclosure shall be provided and it shall have a

minimum of 2.0 m height or extend the full height from the landing floor to ceiling where this is less than 2.0 m.

- 1.2.2 If the safety separation is 1.0 m or more, a fixed enclosure to a minimum height of 1.5 m shall be provided.
- 1.2.3 A liftway enclosure shall also be provided to protect workers working on platforms or scaffolding erected close to the liftway at the external wall of building or other superstructures from being struck by any part of the moving lift cage.
- 1.2.4 The size of any perforation or opening in the liftway protection and gates, when closed, related to the clearances from adjacent moving parts shall be in accordance with EN ISO 13857:2019 Table 4, except where the distance between the liftway protection and gates and any travelling part of the lift in normal operation is not less than 1 m.
- 1.3 Strength of liftway enclosure (including base enclosure)
The strength liftway enclosure wall and its frame shall comply with the requirements in **Section E 4**.
- 1.4 Landing platform
Landing platforms are often erected across the space between the building and the liftway to serve as access to the landings for the passengers. The design and construction of such landings shall comply with the following requirements:
 - 1.4.1 It shall be of sound construction, adequate strength and free from patent defects.
 - 1.4.2 It shall be either closely boarded floor or shall be of a platform consisting of open metal work having interstices below or equal to 38 cm² in area.
 - 1.4.3 The width of the landing platform shall be greater than the width of the landing gate and in any case not less than 650 mm.
 - 1.4.4 Every board or plank forming part of the landing platform shall be of a thickness capable of affording adequate security having regard to the distance between the supports, and be not less than 200 mm in width and not less than 25 mm in thickness or not less than 150 mm in width when the board or plank exceeds 50 mm in thickness.
 - 1.4.5 Every side of landing platform from which a person is liable to fall a distance of more than 2.0 m shall be provided with a suitable fence or guardrail of adequate strength to a height between 1 000 mm and 1 150 mm. Intermediate guardrail at half the height of the top rail and a toe board of not less than 200 mm high shall be provided.

2 LANDING GATES

2.1 A landing gate shall be provided for every access to the lift cage. Landing gates shall be rigid and shall not open towards the liftway.

2.2 Sliding gate

If sliding gates are used, they shall be designed to avoid, during normal operation, derailment, jamming or displacement at the ends of their travel and shall comply with the following:

2.2.1 Horizontally sliding gates shall be guided at both the top and bottom parts. Vertically sliding gates shall be guided at both sides.

2.2.2 Vertically sliding gate panels shall be suspended by at least two independent wire ropes/chains. The factor of safety of wire ropes/chains shall not less than 6 with respect to the minimum breaking load of wire ropes/chains. They shall be retained in their pulleys/chainwheels.

Any counterweight used in connection with a gate shall be guided and shall be prevented from running off the guides even in the event of failure of its suspension.

The difference in weight between door leaf and any counterweight(s) shall not exceed 5.0 kg.

Means shall be provided to prevent crushing of fingers between gate panels.

2.2.3 The pulley / chainwheel diameter used for sliding gates shall be not less than 15 times the nominal wire rope diameter. The terminations of wire ropes shall be swaged or fixed with wedge grips. Wire rope grips shall not be used.

2.3 Landing gates shall not be actuated to open and close by a mechanical device which is operated by the movement of the lift cage.

2.4 Landing gate thresholds shall be designed in accordance with **Section B 5.8**.

2.5 A vision panel of sufficient strength shall be provided for solid landing gate. It shall be positioned such that the passengers on the landing side can ascertain whether the lift cage is at the landing level. The vision panel shall comply with **Section B 5.3**.

2.6 Power operated horizontally and vertically sliding gate shall be designed and constructed in accordance with Section E, Part 1, Clauses 5.3.6.2.2.1 and 5.3.6.2.2.3 respectively of the Code of Practice on the Design and Construction of Lifts and Escalators 2019 Edition issued by EMSD.

2.7 Landing gate shall be securely fixed and shall not be displaced accidentally.

2.8 Each landing gate shall be capable of being unlocked in the event of an

emergency from the landing side with the aid of a special tool, e.g. unlocking triangle key. The tool shall be kept properly and readily at site for use by competent workers in case of need.

3 DIMENSIONS AND CLEARANCES OF LANDING GATES

- 3.1 The clear height of the landing gate opening shall be not less than 2.0 m. When the available clearance of the landing floor is not enough, the landing opening shall extend the full height available and in no case shall be less than 1.8 m. If perforated panel is used, the size of perforations shall conform to ISO 13857:2019 Table 4.
- 3.2 When the width of the lift cage is smaller than the projection of the opening of landing gate, any gap so formed shall not be greater than 100 mm.
- 3.3 When closed, the landing gates shall fill the liftway openings.
- 3.4 Any clearances around the edges of each landing gate or between landing gate sections shall conform to ISO 13857:2019 Table 4 except for under the gate where the clearance shall not be greater than 35 mm.

4 STRENGTH OF LANDING GATES

The full height landing gates shall possess mechanical strength such that in the locked position and when a force of 300 N is applied at right angles to the gate at any point on either face, the force being applied using a rigid square or round flat face of 5 000 mm², they shall

- resist without permanent deformation;
- resist without elastic deformation greater than 30 mm;
- operate satisfactorily after such a test.

When a force of 600 N is applied at right angles to the gate at any point on either face, the force being applied using a rigid square or round flat face of 5 000 mm², it may fail the above criteria but shall remain secure.

5 GATE INTERLOCK

All landing gates and lift cage gates for normal access shall be fitted with an electrically and mechanically operated locking device. The design of locking devices shall comply with **Section E 6**. A certificate of test and examination of the type of the electrically and mechanically operated locking device shall be provided.

- 5.1 It shall not be possible to open any landing gate from the landing side, or to open any lift cage gate from inside the lift cage, unless the lift cage floor is within 150 mm above or below that particular landing floor.

- 5.2 It shall not be possible under normal operating conditions to start the operation of the lift cage or to keep it in motion, unless all gates (including lift cage gates and landing gates) are within 35 mm of the closed position.
- 5.3 When there is more than one lift cage gate, only the lift cage gate at the landing side shall be able to be opened when the lift cage floor is within 150 mm above or below the landing.

6 LOCKING DEVICES

- 6.1 All locking devices shall be fastened securely and the fastenings shall be restrained against working loose.
- 6.2 In the case of flap type locks, the flaps shall overlap the gate leaves over the entire width by an amount sufficient to prevent the gate from opening. It shall not be possible for the locking flap to drop into the closed position while the gate leaf or leaves are in any position other than the closed position.
- 6.3 The electrical contacts in the gate locking devices shall be opened positively and independent of gravity. They shall be actuated by the movement of the lock.
- 6.4 All gate locking devices together with any associated actuating mechanism and electrical contacts, shall be so situated or protected so as to be normally inaccessible to persons from the landing side. The devices shall also be so designed that they cannot readily be made inoperative by an unauthorized person interfering with the mechanism.
- 6.5 The locking devices shall be capable of resisting a force of 100 kg at the level of the lock in the opening direction of the gate.
- 6.6 Gate locking device shall be designed to permit servicing. Electro-mechanical locks shall be encased. Parts sensitive to water, deleterious dust and other contaminants shall be contained within sealed housing. A minimum protection of IP4X of BS EN 60529 shall be fulfilled.
- 6.7 The locking elements shall be held in the locked position by springs or weights. Where springs are used, they shall be in compression and adequately supported. The failure of a spring shall not render a lock unsafe.
- 6.8 The electrical switch in gate locking devices shall be a safety switch.
- 6.9 The removal of any detachable cover shall not disturb any of the lock mechanism or the wiring. All detachable covers shall be retained by captive fastenings.
- 6.10 The lift cage shall not be able to be kept in motion unless all locking elements are engaged by not less than 7 mm. The locking elements shall engage by not less than 10 mm at right angles to the direction of motion of the part to be locked.

7 CALLING FOR LIFT SERVICE

Every landing shall be provided with a call button for the passenger to activate an electric bell located at a specified location (usually at the base enclosure or main access) when requesting lift service.

- 7.1 The call button shall be of continuous pressure type.
- 7.2 The sound emitted from the electric bell shall be distinguishable from the sounds emitted from the audible emergency alarm and the overload sensing device.
- 7.3 The call button shall have a minimum protection of IP54 of BS EN 60529.

8 LIGHTING

Every landing shall be provided with electric lighting that can provide a light intensity of at least 50 lux at floor level. A switch shall be provided to switch on and off the lighting.

9 ACCESS TO LANDING GATES

A free space of at least 2 000 mm high shall be provided in front of the landing gate on the landing side for the access of passengers or materials. When the available clearance of the landing access is not enough, the clearance of the access shall extend the full height available and in no case shall be less than 1 800 mm. A cover shall be provided in front of the landing gate on the landing side to protect the passengers against falling objects.

SECTION F: DRIVING MACHINE

1 BASIC REQUIREMENTS

- 1.1 A builder's lift shall have at least one driving machine of its own. Each driving machine shall be fitted with a driving machine brake which operates immediately to arrest the lift cage when the operating circuit or safety circuit of the builder's lift is broken.
- 1.2 If two or more mechanically separate driving machines are used, each driving machine shall have its own independent brake.
- 1.3 The driving motor shall be coupled to the drive sheave or drive pinions by a positive means according to **Section F 1.13** that they cannot be disengaged from each other.
- 1.4 The lift cage shall, during normal operation, be power driven upwards and downwards at all times. Lowering under gravitational force by alternatively applying and releasing the driving machine brake shall not be allowed during normal operation.
- 1.5 During normal operation, the upward speed of the empty lift cage and downward speed of lift cage with rated load shall not exceed 115% of the rated speed.
- 1.6 The driving machine and its associated moving parts shall be so positioned or guarded to protect persons from injury and guard against damage from falling objects. Effective guards shall be provided for gears, chainwheels, chains, moving shafts, flywheels, guide rollers, couplers and similar revolving components. These moving parts shall be designed to permit easy access for routine inspection and maintenance work. The perforated guards shall have openings conforming to ISO 13857:2019. Any machine enclosure door or gate shall be provided with a lock.
- 1.7 For traction drive, it shall be properly protected against ingress of rain, mortar, concrete, dust and any other harmful materials into the driving machine brake, particularly the traction sheave.
- 1.8 Belts shall not be used for transmission.
- 1.9 Chains and chainwheels shall comply BS ISO 606 equivalent standards. The chainwheels shall be of cast iron or steel, have a minimum of 25 machine cut teeth and have at least 6 teeth in engagement. Means shall be provided to prevent the chain from leaving the chainwheel and riding over the teeth.
- 1.10 Stress concentration shall be minimized by forming adequate fillets where shafts and axles are shouldered. Pulleys or sprockets and their shafts shall be so supported and retained as to prevent them from becoming displaced.

- 1.11 Keys shall be effectively secured against movement.
- 1.12 The brake, motor, gear case and any bearings shall be mounted and assembled so that proper alignment of these parts is maintained under all conditions.
- 1.13 Any separate sheave, spur gear, worm wheel or brake drum shall be fixed to its shaft or other drive unit by any one of the following positive means:
 - (a) sunk keys;
 - (b) splines or serrations;
 - (c) secured by means of machined fitting bolts to a flange forming an integral part of the shaft or driving unit.

2 RACK AND PINION DRIVE

2.1 General

- 2.1.1 All racks and pinions shall be designed in accordance with the requirements of ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5 or other equivalent standards.
- 2.1.2 The rack and pinion tooth module shall be not less than
 - (a) 4 where the forces between the counter rollers (or other means) and the rack are inter-reacted directly without any other elements of the mast in between.
 - (b) 6 where the forces between the counter rollers (or other means) and the rack are inter-reacted indirectly via other elements of the mast in between.

Note: A counter roller is a roller used to counter-react the separating force created by the meshing rack and pinion.

- 2.1.3 When there is more than one drive pinion in mesh with the rack, then either a self-adjusting means shall be provided effectively to share the loading on each drive pinion, or the drive system shall be designed to accommodate all conditions of load distribution between the pinions.
- 2.1.4 The overspeed governor pinion shall be at a position lower than the drive pinions.
- 2.1.5 Visual examination of the pinions shall be possible without the removal of the pinions or major disassembly.

2.2 Pinion

- 2.2.1 The drive pinion, overspeed governor pinion and other pinions engaged with the rack shall be machined from wear resistant material and provide a safety factor of not less than 6. The safety factor is equal to the ultimate tensile stress

of the pinion material divided by the maximum stress exerted on the pinion. The stresses exerted in the pinion teeth shall be capable of sustaining the total suspended load which includes the weight of lift cage, rated load, weight of suspended trailing cables, surplus wire rope on the lift cage roof and the storage drum if provided.

Or

Each pinion shall possess a minimum safety factor of 2.0 against the endurance limit for tooth strength which is based on ISO 6336-1, ISO 6336-3 calculation, taking into account the maximum wear as stated in the manufacturer's instruction handbook. Each pinion shall possess a minimum safety factor of 1.4 against the endurance limit for pitting.

2.2.2 Undercutting of the teeth shall be avoided.

2.2.3 The pinion shall be affixed to the output shaft by positive means. Methods involving friction and clamping shall not be used.

2.3 Rack

2.3.1 The rack shall possess a minimum safety factor of 2.0 against the static limit for tooth strength, taking into account the maximum wear as stated in the manufacturer's instruction handbook.

2.3.2 The rack shall be securely attached to the mast particularly at their ends. Joints in the rack shall be accurately aligned to avoid faulty meshing or damage to teeth.

2.3.3 The load imposed upon the rack by the pinion shall not cause permanent deformation of the rack.

2.4 Rack and Pinion Engagement

2.4.1 Means shall be provided to maintain the rack and all the drive pinions and any safety gear constantly in mesh under all conditions of load. Such means shall not rely solely upon the lift cage guide rollers or shoes. The correct mesh shall be when the pitch circle diameter of the pinion is coincident with, or not more than one-third of the module out beyond the pitch line of the rack. See Figure II.4 in Annex II.

2.4.2 Further means shall be provided to ensure that in the event of failure of the means provided in **Section F 2.4.1**, the pitch circle diameter of the pinion shall never be more than two-thirds of the module out beyond the pitch line of the rack. See Figure II.5 in Annex II.

2.4.3 Means shall be provided to restrict the disengagement of the drive pinion from the rack in such a way that at least 90% of the width of a rack tooth is always engaged with the drive pinion in the event of failure of a roller or shoe. The

maximum disengagement is shown in Figure II.6 in Annex II.

