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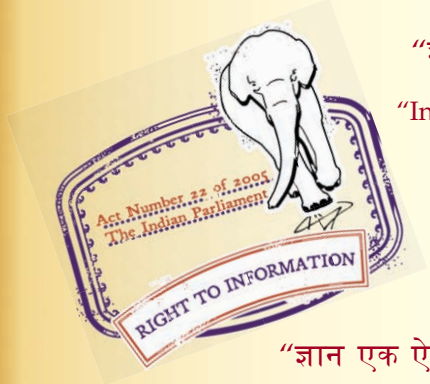
IS 14671 (1999): Code of practice for instalation and maintenance of hydraulic lifts [ETD 25: Lift and Escalators]



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IS 14671 : 1999

(Reaffirmed 2004)

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हाईड्रोलिक लिफ्टों के संस्थापन और अनुरक्षण के लिए रीति संहिता

Indian Standard

CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF HYDRAULIC LIFT

ICS 91.140.90

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

May 1999

Price Group 3

Lifts and Escalators Sectional Committee, ETD 25

FOREWORD

This Indian Standard 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.

Over the last few years the number of hydraulic lifts installed in this country has grown rapidly. Need was therefore left to prepare this code to regulate the installation and maintenance and for safe working of hydraulic lifts and the associated machinery and apparatus.

In the preparation of this code, assistance has been derived from:

BS 5655 (Part 2) :1988/ EN 81 (Part 2) : 1988	Lifts and service lifts, Part 2 : Safety rules for the construction and installation of hydraulic lifts

This standard is one of a series of Indian Standards on lifts and escalators. Other standards published in this series are:

IS 1860 : 1980	Code of practice for installation. operation and maintenance of electric passenger and goods lifts
IS 3534 : 1976	Outline dimensions of electric lifts
IS 4666 : 1980	Specification for electric passenger and goods lifts

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.

Indian Standard

CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF HYDRAULIC LIFT

1 SCOPE

This standard deals with hydraulic lifts, where the car is directly or indirectly driven by the action of one or more hydraulic jacks and whereby the down movement even with the empty car, takes places due to gravitational force.

The standard is intended to assist potential users and manufacturers of hydraulic lifts who are already familiar with electric lifts complying with existing Indian Standards (IS 1860, IS 4666, etc) and in order to maximize the number of components common to both types of lifts.

2 REFERENCES

The following standards are necessary adjuncts to this standard:

IS No.	*Title*
1860 : 1980	Code of practice for installation, operation and maintenance of electric passenger and goods lifts
2365 : 1977	Steel wire suspension ropes for lifts, elevators and hoists (*first revision*)
4666 : 1980	Specification for electric passenger and goods lifts
9803 : 1981	Buffers for electric passenger and goods lifts
10191 : 1982	Car and counterweight guide rails, guide rail supports and fastenings for lifts
11615 : 1986	Car and counterweight guide shoes for electric passenger and goods lifts
11633 : 1986	Lift doors
11706 : 1986	General requirement for car-frame for electric passenger and goods lifts

3 TERMINOLOGY

3.1 Hydraulic Lifts

A lift in which power is derived from an electrically driven pump transmitting hydraulic fluid to one or more jacks acting directly or indirectly on the car. (Hereinafter, the word 'Lift' wherever used refers to 'Hydraulic Lift').

3.2 Direct Acting Type Hydraulic Lifts

The hydraulic ram is directly attached to the lift car or the carframe. An example is shown in Fig. 1.

