इंटरनेट मानक

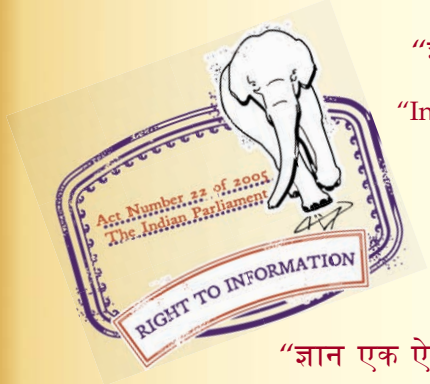
Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 14665-2-1 to 2 (2000): Electric Traction Lifts, Part 2: Code of Practice for Installation, Operation and Maintenance, Section 1: Passenger and Goods Lifts, Section 2: Service Lifts [ETD 25: Lift and Escalators]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS 14665 (Part 2/Sec 1 & 2) : 2000
(Superseding IS 1860:1980 and IS 6620:1972)

भारतीय मानक **(Reaffirmed 2005)**

विद्युत संकर्षण लिफ्टें

भाग 2 संस्थापन, प्रचालन और रख-रखाव के लिए रीति संहिता

अनुभाग 1 यात्री और मालवाहक लिफ्टें

अनुभाग 2 सर्विस लिफ्टें

Indian Standard

ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 1 Passenger and Goods Lifts
Section 2 Service Lifts

ICS 91.140.90

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

April 2000 **Price Group 11**

FOREWORD

This Indian Standard (Part 2/Sec 1 and 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Lifts and Escalators Sectional Committee had been approved by the Electrotechnical Division Council.

The necessity of lifts in multi-storeyed buildings has been so well recognized that no multi-storeyed building is planned without proper provision for lifts. The installation of lifts has been governed in cities by different *Lifts Act* and *Rules* thereunder, which are intended to ensure safe installation and operation of the lifts. However, there is no uniformity in these rules regarding minimum standards of installation which should be fulfilled for safe working of lifts, and this standard is intended to give the necessary guidance for safe installation, operation and standard maintenance of electric passenger, goods and service lifts.

This standard is one among the series of standards finalized by the Lifts and Escalators Sectional Committee as detailed below. This was done in view to align the Indian Standards with the latest developments in the field of Lifts and Escalators and also to align the standards with the European Norms on Lifts and Escalators EN 81. Moreover, these standards are published in view to have a uniform code for electric traction lifts all over the country, where presently different rules are being followed by different states.

New Series		*Superseding*
14665 Electric traction lifts:		
Part 1	Outline dimension	3534 : 1979 Outline dimensions of electric lifts (*first revision*)
Part 2	Code of practice for installation, operation and maintenance:	
Section 1	Passenger and goods lifts	1860 : 1980 Code of practice for installation, operation and maintenance of passenger and goods lifts (*first revision*)
Section 2	Service lifts	6620 : 1972 Code of practice for installation, operation and maintenance of service lifts
Part 3	Safety rules	
Section 1	Passenger and goods lifts	4666 : 1980 Electric passenger and goods lifts
Section 2	Service lifts	6383 : 1971 Electric service lifts
Part 4	Components	
Section 1	Lift buffers	9803 : 1981 Buffers for electric passenger and goods lifts
Section 2	Lift guide rails and guide shoes	10191 : 1982 Car and counter weight guide rails, guide rail supports and fastenings for lifts and 11615 : 1986 Car and counter weight guide shoes for electric passenger and goods lifts
Section 3	Lift carframe, car, counterweight and suspension	11706 : 1986 General requirements of carframe for electric passengers and goods lift
Section 4	Lift safety gears and governors	9878 : 1981 Safety gears and governors for electric passenger and goods lifts

(*Continued on third cover*)

AMENDMENT NO. 3 SEPTEMBER 2012
TO
IS 14665 (Part 2/Sec 1) : 2000 ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 1 Passenger and Goods Lifts

(*Page* 1**,** c*lause* **3.2**) **—** Substitute the following for the existing clause:

'**3.2 Bottom Counterweight Runby**

The distance between the counterweight buffer striker plate and the striking surface of the counterweight buffer when the car floor is in level with the top terminal landing.'

(*Page* 2, *clause* **3.8.1**) **—** Substitute the following for the existing clause:

'**3.8.1** *Bottom Car Clearance*

The clear vertical distance from the floor of the lift-pit to the lowest structural or mechanical part, equipment or device installed beneath the car-platform, except the guide shoes, rollers, safety jaw blocks and platform apron or guard located within 300 mm measured horizontally from the sides of the car platform when the car rests on its fully compressed buffers.'

(*Page* 3, *clause* **3.24**) — Delete.

(*Page* 4, c*lause* **3.41.6**) **—** Substitute the following for the existing clause:

'3.41.6 *Car Switch Operation*

Method of operation by which the movement of lift car is directly under the operation of the attendant by means of a Handle / Switch in the lift car.'

(*Page* 5, *clause* **3.60**) **—** Insert **3.61**, **3.62** *and* **3.63** *after* **3.60**:

Price Group 3

'**3.61** *Compensating Ropes or Chains*

Ropes or chains suspended from the car frame and the counterweight frame, to counterbalance the weight of the suspension ropes.

3.62 Traction Drive

Lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine.

3.63 Trailing Cable

Flexible cable providing electrical connection between the lift car and a fixed point or points.'

(*Page* 8, *clause* **5.6**) **—** Insert new clause **5.7** after **5.6**:

'**5.7** No equipment except that forming a part of the lift or necessary for its maintenance shall be installed in the lift well.'

[*Page* 16**,** *clause* **8.4.1**(a)] — Substitute the following for the existing:

'a) *Power supply mains* — The electric supply for the lifts shall be separate from other building services, on separate circuits from the main switch rooms and shall be taken through armoured cable separately through respective lift shafts. The route of the armoured cable shall be safe from fire. Separate cables for power supply and lighting shall be provided from meter room to machine room.'

(*Page* 17, *clause* **8.4.2.7**) **—** Insert new clause **8.4.2.8** after **8.4.2.7:**

'**8.4.2.8** The trailing cable conductor utilization shall be designed to ensure maximum safety in case of failure of insulation, keeping in mind different voltages that may be present in the cable. Accordingly, conductors of incoming and outgoing safety circuits shall not be adjacent to each other to ensure that the safety circuit does not get bypassed in the eventuality of conductors getting short circuited with each other.'

(*Page* 18, *clause* **9.5**) **—** Insert new clause **9.6** after **9.5**:

'**9.6 Emergency Stop Switch on Car Top**

An emergency stop switch, of manually opened and closed type, shall be provided on top of every lift car and shall be marked conspicuously.'

[*Page* 18, *clause* **10.1**(e) *and* 10.1(f)] — Substitute the following for the existing**:**

'**10.1** e) Requirements associated with machine room and overhead pulley room (*see* **10.6**);

f) Requirements associated with lift well (*see* **10.7**);'

(*Page* 19, *clause* **10.6**) **—** Substitute the following for the existing clause:

'**10.6 Requirements Associated with Machine Room and Overhead Pulley Room**

10.6.1 Machine room should be considered as plant space, and conditions provided to permit reliable operation of electrical switchgear and rotating machinery, and be conducive to good maintenance. Machine room shall be adequately ventilated. It shall be such that the motors and equipments as well as electric cables, etc, are protected as far as possible from dust and humidity. The ambient temperature in the machine room shall be maintained between + 5°C and +40°C. Machine room should also be weatherproof, and if ventilation louvers are provided, they should be designed and located to prevent entry of rain water in the machine room.

Lighting should be provided to give at least 200 lux around the controller and machine. At least one plug socket point shall be provided in the machine room. The switch for the machine room light shall be fixed near the entrance of the machine room. The machine room walls, ceiling and floor should be finished in dust-resisting materials, tiles, etc, or painted as a minimum to stop dust circulation, which otherwise could damage rotating machinery and cause failure of switchgear.

The machine room shall be designed so as to allow free and easy access to all parts of the equipment and the width of the clear space around the machine from any two sides shall in no case be less than 600 mm. Provision shall be made to allow the removal and replacement of various units. The entrance door of the machine room shall have sufficient opening to allow for removal and replacement of machinery therein. The floor of the machine room shall be designed and constructed to carry safely at any point the heaviest part of the equipment and withstand the loads and forces to which they are intended to be subjected to and comply with the requirements stipulated in the National Building Code. If the floor does not extend to the enclosing wall, the open sides shall be adequately guarded by suitable means.

The height of the machine room shall be sufficient to allow any portion of the equipment to be accessible and removable for repairs and replacement and shall not be less than 1 980 mm clear from the floor of the access area and working area. There shall be a clear vertical distance of at least 300 mm above the rotating parts of the machine.

The machine room shall be locked and shall be accessible to those who are concerned with the operation, maintenance and inspection of the machinery or equipment. Approach way to machine room from top landing level shall be direct, easy and safe to walk and preferably be by way of staircase. If this is not possible, sufficiently wide and deep permanent structural steps may be used. These structural steps shall be provided with adequate hand holds, shall not be too steep.

A danger notice board shall be displayed permanently on the outside of the machine room door and near the machinery.

There shall not be any common wall/slab between machine room and water tank.

The machine room shall not be used as a store room or for any purpose other than housing the machinery/components connected with the lift installation. The machine room shall not act as a passage to any other room or utility.

10.6.2 The place in which the overhead pulleys, overspeed governors and similar machinery are fixed shall be easily accessible for maintenance and repair purposes. It shall be lighted adequately and safe working procedure shall be established for maintenance and repair works.'

(*Page* 19, *clause* **10.7**) — Substitute the following for the existing clause:

'**10.7 Requirements Associated with Lift Well and Pit**

10.7.1 Lift wells should be constructed to be weatherproof and of a dust free surface material or should be painted to minimize dust circulation on to moving apparatus and from being pumped by the car movement in to machine room or on to landings and shall be rendered fire-resistant to the greatest possible extent.

The structure of the well shall conform to the requirements as laid in National Building Code and be able to support at least the loads which may be applied by the machine, by the guide rails at the moment of safety gear operation, in case of eccentric load in the car, by the action of buffers, by those which may be applied by the anti rebound devices, by loading and unloading the car, etc.

The well shall have a mechanical strength such that when a force of 300 N, being evenly distributed over an area of 5 cm^2. in round or square section, is applied at right angles to the wall at any point on either face it shall,

a) resist without permanent deformation; and
b) resist without elastic deformation greater than 15 mm.

Where the well is not required to contribute against the spread of fire, for example observation lifts in connection with galleries or atriums, tower buildings, etc. the well does not need to be totally enclosed, provided the height of the enclosure at places normally accessible to persons shall be sufficient to prevent such persons:

1) resist without permanent deformation;
2) being endangered by moving parts of the lift, and
3) interfering with the safe operation of the lift by reaching lift equipment within the well either directly or with hand held objects.

Glass panels placed at points normally accessible to persons shall be made of laminated glass.

Adequate lighting shall be provided in the lift well for safety of maintenance personnel when working on lift car top or in the lift pit.

10.7.2 Should a lift entrance open out in to an area exposed to the weather, the entrance should be protected by a suitable canopy and the ground level sloped up to the lift entrance to prevent rain or drainage water entering the lift well through the clearances around the landing doors. Any push buttons exposed should be of weatherproof type.

The inner surface of the lift-well and its enclosure facing any lift-car entrance shall, so far as practicable, be kept smooth and flush devoid of projections or recesses. Where any projections or tops of the recesses cannot be rendered flush, they shall be levelled on the underside to an angle not less than 60^{o} from the horizontal, by means of metal plates, cement rendering or other fire resisting material.

10.7.3 Where a lift car levelling device is operative with the lift car gate open, such interior surfaces shall always form a smooth and flush surface below each landing level.

10.7.4 Sufficient space shall be provided between the guides for the car and the side walls of the lift well enclosure to allow safe and easy access to the parts of the safety gears for their maintenance and repairs.

10.7.5 All landing openings shall be protected by gates or doors which shall extend to the full height and full width of the landing openings. These openings shall not be less than 680 mm clear in width when the gates or doors are fully opened.

10.7.6 The approach of the landing gate on each floor shall be kept lighted during the whole time the lift is available for use at night, and during the day time, if so required due to insufficient natural light.

10.7.7 Where wire grill or similar construction is used, the mesh or opening shall be such that the opening between the bars shall reject the ball of 32 mm in diameter and the lift well enclosure shall be of sufficient strength to resist accidental impact by users of the staircase or adjoining floors.

10.7.8 Where the clearance between the inside of an open type lift well enclosure and any moving or movable part of the lift equipment of apparatus is less than 50 mm, the opening in the enclosure shall be further protected by netting of square mesh of aperture not greater than 12 mm and of wire not smaller than 1 mm dia.

10.7.9 The distance between the lift-well enclosure on the sides facing any lift-car entrance and the sill edge of the car shall not be more than 30 mm. in the landing zone below the landing gate. If such distance is more than 30 mm., in the lift-well enclosure, the same shall be finished with suitable and smooth plaster work or facia plates so as to make the surface thereof devoid of all projections and recesses. In case the enclosure on the sides facing the lift-car entrance is more than 130 mm. From the sill edge of the lift-car platform, the lift-car door of such lift shall be provided with means to prevent it from being opened except when the lift-car is at the landing served by such car entrance.

10.7.10 When the distance between consecutive landing doorsills exceeds 11 000 mm, intermediate emergency lift landing doors shall be provided such that the distance between landings is not more than 11 000 mm. Rescue to these landings is permissible in case of automatic rescue device operation.

10.7.11 No counter-weight shall be allowed to travel in any lift-well, or part of any lift-well other than that to which it belongs.

10.7.12 On every passenger lift, there shall be provided at each floor, a floor Position Indicator or in use indicator or direction call registering light.

10.7.13 Pit shall be soundly constructed and maintained in a dry and clean condition. Where necessary, provision shall be made for permanent drainage.

10.7.13.1 The floor of the pit shall be able to support beneath each guide rail, force due to mass of guide rails plus the reaction at the moment of safety gear operation.

10.7.13.2 The floor of the pit shall be able to support beneath the car buffer supports, force equal to 4 times the static load being imposed by the mass of fully loaded car and is given by:

$$4g(P + Q)$$

where

P = mass of empty car and components supported by the car, that is part of travelling cable, compensating rope/chain if any, etc, in kg;

Q = rated load; and

g = acceleration due to gravity (9.81 m / s^2).

10.7.13.3 The floor of the pit shall be able to support beneath the counterweight buffer support, 4 times the static load being imposed by the mass of the counterweight and is given by:

$$4g(P + qQ)$$

where

P = mass of empty car and components supported by the car, that is part of travelling cable, compensating rope/chain if any, etc, in kg;

Q = rated load in Kg;

g = acceleration due to gravity (9.81 m / s^2); and

q = Live load balancing factor (normally $q = 0.5$).

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

a) either there shall be installed below the counterweight buffer, a solid pier extending down to solid ground; or
b) the counterweight shall be equipped with the safety gear.

