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MYANMAR

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PART 5C

BUILDING SERVICES

(INSTALLATION OF LIFTS AND ESCALATORS)

MYANMAR NATIONAL BUILDING CODE
TWG No.5 BUILDING SERVICES
Installation of Lifts and Escalators

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MYANMAR NATIONAL BUILDING CODE

TWG No.5C BUILDING SERVICES

Installation of Lifts and Escalators

5C.1 SCOPE

5C.1.1 This Section covers the essential requirements for the installation, operation and maintenance and also inspection of lifts (passenger lifts, goods lifts, hospital lifts, service lifts and dumb waiters) and escalators so as to ensure safe and satisfactory performance.

5C.1.2 This Section gives information that should be exchanged among the architect, the consulting engineer and the lift / escalator manufacturer from the stage of planning to installation including maintenance.

5C.2 TERMINOLOGY

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

5C.2.1 A lift (Elevator), is a Type of vertical transport equipment that efficiently moves people or goods between floor of a building , vessel or other structures .

5C.2.1.1 Automatic Rescue Device

A device meant to bring a lift stuck between floors due to loss of power, to the nearest level and open the doors in order to allow trapped passengers to be evacuated. Such a device may use some form of internal auxiliary power source for such purpose, complying with all the safety requirements of a lift during normal run. The speed of travel is usually lower than the normal speed. In the case of manual doors on reaching the level, the device shall allow the door to be opened and in case of power operated doors the device shall automatically open the door.

5C.2.1.2 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.

5C.2.1.3 Bottom Counterweight Runby

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

5C.2.1.4 Buffer

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

5C.2.1.5 Oil Buffer

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

5C.2.1.6 Oil buffer stroke

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

5C.2.1.7 Spring Buffer

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

5C.2.1.8 Spring buffer load rating

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

5C.2.1.9 Spring buffer stroke

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

5C.2.1.10 Call Indicator

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

5C.2.1.11 Car Bodywork

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

5C.2.1.12 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.

5C.2.1.13 Car Frame

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

5C.2.1.14 Car Platform

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

5C.2.1.15 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 300mm, measured horizontally from the sides of the car platform when the car rests on its fully compressed buffers.

5C.2.1.16 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.

5C.2.1.17 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.

5C.2.1.18 Control

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

5C.2.1.19 Single-Speed Alternating Current Control

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

5C.2.1.20 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.

5C.2.1.21 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.

5C.2.1.22 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.

5C.2.1.23 Electronic Devices

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

5C.2.1.24 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.

5C.2.1.25 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.

5C.2.1.26 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.

5C.2.1.27 Counterweight

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

5C.2.1.28 Deflector Sheave

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

5C.2.1.29 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.

5C.2.1.30 Door, Mid-Bar Collapsible

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

5C.2.1.31 Door, Multipanel

A door arrangement whereby more than one panel is used such that the panels are connected together and can slide over one another by which means the clear opening can be maximized for a given shaft width. Multipanels are used in centre opening and two sliding doors.

5C.2.1.32 Door, Single Slide

A single panel door which slides horizontally.

5C.2.1.33 Door, Two Speed Sliding

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

5C.2.1.34 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.

5C.2.1.35 Door, Vertical Lifting

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

5C.2.1.36 Door, Swing

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

5C.2.1.37 Door Closer

A device which automatically closes a manually opened door.

5C.2.1.38 Door Operator

A power-operated device for opening and closing doors.

5C.2.1.39 Dumb Waiters

A lift with a car which moves in guides in a vertical direction; has a net floor area of 1sqm meter, total inside height of 1.2 meter, whether or not provided with fixed or removable shelves; has a capacity not exceeding 250kg and is exclusively used for carrying materials and shall not carry any person.

5C.2.1.40 Electrical and Mechanical Interlock

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

5C.2.1.41 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.

5C.2.1.42 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.

5C.2.1.43 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.

5C.2.1.44 Goods Lift

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

5C.2.1.45 Guide Rails

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

5C.2.1.46 Guide Rails Fixing

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

5C.2.1.47 Guide Rails Shoe

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

5C.2.1.48 Hoisting 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.

5C.2.1.49 Hospital lift

A lift normally installed in a hospital/dispensary clinic and designed to accommodate one number bed / stretcher along its depth, with sufficient space around to carry a minimum of three attendants in addition to the lift operator.

5C.2.1.50 Landing Call Push

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

5C.2.1.51 Landing Door

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

5C.2.1.52 Landing Zone

A space extending from a horizontal plane 400 mm below a landing to a plane 400 mm above the landing.

5C.2.1.53 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.

5C.2.1.54 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.

5C.2.1.55 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.

5C.2.1.56 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.

5C.2.1.57 Levelling Zone

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

5C.2.1.58 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. The word 'elevator' is also synonymously used for 'lift'.

5C.2.1.59 Lift Car

The load carrying unit with its floor or platform, car frame and enclosing body work.

5C.2.1.60 Lift Landing

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

5C.2.1.61 Lift Machine

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

5C.2.1.62 Lift Pit

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

5C.2.1.63 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.