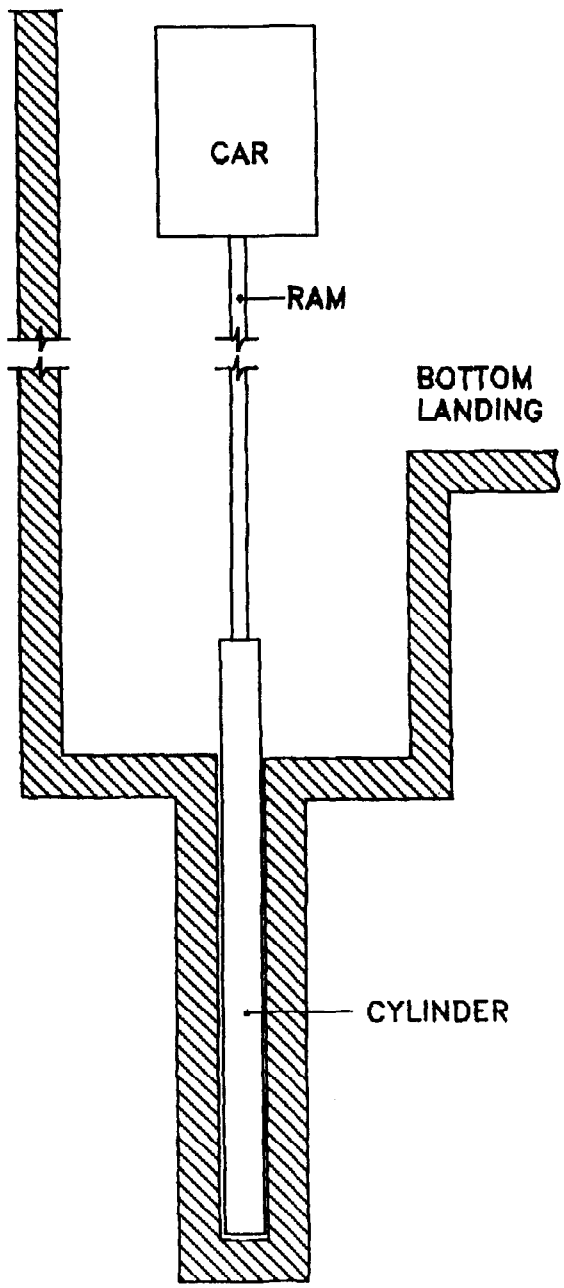

FIG. 1 DIRECT ACTING TYPE HYDRAULIC LIFT

3.3 Indirect Acting Type Hydraulic Lift

The hydraulic cylinder is mounted in the lift shaft adjacent to the car or the car-frame by suspension means (ropes). An example is shown in Fig. 2.

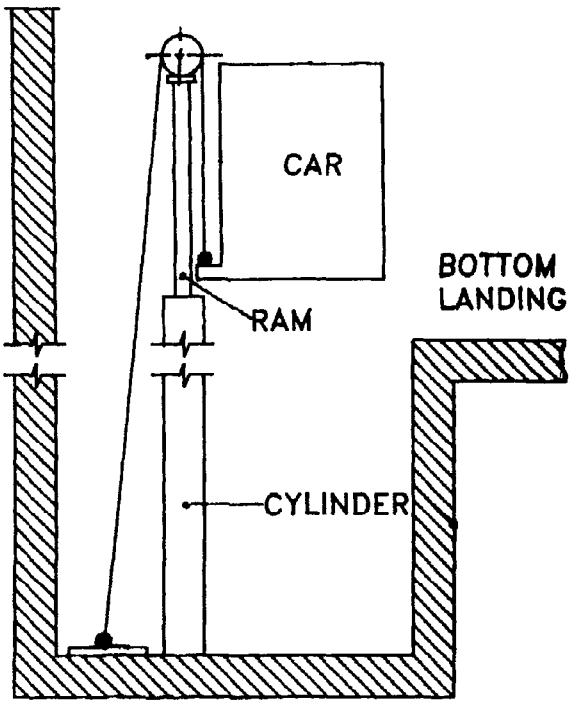

FIG. 2 INDIRECT ACTING TYPE HYDRAULIC LIFT

3.4 Jack

A combination of a cylinder and a ram (or plunger or piston) forming a hydraulic actuating unit.

3.5 Single-Acting Jack

Jack in which displacement in one direction is by fluid action and in the other by gravity.

3.6 Car-Frame or Car Sling

The metal framework carrying the car connected to the means of suspension. The car-frame may be integral with the car enclosure.

3.7 Full Load Pressure

Static pressure exerted on the piping directly connected to the jack, the car with rated load being at test at the highest landing level.