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

10.7.14 In the case of a lift well which is common to more than one lift and where the lift car or the counterweight of one lift is working in juxtaposition to the lift car or counterweight of another lift, such lift cars or counterweights shall be guarded carefully and adequately in order to protect persons working in the lift well or on the lift cars from accidental contact with such cars or counterweights in any part of their travel.

(*Page* 25*, clause* **15.1**) **—** Insert new clause **16** after **15**:

'**16 Notices**

A notice board with the following instructions as applicable, and/or other applicable instructions shall be placed in conspicuous position in the lift car:

a) The lift car shall not be used by more than..... Persons / …….. kg.

b) Close the car and landing door / gate properly, on entering, or while leaving the lift car.

c) Do not open the lift-car gate when the lift-car is moving. The gate should only be opened after the lift-car has stopped opposite a landing gate.

d) Do not put hand or any other object in the collapsible gates.

e) In case of danger, press the alarm button, but do not try to open the car door. Wait inside, until the lift car is brought opposite a landing, and do not attempt to leave the lift car until the landing door is opened fully.

f) Children under 12 years of age shall not use the lift, unless accompanied by an adult.'

(ETD 25)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 FEBRUARY 2011
TO
IS 14665 (PART 2/SEC 1) : 2000 ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 1 Passenger and Goods Lifts

(*Page* 16, *clause* **8.3.14**) — Substitute the following for the existing clause:

8.3.14 *Behaviour of Lifts under Fire Condition for Buildings having Height more than 15* m

8.3.14.1 *Requirements for all lifts* — All lifts (Fire Lifts/Non-fire Lifts/Fire and Non-fire Lifts in group control in individual shafts or in a common shaft) in a building having height more than 15 m shall satisfy following requirements:

a) The walls enclosing the lift well shall have fire resistance of not less than two hours. The lift well shall have permanent vents immediately under the machine room not less than 0.2 m^2 per lift in clear area with wire mesh of size such that it will reject a ball of 25 mm diameter.

b) Lift landing doors shall have a minimum fire resistance rating of 2 h for integrity as per IS 3809 : 1979.

c) In case of common lift well for multiple lifts, the partition walls of the common lift well separating individual lifts shall be either RCC or brick or glass or suitable wire grill/expanded metal of following specifications:

   1) It shall be made of at least 2.2 mm thick steel wire or expanded metal,
   2) It shall reject a ball of 25 mm diameter, and
   3) It shall be so fixed as not to deflect more than 15 mm when subjected to a force of 450 N applied horizontally at any point.

8.3.14.2 *Requirements for fireman's lift(s)*

Price Group 2

8.3.14.2.1 For buildings having height more than 15 m; at least one lift shall meet the following requirements of fireman's lift as given in 8.3.14.2.2 to 8.3.14.2.5.

8.3.14.2.2 The fireman's lift shall have the following minimum requirements:

a) Lift car shall have floor area of not less than 1.43 m^2. It shall also have a loading capacity of not less than 544 kg (8 persons).

b) Door shall be of automatic operation for car and landing.

c) Lift shall work at or above 1m/s so as to reach top floor from ground level within one minute

d) All floors above ground floor shall be accessible directly by the lift.

8.3.14.2.3 *Operation requirement of fireman's lift(s)* — The lift shall be provided with the following as minimum:

a) A two position (ON/OFF) Fireman's Switch which is common to all lifts in a group control at evacuation floor (normally main entrance floor), protected in a box with glass in front with suitable label indicating that it is Fire Switch; and

b) Audio & visual signal in car.

8.3.14.2.4 *Sequence of operation*

a) Return to Evacuation Floor (Phase 1):

1) Shall start when the switch at the evacuation floor is turned to the 'on' position or the signal indicating a fire received from the Automatic Fire Detection and Alarm System (if provided by the building management system) is on. The lift(s) controlled by this switch shall cancel car calls and separate from landing calls and no landing or car calls shall be registered. The audio and visual signal in car shall be turned on. All heat and smoke sensitive door reopening devices shall be rendered inoperative.

2) If the lift is travelling towards the evacuation floor, it shall continue driving to that floor.

3) If the lift is travelling away from the evacuation floor, it shall reverse its direction at the nearest possible floor without opening its door and return non-stop to the evacuation floor.

4) If the lift is standing at a floor other than evacuation floor, it shall close the doors and start traveling non-stop to the evacuation floor.

5) When at the evacuation floor, the lift shall park with doors open.

6) The audio signal is turned off after this drive.

b) Fireman's Service (Phase 2):

The phase 2 operation of the lift shall be as defined below:

1) The phase 2 is started after phase 1, if the Fireman's Switch is 'ON'.

2) The lift does not respond to landing calls. All heat and smoke sensitive door reopening devices are rendered inoperative.

3) When the car call button is pressed the doors start closing. If the button is released before the doors are fully closed, they reopen. The car call is registered only when the doors are fully closed.

4) After registering a car call the lifts start driving to the call. If more than one car call is registered, only the nearest call is answered and the remaining calls will be cancelled at the first stop.

5) At the floor the doors are opened by pushing the door open button. If the button is released before the floors are fully open, they reclose.

6) The lift returns to normal service when it stands at the evacuation floor with floor open and the switch is 'OFF' or by an electrical signal from the automatic fire detection system when it is reset.

8.3.14.2.5 The words 'Fire Lift' shall be conspicuously displayed in fluorescent colour near/on the lift landing doors at each floor.

8.3.14.3 *Requirements for non-fire lifts(s)*

For buildings having height more than 15 meters, the Non-fire lift(s) shall be taken out of normal services in the event of fire, by making use of the following provisions given in **8.3.14.3.1** to **8.3.14.3.6**.

8.3.14.3.1 The Non-fire lift(s) shall be provided with a Manual Two Position (ON/OFF) Fireman Switch acting as a 'Grounding Switch' on the main floor. The switch shall be common for all lifts in a group control. The switch shall be protected in a box with glass in front with suitable label indicating that it is Fire Switch.

When a signal indicating a fire is received from the Automatic Fire Detection and Alarm System or from the Grounding Switch, the Non-fire lift(s) shall react as follows:

a) All landing controls and car controls including the 'door re-open button' shall be rendered inoperative;
b) All existing registered calls shall be cancelled; and
c) The lift shall follow the automatic command initiated by the received signal in the following way:

1) A lift with automatic power operated doors, when parked at a landing, shall close the doors and travel non-stop to the evacuation landing;

2) A lift with manually operated or non-automatic power operated doors, if parked at a landing with open doors, shall remain immobilized at that landing. If the doors are closed, the lift shall travel non-stop to the evacuation landing;

3) A lift travelling away from the designated landing shall make a normal stop and reverse its direction at the nearest possible landing without opening the doors and return to the evacuation landing;

4) A lift travelling towards the designated landing shall continue its travel non-stop to be evacuation landing; and

5) A lift, in the event of becoming blocked due to the operation of a safety device, shall remain immobilized.

8.3.14.3.2 Door reversal devices, which may be affected by heat or smoke, shall be rendered inoperative to allow the doors to close.

8.3.14.3.3 The breakdown or shut down of a lift in a group of interconnected lifts shall not affect the return of other lifts to the evacuation landing.

8.3.14.3.4 On arriving at the evacuation landing, lifts with power operated doors shall park there with the car and landing doors open and removed form service.

NOTE — The doors may close after predetermined time. However it shall be possible to open them with landing call button and manually with special emergency key.

8.3.14.3.5 For lifts with manually operated doors, when the car(s) arrive(s) at the designated landing, its door(s) shall be unlocked and the lift removed from the normal service.

8.3.14.3.6 The lift will automatically be reset to normal operation by:

a) an electrical signal from the automatic fire detection system when it is reset; or

b) the reset of the manual Grounding Switch.

8.3.14.4 *Requirements for fire & non-fire lifts in a group control*

In case there are Fire lifts as well as Non-fire lifts in a group control, the common Fireman-cum-Grounding Switch should function as Fire Switch for Fire lifts and as Grounding Switch for the Non-fire Lifts. Other requirements shall be as per **8.3.14.2** for Fire Lifts and **8.3.14.3** for Non-fire Lifts.

(*Page* 17, *clause* **8.4.2.7**) — Substitute the following for the existing clause:

'**8.4.2.7** A trailing cable which incorporates conductors for control circuits shall be separate and distinct from that which incorporates lighting and signalling circuits. However, use of single travelling cable for lighting, signalling and control circuits is permitted, provided that all the conductors are insulated for the maximum voltage found in the cable.'

(*Page* 17, *clause* **8.4.4.6**) — Add the following new sub-clause:

'**8.4.4.7** There shall be separate earth pit for lifts.'

(*Page* 19, *clause* **10.9**) — Substitute the following for the existing clause:

'It is recommended that it shall not be possible to open the lift car door of an automatic lift from within the car unless the car is in front of a landing in the landing zone. If the door can be opened the opening shall be restricted to 50 mm. It shall be possible to open the car door from outside by an authorized person in case of emergency.'

AMENDMENT NO. 2 NOVEMBER 2011
TO
IS 14665 (PART 2/SEC 1) : 2000 ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 1 Passenger and Goods Lifts

[*Page* 16, *clause* **8.3.14.1**(b), *line* 1 (*see also Amendment No.* 1)] — Substitute '1 h' *for* '2 h'.

(ET 25)

Reprography Unit, BIS, New Delhi, India

Indian Standard

ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 1 Passenger and Goods Lifts

1 SCOPE

1.1 This standard (Part 2/Sec 1) covers the essential requirements, design considerations, testing and precautions to be exercised during installation of passenger and goods lifts operated by electric power, so as to ensure safe and satisfactory performance. It also provides guidance for proper maintenance after installation.

1.1.1 Installation and maintenance of lifts necessarily calls for co-ordination among the various parties concerned, namely, the architect, the consulting engineer, the lift manufacturer and the electrical and mechanical engineer. This code gives the information that should be exchanged between parties from the stage of planning to installation including maintenance.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
732 : 1989	Code of practice for electrical wiring installation (*third revision*)
1950 : 1962	Code of practice for sound insulation of non-industrial buildings
3043 : 1987	Code of practice for earthing
14665 (Part 3/ Sec 1 and 2):2000	Electric traction lifts : Part 3 Safety rules, Section 1 Passenger and goods lifts, Section 2 Service lifts

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Bottom Car Runby

The distance between the car buffer striker plate and the striking surface of the car buffer when the car is in level with the bottom terminal landing.

3.2 Bottom Counterweight Runby

The distance between the counterweight buffer striker plate and the striking surface of the counterweight buffer when the car is in level with the bottom terminal landing.

3.3 Buffer

A device designed to stop a descending car or counterweight beyond its normal limit of travel by storing or by absorbing and dissipating the kinetic energy of the car or counterweight.

3.3.1 *Oil Buffer*

A buffer using oil as a medium which absorbs and dissipates the kinetic energy of the descending car or counterweight.

3.3.1.1 *Oil buffer stroke*

The oil-displacing movement of the buffer plunger or piston, excluding the travel of the buffer-plunger accelerating device.

3.3.2 *Spring-Buffer*

A buffer which stores in a spring the kinetic energy of the descending car or counterweight.

3.3.2.1 *Spring-buffer load rating*

The load required to compress the spring by an amount equal to its stroke.

3.3.2.2 *Spring-buffer stroke*

The distance, the contact end of the spring can move under a compressive load until the spring is compressed solid.

3.4 Call Indicator

A visual and audible device in the car to indicate to the attendant the lift landings from which calls have been made.

3.5 Car Bodywork

The enclosing bodywork of the lift car which comprises the sides and roof and is built upon the car platform.

3.6 Carframe

The supporting frame or sling to which the platform of the lift car, its safety gear, guide shoes and suspension ropes are attached.

3.7 Car Platform

The part of the lift car which forms the floor and directly supports the load.

3.8 Clearance

3.8.1 *Bottom Car Clearance*

The clear vertical distance from the pit floor to the lowest structural or mechanical part, equipment or device installed beneath the car platform aprons or guards located within 300 mm, measured horizontally from the sides of the car platform when the car rests on its fully compressed buffers.

3.8.2 *Top Car Clearance*

The shortest vertical distance between the top of the car crosshead, or between the top of the car where no crosshead is provided, and the nearest part of the overhead structure or any other obstruction when the car floor is level with the top terminal landing.

3.8.3 *Top Counterweight Clearance*

The shortest vertical distance between any part of the counterweight structure and the nearest part of the overhead structure or any other obstruction when the car floor is level with the bottom terminal landing.

3.9 Control

The system governing starting, stopping, direction of motion, acceleration, speed and retardation of moving member.

3.9.1 *Single-Speed Alternating Current Control*

A control for a driving machine induction motor which is arranged to run at a single-speed.

3.9.2 *Two-Speed Alternating Current Control*

A control for a two-speed driving-machine induction motor which is arranged to run at two different synchronous speeds either by pole changing of a single motor or by two different armatures.

3.9.3 *Rheostatic Control*

A system of control which is accomplished by varying resistance or reactance or both in the armature or field circuit or both of the driving-machine motor.

3.9.4 *Variable-Voltage Motor Control (Generator-Field Control)*

A system of control which is accomplished by the use of an individual generator for each lift wherein the voltage applied to the driving-machine motor is adjusted by varying the strength and direction of the generator field.

3.9.5 *Electronic Devices*

A system of control which is accomplished by the use of electronic devices for driving the lift motor at variable speed.

3.9.6 *Alternating Current Variable Voltage (ACVV) Control*

A system of speed control which is accomplished by varying the driving and braking torque by way of voltage variation of the power supply to the driving machine induction motor.

3.9.7 *Alternating Current Variable Voltage Variable Frequency (ACVVVF) Control*

A system of speed control which is accomplished by varying the voltage and frequency of the power supply to the driving machine induction motor.

3.9.8 *Solid-State d.c. Variable Voltage Control*

A solid-state system of speed control which is accomplished by varying the voltage and direction of the power supply to the armature of driving machine d.c. motor.

3.10 Counterweight

A weight or series of weights to counter-balance the weight of the lift car and part of the rated load.

3.11 Deflector Shieve

An idler pulley used to change the direction of a rope lead.

3.12 Door

3.12.1 *Door, Centre Opening Sliding*

A door which slides horizontally and consists of two or more panels which open from the centre and are usually so interconnected that they move simultaneously.

3.12.2 *Door, Mid-Bar Collapsible*

A collapsible door with vertical bars mounted between the normal vertical members.

3.12.3 *Door, Single Slide*

A single panel door which slides horizontally.

3.12.4 *Door, Two Speed Sliding*

A door which slides horizontally and consists of two panels, one of which moves at twice the speed of the other.

3.12.5 *Door, Vertical Bi-parting*

A door which slides vertically and consists of two panels or sets of panels that move away from each other to open and are so interconnected that they move simultaneously.

3.12.6 *Door, Vertical Lifting*

A single panel door which slides in the same plane vertically up to open.