2.4.4 The pinion teeth and the rack teeth shall be square to each other in all planes, within a tolerance of $\pm 0.5^\circ$. See Figure II.7 in Annex II.

2.5 Guarding

Substantial guarding shall be taken to prevent the entry of any material that might cause damage to the rack or pinion.

3 WIRE ROPE SUSPENSION FOR LIFT CAGE AND COUNTERWEIGHT

3.1 The wire ropes shall be steel wire ropes. Wire ropes shall conform to ISO 2408 or other equivalent standards.

3.2 Not less than two wire ropes, independent of one another, shall be provided for suspension and lifting. Means shall be provided to ensure loads are evenly distributed between the wire ropes.

3.3 The nominal diameter of the wire ropes shall not be less than 8 mm. The tensile strength of the wires shall be between 1 570 N/mm² and 1 960 N/mm². The number of individual wires shall be not less than 144. The other characteristics of the wire rope shall correspond to those specified in ISO 2408 or other equivalent standards.

A certificate of the wire rope shall be provided by the manufacturer.

The factor of safety of suspension wire ropes shall be not less than:

- 16 for traction drive with 2 wire ropes
- 12 for traction drive with 3 wire ropes or more
- 6 for the suspension of counterweights, if it is independent of the suspension system of the lift cage

The factor of safety is the ratio between the minimum breaking load of one wire rope and the maximum static force imposed on this wire rope.

The minimum breaking load of a wire rope is the product of the square of the nominal diameter of the wire rope and the tensile strength of the wires and a coefficient appropriate to the type of wire rope construction conforming to an international standard.

3.4 When reeling is used the number to take into account is that of wire ropes and not the falls. Arrangements entailing reverse bends of wire shall be avoided.

3.5 In case of abnormal relative extension, slackening or breakage of any one of the wire ropes, an electric safety device of non-resetting type shall be provided to interrupt the safety circuit and cause the lift cage to stop.

3.6 Termination of wire rope

3.6.1 The strength of the wire rope terminations shall be not less than 80% of the minimum breaking load of that of the wire ropes.

3.6.2 Wire ropes shall be terminated by any one of the following methods:

- swaged or pressed terminal with ferrule
- a wedge and socket anchor
- an eye splice with thimble

Hand spliced and U-bolt grip fixing methods shall not be used.

3.6.3 Visual examination of wire rope terminations shall be possible without the removal of wire ropes or major disassembly of the wire systems.

3.7 Wire rope shall be suitably protected by anti-corrosive coating or lubricant to prevent corrosion and wearing. Zinc coated or corrosion resistant wire ropes are recommended for corrosive environment.

3.8 ISO 4309 shall provide guidance for examination and discard criteria of wire ropes.

3.9 Wire rope storage

For the storage of surplus wire rope for subsequent alteration of height of travel on the lift cage roof, the following requirements shall be complied with:

- (a) Any wire rope connectors or devices used to affix the wire rope at the terminated point shall not cause damage to that affixed section if that section would subsequently become part of the suspension system.
- (b) The ratio between the pitch diameter of the storage drum and nominal diameter of the wire rope shall be not less than 15.
- (c) Surplus wire rope, which is stored under tension, shall be anchored and stored on a storage drum having helical grooves. Helically grooved storage drum shall have a groove depth not less than 1/3 the nominal diameter of the wire rope and shall be pitched so that there is clearance between neighbouring turns of wire rope on the storage drum.
- (d) When ungrooved drums are used, the stored wire rope shall not be under tension. Means shall be provided to relieve the tension in the stored wire rope. The wire rope shall not subject to a bend diameter of less than 15 times the wire rope diameter.
- (e) The storage drum shall be flanged at both ends. When the wire rope is fully wound onto the storage drum the flanges shall project beyond the upper layer of wire rope by at least two times the wire rope diameters. This projection shall be not less than 25 mm.
- (f) Wire rope anchorage shall be protected by not less than 3 dead turns on the storage drum. The anchorages shall be designed to withstand the maximum working load on the wire rope making no allowance for the effect of any dead turns.
- (g) Means shall be provided to prevent overloading the lift cage when

excessive surplus wire rope is wound on the storage drum.

3.10 Pulleys and sheaves

3.10.1 The diameter of the pulleys and sheaves shall be not less than 30d measured at the bottom of the groove where d is the nominal diameter of the rope.

3.10.2 All grooves shall be smoothly finished and their edges rounded. The contour of the grooves shall be circular over an arc of not less than 120° and have a radius of not more than 7.5% nor less than 5% in excess of half the nominal diameter of the wire rope.

3.10.3 The groove depth shall be not less than 1.5 times the normal diameter of the wire rope. The angle of flare on the side of the groove shall be 52°.

3.10.4 Pulleys having wire ropes leading upwards shall be protected against the ingress of foreign objects. Effective precautions shall be taken to avoid wire ropes coming off their grooves.

3.10.5 The fleet angle between the wire rope and a plane normal to the axis of a pulley shall not exceed 2.5°.

4 TRACTION DRIVE

4.1 The suspension system/traction drive shall be designed in accordance with Section E, Part 1 Clause 5.5 of the Code of Practice on the Design and Construction of Lifts and Escalators 2019 Edition issued by EMSD for traction drive with the following additional requirements:

- The driving machine shall not be possible to raise the lift cage when the counterweight is resting on the buffers with the control lever or button of the builder's lift is actuated in the upward direction.
- Clause 5.5.3 shall be satisfied with the exception that in the calculation of the ratio between T1 and T2, 150% of the rated load shall be considered.

4.2 In the case of a vee or undercut drive traction sheave the minimum diameter shall be 40d at the pitch circle diameter of the wire rope in the groove where d is the nominal diameter of the wire rope.

4.3 The wire rope groove in the traction sheave shall have one of the following forms:

- (a) round grooves in which the groove is an arc having a radius not greater than 5% larger than half the nominal diameter of the wire rope and has a depth not less than 1/3 of the nominal diameter of the rope.
- (b) round undercut in which the groove is the same as in (a) but undercut.
- (c) vee grooves in which the straight sides subtend an included angle of $37.5 \pm 2.5^\circ$.

- 4.4 The lead shall not deviate by more than 2.5° from a plane normal to the axis of the sheave groove.

5 DRUM DRIVE

Drum driven lift cages shall not be allowed.

SECTION G: DRIVING MACHINE BRAKE

- 1 The builder's lift shall be provided with a driving machine brake which operates automatically:
 - (a) in case of loss of power supply; or
 - (b) in the event of the loss of the supply to the control circuit.
- 2 The driving machine brake system shall have at least one electro-mechanical brake, but may have additional means of braking or stopping the machine. The brake shall be of friction type.
- 3 Band brakes shall not be used.
- 4 The driving machine brake(s) of a builder's lift shall be capable of bringing the lift cage to rest under 150% of rated load and at its rated speed in the downward direction and maintaining the lift cage stationary. Albeit the Builders' Lifts and Tower Working Platforms (Safety) Ordinance requires testing at 125% of rated load, design at 150% of rated load allows a safety margin. Under all conditions, the retardation of the lift cage shall not exceed 1g. In addition, the driving machine brakes on their own shall be capable of bringing the lift cage to rest under rated load and at the tripping speed of the overspeed governor.
- 5 No toggle or positive locking devices shall be used to hold off the brake.
- 6 In case of only one driving machine brake, at least two brake shoes, pads, or calipers on the brake drum or disc shall be provided. All mechanical parts (springs etc.) of the driving machine brake which brake the driving machine shall be so designed if any one of them fails, the lift cage with rated load would still be arrested.
7. The driving machine brake shall not be released in normal operation unless a continuous electric power is applied to the driving motor.

In the case of an electrically operated brake, the electric supply shall be interrupted by at least two independent electrical devices, whether or not integral with those that cause the interruption of the electric-supply feeding the motors and brakes.

8. If when the lift cage is stationary, one of the devices (i.e. electrical devices) has not interrupted the supply to the driving machine brake, further movement shall be prevented at the latest at the next change in direction of movement.
9. In the case of an electrically operated brake, when the motor may function as a generator, it shall not be possible for the electric device operating the brake to be fed by the motor.
10. Compression springs shall be used to apply the brake. These shall be adequately supported and shall not be stressed in excess of 80% of torsional

elastic limit of the material. Fatigue life calculation shall be considered when there is an adverse effect resulting from failure of compression spring.

11. Brake linings shall be asbestos free and of incombustible material and shall be so secured that normal wear does not weaken their fixings. The wearing surface of brake drums or discs shall be machined and shall be smooth and free from defects.
12. Braking shall become effective immediately after the power supply to the brake is cut off (the use of diode or capacitor connected directly to the terminals of the brake coil is not considered as a means of delay).
13. No earth fault, circuit malfunction or residual magnetism shall prevent the brake from being applied when the supply to the motor is interrupted.
14. The components of the driving machine on which the brake operates shall be positively coupled to the traction sheave, or drive pinion. Belts or friction clutches for coupling the motors to the components on which the brakes operate are not permitted.
15. Brakes shall be provided with means of adjustment to cater for the wear of the friction surfaces. The brake shall be self-compensating whenever practicable.
16. Every driving machine brake, if located on the lift cage roof, shall be capable of being released manually and shall require a constant force to maintain the brake open. The brake shall reapply as soon as the force is released.
17. The brake shall be designed to prevent the ingress of lubricants, water, deleterious dust or other contaminants by means of cover or enclosed housing.

SECTION H: SAFETY GEAR

- 1 Every lift cage shall be provided with a safety gear attached to the lift cage frame. The safety gear shall be activated by an overspeed governor.
- 2 The safety gear shall be tested and certificated and shall have a permanent label marked with the following data:
 - i. maker's name and address
 - ii. model
 - iii. serial number
 - iv. tripping speed
 - v. permitted load
 - vi. stopping distance
 - vii. year of construction
 - viii. expiry date
 - ix. type examination certificate number

Note: The stopping distance is the distance which the lift cage has moved when the safety gear is triggered and until the cage has come to a full stop.

- 3 Counterweights on traction drive shall also be fitted with a safety gear operated by an overspeed governor.
- 4 During erection or demolition, when workmen carry out lift work on the lift cage roof, the safety gear shall be operational at all times unless the lift cage is supported by a means, such as a prop, which shall have a factor of safety of not less than 4 against failure.
- 5 The design of the safety gear shall be capable of stopping and arresting the lift cage with 150 % rated load at tripping speed. The safety gear with any load up to the rated load in the lift cage shall operate with the following retardation:
 - i. between 0.2 g and 1.0 g for traction driven lift cage
 - ii. between 0.05 g and 1.0 g for rack and pinion driven lift cageand both systems shall have no peak exceeding 2.5 g for more than 0.04 sec. These values may be exceeded if the safety device triggers before the resetting operation is completed.
- 6 Any movement of lift cage by means of normal control shall automatically be prevented by an electric safety device of the non resetting type as soon as the safety gear is applied. The motor control and brake control circuits shall be opened automatically.
- 7 When the safety gear has tripped, it shall not be possible to release or reset the safety gear by raising the lift cage by means of normal control. After the tripping of the safety gear, it shall require a competent worker to reset the safety gear and return the lift cage to normal operation. Clear and concise instructions for the release of the safety gear shall be provided at the point of release.

- 8 Testing the function of safety gear shall only be possible at a distance from the lift cage using a remote control. No person is allowed inside the lift cage, underneath the lift cage or on the lift cage roof during the testing of safety gear.
- 9 Pulleys used to carry overspeed governor wire ropes shall be mounted independently of any shaft that carries the suspension wire rope pulleys.
- 10 Where there is relative movement between the gripping surface and the braking surface, the surfaces shall be held clear of each other during normal operation of the lift cage.
- 11 A safety gear designed to grip more than one guide shall operate on all guides simultaneously.
- 12 Safety gears shall not operate to stop an ascending lift cage. If an ascending lift cage is to be stopped on account of overspeed, then a safety gear shall be fitted to the counterweight for this purpose.

Note: An overspeed governor may however be used to cause the motor control and brake control circuits to be opened in the event of overspeed in the upwards direction.
- 13 Suitable provision and protection shall be made to prevent the safety gear from becoming inoperative due to the accumulation of extraneous materials or due to atmospheric conditions.
- 14 Where safety gear of the gripping type is fitted on the lift cage or the counterweight, no component of the safety gear shall be used for both guiding or braking.
- 15 Jaws, blocks or pinions of the safety gear shall not be used for guiding the lift cage under normal operating conditions.
- 16 In safety gear where braking action is achieved by means of coil springs, the springs shall be in the form of compression spring which shall be guided and in the non-loaded condition having a coil pitch of less than twice the nominal wire diameter.
- 17 When the safety gear operates, the load (if any) being uniformly distributed, the floor of the lift cage shall not incline more than 5% with respect to its normal position and shall recover without deformation after such test.
- 18 The tripping speed of the overspeed governor shall not exceed the rated speed of lift cage by more than 0.4 m/s.
- 19 If a lift cage has more than one overspeed governor, then they shall be of the same design and shall apply simultaneously.

- 20 The device that sets the tripping speed of the overspeed governor shall be located, as far as possible, to prevent unauthorized alteration and shall be properly sealed.
- 21 Wire ropes and wire rope attachment, etc., to overspeed governors shall be with dimensions and design as laid down in **Section F 4**. The nominal diameter of the wire rope for the overspeed governor shall be not less than 8 mm. The bending diameter of the wire rope shall be at least 30 times of the nominal diameter of the wire rope for pulleys idling in normal service. Pulleys and drums that rotate only when the safety gear operates shall have a diameter of at least 20 times the nominal diameter of the wire rope.

During the assembly of the builder's lift, a wire rope to an overspeed governor shall be supported directly by the mast.

The tensile force in the overspeed governor wire rope produced by the governor when triggered shall be not less than 300 N or twice that necessary to engage the safety gear whichever is greater.

- 22 For overspeed governors driven by a wire rope, the direction of rotation, corresponding to the operation of the safety gear, shall be marked on the overspeed governor.
- 23 The tripping of the overspeed governor shall not be activated by any device which operates electrically, hydraulically or pneumatically.
- 24 When there is an access underneath the counterweight, the counterweight shall be provided with a safety gear which shall operate in the downward direction upon overspeeding of the counterweight.
- 25 The safety gear shall be discarded within 5 years from the date of installation or according to the manufacturer's recommendation, whichever is shorter.