3.8 Shut-Off Valve

A manually operated two-way value which can permit or prevent flow in either direction.

3.9 Pressure Relief Valve

A value which limits the pressure to a pre-determined value by exhausting fluid.

3.10 Down Direction Valve

Electrically controlled value in a hydraulic circuit for controlling the descent of the car.

3.11 Rupture Valve

A value designed to close automatically when the pressure drops across the value, caused by the increased flow in a predetermined flow direction, exceeds a pre-set amount.

3.12 Electrical Anti-creep System

A combination of precautions against the danger of creeping.

4 CONSTRUCTION, INSTALLATION, PROTECTION, OPERATION AND MAINTENANCE OF HYDRAULIC LIFTS

4.1 Every hydraulic lift and part thereof shall be of sound material of sufficient rating and construction and sufficient mechanical strength for the purpose for which it is intended and shall be installed, protected, worked and maintained in such a manner so as to prevent danger.

4.2 All materials used in hydraulic lifts shall conform to the latest Indian Standards, wherever applicable.

5 MACHINE, JACK AND OTHER HYDRAULIC EQUIPMENT

5.1 General Provisions

Each lift shall have at least one machine of its own. The two following methods of drive are permissible:

a) Direct acting, and
b) Indirect acting.

5.2 Jack

5.2.1 *Calculation of Factor of Safety of Jack*

a) *Pressure calculations*—The jack shall be designed such that, under the forces resulting from a pressure equal to 2.3 times the full load pressure; a safety factor of at least 1.7 referred to the proof stress is assured.
b) *Bucking calculations*—Jacks under compressive loads shall be designed such that, in their fully extended position, and under the forces resulting from a pressure equal to 1.4 times the full load pressure, a safety factor of at least two against buckling is assured.
c) *Tensile stress calculations*—Jacks under tensile loads shall be designed such that, under

the forces resulting from a pressure equal to 1.4 times full load pressure, a safety factor of at least 2 referred to the proof stress is assured.

5.2.2 *Connection Car/Ram (Cylinder)*

a) *Direct-acting lift*—The connection between the car and the ram (cylinder) shall be flexible and shall be constructed as to support the weight of the ram (cylinder) and the additional dynamic forces. The connection means shall be secured.

b) *Indirect-acting lifts*—The head of the ram (cylinder) shall be guided. No parts of the ram head guiding system shall be incorporated within the vertical projection of the car roof.

5.3 Piping

5.3.1 *General*

Piping and fittings which are subject to pressure (connections, values, etc) as in general all components of a lift hydraulic system shall:

a) Be appropriate to the hydraulic fluid used.

b) Be designed and installed in such a way to avoid any abnormal stress due to fixing, tension or vibration:

c) Be protected against damage, in particular of mechanical origin.

5.3.2 *Rigid Pipes*

Rigid pipes and fittings between cylinder and non-return valve or down direction valve(s) shall be designed such that, under the forces resulting from pressure equal to 2.3 times the full load pressure, a safety factor or at least 1.7 referred to the proof stress is assured.

5.3.3 *Flexible Hoses*

The flexible hose between cylinder and non-return valve or down direction valve shall:

a) Be selected with a safety factor of at least 8 relating full load pressure and bursting pressure; and

b) Withstand without damage a pressure of five times full load pressure, this test to be carried out by the manufacture of the hose assembly.

The flexible hose shall be marked in an indelible manner with:

a) the name of the manufacturer or the trademark,

b) the test pressure, and

c) the date of the test.

5.4 Hydraulic Control and Safety Devices

5.4.1 *Shut-Off Valve*

A shut-off valve shall be provided, and shall be located in the machine room. It shall be installed in the circuit which connects the cylinder to the non-return valve and the down direction valve.

5.4.2 *Non-return Valve*

A non-return valve shall be provided and shall be capable of holding the lift car with the rated load at any point when the supply pressure drops below the minimum operating pressure. Non-return valve shall be installed in the circuit between the pump and the shut-off valve.