3.12.7 *Door, Swing*

A swinging type single panel door which is opened manually and closed by means of a spring closer when released.

3.13 Door Closer

A device which automatically closes a manually-opened door.

3.14 Door Operator

A power-operated device for opening and closing doors.

3.15 Car Door Electric Contact

An electric device, the function of which is to prevent operation of the driving machine by the normal operating device unless the car door is in the closed position.

3.16 Electrical and Mechanical Interlock

A device provided to prevent simultaneous operation of both up and down relays.

3.17 Electro-Mechanical Lock

A device which combines in one unit, electrical contact and a mechanical lock jointly used for the landing and/or car doors.

3.18 Emergency Stop Push or Switch

A push button or switch provided inside the car designed to open the control circuit to cause the lift car to stop during emergency.

3.19 Floor Levelling Switch

A switch for bringing the car to level at slow speed in case of double speed or variable speed machines.

3.20 Floor-Selector

A mechanism forming a part of the control equipment, in certain automatic lifts, designed to operate controls which cause the lift car to stop at the required landings.

3.21 Floor Stopping Switch

A switch or combination of switches arranged to bring the car to rest automatically at or near any pre-selected landing.

3.22 Gearless Machine

A lift machine in which the motive power is transmitted to the driving sheave from the motor without intermediate reduction gearing and has the brake drum mounted directly on the motor shaft.

3.23 Goods Lift

A lift designed primarily for the transport of goods, but which may carry a lift attendant or other persons necessary for the loading or unloading of goods.

3.24 Guide Rails

The members used to guide the movement of a lift car or counterweight of goods.

3.25 Guide Rails

The members used to guide the movement of a lift car or counterweight in a vertical direction.

3.26 Guide Rails Fixing

The complete assembly comprising the guide rails bracket and its fastenings.

3.27 Guide Rails Shoe

An attachment to the car frame or counterweight for the purpose of guiding the lift car or counterweight frame.

3.28 Landing Call Push

A push button fitted at a lift landing, either for calling the lift car, or for actuating the call indicator.

3.29 Landing Door

The hinged or sliding porting of a lift well enclosure, controlling access to a lift car at a lift landing.

3.30 Landing Zone

A space extending from a horizontal plane 40 cm below a landing to a plane 40 cm above the landing.

3.31 Levelling Devices

3.31.1 *Levelling Device, Lift Car*

Any mechanism which either automatically or under the control of the operator, moves the car within the levelling zone towards the landing only, and automatically stops it at the landing.

3.31.2 *Levelling Device, One-Way Automatic*

A device which corrects the car level only in case of under-run of the car but will not maintain the level during loading and unloading.

3.31.3 *Levelling Device, Two-Way Automatic Maintaining*

A device which corrects the car level on both under-run and over-run, and maintains the level during loading and unloading.

3.31.4 *Levelling Device, Two-Way Automatic Non-maintaining*

A device which corrects the car level on both under-run and over-run but will not maintain the level during loading and unloading.

3.32 Levelling Zone

The limited distance above or below a lift landing within which the levelling device may cause movement of the car towards the landing.

3.33 Lift

An appliance designed to transport persons or materials between two or more levels in a vertical or substantially vertical direction by means of a guided car or platform.

3.34 Lift Car

The load-carrying unit with its floor or platform, car frame and enclosing bodywork.

3.35 Lift Landing

That portion of a building or structure used for discharge of passengers or goods or both into or from a lift car.

3.36 Lift Machine

The part of the lift equipment comprising the motor and the controlgear therewith, reduction gear (if any), brake(s) and winding drum or sheave, by which the lift car is raised or lowered.

3.37 Lift Pit

The space in the lift well below the level of the lowest lift landing served.

3.38 Lift Well

The unobstructed space within an enclosure provided for the vertical movement of the lift car(s) and any counterweight(s), including the lift pit and the space for top clearance.

3.39 Lift Well Enclosure

Any structure which separates the lift well from its surroundings.

3.40 Lifting Beam

A beam, mounted immediately below the machine room ceiling, to which lifting tackle can be fixed for raising or lowering parts of the lift machine.

3.41 Operation

The method of actuating the control of lift machine.

3.41.1 *Automatic Operation*

A method of operation in which by a momentary pressure of a button the lift car is set in motion and caused to stop automatically at any required lift landing.

3.41.2 *Non-Selective Collective Automatic Operation*

Automatic operation by means of one button in the car for each landing level served and one button at each landing, wherein all stops registered by the momentary actuation of landing or car buttons are made irrespective of the number of buttons actuated or of the sequence in which the buttons are actuated. With this type of operation, the car stops at all landings for which buttons have been actuated making the stops in the order in which the landings are reached after the buttons have been actuated but irrespective of its direction of travel.

3.41.3 *Selective Collective Automatic Operation*

Automatic operation by means of one button in the car for each landing level served and by up and down buttons at the landings, wherein all stops registered by the momentary actuation of the car made as defined under non-selective collective automatic operation, but wherein the stops registered by the momentary actuation of the landing buttons are made in the order in which the landings are reached in each direction of travel after the buttons have been actuated. With this type of operation, all 'up' landing calls are answered when the car is travelling in the up direction and all 'down' landing calls are answered when the car is travelling in the down direction, except in the case of the uppermost or lowermost calls which are answered as soon as they are reached irrespective of the direction of travel of the car.

3.41.4 *Single Automatic Operation*

Automatic operation by means of one button in the car for each landing level served and one button at each landing so arranged that if any car or landing button has been actuated, the actuation of any other car or landing operation button will have no effect on the movement of the car until the response to the first button has been completed.

3.41.5 *Group Automatic Operation*

Automatic operation of two or move non-attendant lifts equipped with power-operated car and landing doors. The operation of the cars is co-ordinated by a supervisory operation system including automatic dispatching means whereby selected cars at designated dispatching points automatically close their doors and proceed on their trips in a regulated manner. It includes one button in each car for each floor served and up and down buttons at each landing (single buttons at terminal landings). The stops set up by the momentary actuation of the car buttons are made automatically in succession as a car reaches the corresponding landings irrespective of its direction of travel or the sequence in which the buttons are actuated. The stops set up by the momentary actuation of the landing buttons may be accomplished by any lift in the group, and are made automatically by the first available car that approaches the landing in the corresponding direction.

3.41.6 *Car Switch Operation*

Method of operation by which the movement of lift car is directly under the operation of the attendant by means of a handle.

3.41.7 *Signal Operation*

Same as collective operation, except that the closing of the door is initiated by the attendant.

3.41.8 *Double Button (Continuous Pressure) Operation*

Operation by means of buttons or switches in the car and at the landings any of which may be used to control the movement of the car as long as the button or switch is manually pressed in the actuating position.

3.42 Operating Device

A car switch, push button or other device employed to actuate the control.

3.43 Overhead Beams

The members, usually of steel, which immediately support the lift equipment at the top of the lift well.

3.44 Over-Speed Governor

An automatic device which brings the lift car and/or counterweight to rest by operating the safety gear in the event of the speed in a descending direction exceeding a predetermined limit.

3.45 Passenger Lift

A lift designed for the transport of passengers.

3.46 Position and/or Direction Indicator

A device which indicates on the lift landing or in the lift car or both, the position of the car in the lift well or the direction or both in which the lift car is travelling.

3.47 Rated Load

The maximum load for which the lift car is designed and installed to carry safely at its rated speed.

3.48 Rated Speed

The means of the maximum speed attained by the lift car in the upward and downward direction with rated load in the lift car.

3.49 Retiring Cam

A device which prevents the landing doors from being unlocked by the lift car unless it stops at a landing.

3.50 Roping Multiple

A system of roping where, in order to obtain a multiplying factor from the machine to the car, multiple falls of rope are run around sheaves on the car or counterweight or both. It includes roping arrangement of 2 to 1, 3 to 1, etc.

3.51 Safety Gear

A mechanical device attached to the lift car or counterweight or both, designed to stop and to hold the car or counterweight to the guides in the event of free fall, or, if governor operated, of over-speed in the descending direction.

3.52 Sheave

A rope wheel, the rim of which is grooved to receive the suspension ropes but to which the ropes are not rigidly attached and by means of which power is transmitted from the lift machine to the suspension ropes.

3.53 Slack Rope Switch

Switch provided to open the control circuit in case of slackening of rope(s).

3.54 Suspension Ropes

The ropes by which the car and counterweight are suspended.

3.55 Terminal Slow Down Switch

A switch when accuated shall compulsorily cut off the high speed and switch on the circuitry to run the elevator in levelling speed before reaching on terminal landings.

3.56 Terminal Stopping Switch Normal

Switch for cutting all the energizing current in case of car travelling beyond the top or bottom landing or a switch which cuts off the energizing current so as to bring the car to a stop at the top and bottom level.

3.57 Terminal Stopping Device Final

A device which automatically cause the power to be removed from an electric lift driving-machine motor and brake, independent of the functioning of the normal terminal stopping device, the operating device or any emergency terminal stopping device, after the car has passed a terminal landing.

3.58 Total Headroom

The vertical distance from the level of the top lift landing to the bottom of the machine room slab.

3.59 Travel

The vertical distance between the bottom and top lift handing served.

3.60 Geared Machine

A machine in which the power is transmitted to the sheave through worm or worm and spur reduction gearing.

4 EXCHANGE OF INFORMATION

4.1 If the projected installation is within the scope of 7, the guidelines laid down together with Fig. 1, will enable the preliminary scheme for the installation to be established.

Although the recommended outline for the various classes of lifts given in 7 enables the general planning details to be determined by the architect, these should be finally settled, at the earliest possible stage, by detailed investigation with the purchaser's representative reaching agreement with the lift maker, where necessary, before an order is finally placed. This will enable a check to be made and information to be exchanged, on such vital matters as:

a) the number, capacity, speed and disposition of the lifts necessary to give adequate lift service in the projected building;

b) the provision of adequate access to the machine room;

c) the loads which the lift will impose on the building structure, and the holes to be left in the machine room floor and cut-outs for wall boxes for push-buttons and signals;

d) the necessity for and type of insulation to minimize the transmission of vibration and noise to other parts of the building;

e) the special requirements of local authorities and other requirements set out in the 'planning permit';

f) the need for the builder to maintain accuracy of building as to dimensions and plumbing;

g) the periods of time required for preparation and approval of relevant drawings for manufacturing and the installation of the lift equipment;

h) the requirements for fixing guide brackets to the building structure;

j) the time at which electric power will be required before completion to allow for testing;

k) the requirements for electrical supply feeders, etc;

m) the requirements for scaffolding in the lift well and protection of the lift well prior to and during installation of equipment; and

n) delivery and storage of equipment.

5 ESSENTIAL REQUIREMENTS

5.1 Conformity with *Lifts Act* and *Rules*

The installation shall be carried out in conformity with *Lifts Act* and *Rules* thereunder, wherever they are in force.

5.2 Conformity with *Indian Electricity Act* and *Rules*

All electrical works in connection with installation of electric lifts shall be carried out in accordance with the provisions of *Indian Electricity Act,* 1910 and the provisions of the *Indian Electricity Rules,* and shall also comply with the provisions of IS 732.

5.3 Conformity with Indian Standards

5.3.1 The lift shall conform to IS 14665 (Part 3 Sec 1).

5.3.2 All materials, fittings, appliances, etc, used in electrical installations shall conform to Indian Standard specifications wherever these exist. In case of materials for which Indian Standard specifications do not exist, the materials shall be approved by a competent authority.

5.4 Conformity with Fire Regulations

The installation shall be carried out in conformity with the local fire regulations and rules thereunder wherever they are in force.

5.5 Bottom and Top Car Clearances

5.5.1 *Bottom Car Clearance*

When the car rests on its fully compressed buffer, there shall be a vertical clearance of not less than 600 mm between the pit floor and the buffer striker plate or the lowest structural or mechanical part, equipment or device installed. This clearance shall be available beneath the whole area of the platform except for :

a) guide shoes or rollers, safety jaw blocks, platform aprons, guards of other equipment located within 300 mm, measured horizontally from the sides of the car platform; and

b) Compensating sheaves.

Provided that in all the cases, including small cars, a minimum clearance of 600 mm is available over a horizontal area of 800 mm × 500 mm.

Provided also that in all the cases, when the car rests on its fully compressed buffers, there shall be a vertical clearance of not less than 50 mm between any part of the car and any obstruction of device mounted in the pit.

5.5.2 *Top Car Clearance*

The vertical clearance between the car cross-head and the nearest overhead obstruction within 500 mm measured horizontally to the nearest part of the cross-head when the car platform is level with the top landing, shall be not less than the sum of the following:

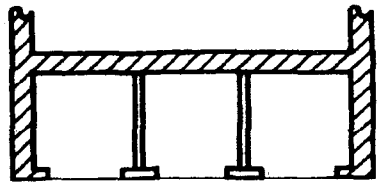
a) The bottom counterweight runby;

b) The stroke of the counterweight buffer used;

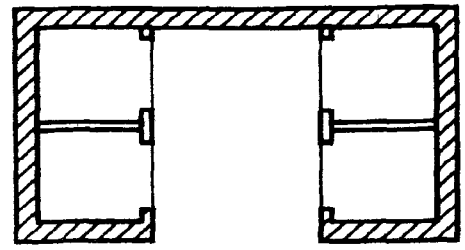
c) One-half of the gravity stopping distance based on:

1) 115 percent of the rated speed where oil buffers are used and no provision is made to prevent the jump of the car at counterweight buffer engagement, and

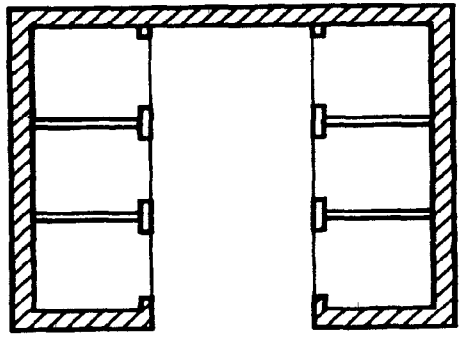
2) Governor tripping speed where spring buffers are used.



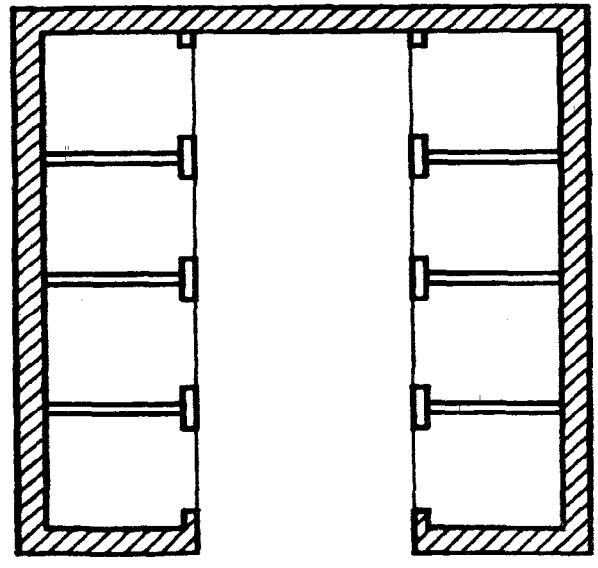
1A Straight Line Arrangement for Three Lifts



1B Alcove Arrangement for Four Lifts



1C Arrangement for Six Lifts



1D Arrangement for Eight Lifts

FIG. 1 ARRANGEMENT OF LIFTS

NOTE — The gravity stopping distance based on the gravity retardation from any initial velocity may be calculated according to the following formula :

$$S = 5.1\ V^2$$

where

S = free fall in cm (gravity stopping distance), and

V = initial velocity in m/s.

d) 600 mm.