SECTION I: OVERLOAD SENSING DEVICES

Every builder's lift shall be installed with an overload sensing device to give clear visual and audible signals in the lift cage in case of overloading and overmoment. The overload sensing device shall measure the load which shall include the passengers and materials inside the lift cage and any materials on the lift cage roof.

1 Overload alarm system

A mandatory overload alarm system shall be provided for every builder's lift with the following requirements:

- (a) The overload setting of the overload alarm system shall be greater than the rated load and less than 110% of the rated load of the builder's lift.
 - (b) When the load exceeds the overload setting, the overload alarm system shall give a continuous audible and visual (in red light) alarms. Simultaneously, the lift cage shall be prevented from movement by interrupting the control circuit. When the load is reduced to below the overload setting, the alarms shall be interrupted.
 - (c) Additional pre-warning alarms initiated at a setting below the overload setting will be allowed provided that the pre-warning alarms are distinguishable from the audible and visual alarms at the overload setting. However the pre-warning alarms shall not be activated at a setting below 90% of the rated load of the builder's lift and any pre-warning audible alarm if provided shall be cut off when the lift cage is moving.
- 2 The audible alarms shall be clearly distinguishable from other sounds emitted from pagers, wireless telephones, audible emergency alarm and bells for calling of lift service. The visual warnings shall be clearly distinguishable under all conditions.
 - 3 All visual alarms, information displays, switches and controls shall have clear markings on or adjacent to them, with symbols or words in both Chinese and English to indicate their function and mode of operation.
 - 4 Any faults or abnormalities of the overload sensing device shall interrupt the movement of the lift cage and activate the overload alarm system.
 - 5 The overload sensing device shall be designed to operate in ambient temperatures between -20 °C and +60 °C. The design should be taken into account that under the circumstances described a temperature higher than +60 °C can be reached inside the housing.
 - 6 The overload sensing device shall be protected against rain, water spray, frost, dirt, dust, condensation or other adverse conditions. The degree of protection shall be at least IP55 of BS EN 60529.
 - 7 The overload sensing device shall not be liable to electromagnetic interference giving false alarm signals.

- 8 An overmoment sensing device may not be required if the moment exerted by the load is covered by stability and stress calculations together with overload sensing device.
- 9 The overload sensing device shall measure the load correctly even the load is distributed unevenly and unsymmetrically. The design and construction of the overload sensing device shall take into consideration the inaccuracy and variation of characteristics and parameters of the components used. Having taken into account the unsymmetric load distribution and inaccuracy of the components used, the overload alarms shall still be activated when the load inside the lift cage is between 100% and 110% of the rated load.
- 10 The overload sensing device shall be able to detect the load during loading and unloading.
- 11 If the overload sensing device can be adjusted to suit more than one rated load, the overload sensing device shall have a light indicator or visual display to indicate the selected rated load and it shall be carried out by a competent worker only. Adjustment of the overload sensing device by unauthorized persons shall be prevented.
- 12 If the power supply is interrupted, the data, information, selected rated load and calibration of the overload sensing device shall not be changed.
- 13 No provision shall be made for unauthorized persons to cancel the overload alarms when the load has exceeded the overload setting.
- 14 The design and construction of the overload sensing device shall take into account the need to test the system without substantial disassembly. The performance of the overload system device shall not be affected after such test. The overload sensing device shall be capable of sustaining a load inside the lift cage not exceeding 125% of the rated load.
- 15 The overload sensing device shall be capable of sustaining loading from shock and vibration, loading encountered during transportation, erection, operation, dismantling and maintenance as well as influences from environment such as rain and wind.
- 16 Assurance of system safety integrity of the overload sensing device shall be achieved by:
 - (a) causing the overload sensing device to fail to a safe condition in the event of an open circuit, short circuit or earth fault on all external wiring and devices;
 - (b) carrying out periodic functional checks to verify that warnings and displays are operating correctly.

Note : Manufacturers should use components which comply with BS 9000 or other standards that provide an equivalent integrity. Components should be conservatively rated to achieve a high mean time between

failures.

- 17 The power supply for an overload sensing device shall have a nominal voltage not exceeding 50 Va.c. or 120 Vd.c.

Note: It is recommended that the power supply voltage should be as low as is reasonably practicable.

- 18 The overload sensing device shall be designed to operate correctly for supply voltages in the range +20% to -15% of the nominal voltage. The overload sensing device shall continue to function correctly or fail to a safe condition if the supply voltage is outside this range. It shall operate correctly in the event of voltage recovery from the minimum value. Protection against voltage variations and surges and supply voltage reversal (in the case of d.c.) shall be provided.

- 19 The overload sensing device shall be designed to operate correctly for supply frequency variations (in the case of a.c.) as follows:

- (a) $\pm 2\%$ for power supplies derived from the mains;
- (b) $\pm 5\%$ for power supplies derived from engine driven generators.

Note: It is important that the power supply to the system to be so arranged that the overload sensing device is energized before movement of the lift cage could be initiated.

- 20 All signals and power supplies transmitted between units of the overload sensing shall be by means of discrete insulated conductors. The structure of the builder's lift shall not be used to transmit power, signals or the functional signal return.

- 21 Electrical signals which initiate continuous audible and visual alarms shall be separated from those used to drive visual displays if provided and other circuits to minimize common cause failures.

- 22 The operation of transducers, associated conductors and connections shall be continuously monitored for out of range condition. Should a fault occurs, the overload sensing device shall fail to a safe condition.

- 23 An instruction manual written clearly and precisely in Chinese or English shall be provided with every overload sensing device. This manual may be an integral part of the instruction manual for the builder's lift to which the overload sensing device is fitted.

The instruction manual shall contain all the information to permit the correct installation, calibration, testing, inspection, maintenance and use of the overload sensing device. It shall also contain any information about special procedures to be followed during erection, dismantling, maintenance, cleaning, repair and overload testing of the builder's lift.

SECTION J: ELECTRICAL INSTALLATIONS AND APPLIANCES

(1) ELECTRICAL DESIGN AND CONSTRUCTION

1.1 General provisions

Electrical installations and appliances shall be in accordance with the Code of Practice for the Electricity (Wiring) Regulations issued by EMSD. For electronic components the related possible field of temperature for use shall be considered.

1.2 Protection against electric faults

1.2.1 General provisions

Any one of the faults envisaged in **Section J 1.2.2(i)** in the electric equipment of the builder's lift shall not, on its own, be the cause of a dangerous malfunction of the builder's lift.

1.2.2 Electrical faults

- (i) The following faults are envisaged in the electrical equipment of the builder's lift:
 - a. absence of voltage
 - b. voltage drop
 - c. insulation fault in relation to the metalwork or the earth
 - d. short circuit or open circuit, changing in parameters of an electrical component such as resistor, capacitor, transistor, lamp
 - e. non-attraction or incomplete attraction of the moving armature of a contactor or relay
 - f. non-separation of the moving armature of a contactor or relay
 - g. non-opening of a contact
 - h. non-closing of a contact
- (ii) The non-opening of a contact in **Section J 1.2.2(i)g** need not be considered in the case of safety contacts conforming to **Section J 1.2.6**.

1.2.3 Phase reversal and failure

- (a) Builders' lifts connected to polyphase a.c. power supplies shall incorporate means to prevent the motor being energized in the event of a phase reversal.
- (b) In the event of a phase failure the machine shall not start, and may stop immediately if the lift cage is moving. In the case of failure of one of the phases of the supply to the directional control device failing, the machine shall stop.

If failure of one phase occurs, it is allowable that the lift cage continues to run at the most to the next restart provided that the driving machine(s)

has sufficient driving capacity to drive the lift cage with rated load and also sufficient braking capacity to arrest the lift cage as specified in **Section G 4**. The effect of excessive overheating of the driving motor(s) shall be considered and prevented by means of thermal protective devices in the motor windings.

1.2.4 Earthing protection

When a circuit in which there is an electric safety device in conformity with **Section J 1.2.5** is short-circuited to earth as in **Section J 1.2.2(i)c**, it shall:

- (a) either cause the immediate stopping of the machine, or
- (b) prevent restarting of the machine after the first normal stop.

The return to service shall not be possible except by a competent worker.

1.2.5 Electric safety devices

During operation of one of the electric safety devices listed in Table 4, movement of the machine shall be prevented or it shall be caused to stop immediately as indicated in **Section J 1.2.8**. The electric safety devices shall consist either of:

- (a) one or more safety contacts satisfying **Section J 1.2.6**, directly cutting the supply to the contactors or their relay contactors or the electrical devices referred to in **Section J 3** or
- (b) be a safety circuit satisfying **Section J 1.2.7** consisting of either:
 - i. One or more safety contacts satisfying **Section J 1.2.6** not directly cutting the supply to the contactors referred to **Section J 3** or their relay contactors, or
 - ii. Contacts not satisfying the requirements of **Section J 1.2.6**.

Apart from the exceptions permitted in the Code, no electric equipment shall be connected in parallel with an electric safety device.

1.2.6 Safety contacts

(a) Positive separation of contacts

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

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

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

(b) Types of safety contacts

The safety contacts shall fulfill **Section J 1.2.2(ii)** and shall be provided for an rated insulation voltage of 250 V minimum.

The safety contacts shall belong to the categories as defined in BS EN 60947-5-1 or other relevant international standards:

- i. AC-15 for safety contacts in a.c. circuits
- ii. DC-13 for safety contacts in d.c. circuits

The clearances shall be at least 3 mm, the creeping distances at 4 mm and the distances for the breaking contacts at least 4 mm after separation.

In case of multiple breaks, the distance after separation between the contacts shall be at least 2 mm.

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

1.2.7 Safety circuits

Safety circuit shall comply with the requirements of **Section J 1.2.1** relating to the appearance of a fault. In addition, they shall be designed such that:

- (a) If one fault combined with a second fault can lead to a dangerous situation, the builder's lift shall be stopped at the latest at the next operating sequence in which the first faulty element should participate. All further operation of the builder's lift shall be impossible as long as this fault persists.

The possibility of the second fault occurring after the first, and before the builder's lift has been stopped by the sequence mentioned, is not considered.

- (b) If a dangerous situation can only occur through the combination of several faults, the stopping and maintaining in a stopped position of the builder's lift shall be brought about at the latest before the possible appearance of the fault which, in conjunction with the already existing faults, would lead to the dangerous situation.
- (c) On restoration of the power supply after it has been disconnected, maintenance of the builder's lift in the stopped position is not necessary, provided that during the next sequence stopping is reimposed in the cases covered in preceding (a) and (b).
- (d) In redundancy-type circuits measures shall be taken to limit as far as possible the risk of defects occurring simultaneously in more than one circuit arising from a single cause.

1.2.8 Operation of electric safety devices

When operating to ensure safety, an electric safety contact shall prevent the setting in motion of the machine or initiate immediately its stopping. The electric supply to the brake shall likewise be broken.

The electric safety contacts shall act directly on the equipment controlling the supply to the machine in accordance with the requirements of **Section J 3**.

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

1.2.9 Control of electric safety devices

The components controlling the electric safety switches shall be built so that they are able to function properly under the mechanical stresses resulting from continuous normal operation.

If the devices for controlling electrical safety devices are through the nature of their installation accessible to persons, they must be so built that these electrical safety devices cannot be rendered inoperative by simple means. A magnet or a properly designed bridge piece is not considered a simple means.

1.2.10 Safety switches

All gate switches, stopping switches, final limit switches, slack rope switches, overspeed safety device switches, etc., shall be safety switches. They shall contain safety contacts which comply with **Section J 1.2.6**. During operation of one of the electric safety switches listed in Table 4, movement of the lift cage shall be prevented or it shall be caused to stop immediately.

Table 4: Conditions for use of electric switches

Section	Operation function of electrical switches	Conditions
B 5.4	closed position of lift cage gate	safety switch, self-resetting
B 6.4	closed position of trapdoor -under inspection control -under normal operation	safety switch, self-resetting safety switch in a safety circuit
D 1.5	buffer switch	safety switch in a safety circuit
E 1.1.2, E 5	closed position of landing gates	safety switch, self-resetting
E 6	closed position of landing gate locking device	safety switch, self-resetting
F 3.5	abnormal relative extension of wire rope in driving machine	safety switch, not self-resetting safety switch in a safety circuit
H 6	operation of safety gear	safety switch, not self-resetting safety switch in a safety circuit

Section	Operation function of electrical switches	Conditions
J 2.4	slack rope switch in driving machine	safety switch, not self-resetting safety switch in a safety circuit
J 2.4	slack rope switch in suspension of counterweight	safety switch, not self-resetting safety switch in a safety circuit
J 2.1.1, J 2.2.2	terminal limit switch, terminal slowing switch	without any conditions
D 2.2, D 2.3, J 2.1.3	final limit switch	safety switch, not self-resetting safety switch in a safety circuit
J 2.5, J 4.1.1	emergency stopping device	safety switch, not self-resetting
J 2.5	stopping device	safety switch, self-resetting
J 4.2.5	inspection switch	safety switch, not self-resetting
K 2.2	emergency electrical operation device	safety switch, not self-resetting

1.3 Main isolating switch

- 1.3.1 For each builder's lift there shall be a manually operated main isolating switch or circuit breaker capable of isolating every pole of the supply network. The switch or breaker shall be capable of disconnecting the drive motor starting current. It shall have stable open and close positions.
- 1.3.2 The main isolating switch shall be positioned in an easily accessible position. Where this switch is housed in a cabinet, the operating handle shall be accessible outside the cabinet.

The handle shall open the contacts positively and the handle shall be capable of being locked in the off position.

The "On" and "Off" positions of the switch shall be clearly marked in both Chinese and English.

- 1.3.3 The main isolating switch shall be at the base enclosure near the power feeding.

1.4 Cables and wiring

- 1.4.1 The size of all cables supplied with the builder's lift shall be such that the rating is adequate for the maximum current to be carried under all conditions of operation in service, including starting.
- 1.4.2 The mains cable for connecting the builder's lift to the supply network shall be such that the rating and size comply with **Section J 1.4.1**.

1.4.3 All cables and wiring for the builder's lift shall be located and installed to provide protection from mechanical damage that may be caused during the use of the builder's lift.

1.4.4 Terminals shall be adequately shrouded and incoming power terminals shall be covered and marked "LIVE TERMINAL" in both Chinese and English.

Power and control circuits shall be grouped and, where necessary, separated by insulating barriers; they shall also be marked according to the designation of the circuits.