5.4.3 *Pressure Relief Valve*

A pressure relief valve shall be provided and shall be adjusted to limit the pressure to 1.4 times the full load pressure. It shall be connected to the circuit between the pump and the non-return valve. The hydraulic fluid shall be returned to the tank.

5.4.4 *Down Direction Valve*

Down direction valves shall be held open electrically. Their closing shall be affected by the hydraulic pressure from the jack and by at least one guided compression spring per valve.

5.4.5 *Filters*

In the circuit between the tank and the pump and in the circuit between the shut-off valve and the down direction valve filters or similar devices shall be installed. The filter or similar device between the shut-off valve and the down direction valve shall be accessible for inspection and maintenance.

5.5 Checking the Pressure

A pressure gauge shall be provided. It shall be connected between the non-return valve or the down direction valve and the shut-off valve. The connection shall be provided with an internal thread of either M20 × 1.5 or G 1/2 inch.

5.6 Fluid Level in the Tank

It shall be easy to check the level of the hydraulic fluid in the tank.

5.7 Speed

The rated speed shall not be greater than 1.0 mps. The speed of the empty car upwards shall not exceed the rated upward speed by more than 8 percent and the speed of the car with rated load downwards shall not exceed the rated downward speed by more than 8 percent, in each case this relates to the normal

operating temperature of the hydraulic fluid. For a journey in the upward direction it is supposed that the supply is at its rated frequency and the motor voltage is equal to the rated voltage of the equipment.

5.8 Manual Emergency Operation

5.8.1 *Moving the Car Downwards*

The lift shall be operated with a manually operated valve located in the machine room to allow the car, even in the case of a power failure, to be lowered to a level where the passengers can leave the car. The speed of the car shall not exceed 0.3 m/s.

5.8.2 *Moving the Car Upwards*

A hand pump which causes the car to move in the upwards direction shall be permanently installed for every lift whose car is fitted with a safety gear. It shall be connected to the circuit between the non-return valve or down direction valve and the shut-off valve.

5.9 Motor Run Time Limiter

A motor run time limiter shall be provided. This device shall stop the motor and keep it stopped when it remains energized longer than the time required for the full travel upwards with rated load, plus a maximum of 60s. The return to normal service shall only be possible by manual resetting. On restoration of the power after a supply disconnection, maintenance of the machine in the stopped position is not necessary.

5.10 Protection Against Overheating of the Hydraulic Fluid

A temperature detecting device shall be provided. This device shall stop the machine and keep it stopped as long as the temperature of the hydraulic fluid exceeds a pre-set value prescribed by the manufacturer.

6 DIMENSIONAL TOLERANCES

6.1 The overhead dimensions and pit depth for hydraulic lifts shall be not less than 3 450 mm and 1 100 mm respectively.

7 MACHINE ROOMS

The machine and its associated equipment shall be kept in a special room with proper enclosure. Machine rooms shall be properly ventilated to effectively dissipate the heat generated. They shall be such that the motors and equipment, as well as electric cables etc, are protected as far as possible from dust, harmful fumes and humidity.

7.1 The machine room may be located adjacent to the pit or any landing but in no case shall the distance between the pump unit and cylinder inlets exceed 20 m.

7.2 The dimensions of machine rooms shall be sufficient to permit easy and safe access for servicing personnel to all the components, especially the electrical equipment. In particular there shall be provided:

a) a clear horizontal area in front of the panels and the cabinets. This area is defined as follows:

   depth, measured from the external surface of the enclosures; at least 0.7 m. This distance may be reduced to 0.6 m in front of protruding controls, (handles, etc).

   width, the greater of the following values: 0.5 m or the full width of the cabinet or panel.

b) a clear horizantal area of at least 0.5 m × 0.6 m for servicing and inspection of moving parts at points where this is necessary and, if need be, manual emergency operation.

c) access ways to hese clear spaces which shall have a width of at least 0.5 m. This value may be reduced to 0.4 m in areas where there are no moving parts.

8 GUIDE RAILS, GUIDE SHOES AND BUFFERS

Guide rails, guide shoes and buffers shall generally conform to IS 10191; IS 11615; and IS 9803 respectively. The requirements specified in **2.24**, **2.25**, **2.26**, **2.27** and **2.3** of IS 1860; **5** and **6** of IS 4666; shall apply.