Where there is a projection below the ceiling of the well and the projection is more than 500 mm, measured horizontally from the centre line of the cross-head, but over the roof of the car, a minimum vertical clearance not less than that calculated above shall also be available between the roof of the car and the projection.

Provided that the vertical clearance between any equipment mounted on top of the car and the nearest overhead obstruction shall be not less than the sum of the three items (a), (b) and (c) as calculated above plus 150 mm.

5.5.3 *Bottom Runby for Cars and Counterweights*

5.5.3.1 The bottom runby of cars and counterweights shall be not less than the following:

a) 15 cm where oil buffers are used.

b) Where spring-buffers are used:

1) 15 cm for controls as in **3.9.4** to **3.9.8,** and

2) not less than the following for controls as in **3.9.1** to **3.9.3**:

Rated Speed	*Runby*
m/s	cm
Up to 0.125	7.5
0.125 to 0.25	15
0.25 to 0.50	22.5
0.50 to 1	30

5.5.3.2 *Maximum bottom runby*

In no case shall the maximum bottom runby exceed the following:

a) 60 cm for cars, and

b) 90 cm for counterweights.

5.5.4 *Top Counterweight Clearances*

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

a) the bottom car runby,

b) the stroke of the car buffer used,

c) 15 cm, and

d) one-half the gravity stopping distance based on:

1) one hundred and fifteen percent of the rated speed where oil buffers are used and no provision is made to prevent jump of the counterweight at car buffer engagement, and

2) governor tripping speed where spring buffers are used.

5.6 In order to maintain a safe work environment, clear warning signs should be installed in all work areas to avoid potential hazards.

6 DIMENSIONAL TOLERANCES

6.1 Lift Well Dimensions

Plan dimensions of lift wells given by the lift maker represent the minimum clear plumb sizes. The purchaser's representative, in conjunction with the builder, should ensure that adequate tolerances are included in the building design so that the specified minimum plumb dimensions are obtained in the finished work.

Dimensions in excess of these minimum plumb dimensions for lift well and openings (but not less) can be accommodated by the lift maker up to certain maximum values, beyond which changes in design may be necessary involving additional expense or work by the builder. The purchaser's representative should take these factors into account when specifying the lift well structural dimensions on the basis of the constructional tolerance appropriate to the building technique.

6.2 Landing Door Openings

It is very important that finished landing openings should be accurate to design size, and plumb one above the other for the full travel of the lift. In constructing the structural openings in concrete walls to lift wells it is not possible to achieve a degree of accuracy vertically which will allow doors and frames to be inserted in the openings without some form of masking or packing to overcome inaccuracies. Provisions should, therefore, be made in design by increasing the nominal height from design finished floor level, and width of openings to each jamb and head.

In addition, the alignment of the outer face of the front wall of the lift well is of importance when architrave of fixed dimensions are called for, and in this case the alignment of the outer face from floor to floor should not vary to a greater extent than can be accommodate by the subsequent front wall finish, the architrave being set accurately plumb.

To facilitate accurate alignment of landing sills it is common practice to provide at each landing an

independent threshold, the position of which can be adjusted.

6.3 Structural Limits for Lift Wells at Any Level

If the net plumb well (dimensions *A* and *B* of Fig. 2) and the nominal structural entrance openings (dimensions *C* and *D* of Fig. 2) are defined by plumb lines, the actual wall should not encroach on these dimensions.

Dimension *K* (inside face of wall of Fig. 2) should fall within the following limits :

For wells up to 30 m	– 0 + 25 mm
For wells up to 60 m	– 0 + 35 mm
For wells up to 90 m	– 0 + 50 mm

When architrave are to be supplied by the lift maker dimension *L* (side of structural opening of Fig. 2) should fall within the limits of 0 and 25 mm and dimension *M* (outer face of the front wall of Fig. 2) should not vary to a greater extent than can be accommodated by the subsequent front wall finish, the architrave being set accurately plumb.

When entrance linings are supplied by the builder, corresponding provision should be made for the finished openings to be accurately plumb one above the other for the full travel of the lift end to design size.

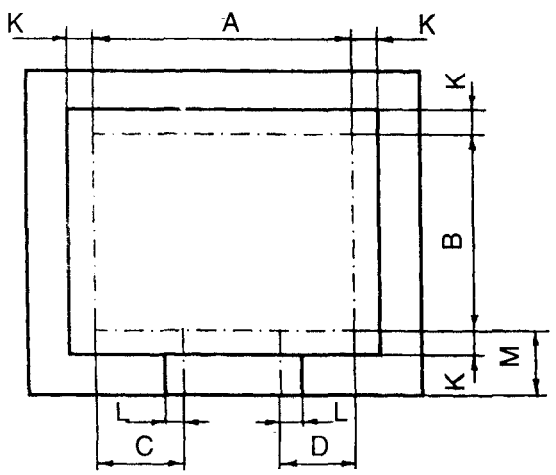


FIG. 2 LIFT WELL TOLERANCE

7 PRELIMINARY DESIGN

7.1 Number of Lifts and Capacity

7.1.1 Two basic considerations, namely, the quantity of service required and the quality of service desired, determine the type of lifts to be provided in a particular building. Quantity of service gives the passenger handling capacity of the lifts during the peak periods and the quality of service is measured in terms of waiting time of passengers at various floors. Both these basic factors require proper study into the character of the building, extent and duration of peak periods, frequency of service required, type and method of control, type of landing doors, etc. In busy cities, patience, coefficient being low, satisfaction cannot be obtained if lifts with adequate capacities and speeds are not provided. In view of many variables, no simple formula is possible for determining the most suitable lifts.

7.1.2 The number of passenger lifts and their capacities, that is load and speed, required for a given building depend on the characteristics of the building. The most important of these are:

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

b) the pitch of the floors;

c) the population of each floor to be served; and

d) the maximum peak demand. This demand may be unidirectional, as in up and down peak periods, or a two-way traffic movement.

It should be appreciated that all calculations on the traffic handling capabilities of lifts are dependent on a number of factors which vary according to the design of lift and the assumptions made on passenger actions. It follows, therefore, that the result of such calculations can only be put to limited use of a comparative nature. For instance, they can with advantage be used to compare the capabilities of lifts in a bank with different loads and speeds provided the same set of factors are used for all cases. On the other hand, they cannot be used to compare the capabilities of different makes of lift used for a given bank of lifts.

Different authorities and manufacturers differ widely in their methods of calculation, due to the variations in lift performance, especially with regard to rates of acceleration and deceleration and door operation times, which form the components of performance time. Therefore, the calculations made by different organizations will not necessarily agree.

7.2 Preliminary Lift Planning

7.2.1 *General*

Methods of calculating the traffic handling capabilities of lifts were first devised for office buildings. In due course detailed modifications were devised to suit other applications without altering the basic principles. The application to office buildings is still the most frequently used.

Therefore, the following general method may be used as general guidance on preliminary lift planning for offices, bearing in mind the differences set out in the last paragraph of **7.1.2.**

A lift installation for office building is normally designed to populate the building at a given rate and the three main factors to be considered are:

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

b) handling capacity or the maximum flow rate required by these people,

c) interval or the quality of service required.

7.2.2 *Population*

The first point to be ascertained from the eventual occupier is the total building population and whether this is likely to increase in the future.

If a definite population figure is unobtainable an assessment should be made from the net area, and probable population density. Average population density can vary from about one person per 4 m^2 to one person per 20 m^2. It is essential, therefore, that some indication of the probable population density should be obtained from the building owner. If no indication is possible (a speculative development for example) population in the region of 5 m^2 per person for general office buildings is usually assumed.

7.2.3 *Quantity of Service*

The quantity of service is a measure of the passenger handling capacity of a vertical transportation system. It is measured in terms of the total number of passengers handled during each five-minute peak period of the day. A five-minute base period is used as this is the most practical time over which the traffic can be averaged. The passenger handling capacity should be approximately 10 percent to 15 percent of the estimated population that has to be handled in the building in five minutes for diversified tenancy office building and 15 percent to 25 percent for single purpose occupancy office building. For residential buildings, 7.5 percent is sufficient.

7.2.4 *Quality of Service*

The quality of service on the other hand is generally measured by the passenger waiting time at the various floors. The following shall be the guiding factor for determining this aspect:

Quality of Service or Acceptable Interval	
20 to 25 seconds	Excellent
30 to 35 seconds	Good
34 to 40 seconds	Fair
45 seconds	Poor
Over 45 seconds	Unsatisfactory

NOTE — For residential buildings, longer intervals should be permissible.

7.2.5 *Traffic Peaks*

The maximum traffic flow during the morning peak period is usually use as a measure of the vertical transportation requirement in an office building. The employees of all offices are subject to discipline and are required to be at their place in time. Consequently, the incoming traffic flow is extremely high and the arrival time is over a short period.

Sometimes it becomes necessary to reduce the maximum traffic flow by staggering the arrival of the employees so that different groups arrive at different times. This reduces the peak and also the requirement of lifts. However, many organizations may object to staggering and prefer to have all employees arrive at the same time since it is claimed that staggering will affect the proper co-ordination of business.

7.2.6 *Capacity*

The minimum size of car recommended for a single purpose buildings is one suitable for a duty load of 884 kg. Generally, for large office buildings cars with capacities up to 2 040 kg are recommended according to the requirements.

7.2.7 *Speed*

It is dependent upon the quantity of service required and the quality of service desired (*see* **7.2.3** and **7.2.4**). Therefore, no set formulae for indicating the speed can be given. However, the following general recommendations are made:

No. of Floors	*Speed*
4 to 5	0.5 to 0.75 m/s
6 to 12	0.75 to 1.5 m/s
13 to 20	Above 1.5 m/s

7.2.8 *Layout*

The shape and size of the passenger lift car bears a distinct relation to its efficiency as a medium of traffic handling. A study of the most suitable proportions for these lifts reveal that the width of the lift well entrance is, in reality, the basic element in the determination of the best proportions. In other words, the width of the car is determined by the width of the entrance, and the depth of the car is regulated by the loading per square metre permissible under this standard. Centre opening doors are the most practicable and the most efficient entrance units for passenger lifts.

7.2.9 *Determination of Transportation or Handling Capacity During the Morning Peak*

7.2.9.1 The handling capacity is calculated by the formula:

$$H = \frac{300 \times Q \times 100}{T \times P}$$

where

H = handling capacity as the percentage of the peak population handled during 5 min period,

Q = average number of passengers carried in a car,

T = waiting interval, and

P = total population to be handled during peak morning period. (It is related to the area served by a particular bank of lifts.)

The value of 'Q' depends on the dimensions of the car. It may be noted that the car is not loaded always to its maximum capacity during each trip and, therefore, for calculating 'H' the value of 'Q' is taken as 80 percent of the maximum carrying capacity of the car.

The waiting interval is calculated by the formula:

$$T = \frac{RTT}{N}$$

where

T = waiting interval;

N = number of lifts, and

RTT = round trip time, that is, the average time required by each lift in taking one full load of passengers from ground floor, discharging them in various upper floors and coming back to ground floor for taking fresh passengers for the next trip.

RTT is the sum of the time required in the following process:

a) Entry of the passengers on the ground floor,

b) Exit of the passengers on each floor of discharge,

c) Door closing time before each starting operation,

d) Door opening time on each discharging operation,

e) Acceleration periods,

f) Stopping and levelling periods,

g) Periods of full rated speeds between stops going up, and

h) Periods of full rated speeds between stops going down.

It is observed that the handling capacity is inversely proportional to waiting interval which in turn is proportional to RTT. Reducing the RTT of a lift from 120 to 100 s increases its handling capacity by 20 percent.

The round trip time can be decreased not only by increasing the speed of the lift but also by improving the design of the equipment related to opening and closing of the landing and car doors, acceleration, deceleration, levelling and passenger movement. These factors are discussed below:

a) The most important factor in shortening the time consumed between the entry and the exit of the passengers to the lift car is the correct design of the doors and the proper car width. For comfortable entry and exit for passengers it has been found that most suitable door width is 1 000 mm and that of car width is 2 000 mm.

b) The utilization of centre opening doors has been a definite factor in improving passenger transfer time, since when using this type of door the passengers, as a general rule, begin to move before the doors have been completely opened. On the other hand, with a side opening door the passengers tend to wait until the door has completely opened before moving.

The utilization of centre opening doors also favours the door opening and closing time periods. Given the same door speed, the centre opening door is much faster than the side opening type. It is beyond doubt that the centre opening door represents an increase in transportational capacity in the operation of a lift.

7.2.9.2 An example illustrating the use of the above consideration is given below:

Gross area per floor = 1 100 m^2

Net usable area per floor = 950 m^2

No. of landings including ground = 15

Assuming population density = 9.5 m^2 per person

Probable population in 14 upper floors = $P = \frac{14 \times 950}{9.5}$ = 1 400 persons

Taking 20 passengers lift with 2.5 m/s the calculated RTT = 165 s

Q $= 20 \times 0.8 = 16$

a) Taking No. of lifts N $= 4$

$$T = \frac{RTT}{N} = \frac{165}{4} \qquad = 41 \text{ s}$$

$$H = \frac{300 \times Q \times 100}{T \times P} \qquad = \frac{300 \times 16 \times 100}{41 \times 1\,400}$$

$= 8.3$ percent

b) Taking No. of lifts N $= 6$

$$T = \frac{165}{6} \qquad = 27.6 \text{ s}$$

$$H = \frac{300 \times Q \times 100}{T \times P} \qquad = \frac{300 \times 16 \times 100}{27.6 \times 1\,400}$$

$= 12$ percent

7.3 Quite Operation of Lifts

Every precaution should be taken with passenger lifts to ensure quiet operation of the lift doors and machinery. The insulating of the lift machine and any motor generator from the floor by rubber cushions, or by a precast concrete slab with rubber cushions, prevents transmission of most of the noise. Some recommendations, useful in this connection are given in IS 1950.

7.4 Position of Machine Rooms

It will be noted that all lifts conforming to IS 14665 (Part 3/Sec 1), have machine rooms immediately over the lift well, and this should be arranged whenever possible without restricting the overhead distance required for normal safety precautions.

Alternative machine positions should only be considered when there are special reasons justifying the additional cost, such as headroom restrictions imposed by the planning authority for lifts serving the top floor.

It is desirable that emergency exit may be provided in case of large machine rooms having four or more elevators.