1.4.5 When positioning a cable, allowance shall be made for the stresses to which the cable can be subjected as a consequence of mechanical action. When the cable is led into motors, apparatus, connection boxes, etc., this shall be done in an appropriate manner for each type of cable and in such a way that the cable is protected against the stresses occurring.

1.4.6 Trailing cables and flexible cables shall be protected against wear, breakage or tearing. The outer sheath of the cable shall be led in and securely fixed at the lead-in point so that the cores are not subjected to harmful tension or twisting in the connection space. Normal sealing glands with packing are not regarded as meeting the requirement for relief from pulling and twisting.

1.4.7 Cables shall be connected and branched in permanently mounted and enclosed terminal blocks or by means of strong connectors intended for the purpose. Loose clamps or jointing of cables, e.g. flexible cables, in any other manner than by means of the devices intended for the purpose, shall not be used.

1.4.8 Special attention shall be paid to electric cables which hang from the lift cage with regard to cable strength and the effects of climates. Precautions shall be taken to ensure the free and safe movement of the trailing cable throughout the full range of travel of the lift cage.

1.4.9 The control gear cabinet shall contain such drawings or documentation as are necessary to aid maintenance and fault finding, e.g. circuit diagram and a wiring diagram.

1.5 Contactors and relay-contactors, components of safety circuits

1.5.1 The main contactors (i.e. those necessary to stop the machine according to **Section J 3**) shall belong to the following categories defined in BS EN IEC 60947-4-1 or other relevant standards:

- (a) AC-3 for contactor for a.c. motor
- (b) DC-3 for contactor for d.c. motor

These contactors shall in addition allow 10% of starting operations to be made as inching.

1.5.2 If, because of the power they carry, relay contactors must be used to operate the main contactors, those relay contactors shall belong to the following categories as defined in BS EN 60947-5-1 or other relevant international standards:

- (a) AC-15 for controlling a.c. electromagnets
- (b) DC-13 for controlling d.c. electromagnets

1.5.3 Both for the main contactors referred to in **Section J 1.5.1** and for the relay contactors referred to in **Section J 1.5.2**, it may be assumed in the measures taken to comply with **Section J 1.2.2**, that

- (a) if one of the break contacts (normally closed) is closed, all the make contacts are open;
- (b) if one of the make contacts (normally open) is closed, all the break contacts are open.

1.5.4 Components of safety circuits

- (a) When devices as per **Section J 1.5.2** are used as relay in a safety circuit, the assumption of **Section J 1.5.3** shall also apply.
- (b) If relays are used which are such that the break and make contacts are never closed simultaneously for any position of the armature, the possibility of partial attraction of the armature (see **Section J 1.2.2i(e)**) can be disregarded.
- (c) Devices (if any) connected after electric safety devices shall meet the requirements of **Section J 1.2.6(b)** as regards the creep distances and the air gaps (not the separation distances).

The requirement does not apply to the devices mentioned in **Section J 1.5.1**, **J 1.5.2** and **J 1.5.4(a)** and which themselves fulfil the requirements of BS EN 60947-5-1, BS EN IEC 60947-4-1, or other relevant international standards.

1.6 Control circuit

Guidance on the design of control circuit is given in PD 5304 or other equivalent standards.

1.6.1 The voltage of the builder's lift control and operating circuits shall not exceed 130 V with respect to earth and shall be connected to an alternating current network via an isolating transformer with separate primary and secondary windings and with the primary windings earth screened.

One pole of the secondary winding, or if a rectifier is connected to it one d.c. pole, shall be directly connected to earth.

1.6.2 Control circuits shall be so arranged that any fault except open circuit faults, will be faults to earth. Any faults, or the discharge or failure of any circuit component, shall not set up an unsafe condition, e.g. starting or continuing lift cage motion when any safety contact has opened or is opening.

- 1.6.3 All safety circuits shall be designed to prevent an intercircuit fault.
- 1.6.4 Control circuits shall be protected by fuses or equivalent devices, independently of the protection provided for the main circuits. In the event of an earth fault in any control circuit of the builder's lift, the circuit shall be disconnected as a result of rupturing a fuse or similar protective device.
- 1.6.5 Switches shall not be connected between the earth and the control circuit operating coils.
- 1.7 Electrical control panels and cabinets
 - 1.7.1 The control panels for the electrical equipment shall be arranged outside the danger area of moving parts.
 - 1.7.2 To prevent unauthorized access during normal use of the lift cage, doors or covers that are provided for maintenance and inspection shall be secured by devices that required a spanner, key or special tool to remove or loosen them. Should threaded fasteners be used they shall be of the captive type.
- 1.8 Control equipment, relays and contacts
 - 1.8.1 The control panel or their supporting frames shall be constructed of materials that do not support combustion.
 - 1.8.2 The main and auxiliary resistors shall be adequately supported and ventilated.
 - 1.8.3 Interlocking shall be provided, where necessary to ensure that the relays and contactors operate in proper sequence.
 - 1.8.4 Contactors for reversing direction of travel shall be mechanically and electrically interlocked.
 - 1.8.5 Every electric motor shall be protected from overcurrent.
- 1.9 Protection against the effects of external influences

Any electrical apparatus shall be protected from the harmful or hazardous effects of external influences and falling objects (e.g. rain, mortar, dust). The degree of protection shall be at least IP 65 for portable control devices, IP 53 for control cabinets, switches and the electrical components of the brake, and IP 44 for motors.
- 1.10 Earthing

The mast structures, machine frames, controller frames, governor frames, casing of electric safety devices, and other similar exposed metallic parts, including guide rails, of the builder's lift which carry electrical equipment, shall be bonded to the main earthing terminal of the main isolating switches by supplementary bonding through protective conductors.

2 CONTROL DEVICES

2.1 Travel limit switches

The permitted combinations of travel limit switches shall comply with Table 5 below:

Table 5:

Description		Traction Drive	Rack and Pinion Drive
terminal limit switch	top	yes	yes
	bottom	yes	yes
final limit switch	top	yes	yes
	bottom	yes	yes
terminal slowing switch	top	optional	optional
	bottom	optional	optional

2.1.1 Terminal limit switches

Terminal limit switches shall be provided to each liftway or lift cage and shall be positively operated and of self-resetting type. The switches shall be so arranged that their operation will result in the lift cage being automatically stopped from rated speed at the highest and lowest landings before contacting the final limit switch.

2.1.2 Terminal slowing switches

When the builder's lift is of the multi-speed or variable speed type, a set of slowing switches shall be fitted at the terminal landings. These switches shall be of the self-resetting type, arranged so as to decelerate the lift cage to the minimum speed prior to the lift cage reaching the terminal limit switch. This function shall be performed independent of the position of the control in the lift cage.

2.1.3 Final limit switches

(a) Top final limit switches

A top final limit switch of positively operated and non-resetting type shall be provided to interrupt the power supply to the motor and brake on all phases before contact is made with any mechanical stop, e.g. buffer. If there are no buffers the top final limit switch shall be positioned such that the lift cage will come to a stop before reaching the end of the liftway. After triggering the top final limit switch, all movements of the builder's lift shall be prevented and it shall be reset by a competent worker.

(b) Bottom final limit switches

A bottom final limit switch of positively operated and non-resetting type shall be provided to interrupt the power supply to the motor and brake on all phases such that the lift cage is not driven against the buffers. After triggering the bottom final limit switch, all movements of the builder's lift shall be prevented and it shall be reset by a competent worker.

The top and bottom final limit switches must not be actuated by same operating elements as the terminal limit switches. The switches shall be directly operated by the movement of the lift cage or its related parts.

2.2 Electrically and mechanically operated locking device

When a safety switch forms part of the electrical and the mechanical interlocking of the landing gates of liftway and the lift cage gates, the safety switch shall be mechanically coupled so that it cannot close the circuit while the gate is open. The interlock shall comply with **Section E 5**.

2.3 Emergency exit safety switch

The switch specified in **Section B 6.4** shall be so positioned that any movement to open the emergency door or trapdoor during normal operation of the builder's lift would result in the control circuit of the lift cage being interrupted.

Note: Provision may be made to short circuit this switch specifically for the purposes of inspection and erection when the control is transferred to the roof of the lift cage. In the interests of safety, this provision should not be used to facilitate the carriage of long materials.

2.4 Slack rope device

Wire rope suspended builder's lift of traction drive and wire ropes for counterweight shall be incorporated with a slack rope device of non-resetting type. The switch shall be so arranged to interrupt the control circuit of the control equipment in the event of any wire rope breakage or becoming slack. After triggering the slack rope switch all movements of the lift cage shall be prevented until the device is reset by a competent worker.

2.5 Stopping devices

The stopping devices shall consist of electric safety devices in conformity with **Section J 1.2.5**. They shall be bi-stable such that a return to normal operation cannot result from an involuntary action. The stopping devices including any power operated gates, provided in the following location shall stop, and maintain the builder's lift out of service.

- (a) outside the base enclosure
- (b) in the pulley room, if any
- (c) on the lift cage roof, if intended to be accessible
- (d) inside the lift cage
- (e) at the services/inspection control device

The stopping devices, (c), (d) and (e), shall be emergency stopping devices. All the switches above shall be clearly identified.

3 STOPPING THE MACHINE

- 3.1 The stopping of the machine by means of an electric safety device in conformity with **Section J 1.2.5** shall be achieved by the interruption of the supply to the motor and brake, by either:
- (i) the safety switch itself or
 - (ii) actuated by two independent contactors, the contacts of which shall be in series in the supply circuit.

Use of devices other than contactors is not covered by this Code. Other devices can be used provided that the same level of safety is ensured.

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

4 CONTROL MODES

4.1 Normal operation

- 4.1.1 The control station inside the lift cage shall be provide with the minimum "Up", "Down" and "Emergency Stop" controls. An indelible inscription indicating the "UP", "DOWN" and "EMERGENCY STOP" of the controls in both Chinese and English shall be prominently displayed adjacent to the controls. The controls shall be placed in a position:

- (a) which give the competent operator ample room for operation and a clear view of the landing levels; and
- (b) that it is impossible to reach them by hand from outside a closed landing gate.

- 4.1.2 The builder's lift shall be controllable from inside the lift cage in normal operation. The "Up" and "Down" controls shall be of deadman control type. That means the lift cage shall stop from moving after the "Up" or "Down" controls return to neutral or off position upon release of the lever or switch in the actuated positions.

- 4.1.3 At all other control stations, there shall be a "Stop" control.

- 4.1.4 The controls excluding the "Emergency Stop" control shall be prevented from accidental actuation. On switching on the power, or restoration after power failure, the lift cage shall not move without the actuation of the controls.

- 4.1.5 A device shall be provided to prevent a lift cage from movement for at least two seconds after the lift cage has been stopped at the landing gate.

- 4.1.6 During normal operation, it shall not be possible to control the lift cage from

other control stations except inside the lift cage.

4.1.7 The controls of lift cage shall be so arranged that control can be effected from one location only at any one time.

4.1.8 A switch to render the control circuit inoperative shall be fitted in the lift cage as a means of preventing unauthorized operation of the builder's lift. The switch shall be of a type that cannot be turned to the "On" position until a key has been inserted, the key being trapped when turned and not removable until returned to the "Off" position.

4.2 Inspection and erection operations

4.2.1 The lift cage shall only be operated from inside the lift cage or from the lift cage roof during erection, dismantling and maintenance. If some parts of the walls of the lift cage are removed leaving an opening more than 1.1 m high to facilitate erection, dismantling and maintenance inside the lift cage, an electric safety device shall be provided to check that these parts are properly reinstalled before normal operation of the builder's lift can be returned.

4.2.2 The maximum travelling speed of the lift cage shall not exceed 0.7 m/s during erection, dismantling and maintenance. All safety devices controlling the movement of the lift cage shall remain in operation.

4.2.3 If the running of the lift cage is obstructed by parts of the lift cage itself (e.g. lifting equipment on lift cage roof) during the course of travel, the lift cage shall be prevented from moving.

4.2.4 "Emergency Stop" switches shall not be bridged during erection, dismantling and maintenance.

4.2.5 A selector switch with 2 positions marked "Normal" and "Inspection" shall be provide for erection, dismantling, inspection and maintenance purposes. The "Inspection" mode shall comply with the following:

- (a) the switch which shall be an electric safety device. It shall be bi-stable and lockable. It shall override all other control signals except from the "Inspection" control. The normal operation of the builder's lift shall only be effected by return of the switch to "Normal" mode.
- (b) control shall be by the use of continuous pressure type "Up" and "Down" push-buttons. They shall be protected against inadvertent operation. The directions of movement of the lift cage shall be clearly marked on or adjacent to the buttons.
- (c) an "Emergency Stop" switch shall be provided according to **Section J 2.5**.

4.2.6 When the top final limit and terminal limit switches are not incorporated or functioning, alternative means shall be provided to prevent the lift cage coming off the top end of the guides.

4.2.7 Remote control shall be provided only to facilitate testing of the builder's lift.

SECTION K: EMERGENCY OPERATION

1 AUDIBLE EMERGENCY ALARM

In order to call for outside assistance, there shall be provide in the lift cage an audible alarm device easily recognizable and accessible to the competent operator. The device shall be a bell or similar devices installed at the lift cage. The device shall be capable of functioning for at least 60 minutes after power failure to the lift cage.

When the audible emergency alarm is not effective in alerting the rescue personnel because of the long distance away, an additional means such as an intercom, a walkie talkie or a communications system shall be provide inside the lift cage for the competent operator to communicate with the rescue personnel stationed on the construction site.

The push-button or switch for actuating the audible emergency alarm shall be clearly marked "LIFT ALARM" in both Chinese and English. In the case of more than one builder's lift, it shall be possible to identify the lift cage from which the call is being activated.

2 EMERGENCY LOWERING OPERATION

If there is a power failure or failure of controls, it shall be possible to bring the lift cage to a landing where the passengers and competent operators can safely leave the lift cage. This shall be done by manual or electrical control, and shall be from the lift cage roof or outside the liftway.

2.1 Manual emergency lowering

When the builder's lift is provided with manual emergency lowering device to move the lift cage to a landing in case of emergency. The following shall be complied with:

- the normal motor brake shall be capable of being released by hand with a constant force of no more than 400 N.
- the device shall if it is located in the lift cage be protected from misuse.
- precautions shall be taken that when emergency lowering is carried out when there is more than one driving machine. As some of the brakes may be made ineffective (e.g. the brakes are released by wedging) to facilitate the emergency lowering, the remaining effective brake(s) in exercising the emergency lowering must be capable of arresting the lift cage with a capacity as described in **Section G 4**.
- the device shall be operated by a competent worker.
- the speed shall be controlled automatically and shall be less than the overspeed governor triggering speed but shall not be more than 1.0 m/s.