5C.2.1.64 Lift Well Enclosure

Any structure which separates the lift well from its surroundings.

5C.2.1.65 Operation

The method of actuating the control of lift machine.

5C.2.2 Operation

5C.2.2.1 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.

5C.2.2.2 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.

5C.2.2.3 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.

5C.2.2.4 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.

5C.2.2.5 Group Automatic Operation

Automatic operation of two or more non-attendant lifts equipped with power-operated car and landing doors. The operation of the car is co-ordinated by a supervisory operation system including automatic dispatching means whereby selected car at designated dispatching points automatically close their doors and proceed on their trips in a regulated manner.

Typically, it includes one button in each car for each floor served and up and down buttons at each landing (single button 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 directions 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.

5C.2.2.6 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.

5C.2.2.7 Signal Operation

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

5C.2.2.8 Double Button (Continuous Pressure) Operation

Operation by means of buttons or switches in the car and 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.

5C.2.2.9 Operating Device

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

5C.2.3 Others:

5C.2.3.1 Overhead Beams – The members, usually of steel, which immediately support the lift equipment at the top of the lift well.

5C.2.3.2 Over Speed Governor – An automatic device which brings the lift car and /or counter weight to rest by operating the safety gear in the event of the speed in a descending direction exceeding a predetermined limit.

5C.2.3.3 Passenger Lift – A lift designed for the transport of passengers.

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5C.2.3.4 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.

5C.2.3.5 Rated Load (Lift) – The maximum load for which the lift car is designed and installed to carry safely at its rated speed.

5C.2.3.6 Rated Load (Escalator) – The load which the escalator is designed and installed to lift at the rated speed.

5C.2.3.7 Rated Speed (Lift) – The mean of the maximum speed attained by the lift car in the upward and downward direction with rated load in the lift car.

5C.2.3.8 Retiring Cam – A device which prevents the landing doors from being unlocked by the lift car unless it stops at a landing.

5C.2.3.9 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 sheave on the car or counterweight or both. It includes roping arrangement of 2 to 1.3 to 1 etc.

5C.2.3.10 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. Any anticipated impact force shall be added in the general drawing or layout drawing.

5C.2.3.11 Service Lift – A passenger cum goods lift meant to carry goods along with people.

Typically in an office building this may be required to carry food or stationeries, in a residential building to carry a bureau or accommodate a stretcher and in a hotel to be used for food trolleys or baggage. There is a need in such lifts, to take care of the dimensions of the car and the door clear opening in line with the type of goods that may have to be carried based on mutual discussion between supplier and customer. Also, such lifts shall have buffer railings in the car at suitable height to prevent damage to the car panels when the goods are transported. Typically such lifts, if provided with an automatic door, may use some means to detect trolleys and stretcher movement in advance to protect the door against damage. The car floor load calculations and car area of such a lift is as in the case of a passenger lift except that these are not meant to carry heavy concentrated loads.

5C.2.3.12 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.

5C.2.3.13 Slack Rope Switch – Switch provided to open the control circuit in case of slackening of rope(s).

5C.2.3.14 Suspension Ropes – The ropes by which the car and counter weight are suspended.

5C.2.3.15 Terminal Slow Down Switch – A switch when actuated shall compulsorily cut off the high speed and switch on the circuitry to run the lift in Levelling speed before reaching on terminal landings.

5C.2.3.16 Terminal Stopping Switch Normal – Switch for cutting all the energizing current in case of car travelling beyond the top bottom landing or a switch cuts off the energizing current so as to bring the car to stop at the top and bottom level.

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5C.2.3.17 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.

5C.2.3.18 Total Headroom – The vertical distance from the level of the top lift landing to the bottom of the machine room slab.

5C.2.3.19 Travel – The vertical distance between the bottom and top lift handing served.

5C.2.3.20 Geared Machine – A machine in which the power is transmitted to the sheave through worm or worm and spur reduction gearing.

5C.3 GENERAL

5C.3.1 The appropriate aspect of lift and escalator installation shall be discussed during the preliminary planning of the building with all the concerned parties, namely, client, architect, consulting engineer and/or lift/escalator manufacturer. This enables the lift/escalator manufacturer to furnish the architect and/or consulting engineer with the proposed layout on vice-versa.