7.5 Goods Lifts

Normally, goods lifts have lower speeds than passenger lifts for the same travel, because traffic conditions are less demanding, and more time is required for loading and unloading.

As loads for goods lifts increase in size and weight, so the operation of loading and unloading becomes more difficult. Therefore, it is usual to require greater accuracy of levelling as the capacity of the goods lift increases.

A large capacity goods lift at high speed is often a very uneconomical preposition. The inherent high cost is enhanced due to the very small demand for such equipment, much of which is custom made. The high capital cost of the lift, building work and electrical supply equipment usually shows a much smaller return as an investment than more normal sizes of lifts.

8 POWER AND CONTROL SYSTEMS

8.1 Features Associated with Power Systems

8.1.1 *Industrial Switchgear*

Switchgear for controlling lift power systems is characterized by its high duty cycle and its high rupturing capacity. Switchgear must be robust enough and shall be so designed as to withstand the high duty cycle and high rupturing capacity introduced during the operation of the lifts.

8.1.2 *Flameproof Equipment*

Because of the complications involved in the use of flameproof equipment, the power and the control systems should be as simple as possible. If possible, the machine room should be arranged in such a way that normal equipment can be used.

8.1.3 *Levelling Accuracy*

The levelling tolerances given in IS 14665 (Part 3/ Sec 1) are those which can be reasonably expected between no load and full load in either direction.

Where greater levelling accuracy is required, careful examination should be made to see whether such increased precision is justified or practical. Advice should also be obtained, as additional apparatus and cost may be involved, and in some cases the requirement may not be practicable.

8.1.4 *Corrective Levelling*

This should only be used when it is impossible otherwise to achieve the required levelling tolerances, or on long travel lifts to maintain the required levelling tolerances during loading and unloading. Generally, a.c. motors are not suitable for corrective levelling except for certain special power systems using auxiliary levelling motors.

8.1.5 *Levelling with Variable Voltage*

A variable voltage system is one using continuous regulation which minimizes speed differences due to load variation. Therefore, the actual levelling speed is of less importance than the general refinement of its regulation control. In fact no levelling speed as such may be identifiable.

8.1.6 *Overload Tests*

A lift is designed to operate and transport the contract load at the required duty cycle, and should not, by

intention, or habitually, be used to carry overloads. During test, as a safeguard to cover variable supply and temperature conditions, a lift is checked for the car to complete one round trip with contract load plus 10 percent at nominal supply voltage and nominal ambient temperature. There is also a static test with contract load plus 25 percent to check that the brake will sustain the car.

It is unnecessary to specify and additional overload test or capacity, and in fact it is detrimental to the normal running efficiency and safety of the lift to do so.

8.1.7 *Occasional Extra Load*

It is not good practice to request that a lift should be designed to carry an occasional extra load. It is tantamount to specifying an excessive overload test which is detrimental to the normal running efficiency and safety of the lift.

8.2 Description of Operation Systems

8.2.1 *Methods of Control Systems*

The methods of control systems are as follows:

a) Attendant and dual control (*see* **8.2.2**), and

b) Automatic push button operation (*see* **8.2.3**).

8.2.1.1 *Types of control systems*

The types of control systems are as follows:

a) Collective control (*see* **8.2.4**);

b) Single push button collective control (*see* **8.2.5**);

c) Down collective control (*see* **8.2.6**);

d) Directional collective control for one car (*see* **8.2.7**);

e) Directional collective control for two or three cars (*see* **8.2.8**); and

f) Group supervisory control (*see* **8.2.9**).

Features of control systems are described in **8.3.**

8.2.2 *Attendant and Dual Control*

Type of operation whereby the attendant directly controls the movement of the car by means of a handle operated switch or push buttons. The car switch operation, signal operation and the attendant feature of dual operation, generally form part of this. Dual operation is the type where there is a provision for both automatic control and attendant operation, the transfer of operation being achieved by a key operated switch in the car. Due to improvements in automatic operation, these types are sparingly used with the exception of an automatic with attendant operation.

It is, however, possible to add a car preference feature to all current types of operation system (*see* **8.3.2**).

8.2.3 *Automatic Control*

Automatic control is a method of operation by which a momentary pressure on a push button sets the car in motion and causes it to stop automatically at any required lift landing. This is the simplest control system and it is sometimes referred to as push button control.

A car answers a landing or car call whichever is actuated first by momentary pressure, provided the lift is not in use. Momentary pressure of a car push button will send the car to the designated floor. The car always responds to a car push button in preference to a landing push button.

With this type of control, a RED landing signal light or direction arrow indicates that the car is in use, that is the lift is travelling.

This type of control is recommended for the following applications:

a) A single passenger lift serving up to 4 floors.

b) Goods lifts serving any number of floors, where it is usually the most suitable form of control.

For special purposes, the following two systems may be considered:

a) Despatch from landings as an additional feature for a goods lift with manually operated doors. The call is registered by pressing the car push button and when the doors are closed the car will travel to the designated floor.

b) Automatic, with attendant control as an additional feature on goods lifts with a key operated switch in the car to transfer the control from normal automatic to attendant operation. There is also a visual call indicator with buzzer in the car to indicate to the attendant the landing floors at which push buttons have been pressed when the car is under attendant control.

8.2.4 *Collective Control*

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

Collective control of any form is usually not suitable for goods lifts, except where loading is not expected to fill the car and additional loads can be taken at other stops.

8.2.5 *Single Push Button Collective Control*

Single push button collective control has a single push button at each landing. It is recommended, as the direction in which it is desired to travel cannot be registered by the intending passenger.

8.2.6 *Down Collective Control*

Down collective is a control system where landing calls are registered from a single push button, irrespective of the car being in motion or the landing door being open, and calls are stored until answered. Any number of car calls can be registered and the car will stop in sequence in the down direction at each of the designated floors. The car will travel in the up direction to the highest call registered, stopping only in response to car calls. It will then travel downwards answering calls in floor sequence. If only one call has been registered the car travels to the floor of call.

This system is suitable where there is traffic between the ground and upper floors only, and no interfloor traffic. Two or three car banks have interconnected control.

With this type of control the following signals are included:

a) A landing signal light indicates that the call has been registered and will be answered.

b) Illuminated car position indicator above car entrance.

8.2.7 *Directional Collective Control for One Car*

Directional collective control for one car is a control system having UP and DOWN push buttons at intermediate landings whereby the call is registered for the intended direction of travel. Calls from the car or landing push buttons are registered and stored until answered. The car will answer calls in floor sequence in one direction of travel. Calls for the opposite direction of travel are answered when the direction of travel is reversed. If only one call has been registered the car travels to the floor of call.

This system is suitable for single lifts serving 4 or more floors with interfloor traffic, such as small office blocks, hotels and blocks of flats.

With this type of control the following signals are included:

a) A landing signal light for each landing push button indicates that the call has been registered and will be answered.

b) Illuminated car position indicator above the entrance in the car.

c) Arrow shaped signal lights in the back of the car or on the landing to indicate to the entering person in which direction the car is going to depart.

8.2.8 *Directional Collective Control for Two or Three Cars*

Directional collective control for two or three cars is a system covering a control in which the two or three cars in a bank are interconnected. One push button unit with UP and DOWN push buttons are required at each landing and the call system is common to all lifts. If, for architectural balance, in the case of a three car bank, extra push button units are required, these should be specified. Each landing call is automatically allocated to the best placed car. The control is designed so that cars are effectively spaced and thus give even service. When a car reaches the highest floor to which there is a call, its direction of travel is automatically reversed when it next starts. One or more cars will return to the parking floor

Automatically bypassing of landing calls when a car is fully loaded is an essential feature for three-car banks. It is also necessary for two-car banks in offices. Other cars will continue to provide service to all floors.

When three-car banks serve 7 or 8 floors and over, some form of automatic supervisory control (as described in **8.2.9**) is generally necessary in the interests of efficiency.

With this type of control the following signals are included:

a) A landing signal light for each landing push button indicated that the call has been registered and will be answered.

b) Illuminated car position indicator above the entrance in the car.

c) Arrow shaped signal lights in conjunction with an audible single stroke gong are required above each landing entrance to indicate to the waiting person(s) which car is going to stop and in which direction it will continue its course.

For light traffic conditions, two cars having arrow shaped signal lights in the back of each car or on the landing to indicate to the entering person in which direction the car is going to depart, can be used as an alternative.

8.2.9 *Group Supervisory Control*

A bank or group of intensive traffic passengers lifts requires a supervisory system to co-ordinate the operation of individual lifts which are all on collective control and are interconnected.

The very nature of intensive service calls for a sophisticated automatic supervisory control system so as to match the speed capacity of these lifts.

The supervisory system regulates the despatching of individual cars and provides service to all floors as different traffic conditions arise, minimizing such

unproductive factors as idle cars, uneven service and excessive waiting time. The system will respond automatically to traffic conditions, such as UP and DOWN peaks, balanced or light traffic, and provides for other specialized features.

If desired, a master station can be provided in the lift lobby which gives, by indicators, visual information regarding the pattern under which the system is operating. Where the system is based on a definite programme, control means are provided for altering the type of traffic programme. There are other facilities, such as the removal of any lift from service.

8.3 Features of Operation Systems

8.3.1 *List of Features for Operation System*

Features covered are:

a) Car preference (*see* **8.3.2**),

b) Landing call automatic bypass (*see* **8.3.3**),

c) Motor generator shut down (*see* **8.3.4**),

d) Basement service (*see* **8.3.5**),

e) Hospital service (*see* **8.3.6**),

f) Manually closed doors (*see* **8.3.7**),

g) Automatically power closed doors (*see* **8.3.8**),

h) Controlled power closed doors (*see* **8.3.9**),

j) Safe operation of doors (*see* **8.3.10**),

k) Director service (*see* **8.3.11**),

m) Indication of car at landing (*see* **8.3.12**),

n) Service switches (*see* **8.3.13**),

p) Fire switch (*see* **8.3.14**), and

q) Push buttons and signals (*see* **8.3.15**).

8.3.2 *Car Preference*

Sometimes it is necessary to give a special personal service or a house service. When this service is required and for whatever purpose, it should be specified as 'car preference'. The transfer from normal passenger control to 'car preference' is by a key operated switch in the car. The operation is then from the car only and the doors remain open until a car call is registered for a floor destination. All landing calls are bypassed and car position indicators on the landings for this lift are not illuminated. The removal of the key when the special operation is completed restores the control to normal service.

8.3.3 *Landing Call Automatic Bypass*

For collective operation, automatic bypassing of landing calls can be provided. This device will bypass landing calls when a car is fully loaded but the calls are not cancelled.

8.3.4 *Motor Generator Shut Down*

Lifts controlled by variable voltage system automatically shut down when subject to an over-riding control which puts them out of service under certain conditions; for example, no demand for lift service. They are automatically put back into service as required.

8.3.5 *Basement Service*

For lifts with collective control when service is required below the main parking floor, which is usually the ground floor, to a basement and/or a sub-basement, the lift maker should be informed of the type of service required, as special technical considerations are then usually necessary.

8.3.6 *Hospital Service*

Lifts for carrying beds and stretchers require a 'car preference' switch so than an attendant can have complete control of the car when required. This requirement should be specified as 'car preference' and it will function as described in **8.3.2.** Otherwise such lifts can have the same control systems as for normal passenger lifts, the choice depending on the number of floors served, the service required and the number of lifts.

8.3.7 *Manually Operated Doors (Without Closers)*

A 'door open' alarm should be provided to draw attention to a car or landing door which has been left open.

8.3.8 *Automatically Power Closed Doors*

For passenger operation when the car arrives at a landing the doors will automatically open and then close after lapse of a time interval. This time interval can be overruled by the pressure of a push button in the car to give instant door closing.

An 'open door' push button is provided in the car to reverse closing motion of the doors or hold them open.

8.3.9 *Controlled Power Closed Doors*

When there are conditions that particularly affect the safety of passengers or damage to vehicles or trucks, the closing of the doors should only be made by the continuous pressure of push buttons in the car or on landings.

A 'door open' alarm should be provided to draw attention to a car or landing door which has been left open. This means of operation is required for some forms of goods lifts.

8.3.10 *Safe Operation of Doors*

The safety of passengers passing through lift entrances is fully covered by the provision of IS 14665 (Part 3/ Sec 1). No modification of these provisions should be specified.

8.3.11 *Director Service*

There are many forms of giving special service for individuals, but they should always be avoided. They range from key operated switches at preferred landings to the complete segregation of one out of a bank of lifts. It is obvious that any preferential treatment of this nature can seriously jeopardize the efficiency of the service as a whole. When a bank of say three lifts is installed to meet the anticipated traffic requirements, and then, when the building is occupied, one lift is detached permanently for directors' service, the traffic handling can be reduced by a half rather than a third.

When preferential service is imperative, then the car preference feature should be available (*see* **8.3.2**).

8.3.12 *Indication of Car Arrival*

As all lift cars are illuminated when available (in service), it is recommended that this illumination be used to signal the arrival of a car at a landing in preference to special signals such as LIFT HERE signs since signal lamps can fail when the lift is still operating satisfactorily.

The following is the practice adopted for vision panels in doors:

a) For lifts with manually operated car and landing doors, vision panels are provided in all doors;

b) For lifts with power operated car doors and manually operated landing doors, vision panels are provided in the landing doors only;

c) For lifts with automatically opened car and landing doors, no vision panels are required; and

d) When vision panels are provided they should comply with the requirements of IS 14665 (Part 3/Sec 1).

8.3.13 *Service Switches*

When switches are provided to take cars out of service, that is because the remaining cars in the group can cater for the required passenger traffic, it is essential that such switches should not stop the fireman's control from being operative in the event of the lift being designated as a fireman's lift. Service switches should not be confused with maintenance switches, which are only used when it is dangerous to attempt to operate the lift because maintenance work is actually in progress. A control station fitted on top of the car is regarded as a maintenance switch.

8.3.14 *Fire Switch*

When required by the fire authority a fire switch has to be provided, the function of which is to enable the fire authority to take over the complete control of one or more lifts in an installation [*see* IS 14665 (Part 3/Sec 1)].

8.3.15 *Push Buttons and Signals*

It is most important that the purpose of every push button and signal should be clearly understood by all passengers.

8.4 Electrical Installation Requirements

8.4.1 *General*

IS 14665 (Part 3/Sec 1) states the requirements for main switches and wiring with reference to relevant regulations. The lift maker should specify, on a schedule, particulars of full load current, starting current, maximum permissible voltage drop, size of switches and other details to suit requirements. For multiple lifts a diversity factor may be used to determine the cable size and should be stated by the lift manufacturer.

It is important that the switches at the intake and in the machine room which are provided by the electrical contractor are the correct size, so that correctly rated HRC fuses can be fitted. No form of 'NO VOLT' trip relay should be included anywhere in the power supply of the lift.

The lift maker should provide overcurrent protection for power and control circuits, either on the controller or by a circuit breaker, but the following are not included in the contract:

a) *Power supply mains* – The lift sub-circuit from the intake room should be separate from other building service.