2.2 Electrical emergency lowering

- 2.2.1 When an electrical emergency lowering system is provided, an emergency electrical operation device in conformity with **Section J 1.2.5** shall be provided. This device shall be only accessible to competent workers and shall prevent all movement of the lift cage except that controlled by this device. The electrical supply shall be from the normal mains or a standby generator.
- 2.2.2 Operation of emergency electrical operation device shall permit the control of the lift cage movement by continuous pressure type push-buttons situated near the emergency operation switch. The "Up" and "Down" push-buttons shall be clearly marked in Chinese and English and shall be prevented from unauthorized operation.
- 2.2.3 After operation of the emergency electrical operation device, all movement of the lift cage except that controlled by this device shall be prevented. The emergency operation switch may render inoperative by itself or through another electric safety device, the following electric safety devices of:
- i. safety gears
 - ii. overspeed governor
 - iii. buffers
 - iv. final limit switches
 - v. slack rope switch in circuit when the lift cage is being raised
- 2.2.4 The emergency operation switch and its push buttons shall be so placed that the movement of the lift cage can easily be observed when using them.
- 2.2.5 The lift cage speed shall be controlled automatically and shall not exceed the tripping speed of the overspeed governor. The maximum emergency lowering speed of the lift cage shall not exceed 0.7 m/s.

PART 4

VERIFICATION

1 VERIFICATION OF DESIGN

Table 6 indicates the methods by which the safety requirements and measures described in Part 3 shall be verified by the manufacturer for each new model of builder's lift, together with a reference to the corresponding section in this Code. All verification records shall be kept by the contractor.

Table 6 – Means of verification of the safety requirements and / or measures

Clause	Safety requirements	Visual inspection ^a	Performance check/test ^b	Measurement ^c	Drawing/calculation ^d	User info ^e
Section A: Structural design						
2.1	General				v	
2.2	Forces and load combinations				v	v
2.3	Other considerations				v	
2.4	Safety factors				v	
2.5	Combination of loads and forces				v	
2.6	Stability of builder's lift				v	v
2.7	Design details of steel structure				v	
2.8	Fatigue calculation				v	v
2.9	Builder's lift support conditions				v	v
Section B: Lift cage						
1	Basic requirements	v	v	v	v	v
2	Lift cage floor	v	v	v	v	v
3	Lift cage walls	v	v	v	v	v
4	Lift cage roof	v	v	v	v	v
5	Lift cage gate	v	v	v	v	v
6	Emergency exit	v	v	v	v	v
7	Lighting inside lift cage	v	v	v		v
Section C: Base frame, mast and guide, wall anchorage						
1	Base frame					
1.1	Design	v			v	v
1.2	Adjustable supporting device	v		v	v	v
1.3						
1.4	Allowance stress of the foundation or support				v	v
2	Mast and guide					
2.1	Rigid guides	v				
2.2	Mast deflection	v		v		
2.3	Design				v	
2.4	Means of identification	v				
2.5	Prevent corrosion	v				v

Clause	Safety requirements	Visual inspection ^a	Performance check/test ^b	Measurement ^c	Drawing/calculation ^d	User info ^e
2.6	Drive element	v			v	
2.7	Mast sections					v
2.8	Non-destructive test					v
3	Wall anchorage					
3.1 /3.2	Design				v	
3.3	Load exerted by the anchorages on the adjoining structure				v	v
3.4	Distance between two consecutive anchorages				v	v
3.5	Extension structure				v	v
Section D: Buffer, overrun, counterweight, lifting equipment						
1	Buffer					
1.1	Placement	v				v
1.2	Retardation		v	v	v	
1.3	Buffer travel with lift cage	v		v		
1.4	Energy accumulation type buffers	v	v	v		
1.5	Hydraulic buffers	v	v			v
1.6	Characteristics				v	
2	Overrun					
2.1	Final limit switch	v	v			v
2.2	Bottom limit switch	v	v			v
2.3	Upper overrun	v	v	v		v
3	Counterweight	v				v
4	Lifting equipment	v	v	v	v	v
Section E: Liftway enclosure and landing gates						
1	Liftway enclosure					
1.1	Base enclosure	v	v	v		v
1.2 /1.3	Liftway enclosure at all levels	v		v	v	v
1.4	Landing platform	v		v	v	v
2	Landing gates					
2.1	Opening of gate	v	v			v
2.2	Sliding gate	v	v	v	v	v
2.3	Actuation	v				v
2.4	Thresholds		v		v	
2.5	Vision panel	v	v	v		v
2.6	Power operated horizontally and vertically sliding gate	v	v	v	v	v
2.7	Accidental displacement		v			
2.8	Unlock in emergency	v	v			v
3	Dimensions and clearances of landing gates	v	v	v		v
4	Strength of landing gates	v	v	v	v	
5	Gate interlock^f	v	v	v		
6	Locking devices^f	v	v	v		
7	Calling for lift service	v	v			
8	Lighting	v	v			
9	Access to landing gates	v				v
Section F: Driving machine						

Clause	Safety requirements	Visual inspection ^a	Performance check/test ^b	Measurement ^c	Drawing/calculation ^d	User info ^e
1	Basic requirements	v	v	v		
2	Rack and pinion drive	v	v	v	v	
3	Wire rope suspension for lift cage and counterweight	v	v	v	v	
4	Traction drive	v	v	v	v	
Section G: Driving machine brake		v	v	v	v	v
Section H: Safety gears ^f		v	v	v	v	v
Section I: Overload sensing devices		v	v	v	v	v
Section J: Electrical installations and appliances						
1	Electrical design and construction					
1.1	General	v			v	v
1.2	Protection against electric faults	v	v	v		v
1.3	Main isolating switch	v	v			v
1.4	Cables and wiring	v	v		v	v
1.5	Contactors and relay-contactors, components of safety circuits	v				
1.6	Control circuit	v	v			v
1.7	Electrical control panels and cabinets	v				
1.8	Control equipment, relays and contacts	v				
1.9	Protection against the effects of external influences	v				v
1.10	Earthing	v	v			v
2	Control devices					
2.1	Travel limit switches	v	v			v
2.2	Electrically and mechanically operated locking device	v	v			v
2.3	Emergency exit safety switch	v	v			v
2.4	Slack rope device	v	v			v
2.5	Stopping devices	v	v			v
3	Stopping the machine	v	v			v
4	Control modes					
4.1	Normal operation	v	v			v
4.2	Inspection and erection operations	v	v			v
Emergency operation						
1	Audible emergency alarm	v	v			v
2	Emergency lowering operation					
2.1	Manual emergency lowering	v	v			v
2.2	Electrical emergency lowering	v	v			v

Clause	Safety requirements	Visual inspection ^a	Performance check/test ^b	Measurement ^c	Drawing/calculation ^d	User info ^e
<p>^a Visual inspection will be used to verify the features necessary for the requirement by visual examination of the components supplied.</p> <p>^b A performance check / test will verify that the features provided perform their function in such a way that the requirement is met.</p> <p>^c Measurement will verify by the use of instruments that requirements are met, to specified limits.</p> <p>^d Drawings / calculations will verify that the design characteristics of the components provided meet the requirements.</p> <p>^e Verify that the relevant point is dealt with in the instruction handbook or by marking.</p> <p>^f See certain special verification tests required for some critical components.</p>						

2 SPECIAL VERIFICATION TESTS

2.1 Introduction

Special verification tests shall be carried out on the following components:

- locking devices for landing and cage gates;
- safety gears and overspeed governors;
- energy accumulation type buffers and energy dissipation buffers.

Records of the tests shall be made and kept by the contractor of the builder's lift.

2.1.1 The tests shall be carried out by an organisation operating an approved full quality assurance system. This organisation can be the manufacturer of the component or his authorised representative or a test laboratory.

2.1.2 If the manufacturer or his authorised representative or the test laboratory does not have the means for certain tests or examinations, it may have the tests conducted by a qualified body.

2.1.3 The precision of the instruments shall allow measurements to be made within the following tolerances:

- ± 2 % masses, forces, distances, times, speeds;
- ± 4 % accelerations, retardations;
- ± 2 % voltages, currents;
- ± 2 °C temperatures.

2.1.4 The report shall at least contain the following information:

- name of the testing facility;
- test report number;
- category, type and make or trade name;
- manufacturer's name and address;
- date of test;

- documents according to **Part 4, 2.2.3**;
- place, date, name of person performing the test.

2.2 Locking devices for cage and landing gates

2.2.1 Field of application

These procedures are applicable to locking devices for gates. It is understood that each component taking part in the locking of gates and in the checking of the locking forms part of the locking device.

2.2.2 Object of the test

The locking device shall be submitted to a test procedure to verify that insofar as construction and operation are concerned, it conforms to the requirements imposed by this Code.

2.2.3 Associated documents

The following documents shall be attached to the test report:

- a schematic arrangement drawing with description of operation showing clearly all the details relating to the operation and the safety of the locking device, including the effective engagement of the locking elements and the point at which the electrical safety device operates and the operation of the emergency unlocking device;
- information on the type of locking device (AC and / or DC) and their rated voltage and rated current.

2.2.4 Test samples

The test shall be carried out on a production model.

If the test of the locking device is only possible when the device is mounted in the corresponding gate (for example, sliding gates with several panels or hinged gates with several panels) the device shall be mounted on a complete gate in working order. However, the gate dimensions may be reduced by comparison with a production model, on condition that this does not falsify the test results.

2.2.5 Examination of operation

This test has the aim of verifying that the mechanical and electrical components of the locking device are operating correctly with respect to safety, and in conformity with the requirements of this Code.

In particular it shall be verified:

- that there is at least 7 mm engagement of the locking elements before the electric safety device operates (see **Section E 6.10**);
- that it is not possible from positions normally accessible to persons to operate the builder's lift with a gate open or unlocked.

2.2.6 Tests

These tests have the purpose of verifying the strength of the mechanical locking components and the electrical components.

The sample of the locking device in its normal operating position shall be controlled by the devices normally used to operate it.

The sample shall be lubricated in accordance with the normal requirements of the manufacturer of the locking device.

The number of complete cycles of operation shall be registered by mechanical or electrical counters.

2.2.7 Endurance test

The locking device shall be submitted to 200 000 complete cycles ($\pm 1\%$) (one cycle comprises one unlocking and one relocking operation).

The driving of the device shall be smooth, without shocks.

During the endurance test the electrical safety switch shall be mechanically operated by the lock as in normal operation.

2.2.8 Static test

A test shall be made consisting of the application over a total period of 5 mins of a static force of 1 kN.

This force shall be applied in the opening direction of the gate and in a position corresponding as far as possible to that which will be applied when a user attempts to open the gate.

2.2.9 Criteria for the tests

After the endurance test (Part 4 - 2.2.5) and the static test (Part 4 - 2.2.8) there shall not be any wear, deformation or breakage which could adversely affect safety.

2.3 Safety gears and overspeed governors

2.3.1 General provisions

The safety gears and their compatible overspeed governor shall be tested in combination, using the suspension and guiding system employed in normal service.

The manufacturer shall state for what mass (kg) and rated speed (m/s) the test is to be carried out. If the safety gears have to be certified for various masses and speeds then these shall be specified.

2.3.2 Method of test

A representative combination of every new version of safety gears and compatible overspeed governor shall be tested to apply stresses to all parts equivalent to those resulting from drop tests with the total permissible mass.

The tests shall be conducted at the governor tripping speed specified by the

manufacturer.

The total number of repeated tests shall be not less than 30. At least there shall be:

- 10 tests with rated load, drive engaged;
- 5 tests with empty cage, drive engaged;
- 5 tests with 1.5 times rated load, drive engaged;
- 5 tests with rated load, drive disengaged;
- 5 tests with 1.5 times rated load, drive disengaged.

Direct or indirect measurements shall be made of:

- the total height of the fall;
- the braking distance;
- the speed of tripping;
- retardation as a function of time.

The following shall be checked:

- that retardation conforms with **Section H 5**;
- that the maximum speed of tripping conforms to **Section H 18**;
- that there are no cracks or deformations;
- in the case of a rope driven overspeed governor, that the tensile force in the rope conforms to **Section I 11**.

2.3.3 Test report

The report shall indicate:

- information according to **Part 4 - 2.1.4**;
- type and application of the safety gears and overspeed governor;
- type(s) and model(s) of builder's lift(s);
- the limits of the permissible total masses for the safety gears include inertia effects;
- the limits of the tripping speed for the overspeed governor;
- for safety gears operating on the guides, the permissible thickness of the guide blade, the minimum width of the gripping areas, the state of lubrication of the guides and their surface condition;
- in the case of overspeed governors driven by rope, the diameter of the rope to be used, its construction, the tensile force on the rope which can be produced by the governor when tripped and, if a traction pulley is used, the minimum tensioning force.

2.4 Energy accumulation type buffers with buffered return movement and energy dissipation buffers

Special verification tests for these types of buffer shall be carried out according to the test procedures for type examination given in EN 81-50.

2.5 Verification tests on each builder's lift before first use

The manufacturer shall perform or have performed static and dynamic tests to ensure that the builder's lift has been correctly manufactured and assembled in order to check that all the devices provided are present and operating correctly. These tests may be carried out at the manufacturers' premises or those of his authorized representative or at the place of use under the control of the manufacturer.