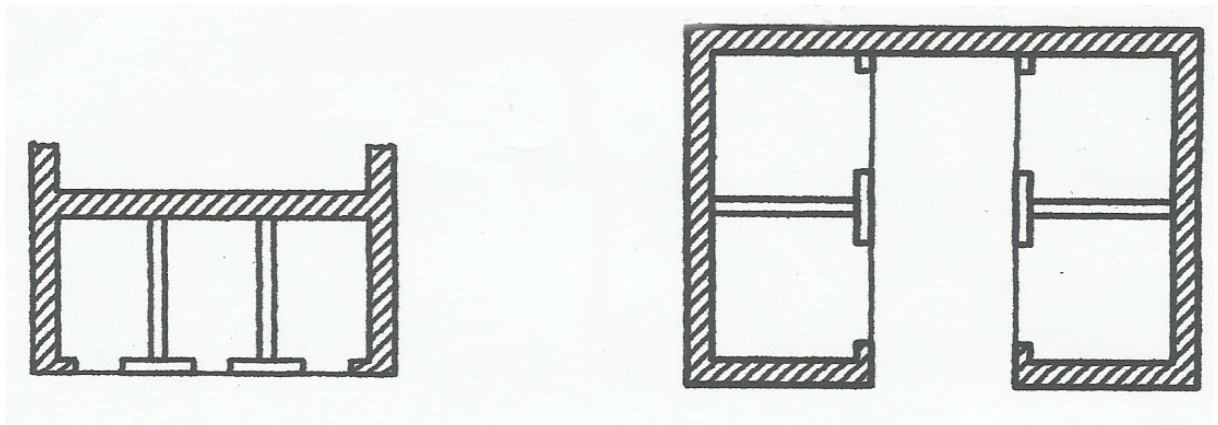
5C.3.2 Exchange of Information

5C.3.2.1 If the proposed installation is within the scope of 6, the guidelines laid down together with Fig.1 will enable the preliminary scheme for the installation to be established.

Figure 1 shows only some of the typical arrangements and variations are possible with respect to number of lifts and the layout.

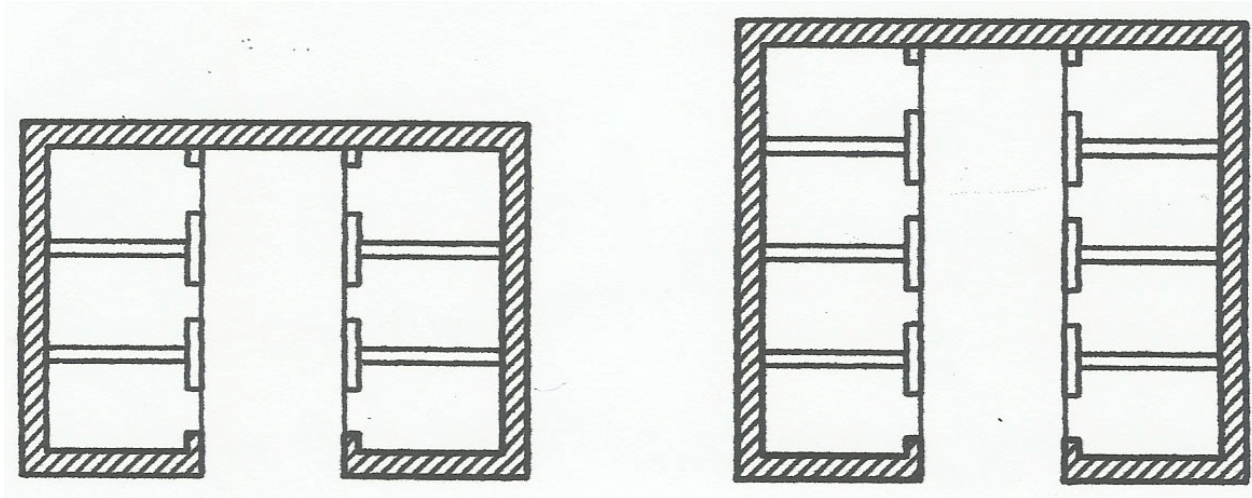
Although the recommended outline for the various classes of lifts given in 6 enables the general planning details to be determined by the architect, these should be finally settled at the earliest possible stage by detailed investigation with the purchaser's representative reaching agreement with the 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 proposed 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;



**1A STRAIGHT LINE
ARRANGEMENT FOR THREE LIFTS
FOUR LIFTS**

1B ALCOVE ARRANGEMENT FOR



**1C ARRANGEMENT FOR SIX LIFTS
FOR EIGHT LIFTS**

1D ARRANGEMENT

Figure 1 Arrangement of Lifts

- 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 in plumb;
- 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; and brackets spacing is not more than 2500 mm.
- i) The time at which electric power will be required before completion to allow for testing;
- j) Lift well shall be adequately ventilated at the top of the shaft to the external air by means of one or more permanent openings having a total unobstructed area of at least 1% of the horizontal section of the well and not less than 0.1 m² for each lift in the shaft.
- k) Where the depth of a pit, measured from the lower terminal landing exceeds 1000 mm and where no other means of access exists, a ladder shall be fixed permanently within reach of the lower terminal landing door. The pit ladder or the handholds for the pit ladder shall extend up to 1500 mm above the bottom terminal floor to enable safe descent into the pit. Where more than one lift is operating in the same pit, pit ladder shall be installed for every lift.
- l) Pits shall be waterproofed before installation of the lift equipment by the use of tanking, membranes or other positive means and where required, shall have a covered sump located therein. The sump cover shall be a non-slip type and shall be not easily displaced. The sump shall not be connected to any closed drainage system; but may

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be connected into an open-ended drain below the sump level so that it cannot be flooded.