   Each lift should be capable of being isolated from the mains supply. This means of isolation should be lockable.

b) For banks of interconnected lifts, a separate sub-circuit is required for the common supervisory system, in order that any car may be shut down without isolating the supervisory control of the remainder.

c) *Lighting* – Machine rooms and all other rooms containing lift equipment should be provided with adequate illumination and with a switch fixed adjacent to the entrance. At least one socket outlet, suitable for lamps or tools, should be provided in each room.

The supply to the car light should be from a separate circuit, and controlled by a switch in the machine room. For multiple lifts with a common machine room a separate supply should be provided for each car. The car lighting supply should be independent of the power supply mains.

Plug should be provided with a light, the switch for which should be in the lift well, and accessible from the lower terminal floor entrance.

When the alarm system is connected to a transformer or trickle charger, the supply should be taken from the machine room lighting.

8.4.2 *Electric Wiring and Apparatus*

8.4.2.1 All electrical supply lines and apparatus in connection with the lift installation shall be so constructed and shall be so installed, protected, worked and maintained that there may be no danger to persons therefrom.

8.4.2.2 All metal casings or metallic coverings containing or protecting any electric supply lines of apparatus shall be efficiently earthed.

8.4.2.3 No bare conductor shall be used in any lift car as may cause danger to persons.

8.4.2.4 All cables and other wiring in connection with the lift installation shall be of suitable grade for the voltage at which these are intended to be worked and if metallic covering is used it shall be efficiently earthed.

8.4.2.5 Suitable caution notice shall be affixed near every motor or other apparatus in which energy is used at a pressure exceeding 250 V.

8.4.2.6 Circuits which supply current to the motor shall not be included in any twin or multicore trailing cable used in connection with the control and safety devices.

8.4.2.7 A trailing cable which incorporates conductors for the control circuits shall be separate and distinct from that which incorporates lighting and signalling circuits in the case of buildings less than 30 m in height. In the case of building more than 30 m in height or where high speed lifts (1.52 m/s or more) are employed, use of single travelling cable for lighting and control circuits is permitted, provide that all conductors are insulated for the maximum voltage found in the cable.

8.4.3 *Emergency Signal or Telephone*

It is recommendatory that lift car be provided either with an emergency signal that is operative from the lift car and audible outside the lift well or with a telephone.

When an alarm bell is to be provided, each car is fitted with an alarm push which is wired to a terminal box in the lift well at the ground floor by the lift maker. This alarm bell, to be supplied by the lift maker (with indicator for more than one lift), should be fixed in an agreed position and wired to the lift well. The supply may be from a battery (or transformer) fixed in the machine room or, when available, from the building fire alarm supply.

When a telephone is to be provided in the lift car the lift maker should fit the cabinet in the car and provided wiring from the car to a terminal box adjacent to the lift well. Where a telephone is to be connected to an outgoing switchboard, a post office type should be fitted (for which a rent is charged).

The type of telephone should be stated in the enquiry.

8.4.4 *Earthing*

8.4.4.1 The terminal for the earthing of the frame of the motor, the winding machine, the frame of the control panel, the cases and covers of the tappet switch and similar electric appliances which normally carry the main current shall be at least equivalent to a 10 mm diameter bolt, stud or screw. The cross-sectional area of copper earthing conductor shall be not smaller than half that of the largest current-carrying conductor subject to an upper limit of 65 mm^2 (*see also* IS 3043).

8.4.4.2 The terminal for the earthing of the metallic cases and covers of door interlocks, door contacts, call and control buttons, stop buttons, car switches, limit switches, junction boxes and similar electrical fittings which normally carry only the control current shall be at least equivalent to a 5 mm brass screw, such terminal being one specially provided for this purpose, and the earth conductor shall be at least equivalent to a 7/0.750 mm conductor.

8.4.4.3 The earthing conductor shall be secured to earthing terminal in accordance with the recommendations made in IS 3043 and also in conformity with the latest provisions of *Indian Electricity Rules.*

8.4.4.4 The exposed metal parts of electrical apparatus installed on a lift car shall be sufficiently bonded and earthed.

8.4.4.5 Where screwed conduit screws into electric fittings carrying control current making the case and cover electrically continuous with the conduit, the earthing of the conduit may be considered to earth the fitting. Where flexible conduit is used for leading into a fitting, the fitting and such length of flexible conduit shall be effectively earthed.

8.4.4.6 One side of the secondary winding of bell transformers and their cases shall be earthed.

9 MACHINE / EQUIPMENT GUARDING

All open rotating parts shall be effectively guarded from accidental or incidental contact.

9.1 Pit Stop Switch Accessible from Landing and Pit

All pits must be equipped with an emergency stop switch which is easily accessible from the lowest landing and the pit floor. If more than one switch is required, two switches must be wired in series.

9.2 Pit Ladder

Where pit floor is greater than 1 300 mm below the lowest landing sill, a pit ladder must be used.

9.3 Pit Counter Weight Protection

A physical means of protection must be provided to prevent accidental contact with the counter weight and rope compensation sheave.

9.4 Stop Switch in Split-Level Machine Room

Stop switches shall be provided in split-level or separated machine room to have sufficient control over moving equipment.

9.5 Stop Switches for Machine Below Installations

Stop switches shall be provided at convenient locations for all lift installations other than machine above to have sufficient control over moving equipment.

10 CONDITIONS FOR OPTIMUM PRACTICE

10.1 General

The subjects covered are as follows:

a) Application of rope compensation (*see* **10.2**);

b) Lift entrance operation (*see* **10.3**);

c) Painting at works and on site (*see* **10.4**);

d) Special environments (*see* **10.5**);

e) Ventilation of machine rooms (*see* **10.6**);

f) Lighting and treatment of walls and floors, etc (*see* **10.7**);

g) Stairwell enclosures (*see* **10.8**);

h) Car door locks (*see* **10.9**);

j) Handwinding release procedure and installation (*see* **10.10**); and

k) Guide shoes (*see* **10.11**).

10.2 Application of Rope Compensation

The purpose of rope compensation is to minimize the out-of-balance rope tension on the driving sheave with the car at any position in the lift well due to the weight of suspension ropes and travelling cables.

Unless this weight relationship is minimized for long travel lifts, the traction between suspension ropes and driving sheave may create a dangerous situation by being deficient or excessive.

Rope compensation may be used for any travel, but it is usually only necessary for travels over 30 m.

For slow speed lifts only, that is below 2.5 m/s, chains can be used as the means of compensation.

For speeds of 2.5 m/s and above, steel wire rope should be hung between car and counterweight, passing round an idler tension pulley in the lift pit.

For speeds above 3.5 m/s it is necessary to use a lock-down arrangement of idler tension pulley to prevent the counterweight jumping with application of car safety gear.

A switch should be provided to the idler tension pulley in the lift pit to isolate the control circuit should the normal operating condition be disturbed.

10.3 Lift Entrance Operation

10.3.1 *General*

Every lift journey involves two horizontal movements, in and out of the car, to one vertical movement. The type of door, and the operation of the doors, play a major part in the service given, and should receive careful consideration.

10.3.2 *Goods Traffic*

Most types of goods traffic require relatively longer loading and unloading times and manual doors are frequently used for economy and simplicity.

Power operation can be applied, especially for large entrances, to give automatic opening; the doors then always open fully, reducing the risk of damage. For many types of goods traffic, it is preferable for the closing, though powered, to be controlled by continuous pressure button, rather than being automatically initiated [*see* IS 14665 (Part 3/Sec 1)].

For heavy duty lifts, a power operated vertically sliding door is preferred; this can be made extremely robust, and is capable of extension to very large entrances.

10.4 Painting at Works and on Site

Lift equipment with normally receive a protective coat of paint at works before despatch to site. Further painting of lift equipment will be necessary, and is normally in the form of a finishing coat and can take place on site. Alternatively, the further painting of the equipment may be carried out at works as a finishing coat with normal touching up after site erection as may be necessary.

Any additional painting, due to site conditions during erection and/or final operating conditions in the premises, is subject to negotiation between the lift maker and the purchaser.

Decorative finishes are a subject for separate negotiation.

10.5 Special Environments

Standard lift equipment is suitable for use inside normal residential, commercial and industrial buildings but where unusual environments are likely to be

encountered, the advice of the lift maker should be sought at the earliest possible stage to enable the most economic satisfactory solution to be found. Special mechanical protection and/or electrical enclosures may be necessary as well as compliance with statutory or other regulations and with the purchaser's particular requirements, which should be fully considered at the time of enquiry.

Examples of situations which necessitate special consideration are:

a) exposure to weather, for example, car parks;

b) low temperatures, for example, cold stores;

c) high temperatures, for example, boiler plant;

d) hosing-down, for example, for hygiene or decontamination;

e) corrosive atmosphere, for example, chemical works;

f) dusty atmospheres, for example, boiler plant and flour mills; and

g) explosive atmospheres, for example, gas plant.

10.6 Ventilation of Machine Rooms

Machine rooms shall be ventilated. They shall be such that the motors and equipment as well as electric cables etc, are protected as far as possible from dust, harmful dusts and humidity. The ambient temperature in the machine room shall be maintained between + 5°C and +40°C.

10.7 Lighting and Treatment of Walls, Floors, Etc

10.7.1 All machine rooms should be considered as plant space, and conditions provided to permit reliable operation of electrical switchgear and rotating machinery, and be conducive to good maintenance.

Lighting should be provided to give at least 200 lux around the controller and machine. The machine room walls, ceiling and floor should be faced in dust-resisting materials, tiles, etc, or painted as a minimum to stop dust circulation which otherwise could damage rotating machinery and cause failure of switchgear. Machine rooms should also be weatherproof and if ventilation louvers are provided they should be designed and sited to prevent snow being driven through or to the apparatus.

10.7.2 Lift wells should be constructed to be weatherproof and of a dustfree surface material or should be painted to minimize dust circulation on to moving apparatus and from being pumped by the car movement into machine rooms or on to landings.

Lighting should be provided at the top and bottom of each lift well for safety of maintenance personnel when stopping on to lift car tops or into lift pits.

10.7.3 Should a lift entrance open out into an area exposed to the weather the entrance should be protected by a suitable canopy and the ground level sloped up to the lift entrance to prevent during rain or surface drainage from entering the lift well through the clearances around the landing doors. Any push buttons so exposed should be of weatherproof type.

10.8 Stairwell Enclosures

The location of lifts in stairwells is not recommended.

The use of stair stringers for fixing of guides normally involves extensive site measurement in order to fabricate purpose-made brackets. The resulting attachments are often unreliable and lacking in robustness. For stairwells of normal width, the span required for the lift machine support beams is excessive and, unless uneconomic sections are used, the deflections under varying load adversely affect the motion of the lift.

The necessary provision of suitable continuous enclosures can be very expensive.

10.9 Car Door Locks

10.9.1 It shall not be possible under normal operation to open a car door whilst the car is in motion.

It is undesirable to specify and further restriction on the possibility of opening the car door.

If the car is stopped away from floor level through power supply failure, fault conditions or maintenance operation, the possibility of opening the car door easily from within the car is beneficial for a number of reasons, as follows:

a) Car ventilation is increased and if, as is often the case, the car door opening partially overlaps a landing opening, claustrophobic conditions are lessened.

b) In some cases passengers may be released through the restricted opening available by unlocking the landing door with the release key. Even if this is not possible, communication may be improved, aid given and panic averted.

c) In circumstances, such as fire, rescue should be facilitated by minimizing obstruction as far as is compatible with safety requirements.

10.10 Handwinding Release Procedure and Indication

The release procedure by handwinding should only be carried out in an emergency and by authorized persons who have received the necessary instruction, because it is dangerous for any other persons to attempt to do so.

Before attempting to move the car, it is imperative that any person in the car be warned of the intention to move the car, and that they do not attempt to leave the car until they are advised that it is safe to do so. Any failure to carry out this precaution may render the person concerned guilty of negligence should an accident occur.

Before attempting to handwind the lift machine, it is vital that the supply is switched off at the main switch.

It is usually necessary to have two persons in the machine room; one to operate the brake release and the other to carry out the handwinding. The exceptions are small lift machines where the handwinding and brake release equipment are so located that they can be easily controlled by one man, and larger machines which need two men to operate the handwinding alone with an additional man to control the brake release.

If the car is stuck in the lift well and cannot be moved when an attempt is made to move it in a downward direction, then no attempt at handwinding should be made because the car safety gear may have set. Any further procedure should be carried out under the instruction of a qualified lift mechanic.

Provided the car is free to be moved in the downward direction, then it should be hand wound to the nearest floor. There is a preference to move the car in a downward direction. However, this may not always be practical owing to the distance involved and the time taken to complete the movement. In addition the amount of out of balance load on the counterweight side, due to the size of car and the small number of persons inside it, may make it necessary to wind the car upwards. In the case of higher speed lifts the direction of handwinding will usually be governed by the effort required to move the car because of the absence of a large gear reduction ratio.

It is essential that all detail operations be carried out according to the manufacturer's instructions for the lift concerned, and these should be clearly stated and permanently displayed in the form of a notice in the machine room.

10.11 Guide Shoes

The following comments will facilitate the correct application of the various types of guide shoe available.

Goods lifts have a relatively heavy reaction between guide shoe and guide. For this reason roller guide shoes are not suitable for goods lifts, so sliding guide shoes should be used.

For passenger lifts, including bed lifts, sliding or roller guide shoes may be used.

Roller guide shoes can be used for lifts with geared machines, but sliding guide shoes have the advantage that they tend to smooth out vibrations in the car due to gear motion.

For installations with a high mechanical efficiency, such as gearless lifts, roller guide shoes are preferable. Sliding guide shoes can be used but they have a variable coefficient of friction due to variations in the state of lubrication.

Roller guide shoes have the advantage of not requiring any lubrication the guides and so promote cleanliness and reduce the fire risk. On the other hand, they require some provision for horizontal movement of the car, and generally cost more than sliding shoes. The risk of noise from the roller/ball bearings in roller guide shoes is reduced by increasing the diameter of the roller for the higher speed lifts. For 5.0 m/s the roller diameter for car and counterweight should be not less than 250 and 150 mm, respectively, and for 2.5 m/s, 150 and 75 mm, respectively.

Sliding guide shoes for speeds exceeding 1.0 m/s should be resiliently mounted, and self-aligning with automatic lubrication. For lower speeds, solid adjustable guide shoes are sufficient with grease lubricant applied manually to the guide.

11 LIFT ENQUIRY OR INVITATION TO TENDER

11.1 General

A period of four weeks is normally sufficient for return of tenders. This should be extended if large numbers of lifts or special requirements are involved.

The enquiry documents should be kept to the essential minimum, and should be strictly confined to material relevant to the lift work and to the particular project concerned.