In particular the following shall be verified and recorded in a test report:

- Proper function of all limit switches;
- Proper function of all controls;
- Function of the safety gears within specified limits;
- Triggering of overload sensing device between 1.0 and 1.1 times rated load;
- Braking distance of brake system within specified limits;
- Proper function of gate locks;
- Dynamic test at 1.1 times rated load;
- Static test at 1.25 times rated load;

PART 5

USER INFORMATION

1 INSTRUCTION MANUAL

Every builder's lift shall be provided with an instruction manual in either Chinese or English which provides technical data concerning the builder's lift. The manual shall be suitably protected and kept. The contents of the instructions shall cover not only the intended use of the machinery but also take into account any reasonably foreseeable misuse thereof. The following technical description and information of the builder's lift shall be provided:

- maker's name and address
- type and model
- range of machines or installations for which the instruction book is applicable
- a repeat of the safety marking and warning signs on the machine and their signification
- load carrying capacity of the lift cage, giving both the number of passengers including the competent operator, rated load (in kg) and the positions of permissible loads
- rated speed of the lift cage (in m/s)
- internal dimensions of the lift cage (width, length and height in m)
- noise levels (in dB)
- maximum height of travel without wall anchorage (in m)
- maximum height of travel with wall anchorages (in m)
- maximum and minimum spacing between two consecutive wall anchorages (in m)
- allowable overhang of mast above the top wall anchorage (in m)
- minimum mast height required above the top landing (in m)
- maximum allowable wind speed during erection and dismantling (in m/s)
- in service maximum wind speed (in m/s)
- a description of the driving machine which shall include:
 - (a) power in kW
 - (b) electric power supply (voltage in V, frequency in Hz, phases)
 - (c) control voltage / frequency [V/Hz]
 - (d) maximum power consumption [kW]
 - (e) minimum power supply [kVA]
 - (f) main power supply fuses and type [A]
 - (g) outlets for portable tools – voltage and current [V, A]
 - (h) starting current (in A)
 - (i) the type of brake
 - (j) a description of the driving machine
 - type and position of the control station
 - type of landing gate (e.g. rising or outward opening)
 - details of wire rope and/or counterweight wire rope when

- the lift cage is of wire rope suspension
 - i. number of wire ropes
 - ii. construction of wire rope
 - iii. nominal diameter (in mm)
 - iv. minimum breaking strength (in kN)
 - v. roping
 - vi. factor of safety of wire rope
- details of terminal and final limit switches (e.g. type)
- full information on the operation and maintenance of safety gears (e.g. type), including method of assessing wear
- full information for the installation, testing, operation, alteration of height of travel, servicing and dismantling of the builder's lift, rescue procedures and emergency operation
- full information to enable foundations and wall anchorage fixings to be designed
- specification of bolts for assembling the structure
- details of operation, calibration, test and examination of overload sensing devices
- an electrical and hydraulic circuit diagrams showing the operation of the electrical and hydraulic components
- operation of audible emergency alarm and other communications system
- operation of lifting equipment and its capacity (in kg)
- details of dimensions and weights of components or assemblies of the builder's lift

2 INSTRUCTIONS FOR ERECTION AND DISMANTLING

The instruction manual shall clearly indicate the various configurations foreseen by the contractor for installing the builder's lift. Where any nonstandard configurations are required, these shall be agreed between the contractor, the owner and the user, and information shall be added as addendum to the instruction handbook.

2.1 Clearances

- clearances around the builder's lift

if the safety distance between any point of access and any adjacent travelling part of the builder's lift is less than 1.0 m the liftway protection shall conform to ISO 13857:2019, Table 1 and be a minimum of 2.0 m high or extend the full height from floor to ceiling where this is less than 2.0 m.

if the safety distance is 1.0 m or more, a fixed protection (handrail, intermediate rail and toe board) to a minimum height of 1.15 m shall be provided.

- clearances above the cage

Sufficient guides shall be provided to allow for the overrun of the cage at the upper end of the liftway. The overrun shall be at least as stated in **Section D 2.3**.

- clearance above the counterweight

When the cage rests on the fully compressed buffers, the free distance above the counterweight shall be at least 0.3 m.

2.2 Foundation

Information shall be given so that the site for the builder's lift can be suitably prepared in order that it shall withstand all resultant forces. The base frame and mast structure shall be supported by a foundation able to take all forces and moments as described in **Section A2**.

If accessible spaces exist underneath the lift base, any counterweight shall be fitted with a safety gear.

2.3 Erection and dismantling

Only competent workers shall erect and dismantle the builder's lift.

Connection of the builder's lift to the electrical supply shall be made by competent workers in accordance with EMSD regulations.

The instruction handbook shall at least include the following:

- recommend the use of a Residual Current Device;
- transportation to the site;
- erection of mast sections and mast ties including information regarding the correct use of bolts (diameter, quality, tightening torque);
- recommendations for lifting of heavy parts;
- installation of, and safety requirements for base enclosure and landing gates, which shall be provided in the liftway protection at every point of access;
- illumination of landings (a statement shall be included to the effect that if the builder's lift is to be used under poor lighting conditions then adequate site lighting shall be provided to illuminate the landings over the full height of travel of the builder's lift);
- test of the completed builder's lift.

The test shall include the following minimum requirements:

- identification of the builder's lift;
- functional tests of:
 - drive systems and brakes;
 - travel limits;
 - cage and landing gates;
 - overload sensing device;

- clearances; the builder's lift shall be dynamically tested throughout the full range of travel with the rated load in the cage as specified by the manufacturer;
- the safety device against falling of the cage shall be dynamically tested as specified by the manufacturer;
- dismantling procedure.

3 INSTRUCTION FOR OPERATING AND USAGE

A separate section shall be included in the instruction handbook which gives clear information for all users of the builder's lift regarding the safe operation and the minimum requirements for the training of competent operator.

Detailed instructions shall be given regarding:

- intended use;
- operation of landing and cage gates;
- loading the cage and possible restrictions regarding load position and concentration and securing of the load;
- use of castors suitable for the possible gaps;
- no loads on the cage roof;
- control of the lift, the function of any controls available to the user inside the cage, at the base enclosure and the landings;
- environmental conditions e.g. maximum in service wind speed.

4 EMERGENCY PROCEDURES

A separate section shall be included which provides all the information necessary for competent workers, regarding the handling of emergencies such as:

- special controls;
- safety devices, e.g. limit switches, safety gears;
- reacting to failures;
- circuit diagram;
- information about access to the cage (see **Section E 6.4** and **Section B 6.3**).

5 REGULAR INSPECTION AND MAINTENANCE

The instruction handbook shall state the frequency of periodic examinations, tests and maintenance depending on manufacturers requirements, operating conditions and frequency of use. Detailed information regarding the items to be checked and suitability for use shall be given.

It shall be stated which parts are subject to wear and the criteria for replacement, e.g. ISO 4309 for replacement of steel wire ropes. The instruction handbook shall include a section dealing with thorough examination with regard to fatigue life (see also **Section A 2.8**).

6 MARKINGS

Markings must be easily legible and permanently attached to the builder's lift.

6.1 Rating plate

- maker's name and address
- year of construction
- type or model
- serial number or manufacturer's number
- rated load and maximum number of persons (in kg and persons)
- maximum height of travel (in m)
- wire rope information
- rated speed (m/s)

6.2 Mast section identification

Each individual mast section shall be marked with serial number.

6.3 Safety gear

- maker's name and address
- model number
- year of construction
- serial number
- tripping speed (m/s)
- permitted load (in kg)
- stopping distance (in m)
- expiry date
- type examination certificate number

6.4 Driving motor

- maker's name
- type or model
- year of construction
- operating speed (rpm)
- rated output (in kW)
- serial number
- class of insulation
- power supply (in V, A, Hz and number of phases)

6.5 Overload sensing device

- maker's name
- type or model
- serial number
- year of construction
- rating (in V, A)
- overload alarm setting (in kg or % of rated load)
- accuracy (in kg or % of rated load)

6.6 Basic user information label

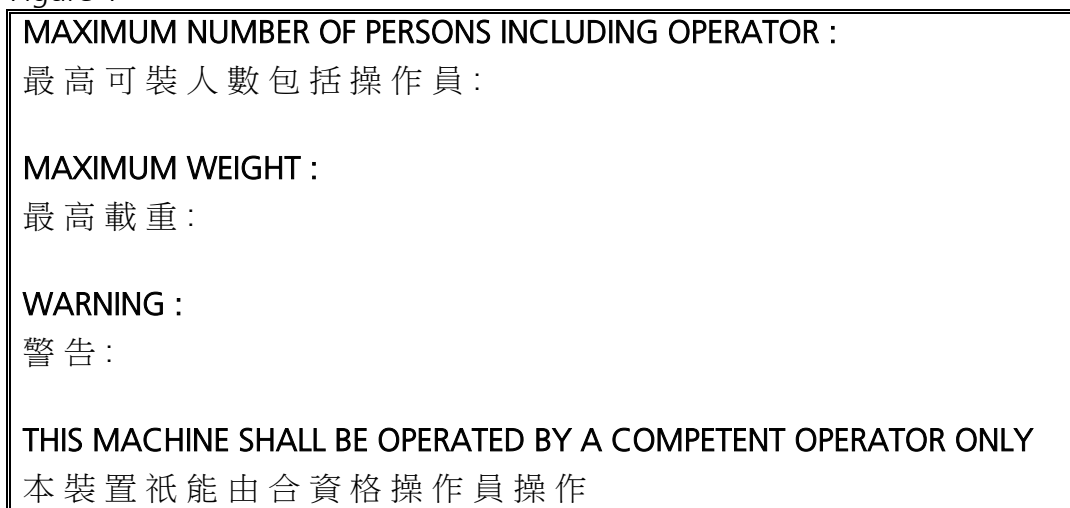
- mast height;
- top overhang of mast;
- bolted mast joints (bolt diameter, bolt quality, tightening torque)
- power supply (residual current device);
- free-standing operation;
- safety clearances;
- sketch of mast ties, with distances between ties;
- out of service position of the cage;
- observation of operating instructions;
- information regarding installations where the counterweight is above an accessible space.

7 NOTICES

7.1 Notice at the lift cage

An indelible notice in both Chinese and English with letters and characters not less than 30 mm in height is prominently displayed in the lift cage as shown Figure 1:

Figure 1



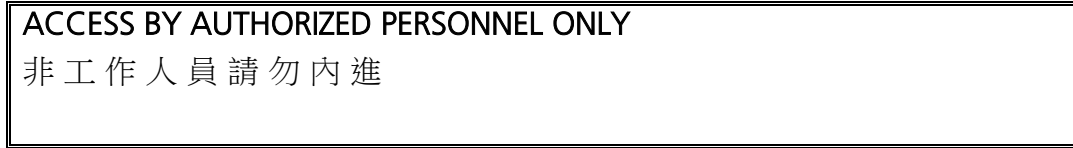
The notice shall be kept legibly at all times.

In addition, if the safe working loads of builders' lifts depend on position of load on the lift cage floor, the restrictions regarding the load position and concentration shall also be displayed with diagrams.

7.2 Notice at base enclosure

An indelible notice in both Chinese and English with letters and characters not less than 50 mm in height shall be displayed at base enclosure as shown Figure 2:

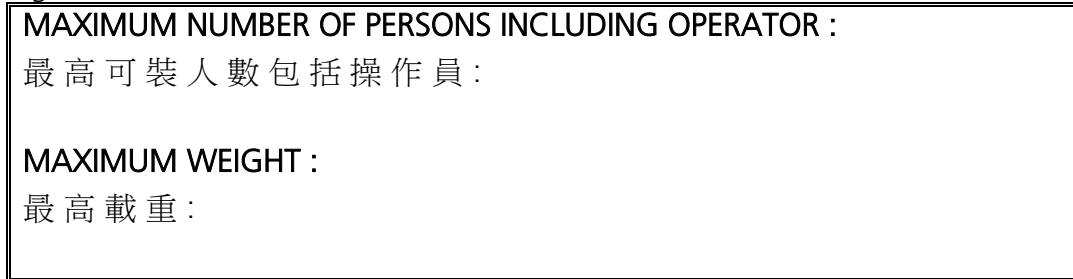
Figure 2



7.3 Notice at every landing

An indelible notice in both Chinese and English with letters and characters not less than 30 mm in height shall be displayed at every landing and at base enclosure as shown Figure 3:

Figure 3



PART 6

TYPE TEST CERTIFICATES

The type test in accordance with Code of Practice on the Design and Construction of Builders' Lifts ("CoP(BL)") should be conducted on a representative unit of the machinery. Type test certificates shall be issued by an accredited testing institution and independent of the manufacturer. The following items shall also be provided with type test:

- driving machine brake
- overspeed governor
- safety gear
- rack and pinion suspension
- buffer
- safety components stipulated as the Code of Practice on the Design and Construction of Lifts and Escalators for jump lift

Note: The requirements for the type test shall follow Annex IX of EU Machinery Directive (2006/42/EC) or other international standards.

PART 7

COMPETENT OPERATORS

1 REQUIREMENTS OF COMPETENT OPERATORS

The competent operators for the operation of builders' lifts shall:

- i. be more than 18 years of age
- ii. be medically fit, with particular regard to eyesight, hearing and reflexes
- iii. have been adequately trained in the operation and working principles of builders' lifts
- iv. have been authorized to operate the builder's lift by the owner
- v. have sufficient knowledge of the working of the builder's lift to enable him to carry out daily checks

2 REQUIREMENTS OF TRAINING

The training for competent operators shall include the following aspects:

2.1 Basic construction and working principles including:

- i. the electrically and mechanically operated locking device of the gates
- ii. the overload sensing device

2.2 Operational aspects including:

- i. the allowable lifting capacity and permitted numbers of passengers to be carried
- ii. operation of the control levers and switches installed inside the lift cage
- iii. the use of audible emergency alarms and other communication systems

Note: the emergency lowering device shall be operated by competent workers and shall not be operated by competent operators

2.3 Daily checks including:

- i. general visual inspection of the builder's lift for irregularities
- ii. inspection of liftway for any obstruction that will endanger the operation of the lift cage
- iii. inspection of the electrically and mechanically operated locking devices for lift cage gate and landing gate.

PART 8

JUMP LIFTS

A jump lift is used in the construction of a high-rise building in a permanent liftway and has a movable machine platform. As the building structure is built higher, the position of the machine platform is raised, so that the traveling height of the cage is extended.

The design of jump lifts shall comply with the Code of Practice on the Design and Construction of Lifts and Escalators. Examination upon completion of installation of jump lifts shall be carried out according to appendix "Examination upon completion of installation of a lift" in the Code of Practice for Lift Works and Escalator Works by a registered examiner.