- m) Where pumps are required, they shall be installed outside the lift well. Pump shall be effectively partitioned from the lift well and separate access for maintenance. The level of any external sump shall be such that water cannot flow back into the lift well. Drains shall not run into pits.
- n) The requirements for electrical supply feeders, etc;
- o) The requirements for scaffolding in the lift well and protection of the lift well prior to and during installation of equipment; and
- p) Delivery and storage of equipment.

5C.3.2.2 Information to be Provided by Architect or Engineer

As a result of preliminary discussion the drawings of the building should give the following particulars and finished sizes;

- a) Number, type and size of lifts and position of lift well;
- b) Particulars of lift well enclosure;
- c) Size, position, number and type of landing doors;
- d) Number of floors served by the lift;
- e) Height between floor levels;
- f) Number of entrances;
- g) Total headroom
- h) Provision of access to machine room;
- i) Provision of ventilation and, if possible, natural lighting of machine room;
- j) Height of machine room; not less than 2100 mm;
- k) Depth of lift pit;
- l) Position of lift machine, above or below lift well;
- m) Size and position of any trimmer joists or stanchions adjacent to the lift well at each floor;
- n) Size and position of supporting steel work at roof levels;
- o) Size and position of any footings or grillage foundations, if these are adjacent to the lift pit; and
- p) In the case of passenger lifts whether the lift cage is required to carry household luggage, such as refrigerator, steel almirah, etc.

5C.3.2.2.1 The lift lobby should be designed appropriately since this has bearing on the traffic handling especially when more number of lifts are involved. In a dual line arrangement (lifts opposite to each other) the lobby can be between 1.5 times to 2.5 times the depth of one car. Typically the more the number of lifts the bigger the multiple to be use. As an example a quadruplex may use 1.5 to 2 times where as an octoplex will need 2

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to 2.5 times. For in line (single line) arrangements, the lobby can be typically half of the above recommendations.

It is preferable that the lift lobby is not used as a thoroughfare but in such cases the lift corridor shall take into account space for people who are moving.

5C.3.2.2.2 The architect/engineer should advise the lift manufacturer, if the Authority has any special requirements regarding lifts in buildings in the administrative area concerned.

5C.3.2.2.3 The architect/engineer should inform the lift/escalator manufacturer of the dates when the erection of the lift/escalator may be commenced and is to be completed so that sufficient time is allowed for the manufacture and erection of the lift/escalator.

5C.3.2.2.4 When submitting application for a building permit to the local Authority, the building plans shall include the details of lifts (number of lifts duly numbered, location, type, type of doors, passenger capacity and speed).

5C.3.2.3 Working Drawings to be Prepared by the lift/Escalator Manufacturer

The lift/escalator manufacturer requires sufficient information for the preparation of working drawings and is usually obtained from architect's drawings supplemented by any information obtained from the site and by collaboration with the other contractors.

5C.3.2.3.1 Working drawings showing the layout of lift/escalator duly numbered, details of builders works, for example, holes in walls for guide fixing, holes in machine room floor for ropes and conduits, recesses for landing sills, supports for lift/escalator machine and loads imposed on the building should be submitted by the lift/escalator manufacturer to the architect/engineer for written approval.

5C.3.3 Electrical Requirement

For information of the electrical engineer, the lift/escalator a manufacturer should advise the architect/engineer of his electrical requirements. This information should be available early in planning stage so that the electrical supply requirements of the lift(s)/escalator(s) may be included in the electrical provisions of the buildings and that suitable cables and switchgear may be provided.

5C.3.4 The requirements given under 4 to 13 deal with installation of lifts and 14 deal with the installation of escalators.

5C.4 ESSENTIAL REQUIREMENTS

5C.4.1 Conformity with Lifts Act and Rules

The installation shall be generally carried out in conformity with Myanmar Electricity (lifts) Act and Rules there under, wherever they are in force.

5C.4.1.1 It is the responsibility of the owner of the premises where the lifts will be installed, to obtain necessary permission from the Authority before and after the erection of lifts and for subsequent operation of lift(s).

5C.4.2 Conformity with Myanmar Electricity Act and Rules

All electrical work in connection with installation of electric lifts shall be carried out in accordance with the provisions of Myanmar Electricity (lift) Rule – 1985 and the provisions framed there under as amended from time to time, and shall also comply with the other provisions of Part 8 'Buildings Service, Section 2 Electrical and Allied Installations'.

5C.4.3 Conformity with Myanmar Standards

5C.4.3.1 The materials shall be approved by the competent authority. For detailed specification for lifts, reference shall be made to accepted standard as according to cp 2 2009 & EN-81-1- 1998 or latest version.

5C.4.4 Conformity with Fire Regulations

5C.4.4.1 The installation shall be carried out in conformity with Part 4 'Fire and Life Safety' and local fire regulations and rules there under wherever they are in force.

5C.4.5 Factor of Safety

The minimum factor of safety for any part of the lift shall not be less than five. Higher factor of safety for various parts shall be applicable in accordance with accepted standards [8-5(3)], cp 2 2009, EN – 81 – 1 – 1998, Myanmar Electricity Rule & Regulation 1985.