The following list indicates the data needed by the lift maker when lifts are selected. When building restrictions, or special types of load, preclude the use of lifts complying with this standard, data additional to the following will be needed according to the particular circumstances:

a) Identification of lift;

b) IS outline reference and type;

c) Contract load and speed;

d) Lift travel and floor-to-floor heights;

e) Location and designation of levels served;

f) Electricity supply (voltage, etc);

g) Power system (*see* **8**);

h) Control system and indicators (*see* **8.2**);

j) Additional items (*see* **11.2**);

k) Finishes (*see* **11.3**);

m) Inclusions and exclusions (*see* **11.4**); and

n) Site programme (*see* **11.5**).

11.2 Additional Items

The enquiry should state any additional items required beyond those specified in IS 14665 (Part 3/Sec 1), such as fireman's control, radio interference suppression and dismantling of existing lift, etc.

Lifts to be installed in adverse conditions, such as chemical works, lifts used with power trucks, and similar specialized applications, require individual consideration according to the circumstances.

11.3 Finishes

Finishes should be specified at the enquiry stage, or provisional sums should be included for them.

Finishes to be considered may include; car bodywork, ceiling, floor, light fitting, ventilation, trims, car and landing doors, including vision panels if required, landing architrave push and indicator fittings, car and landings.

11.4 Inclusions and Exclusions

A number of peripheral items are associated with a lift installation, of which some should always be provided by the builder, and some are best included by the lift maker. The requirements vary to some extent with the type of installation.

It is important that the limits of responsibility are clearly understood , and the enquiry documents should be specific in this respect.

The lift maker should include such items as

a) Guide brackets and wall inserts;

b) Buffers and any associated steelworks;

c) Pit screen to counterweight;

d) Steel beams of raft for machine and pulleys;

e) Sound insulation to machine where this is required;

f) Doors;

g) Door tracks;

h) Supporting steelworks for horizontal sliding doors and frames for hinged doors;

j) Wiring materials for the lift itself, starting from the supplies furnished by the purchaser;

k) Overcurrent protection (type to be specified) (*see* **8.4.1**);

m) Alarm push and bell or telephone (*see* **8.4.3**);

n) Lifting tackle and small electric tools for use during the actual installation;

p) Services of erection staff to install and wire;

q) Services of testing engineer, and provision of the necessary instruments and test weights; and

r) Guarantee of equipment.

The lift maker should exclude the supply and fixing of such items as the following:

a) Builders' work, such as forming lift well, pit and machine room, and building in wall inserts;

b) Machine room floor including any reinforcement necessary for load bearing;

c) Lifting beams in machine room where necessary;

d) Steel surrounds for vertical bi-parting sliding doors;

e) Any necessary tanking, lining or reinforcement of the pit;

f) Dividing beams for multiple wells, and inter-well pit screens;

g) Temporary guarding of openings;

h) Scaffolding, planks and ladders;

j) Off-loading and storage of materials;

k) Cutting away and making good;

m) Site painting of steel work, etc;

n) Working lights, temporary and permanent electricity supplies, etc; and

p) Mess rooms, sanitary accommodation and welfare facilities.

For more detailed discussion of the requirements for site preparation and work by other trades, reference should be made to IS 14665 (Part 3/Sec 1), and to other clauses of this standard, such as **6, 8.4** and **13**.

Apart from the items referred to in the preceding clauses, which are common to almost all lift installations, the following shall apply :

a) Sill support members with toeguards are included as part of the complete doors entrance except for general purpose goods lifts, for which the builder should supply the sill support; and

b) Architrave, or finish surrounds to doors : if of metal, these should be provided by the lift maker, with back filling by the general contractor and if of timber by the joinery contractor.

As referred to in **11.5**, facilities for the use of the main contractor's crane should be provided to assist in installing heavy equipment, in addition to other unloading facilities on site in the course of erection. The main contractor should be instructed to include these facilities in his own quantities.

Where the lift maker agrees to use mobile platforms in place of lift well scaffolding, the general contractor should provide 400/440 V 4-phase and 200/220 V single-phase supply in the lift shaft to operate such equipment, the supply to terminate at the position in the lift well required by the lift maker.

These mobile platforms are limited in use for erection personnel and the transportation of light equipment only, but use of a crane will also be necessary to assist in the installation of the heavy machinery and also in the initial installation of the mobile platform equipment.

11.5 Site Programme

The enquiry should indicate as accurately as possible the contract programme as it affects the lift maker, in particular the target date for lift completion, and the date when the lift site will be prepared and the availability of a crane.

12 ACCEPTANCE OF TENDER AND SUBSEQUENT PROCEDURE

12.1 General

The procedure indicated below particularly relates to the most usual case, where the lift maker is a sub-contractor.

12.2 Order

The main contractor is instructed to place an order with the selected lift maker. If alternative schemes have been offered, the order should clearly indicate which has been accepted.

12.3 Programme

As noted in **11.5** the programme should have been indicated as accurately as possible at the time of enquiry. At the time of order, the programme for manufacture and installation of the lift should be agreed.

The programme should cover each lift separately, including dates such as:

a) the order date,

b) the date when the lift site will be ready,

c) the date for provision of lift electricity supplies, and

d) the lift completion date.

The period between order and delivery of materials falls into two stages; first the finalizing of details, and secondly the actual production of the equipment, when depends on the first stage. Within the first stage, other dates may need to be considered, such as:

a) all relevant building information available,

b) submission of lift maker's drawings,

c) approval of drawings, and

d) final selection of finishes.

Information relevant to programming the site work can be found in other clauses of this standard, such as in **13** and **14**.

12.4 Drawings

Following order, the lift maker should supply drawings showing builder's work required, together with point loadings. To enable these to be prepared, the purchaser's representative should furnish the relevant detail building drawings.

12.5 Approval of Drawings

The purchaser's representative should give written approval of the drawings (after modification if necessary), at the same time asking for such additional copies (up to five of each drawing) as he requires for distribution to other parties concerned.

12.6 Selection of Finishes

Where the contact provides for the purchaser's choice of decorative finishes, colours, etc, the decisions should be communicated by the purchaser's representative as early as possible, and preferably not later than the time of approval of drawings.

12.7 Electricity Supplies to Lift

Operation of the machine under power is required from a comparatively early stage of installation for the most efficient working, and supplies should be furnished accordingly. Whilst temporary supplies may be sufficient for erection purposes, final testing and setting up can only be carried out with the permanent supplies connected. For this reason the timely provision of the permanent supplies is important.

13 CO-ORDINATION OF SITE WORK

13.1 Preparatory Work on Site

It is customary for the lift maker to make periodic visits to the site before his starting date to check progress on the lift well construction and discuss relevant matters with the contractor. The lift maker should assure himself that all building work has been completed in accordance with his requirements.

Immediately before the time for lift erection to commence the lift maker should check that site conditions are fit to permit erection to proceed.

Building work to be completed before lift erection starts includes the following:

a) Pit, lift well and machine room complete and weathertight. Pit dry and watertight, including tanking if necessary and clear of rubbish.

NOTE — In certain system buildings, and buildings of over 10 floors, it may be necessary by prior agreement to start erection before the top portion of the lift well has been constructed, in which case the general contractor should temporarily deck out and waterproof.

b) Preparation for lift fixings in pit, lift well and machine room complete. If built-in wall inserts are used, these should be placed accurately and slots cleared of any seepage of concrete.

c) Steelwork items finally grouted or otherwise fixed in position after checking for correct position by the lift maker (for example lift well trimmers and machine beams).

d) Scaffolding in position, as arranged with the lift maker; lift well, etc, properly fenced and guarded in accordance with current regulation.

e) Entrance preparations completed, including preparations for door frames, push boxes and indicators. In many cases, progress can be facilitated by omitting the front walls of the lift well until the lift car, doors, etc, are installed.

f) Datum line (in elevation) established at each floor to enable the lift maker to set metal sills and frames in relation to finished floor levels.

13.2 Delivery of Material

The lift maker should advise the contractor when equipment is ready for despatch, so that the contractor can make arrangements on site to receive and unload with appropriate hoisting tackle, slings and supports, as near as possible to the lift well.

13.3 Storage

Adequate provision should be made by the building contractor for storing, protecting and preserving against loss, deterioration or damage, all material on the site. Attention is drawn to the adverse affect of damp conditions on electrical equipment and on steel wire ropes.

13.4 Site Meetings

For the successful progress of the work, full co-operation among all parties is essential, and on large sites it will be found that regular meetings of such parties are beneficial. Programmes for the constructional work in that part of the building containing the lift should be made in consultation among all parties concerned.

13.5 Service of Other Trades

The lift erector will require the services of joiners, bricklayers and other trades as the work proceeds, and it is essential that the lift erector should give due notice to the building contractor of the demands to be made on other trades, so that he can plan accordingly.

13.6 Scaffolding, Fencing, Etc

Scaffolding timbers, rollers and similar items required for the unloading and erection of the lift, and also for the proper guarding and close fencing of the lift well should be provided, erected and maintained by the building contractor.

The lift well should not be used as a means of disposal for rubbish from the upper floors. Such practice is dangerous.

The lift well should be handed over to the lift contractor complete, and no other trades should be allowed to work above or below during the whole time of erection of the lift, except by arrangement with the lift contractor.

13.7 System Building Sites

If the building programme allows insufficient time for lift erection in conventional fashion after the well is completely built special procedures are needed. This applies particularly to industrialized multi-storey buildings.

Methods differ in detail. In most cases however the building contractor's crane is used to lower and position pre-assembled batches of lift equipment into the progressively rising top of the lift well.

The building contractor should provide a suitable portable cover to the completed portion of the lift well in order to protect the lift erectors working below against the weather and falling objects.

When the top of the well has been reached it is normal to cap it immediately with a precast load bearing floor slab on to which is lowered the pre-assembled machine room equipment. It then remains for the building contractor to complete and weatherproof the machine room as swiftly as possible.

On all such projects as these the closest co-operation between the building contractor and the lift maker is essential.

13.8 Connecting to Power Supply

The lift maker should give prior warning to the building contractor of the date the power supply to the lift is required, so that suitable arrangements for connection can be made.

14 PROCEDURE FOLLOWING TEST, INCLUDING INSPECTION AND MAINTENANCE

14.1 Acceptance

The purchaser should make timely arrangements for accepting the lift on completion of test, and for insurance cover. Special arrangements (*see* **14.4**) are necessary if there is to be an interval before the lift goes into normal service.

14.2 Guarantee and Servicing

Any guarantee provided by the lift maker should be conditional upon the lift receiving regular and adequate servicing, and should cover the free replacement of parts which prove defective through reasons of faulty materials or workmanship in the guarantee period, which is generally twelve months.

To ensure the continuance of satisfactory and safe operation, the purchaser (or building occupier) should arrange for the completed lift to receive regular servicing by competent persons at such intervals as the type of equipment and intensity of operation demand. Such service can be secured under a service contract. It is desirable and normal for the lift maker to be entrusted with the servicing during the guarantee period of a new lift.

The scope of a service contract may be extended to cover not only regular servicing, but also intermediate service calls, repairs and replacement of worn parts.

The building owner should co-operate with the service engineer, and should ensure that the equipment is properly used, and that unauthorized persons are not permitted to enter the lift well or machine rooms.

Particular attention should be paid to methods of ensuring that lifts are not overloaded when they are used in connection with furniture and equipment removals, and internal redecoration and other similar activities which may be undertaken within the building.

14.3 Statutory Examinations

Lifts in certain premises are required by statutory regulations to be examined at intervals, as specified by the *Lift Act,* by a competent person, who is required to report on a prescribed form. Such reports should normally be kept in a register.

Statutory examinations are not a substitute for servicing; the provision of statutory reports may be specially included in a service contract or may be arranged separately.

14.4 Lift not in Immediate Use (Shut Down Maintenance)

When conditions do not permit a lift to be taken into normal service immediately following completion and acceptance, it should be immobilized. The main contractor should take effective precautions against damage especially to finishes, or damage to equipment from dampness and builder's debris, until such time as the lift is required.

A separate service contract should be made with the lift maker to make regular visits during this period, to inspect, lubricate and report on the condition of the lift.

A date should also be agreed with the lift maker from which his guarantee period will commence.

14.5 Temporary Use of Lifts

If the purchaser intends to permit temporary use of a lift by some other party, such as the building contractor, before taking it into normal service, so that it is not immobilized, then the responsibilities of those concerned should be clearly defined and agreed. In addition to the precautions noted in **13.4**, temporary insurance cover should be arranged.

If temporary use of lifts is envisaged, it should preferably be given consideration at an early stage, having regard to the conditions under which it is likely to take place.

14.6 Cleaning Down

Acceptance following test should include checking the condition of decorative finishes, before the lift maker leaves the site.

After a shut down (or temporary service) period, the lift may require a further general cleaning down immediately before taking into normal service. The lift maker should be instructed accordingly to undertake this work and if any accidental damage has occurred, to repair this at the same time. Both these items should be the subject of extra costs.

15 GENERAL INFORMATION TO BE GIVEN WITH INQUIRY AND ORDER

15.1 When enquiring for or ordering an electrical lift in accordance with this standard, the particulars given below shall be supplied :

Particulars of List

1) Passenger or goods .....
2) Number of lifts required .....
3) Load : number or persons ..... kg .....
4) Rated speed ..... m/s ..... contract speed ..... m/s
5) Travel..... m
6) Serving ..... floors ..... entrances .....

7) Names of floors served .....

8) Method of control .....

9) Position of machine room .....

10) Size of lift well .....

11) Position of counterweight .....

12) Internal size of lift car .....

13) Construction, design and finish of car bodywork .....

14) Car entrances :

a) Number, size and type of doors.

b) Car open in front only or open through or opening on adjacent sides.

c) Power or manual operation.

15) Car light .....

16) Call indicator ..... Position indicator in car .....

17) Landing entrances :

a) Number, size and type of doors, gates or shutters.

b) Location of landing entrances in different floors, if the car has more than one opening.

18) Electric supply :

Power ..... volts ac/dc .....
Phase .....

Cycles ..... Wire system .....

19) Is neutral wire available for control circuit ?

20) Lighting ..... volts ac/dc ..... Cycles .....

21) Are premises subject to *Lifts Act/Rules* ? .....

22) Proposed date for commencement on site .....

23) Proposed date for completion .....

24) Additional items, if required, ...

25) Booklet giving complete details of maintenance schedule and circuit diagram where so specified .....

15.2 The following items are usually excluded from the lift contract:

a) Builder's work, such as cutting away and making good.

b) Lift well enclosure (landing doors are usually included in the contract).

c) Overhead beams, or other steel work or the drilling of any steel work.

d) Scaffolding.

e) Temporary guarding of lift well.

f) Power and lighting cables to lift machine room and lighting cables to half-way point in lift well.

g) Main switch(s) and fuse(s) or circuit breaker(s) in machine room and main switches and fuses for isolating main cables to machine room(s).

h) Surveyor's or other professional fees.

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Indian Standard

ELECTRIC TRACTION LIFTS

PART 2 CODE OF PRACTICE FOR INSTALLATION, OPERATION AND MAINTENANCE

Section 2 Service Lifts

1 SCOPE

1.1 This standard (Part 2/Sec 2) covers the essential requirements, design considerations, testing and precautions to be exercised during installation of service lifts (dumb waiters) operated by electric power so as to ensure safe and satisfactory performance.