9 LIFT CARS AND CAR-FRAMES (CAR SLINGS)

For lift cars and car-frames wherever provided, the requirements specified in **2.14** and **2.16** of IS 1860; **7**, **8** and **13** of IS 4666; shall apply. As regards capacity and loading, the requirements specified in **11** and **12** of IS 4666 shall apply. The car frame shall generally conform to IS 11706.

10 CAR DOORS, LANDING DOORS AND LOCKING DEVICES

The requirements specified in **2.12** , **2.16** and **2.17** of IS 1860 and **9**, **10** and **12** of IS 4666 shall apply. The lift doors shall generally conform to IS 11633.

11 PRECAUTIONS AGAINST FREE FALL OF CAR, DESCENT WITH EXCESSIVE SPEED AND CREEPING

11.1 To prevent the car from free fall or descent with excessive speed, safety gears as defined in **11.2** shall be provided.

11.2 To prevent the car from creeping from a landing level by more than 0.12 m, and likewise, creeping below the lower end of the unlocking zone, the lift shall be provided with either:

a) electrical anti-creep system (*see* **12.2.6**), or
b) additional tripping of safety gear by downward movement of car.

11.3 A protective device shall be provided in the hoistway to ensure safety of person working in the pit against creeping of the car.

12 SAFETY GEARS

12.1 Direct Acting Hydraulic Lifts

All direct acting lifts capable of carrying passengers shall be provided with a rupture valve.

12.2 Indirect Acting Hydraulic Lifts

12.2.1 All indirect acting lifts shall be provided with safety gears complying with the requirements specified in **2.51** of IS 1860 and **15.14** of IS 4666.

12.2.2 The safety gear shall be operated by a safety rope in conjunction with a rupture valve on lifts with a rated speed not exceeding 1.0 mps.

12.2.3 The rupture valve shall be capable of stopping the car in downward movement, and maintaining it stationery at the latest when the speed reaches a value equal to rated speed downwards plus 0.3m/s.

12.2.4 The rupture valve shall be accessible for adjustment and inspection.

12.2.5 The rupture valve shall be either:

a) integral with the cylinder, or
b) directly and rigidly flange mounted, or
c) placed close to the cylinder and connected to it by means or short rigid pipes, having welded, flanged or threaded connections, or
d) connected directly to the cylinder by threading. The rupture valve shall be provided with a thread ending with a shoulder. The shoulder shall butt up against the cylinder.

12.2.6 *Electrical Anti-creep System*

An electrical anti-creep system shall be provided which satisfies the following conditions:

The motor shall be energized in the up direction independent of the position of the doors, when the car is in a zone which extends from maximum 0.12 m below the landing level to the lower end of the unlocking zone.

When the lift has been unused for a period not exceeding 15 min after the last journey, the car shall be despatched automatically to the lowest landing.

13 SUSPENSION

Wherever provided, the suspension ropes shall generally conform to IS 2365. It shall comply with the requirements specified in **2.54** of IS 1860 and **17** of IS 4666.

14 CONTROLLERS AND OPERATING DEVICES

The requirements specified in **22** of IS 4666 shall apply.

15 TERMINAL STOPPING AND FINAL LIMIT SWITCHES

15.1 Every hydraulic lift shall be provided with upper and lower normal terminal limit switches arranged to stop the car automatically within the limits of top car clearance and bottom run by (overtravel) from any speed attained in normal operation. Such limit switches shall act independently of the operation devices, the ultimate or final limit switches and the buffers.

15.2 Hydraulic lifts shall in all cases be provided with an ultimate or final switch arranged to stop the car automatically within the top clearance independent of the normal operating service.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :		Telephone
Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110 002	323 76 17 323 38 41
Eastern	: 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi CALCUTTA 700 054	337 84 99, 337 85 61 337 86 26, 337 91 20
Northern	: SCO 335-336, Sector 34-A, CHANDIGARH 160 022	60 38 43 60 20 25
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