5C.4.6 Additional Requirements for Passenger and Goods Lifts

5C.4.6.1 Bottom and Top Car Clearances

5C.4.6.1.1 Bottom and clearance

When the car rests on its fully compressed buffer there shall be vertical clearance of not less than 600mm between the pit floor and the buffer striker plate or the lowest structural or mechanical part equipment or device installed. The 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 x 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 apart of the car and any obstruction of device mounted in the pit.

5C.4.6.1.2 Top car clearance

The vertical clearance between the car cross-head and the nearest overhead obstruction within 500mm measured horizontally to the nearest part of the crosshead 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

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- 2) Governor tripping speed where spring buffers are used.

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

$$S = 51 V^2$$

where

S = Free fall in mm (gravity stopping distance), and

V = Initial velocity in m/s

- b) 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.

5C.4.6.2 Bottom Run by for Cars and Counterweights

5C.4.6.2.1 The bottom run by of cars and counterweights shall be not less than the following:

- a) 150 mm where oil buffers are used;
- b) Where spring-buffers are used;
 - 1) 150 mm for controls as in 2.1.23 to 2.1.27.
 - 2) Not less than the following for controls as in 2.1.20 to 2.1.22.

Rated Speed	Run by
m/s	mm
Up to 0.125	75
0.125 to 0.25	150
0.25 to 0.50	225
0.50 to 1	300

5C.4.6.3 Maximum Bottom Run by

In no case shall the maximum bottom run by exceed the following:

- a) 600 mm for cars; and
- b) 900 mm for counterweights.

5C.4.6.4 Top Counterweight Clearances

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

- a) the bottom car run by;
- b) the stroke of the car buffer used;
- c) 150 mm; 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.

5C.4.7 Additional Requirements for Service Lifts

5C.4.7.1 Top and Bottom Clearances for Car and Counterweights

5C.4.7.1.1 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) 150 mm for compensating for gravity stopping distance and future repairs to the rope connections at counterweight and at the car or at the suspension points.

5C.4.7.1.2 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 travel of the car from the service level the immediate floor near the pit, shall not be more than the top counterweight clearance, when the wooden buffers are completely crushed.

5C.4.7.1.3 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) 150 mm 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.

5C.4.7.1.4 Runby for Cars and Counterweights

5C.4.7.1.5 The bottom runby for cars and counterweights shall not be less than 150 mm.

5C.4.7.1.6 Maximum bottom runby

In no case shall the maximum bottom runby exceed 300 mm.

5C.4.8 In order to maintain a safe work environment, and to avoid potential hazards, the following shall be provided:

- a) caution sign shall be installed in the areas listed below where potential hazard exists:
 - 1) Trip hazard in machine room; and
 - 2) Caution notice against unauthorized use of rescue devices (for example, brake release device).
- b) Use the hard hats for entry in pit and car top during construction period.
- c) Warning sign shall be provided on the controller so also eliminate, the possibility of contact with any exposed or concealed power circuit.
- d) Car top barricade system shall be provided as primary protection against fall, on car top.
- e) Whenever work is carried out on the lift and lift is not required to be moved on power, notice shall be put on electrical main switch indicating requirement of de-energized condition.
- f) During lift installation/maintenance, protection against fall shall be provided with suitable barricades for all open leading entrances.

5C.4.9 Planning for Dimensions

5C.4.9.1 General

The dimensions of lift well have been chosen to accommodate the door inside the well which is the normal practice. In special cases, the door may be accommodated in a recess in the front wall, for which prior consultation shall be made with the lift manufacturer.

5C.4.9.2 Plan Dimensions

5C.4.9.2.1 All plan dimensions of lift well are the minimum clear plumb sizes. The architect/engineer, in conjunction with the builder, shall ensure that adequate tolerances are included in the building design so that the specified minimum clear plumb dimensions are obtained in the finished work.

5C.4.9.2.2 Rough opening in concrete or brick walls to accommodate landing doors depend on design of architrave. It is advisable to provide sufficient allowances in rough opening width to allow for alignment errors of opening at various landings.

5C.4.9.2.3 When more than one lift is located in a common well, a minimum allowance of 100 mm for separator beams shall be made in the widths shown in Table 1 to 4.

5C.4.9.2.4 For outline dimensions of lifts having more than one car entrance, lift manufacturers should be consulted.

5C.4.9.3 Outline Dimensions

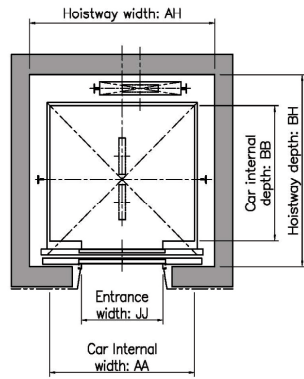
5C.4.9.3.1 The outline dimensions of machine-room, pit depth, total headroom, overhead distance and sill for four classes of lifts to which the standard applies are specified in Tables 1 to 4 as indicated below.