Additionally, the following requirements shall be considered:

1. The strength of the machine platform and the structural supports extended to the steel building framework shall be designed and checked by an RPE in structural or other relevant disciplines. Taking into account the maximum rated load, structural loads (e.g. machine platforms), mass of the empty car, mass of wire ropes (incl. excessive wire ropes stored on reels) and storage reels, traction machine components and climbing/hoisting mechanism. If necessary, the fastening method of the platform structural supports to the building framework should be verified as well.
2. The strength of the steel framework shall conform to national building regulation and shall be able to support at least the loads which may be applied by the machine.
3. For self-climbing platforms, the maximum load induced by climbing actuator (e.g. hydraulic cylinder) shall be verified taking into account the mass of the car, mass of wire ropes and storage reels, structural loads and traction machine components.
4. When compensating wire rope/chain storage device is provided, the additional loads from the components should be considered in the strength calculation. If such device is installed under the car, the strength of the platform used to store the device shall conform to the strength of the car floor in the Code of Practice on the Design and Construction of Lifts and Escalators.
5. The length of wire ropes for the car, counterweight and overspeed governor should be compatible with the maximum height of the building to be constructed. The length of compensating wire ropes or chains should also be considered.
6. The mounting of the traction machine and storage reels shall be securely

fastened. The wire ropes extended from the storage reels to the traction machine should be fixed with clamps. Means shall be provided to prevent wire ropes to slip out of the clamps and self-loosening of the fasteners for the clamps shall be prevented.

7. Protective covers to prevent dust and water from entering the machine platform should be placed at an adequate height in the upper end.
8. The upper guardrails shall be at a height between 1 000 mm and 1 150 mm above the machine platform, the intermediate rails at half the height of top rail and the toe boards not less than 200 mm high shall be provided. Any opening on the platform for the wire ropes to pass through should be guarded by fence not less than 1 000 mm high.
9. Fences in accordance with ISO 13857:2019 with a minimum height of 2.0 m shall be provided to any opening in the well.

ANNEX I

MATERIALS AND MANUFACTURING (INFORMATIVE)

1 MATERIALS

Material of structural parts (excluding others that are not subject to structural calculation) and mechanical parts shall be steels listed in clause 1.1 or steels having mechanical property equal or superior to them. The guides shall be made of steel and shall be rigid. Wire ropes or chains shall not be used as guides.

- 1.1 Structural steel shall be of grade 43, grade 50 or grade 55 of BS 7668, BS EN 10029, BS EN 10025-1, BS EN 10025-3, BS EN 10025-4, BS EN 10025-5, and BS EN 10210-1 or of other equivalent international standards. Other structural steel may be used provided that they comply with international standards.
- 1.2 Welding electrodes for joining structural steel shall be in compliance with the requirements of BS EN ISO 2560 or equivalent standards.
- 1.3 Bolts and nuts shall comply with international standards. High friction grip bolts shall conform to BS EN 14399 Parts 1-8, BS EN 14399-10 and their use shall conform to BS EN 1993-1-8. Plain washers shall be made of steel. High friction grip bolts of other international standards may also be used.

2 MANUFACTURING

Manufacturing of structural parts shall be by welding or bolted joints.

2.1 Welding

- 2.1.1 All welding on stressed parts shall be carried out in accordance with BS EN 1011 Part 1-2 or other equivalent standards. The following calculations of weld strength shall apply:
 - (a) Butt welds shall be treated as parent metal with a thickness equal to the throat thickness (or a reduced throat thickness for certain butt welds) and the stress shall not exceed those allowed for the parent metal.
 - (b) When electrodes appropriate to a lower grade of steel is used for welding together parts of material of higher grade steel, the allowance stresses for lower grades of steel shall apply.
 - (c) When a weld is subject to a combination of stresses, the stress shall be the combined stress. The value of equivalent stresses shall not be greater than that permitted for the parent metal.
- 2.1.2 Welded joints shall be free from defects that will impair the service performance of the construction. Such acceptance requirements, covering both surface and subsurface defects, shall be in accordance with EN 1011-1 and EN 1011-2, bearing in mind that a higher standard of acceptance may be required for

welded joints under fatigue loading. All welds shall be visually inspected in accordance with BS EN ISO 17637. Butt welds in main members shall be subject to non destructive testing methods using either radiographic or ultrasonic examination. The extent of these tests shall be set by the manufacturers taking into account the required performance of the welds and the completed structure.

- 2.1.3 A weld subject to visual inspection shall be acceptable if
- (a) the weld is free from cracks
 - (b) the weld exhibits full fusion between parent metal and weld
 - (c) all craters are filled
 - (d) welds exhibit the required size and profile
 - (e) welds are free from excessive undercut and/or overlap

The following non destructive testing methods and standards are recommended:

Radiographic examination shall be in accordance with ISO 17636-1 and ISO 17636-2. Welds subject to radiographic examination shall be free from cracks and lack of fusion defects. In the case of ultrasonic testing, the calibration, sensitivity and scanning technique employed shall be in accordance with BS EN ISO 17640 as appropriate. Magnetic particle inspection of welds shall be carried out in accordance with BS EN ISO 9934-1. Dye penetration test shall be in accordance with BS EN ISO 3452-1.

- 2.1.4 A report on all of the non destructive tests on butt welds and fillet welds of the builder's lift including the masts, lift cage, wall anchorages, landing gates, base frame, etc., shall be provided by the manufacturer.

2.2 Bolt joint

Bolt holes shall be bored by drill and free from burrs. Precision bolts shall be turned or cold finished and fitted into reamed or drilled holes. Black bolts other than friction grip bolts shall not be used in main members in shear, for joints in stress-bearing members, or in joints subjected to fatigue. Whenever there is a risk of nuts becoming loose due to vibration or alternation of stresses, they shall be securely locked.

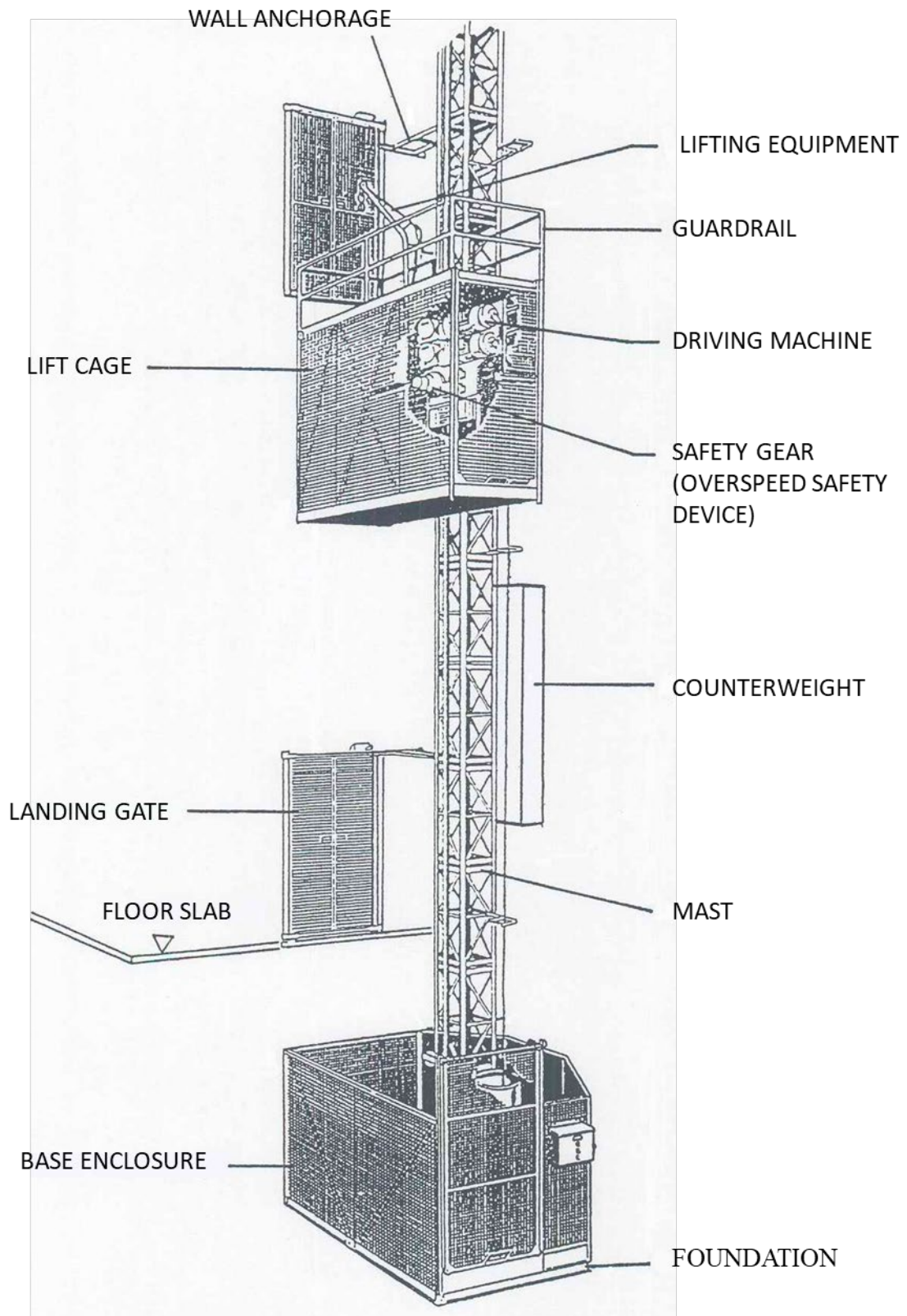
Preloaded bolts shall be grade 8.8 or grade 10.9. They shall be tightened by controlled means.

3 TREATMENT OF STEELWORK

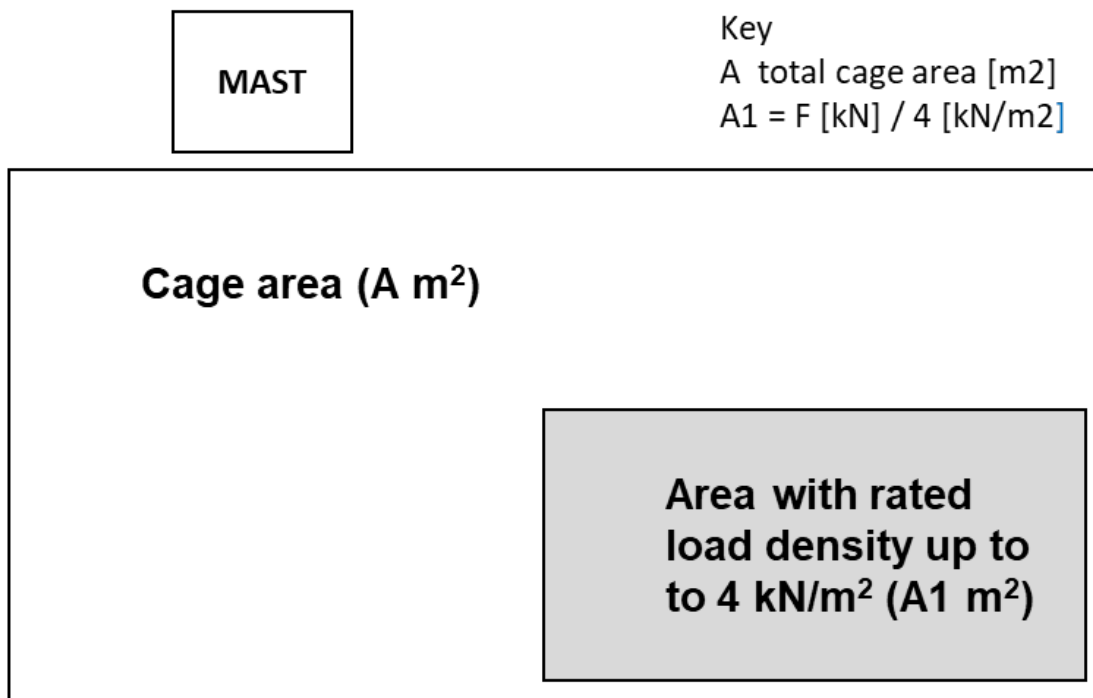
All surfaces which require a protective coating applied shall have a surface preparation to a standard compatible with the protective system to be adopted.

ANNEX II: FIGURES

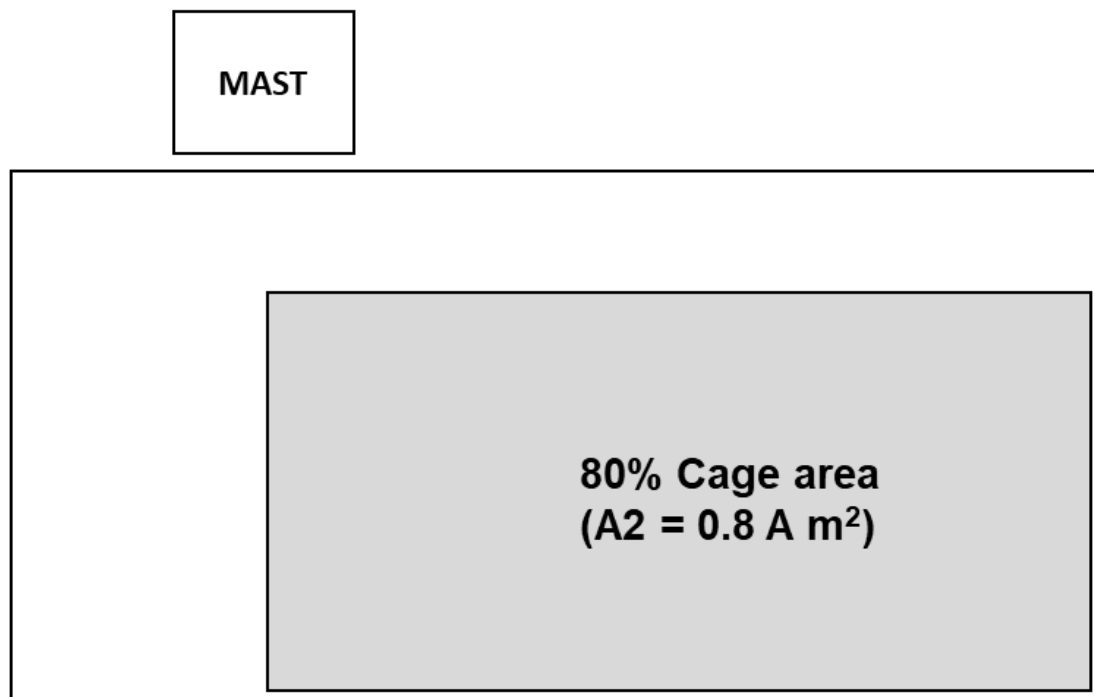
FIGURES II.1, II.2, II.3, II.4, II.5, II.6 and II.7