It also provides guidance for proper maintenance after installation.

1.2 This standard applies to service lifts (dumb waiters) as defined in IS 14665 (Part 3/Sec 2) and does not apply to platforms, motor vehicle lifts, amusement devices, skip hoists, conveyors or similar apparatus used for raising, pilling or tiring.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
732 : 1989	Code of practice for electrical wiring installation (*third revision*)
14665 (Part 2/Sec 1): 2000	Electric traction lifts: Part 2 Code of practice for installation, operation and maintenance, Section 1 Passenger and goods lifts
14665 (Part 3/ Sec 1 and 2) : 2000	Electric traction lifts: Part 3 Safety rules, Section 1 Passenger and goods lifts, Section 2 Service lifts
(Part 4/Sec 3) : 2000	Components, Section 3 Lifts carframe, car, counterweight and suspension
(Part 4/Sec 6) : 2000	Lift doors and locking devices and contacts

3 TERMINOLOGY

3.1 For the purpose of this standard, definitions given in IS 14665 (Part 2/Sec 1) and IS 14665 (Part 3/Sec 2) shall apply.

4 EXCHANGE OF INFORMATION

4.1 Purchaser in consultation with consulting engineer shall furnish to the lift manufacturer at the time of enquiry a set of drawings, giving details of available dimensions and requirements such as :

a) Size and position of lift well with particulars of its enclosures;

b) Number of floors to be served including vertical distance between floors;

c) Position of machine room including provision of access and general layout showing ventilation, etc;

d) Size, position, number and type of landing doors;

e) Total head room; and

f) Depth of pit.

4.1.1 The purchaser should provide the following additional drawings:

a) Size and position of any trimmer joists or stanchions adjacent to the lift well at each floor;

b) Size and position of supporting steel work at roof level; and

c) Size and position of any footings or grillage foundations, if these are adjacent to lift pits.

4.1.2 Purchaser should also supply to the lift manufacturers, particulars of requirements in accordance with IS 14665 (Part 3/Sec 2).

4.2 Builders Work

Preliminary information regarding supporting steel work, builders work, cutting away and making good, should also be available on request.

5 ESSENTIAL REQUIREMENTS

5.1 Conformity with *Lifts Act* and *Rules*

The installation shall be generally carried out in conformity with the safety provisions of relevant *Lifts Act* and *Rules* thereunder, wherever they are in force when such installations are in residential buildings and public places.

5.2 Conformity with *Factory Act* and *Rules*

The installations shall be generally carried out in conformity with provisions of *Factories Act*, 1948 as amended from time to time and Rules thereunder, wherever they are in force when such installations in factories are coming under the purview of *Factories Act*.

5.3 Conformity with Indian *Electricity Act* and *Rules*

All electrical work in connection with installation of electric service lift shall be carried out in accordance with the provisions of *Indian Electricity Act*, 1910 and the latest provisions of *Indian Electricity Rules* and shall also comply with the provisions of IS 732.

5.4 Conformity with Indian Standards

5.4.1 The service lift shall conform to IS 14665 (Part 3/Sec 2).

5.4.2 All materials, fittings, appliances, etc, specified in IS 14665 (Part 3/Sec 2) shall conform to Indian Standard specifications, wherever they exist. The materials shall be approved by a competent authority.

5.5 Lift Wells

5.5.1 No equipment except that forming a part of the service lift or necessary for its maintenance shall be installed in the lift well.

5.5.2 The internal surface of service lift well, so far as practical, shall be kept flush.

5.5.3 Sufficient space shall be provided between the guides for the car and the side walls of the lift well enclosure to allow safe and easy access to the parts of the safety gears for their maintenance and repairs; if such safety gears are provided in accordance with IS 14665 (Part 3/Sec 2).

5.5.4 Lift wells, together with the whole of the contained equipment and apparatus, shall be rendered fire-resisting to the greatest possible extent.

5.5.5 In case of a completely enclosed lift well, with solid landing doors, a notice with the word 'Service Lift' shall be placed outside each landing door.

5.5.6 Every counterweight shall travel in juxtaposition to its car in the same lift well.

5.5.7 It is undesirable that any room passage or thoroughfare be permitted under any lift well. If unavoidable then the pit floor should be strong enough to withstand the impact of free falling loaded car or counterweight.

5.6 Lift Pits, Bottom Clearance and Top Clearance

5.6.1 A lift pit shall be provided at the bottom of every service lift from the loading level of the lowest landing.

5.6.2 Pits shall be soundly constructed and maintained in a dry and clean condition. Where necessary, provision shall be made for permanent drainage.

5.6.3 Where pit depth exceeds 1.5 m, suitable access shall be provided by a cat ladder or any other suitable device and a light point and switch shall also be provided for facility of maintenance and repair work.

5.6.4 *Top and Bottom Clearances for Car and Counterweights*

5.6.4.1 *Top car clearance*

The top car clearance shall be sufficient to avoid any protruding part fixed on the top of the car coming in direct contact with the ceiling or diverting sheave.

The clearance shall be calculated taking into account the following and shall not be less than the sum of the following four items :

a) The bottom counterweight runby,

b) The stroke of the counterweight buffer used,

c) The dimensions of the portion of the diverting sheave hanging underneath the ceiling in the lift well, and

d) 15 cm for compensating for gravity stopping distance and future repairs to the rope connections at counterweight and at the car or at the suspension points.

5.6.4.2 *Bottom car clearance*

The bottom car clearance shall be maintained in such a way that the counterweight shall not come in contact with the ceiling or any part hanging underneath the ceiling, when the car completely rests on fully compressed buffers, provided the buffers are spring type mounted on solid concrete or steel bed.

In case of wooden buffers the bottom car clearance shall be maintained in such a way that the total downward travel of the car from the service level of the immediate floor near the pit, shall not be more than the top counterweight clearance, when the wooden buffers are completely crushed.

5.6.4.3 *Top counterweight clearance*

The top clearance for the counterweight can be calculated taking into account the following and shall not be less than the sum of the following three items:

a) Car runby,

b) Compression of the buffer spring or height of the wooden block used as buffer, and

c) 15 cm to compensate for gravity stopping distance for counterweight and any future repairs to rope connections at the counterweight at the car ends or at the suspension points.

5.6.5 *Runby for Cars and Counterweights*

5.6.5.1 The bottom runby for cars and counterweights shall not be less than 15 cm.

5.6.5.2 *Maximum bottom runby*

In no case shall the maximum bottom runby exceed 30 cm.

5.7 Lift Well Enclosures

5.7.1 Lift well enclosures shall be provided and shall extend on all sides from floor to floor or stair to stair.

5.7.2 The inner sides of the lift well enclosures facing any car entrance shall, as far as practicable, form a smooth, continuous flush surface devoid of projections or recesses.

5.7.3 Where an open lift well would increase the fire risk in a building, the lift well enclosures shall be of fire resisting construction.

5.7.4 Where wire grill or similar construction is used, the mesh or opening shall be such that the opening between the bars shall reject the ball of 30 mm in diameter and the lift well enclosure shall be of sufficient strength to resist accidental impact by users of the staircase of adjoining floors or by materials or trucks being moved in the vicinity.

5.7.5 Where the clearance between the inside of an open type lift well enclosure and any moving or movable part of the lift equipment of apparatus is less than 5 cm, the opening in the enclosure shall be further protected by netting of square mesh of aperture not greater than 1 cm and of wire not smaller than 1 mm (the provision in this clause need not be adhered to for lift wells in factory premises, coming under the purview of *Factories Act*. In such cases provision of **5.7.4** is sufficient).

5.7.6 There shall be no opening in the service lift well enclosure permitting access to the service lift car by passing under the counterweight.

5.7.7 *Indicators*

Where service lifts are installed in totally enclosed wells, car arrival or position indicator and direction arrow or IN USE indicators should be installed on each landing along with operation push buttons.

5.7.8 *Landing Doors*

Every service lift well shall, on each side from which there is access to a car, be fitted with a door. Such a door shall be fitted with efficient electromechanical locking so as to ensure that it cannot be opened except when the service lift car is at landing and that the service lift car cannot be moved away from the landing until the door is closed and locked. If the door is mechanically locked, means should be provided for opening the same by means of special key during emergency or inspection.

5.7.9 *Automatic Devices for Cutting Off Power*

An efficient automatic device shall be provided and maintained in each service lift whereby all power shall be cut off from the motor before the car or counterweight lands on the buffers.

5.8 Service Lift Cars

5.8.1 Where necessary doors shall be provided to service lift cars [*see* IS 14665 (Part 3/Sec 2)].

5.9 Locking Devices for Landing Doors and Shutters

5.9.1 The system of landing door or shutter interlocks shall be of the kinds as provided in IS 14665 (Part 4/Sec 6).

5.9.2 The design of the locking system shall be such that reasonable wear between working parts does not permit interference with the operation of the lift by movement of the lock handles.

5.10 Suspension Ropes

The provisions of IS 14665 (Part 4/Sec 3) shall apply.

5.11 Sheaves and Pulleys

Provision of IS 14665 (Part 3/Sec 2) shall apply.

5.12 Counterweight

Provision of IS 14665 (Part 4/Sec 3) and IS 14665 (Part 2/Sec 1) shall apply.

5.13 Motor Room and Overhead Structures

5.13.1 The service lift machine controller and all other apparatus and equipment of the same, excepting such apparatus and equipment as function in the lift well or other positions shall be placed in the motor room which shall be adequately lighted and rendered fireproof and weatherproof.

5.13.2 The secondary sheaves, pulleys, floor selecting equipment may be placed in a place other than the motor room but such position shall be adequately lighted and rendered fireproof and weatherproof.

5.13.3 The machine room floor shall be designed and constructed to carry safely at any point the heaviest portion or unit of equipment both during erection and for maintenance purpose.

5.13.4 The machine room shall be kept closed except to those concerned with the operation and maintenance of machinery or equipment.

5.13.5 The machine room shall be equipped with an insulated portable hand lamp provided with flexible cord for examining the machinery.

5.13.6 If any machine room floor or platform does not extend to the enclosing walls, the open sides shall be provided with hand rails or otherwise suitably guarded.

5.13.7 The machine room shall be provided with access doors opening outwards.

5.13.8 The machine room shall not be used as a store room or for any purpose other than housing the lift machinery and its associated apparatus and equipment.

5.13.9 All machines, pulleys, and similar units shall be so supported and held as to prevent any of these machines or parts thereof becoming loose or displaced affecting their safe working. Supporting beam shall be of steel or reinforced concrete.

5.13.10 There shall be direct access to the service lift machine room.

5.13.11 The height of the machine room shall be sufficient to allow any portion of equipment to be accessible and removable for repair and replacement, and shall be not less than 1.2 m clear from the floor.

5.13.12 The total load on the overhead beams shall be assumed as equal to all equipment resting on the beams plus twice the maximum load suspended from the beams.

5.13.13 The factor of safety for all overhead beams and supports based on ultimate strength of the material and load in accordance with **5.13.12** shall be not less than the following :

For steel	5
For reinforced concrete	7

The deflection of the overhead beams under the maximum static load calculated in accordance with above shall not exceed 1/1 500 of the span.

5.14 Housing of Overhead Pulleys

The penthouse or other space in which overhead pulleys, are housed shall have a clear height of at least 1.0 m and shall allow safe and convenient access and where practicable, have a substantial platform or floor and be provided with permanent and adequate artificial illumination.

5.15 Buffers

5.15.1 Buffers shall be placed symmetrically with respect to the centre of gravity of the lift car within a tolerance of ±5 cm and shall be so arranged, that the service lift car, in ordinary circumstances of operations cannot strike them.

5.15.2 The buffers shall be fitted under counterweight, similar to those specified for service lift cars and arranged symmetrically below the weight.

5.16 Safety Gear Test

Provisions of IS 14665 (Part 2/Sec 1) shall apply.

5.17 Slack Rope Switch

Provisions of IS 14665 (Part 2/Sec 1) shall apply.

6 ELECTRICAL WIRING AND APPARATUS

6.1 Provisions of IS 14665 (Part 2/Sec 1) shall apply.

7 POSITIONING OF MACHINE ROOM

7.1 Provisions of IS 14665 (Part 2/Sec 1) shall apply.

7.2 Structural Consideration

7.2.1 Lift well enclosures, lift pits, machine room and machine supports besides conforming to the essential requirements in **5**, should form part of the building construction and comply with the lift manufacturer's drawings.

7.2.2 *Machine Room*

Floors shall be designed to carry a load of not less than 350 kg/m^2 over the whole area and also any load which may be imposed thereon by the equipment used in the machine room or by any reaction from such equipment both during periods of normal operation and repair.

7.2.3 The side wall of the service lift well may be made of reinforced cement concrete at least 7.5 cm thick so as to provide satisfactory anchoring arrangement for the guides.

7.3 Access to Machine Room and Lift Pits

Safe and convenient access to every machine room shall be provided. Access to the machine room above a lift well may be either from the roof or by an internal staircase or by a removable ladder with a proper arrangement for fixing.

7.4 Fire Protection

Provisions of IS 14665 (Part 2/Sec 1) shall apply.

7.5 Quite Operation

Provisions of IS 14665 (Part 2/Sec 1) shall apply.

7.6 Supply Cables and Switches

Provisions of IS 14665 (Part 2/Sec 1) shall apply.

8 TESTING

8.1 Test shall be carried out in accordance with IS 14665 (Part 3/Sec 1).

9 RUNNING AND MAINTENANCE

9.1 Provision of IS 14665 (Part 2/Sec 1) shall apply.

ANNEX A
(*Foreword*)

COMMITTE COMPOSITION

Lifts and Escalators Sectional Committee, ET 25

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(*Continued from second cover*)

New Series	*Superseding*
Section 5 Lift retiring cam	10448 : 1983 Retiring cam for passenger and goods lifts
Section 6 Lift doors and locking devices and contacts	7759 : 1975 Lift door locking devices and contacts and 11633 : 1986 Lift doors
Section 7 Lift machines and brakes	10913 : 1984 Brakes for electric passenger and goods lifts
Section 8 Lift wire ropes	–
Section 9 Controller and operating devices for lifts	–
Part 5 Inspection manual	–

This standard does not cover outline dimension of lift wells, lift pits and other layout dimensions necessary for lift installation. These are covered in IS 14665 (Part 1).

Indian Standard specification for safety rules for electric passenger, goods and service lifts IS 14665(Part3/Sec 1 and 2) prescribes the constructional and safety requirements and methods of tests for electric passenger, goods and service lifts. This standard of practice is intended to cover such of those aspects dealing with installation, operation and maintenance of electric traction lifts.

Where the term 'purchaser's representative' is used in this standard, it should be considered to refer to the architect, consulting engineer, or other competent person nominated by the purchaser to act on his behalf, and who will be able to give specialized advice.

The committee responsible for preparation of this standard is given is Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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This Indian Standard has been developed from Doc: No. ET 25 (4098).

Amendments Issued Since Publication

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