1. Recommended Dimensions of Passenger Lifts and Service Lifts

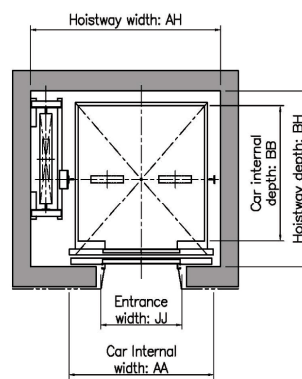
(Machine Room System)

All dimensions in millimeters

Hoistway Plan

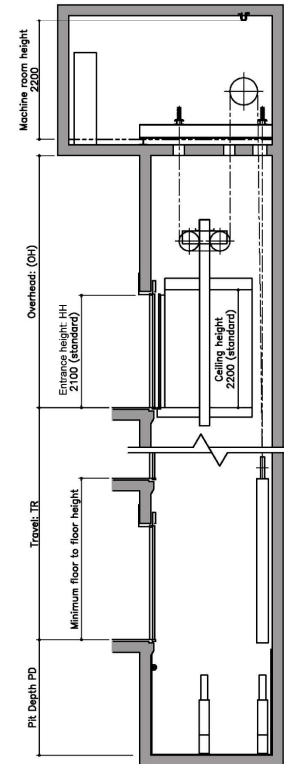


Shown for CO doors
Counterweight rear drop

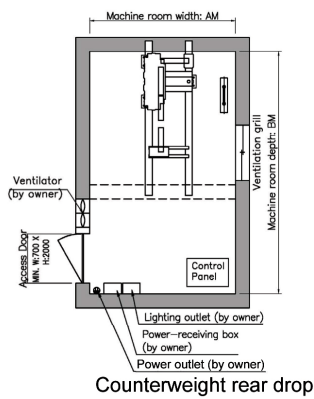


Shown for CO doors
Counterweight side drop

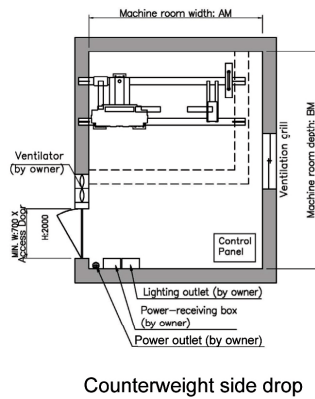
Hoistway Section



Machine Room Plan



Counterweight rear drop



Counterweight side drop

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Table-1(a)

Number of persons	Rated Capacity (kg)	Rated Speed (m/sec)	Door Type	Entrance Width (mm) JJ	Car internal dimensions (mm) AA x BB	Counter-weight position	Minimum hoistway dimensions (mm) AH x BH /car	Minimum machine room dimensions (mm) AM x BM /car
6	450	1.0	CO	800	1400x850	Rear	1750x1400	2000x3250
						Side	2100x1200	2500x2900
8	550	1.0			1400x1030	Rear	1750x1590	2000x3350
		1.5				Side	2100x1380	2500x3000
9	600	1.0			1400x1100	Rear	1750x1660	2000x3550
		1.0				Side	2100x1450	2500x3000
10	700	1.0			1400x1250	Rear	1750x1810	2000x3600
		1.5				Side	2100x1600	2500x3100
11	750	1.0 1.5 1.75			1400x1350	Rear	1750x1910	2000x3700
						Side	2100x1700	2500x3100
13	900				900	Rear	2050x1910	2100x3700
						Side	2400x1730	2500x3100
15	1000			1600x1500	Rear	2050x2060	2100x3850	
					Side	2400x1880	2500x3200	
17	1150			1000	Rear	2250x1860	2300x3700	
					Side	2600x1680	2600x3000	
				1100	Rear	2250x2110	2300x3900	
					Side	2650x1880	2900x3100	
20	1350			1000	Rear	2450x1960	2500x3450	
					Side	2850x1730	3100x3000	
			1100	Rear	2250x2310	2300x4100		
				Side	2650x2080	3000x3200		
1100	2000x1550		Rear	2450x2160	2500x3650			
			Side	2850x1930	3200x2800			

Table 1(b)

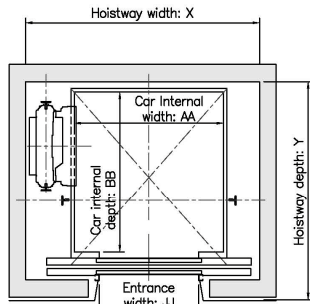
Rated Speed (m/sec)	Maximum travel (m) TR	Maximum number of Stops	Minimum overhead (mm) OH	Minimum pit depth (mm) PD	Minimum machine room clear height (mm)	Minimum floor to floor height (mm)
25	60	30	4400	1360	2200	2500
1.5	90		4560	1410		
1.75			4630	1410		