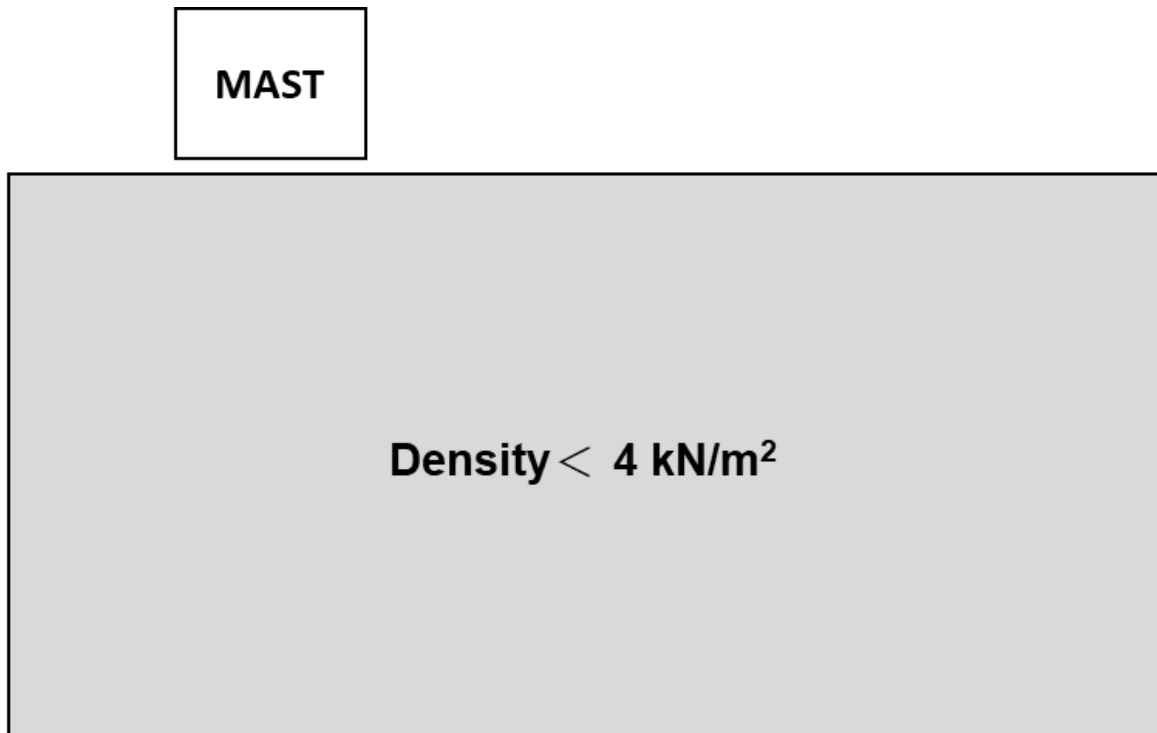
FIGURES II.1 : ONE TYPICAL LAYOUT OF A BUILDER'S LIFT



FIGURES II.2a : LOADING CASE OF SECTION A 2.2.3a



FIGURES II.2b : LOADING CASE OF SECTION A 2.2.3b



FIGURES II.3 : EVENLY DISTRIBUTED LOAD CASE

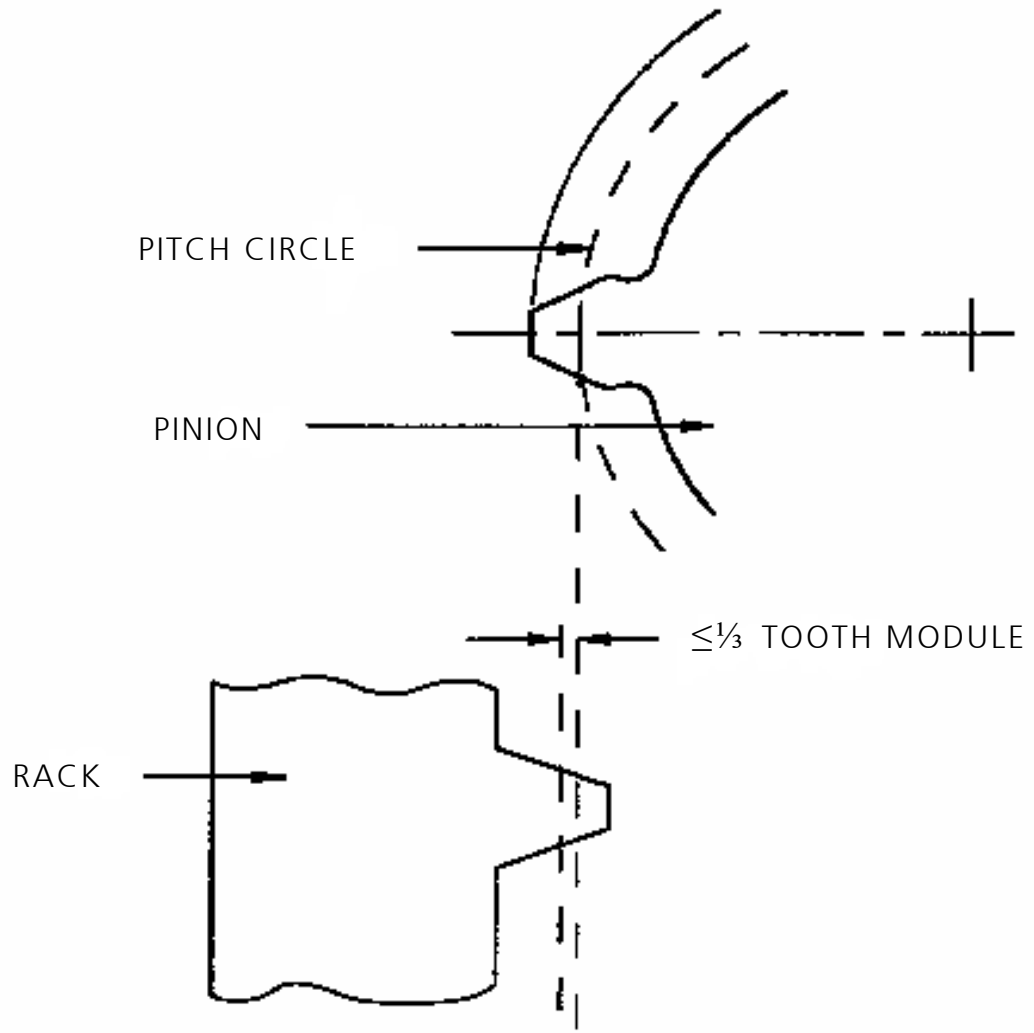


FIGURE II.4

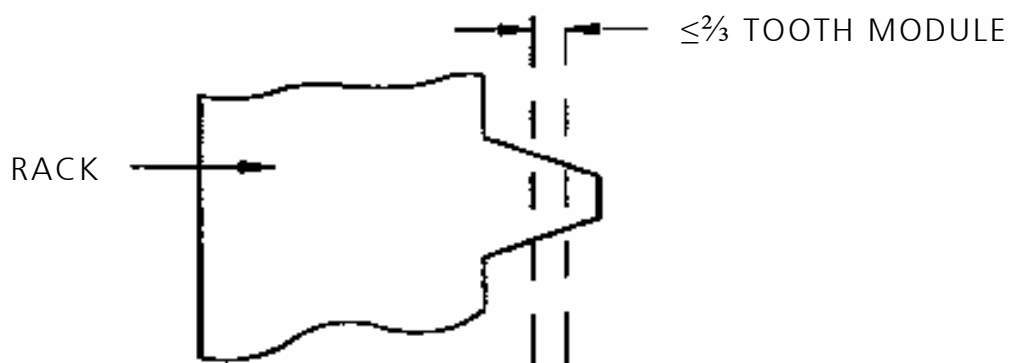


FIGURE II.5

FIGURES II.4 & II.5: SEPARATION OF PINION FROM RACK

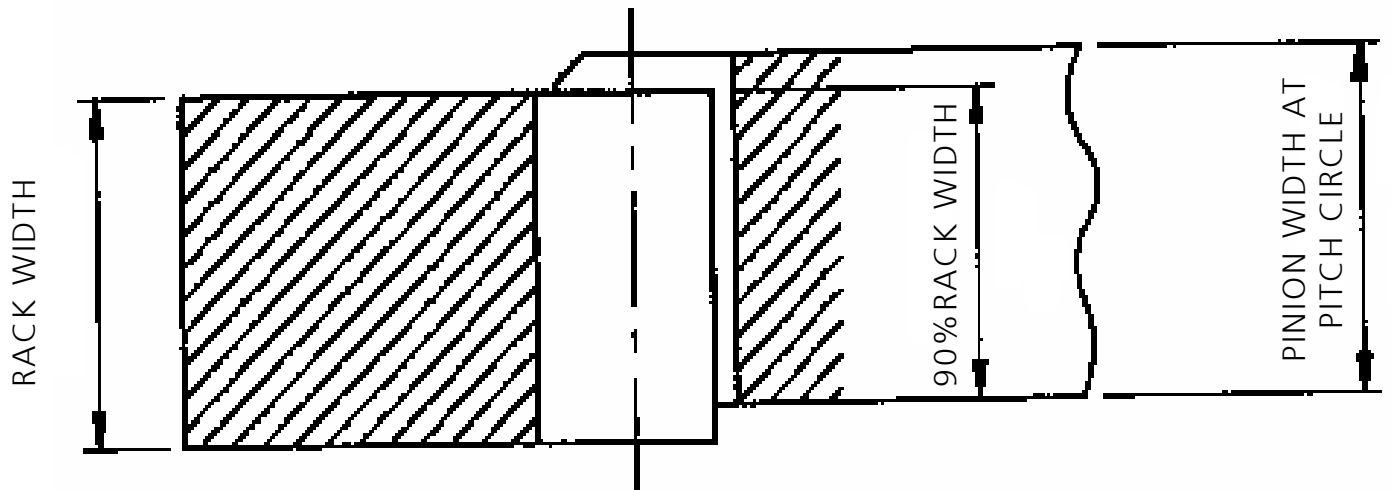


FIGURE II.6: RACK / PINION ENGAGEMENT

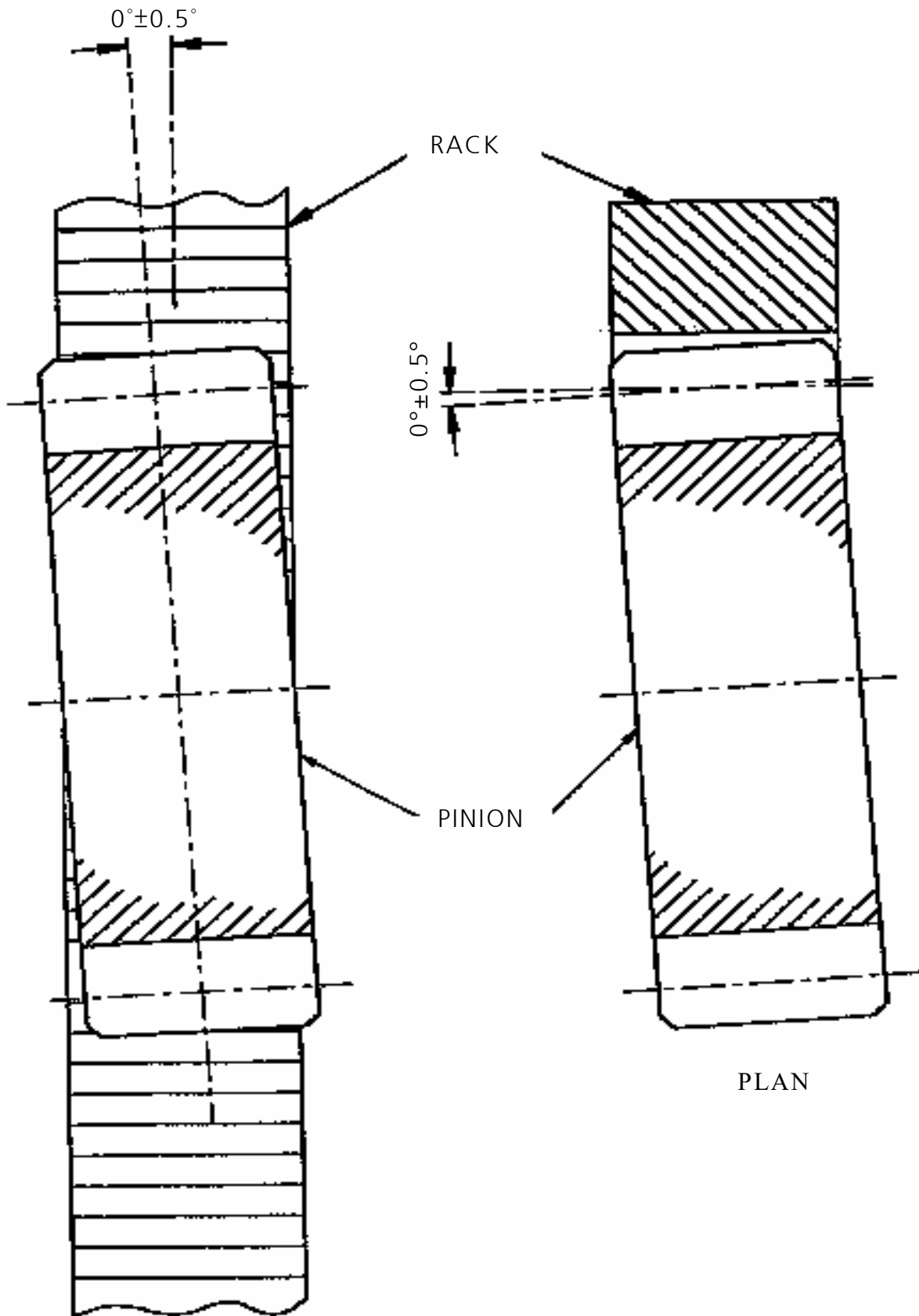


FIGURE II.7: RACK / PINION ENGAGEMENT

ANNEX III

REFERENCES

- (a) Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on Machinery
- (b) GB 26557-2011, Builders hoists for persons and materials with vertically guided cages
- (c) EN 12159:2012, Builders' hoists for persons and materials with vertically guided cages
- (d) GB 23821-2009, Safety of Machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs
- (e) ISO 13857, Safety of Machinery – Safety distances to prevent hazard zones being reached by upper and lower limbs
- (f) Code of Practice on Wind Effects in Hong Kong - 2019 by Buildings Department
- (g) Code of Practice on the Design and Construction of Lifts and Escalators by EMSD
- (h) Code of Practice for the Electricity (Wiring) Regulations by EMSD
- (i) Construction Sites (Safety) Regulations, Chapter 59I
- (j) Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations, Chapter 59J
- (k) Electricity Ordinance, Chapter 406
- (l) Lifts and Escalators Ordinance, Chapter 618

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