2. Recommended Dimensions of Passenger Lift and Service Lift

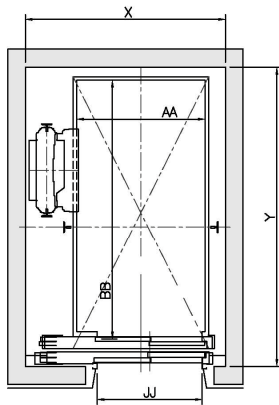
(Machine Room Less System)

All dimensions in millimeters

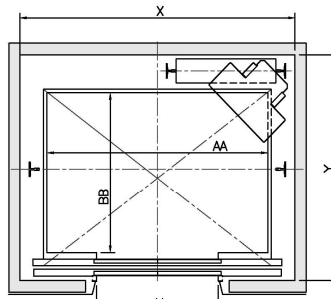
Hoistway Plan



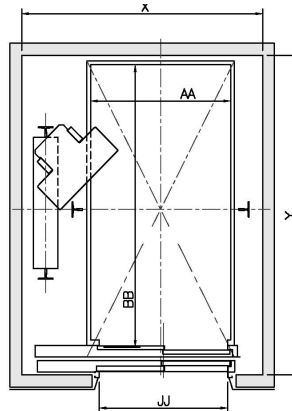
Shown for CO doors
Counterweight side drop
(Capacity 630kg ~ 1050kg)



(Capacity 450kg ~ 1050kg)

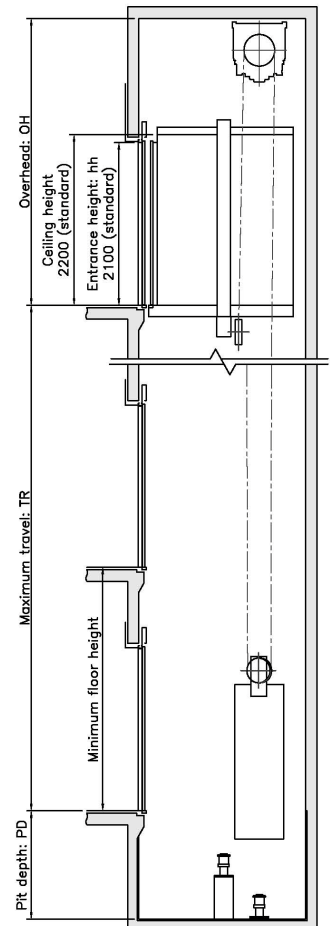


Shown for CO doors
Counterweight rear drop
(Capacity 1275kg ~ 1600kg)



(Capacity 1275kg ~ 1600kg)

Hoistway Section



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Table -2(a)

Code Number	Number of Persons	Rated Cap (Kg)	Door Type	Counter Weight Position	Car Internal Dimensions (mm) AA x BB	Entrance with(mm) JJ	Hoistway Dimensions (mm) X x Y
P 6	6	450	Co	Side	930 x 1300 1000 x 1200	800	1550 x 1700
P 8	8	550	Co	Side	1100 x 1300 1030 x 1400	800	1650 x 1700
P 9	9	600	Co	Side	1100 x 1400	800	1950 x 1720
P 10	10	700	Co	Side	1250 x 1400	800	2100 x 1720
P 11	11	750	Co	Side	1350 x 1400	900	2200 x 1720
P13	13	900	Co	Side	1350 x 1600	900	2350 x 1950
P 15	15	1000	Co	Side	1500 x 1600	900	2500 x 1950

Table -2(b)

Rated Speed (m/s)	Rated Capacity (Kg)	Maximum overhead (OH)	Maximum pit depth (mm) PD	Minimum Floor Height (mm)
1.0	450 - 750	3600	1300	2500
	900-1000	4100	1550	
1.6	450 - 750	3750	1400	
	900 – 1000	4250	1650	
1.75	450 - 750	3850	1450	
	900 – 1000	4350	1700	

3. Recommended Dimensions of Hospital Lifts

All dimensions in millimeters

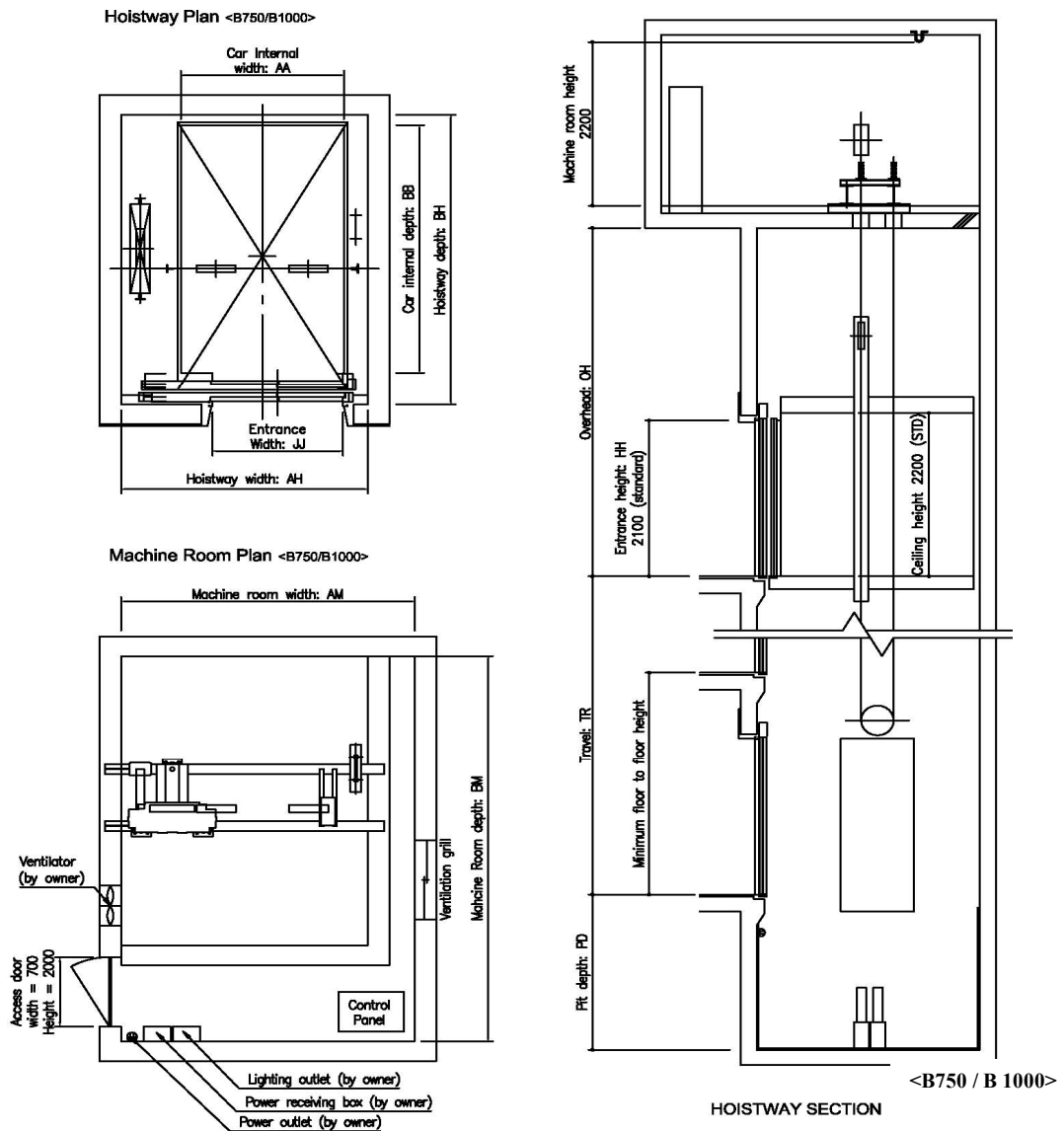


Table -3(a)

Number of persons	Rated Capacity (kg)	Rated Speed (m/sec)	Door Type	Counter-weight position	Car internal dimensions (mm) AA x BB	Entrance Width (mm) JJ	Minimum hoistway dimensions (mm) AH x BH /car	Minimum machine room dimensions (mm) AM x BM /car
11	750	1.0	2S	Side	1300x2300	1100	2135x2730	2600x3900
15	1000	1.5						
		1.75			1500x2500	1200	2335x2930	2700x3900

Table -3(b)

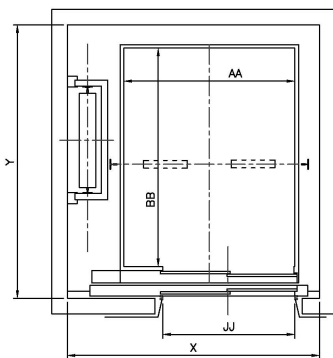
Rated Speed (m/sec)	Maximum travel (m) TR	Maximum number of Stops	Minimum overhead (mm) OH	Minimum pit depth (mm) PD	Minimum machine room clear height (mm)	Minimum floor to floor height (mm)
1	60	30	4400	1360	2200	2500
1.5	90		4560	1410		
1.75			4630	1410		

4. Recommended Dimensions of Good / Cargo / Freight Lift

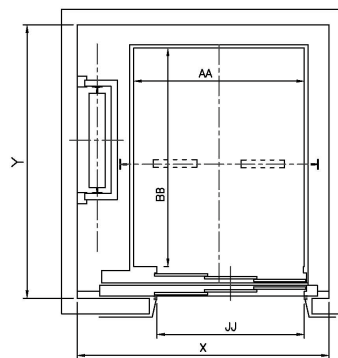
All dimensions in millimeters

Hoistway Plan

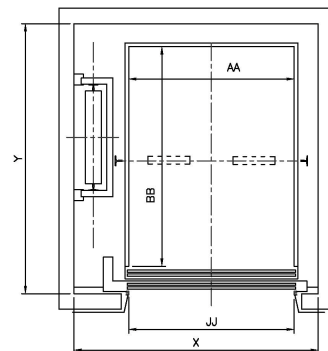
Hoistway Plan for 2-panel side opening door (2S)



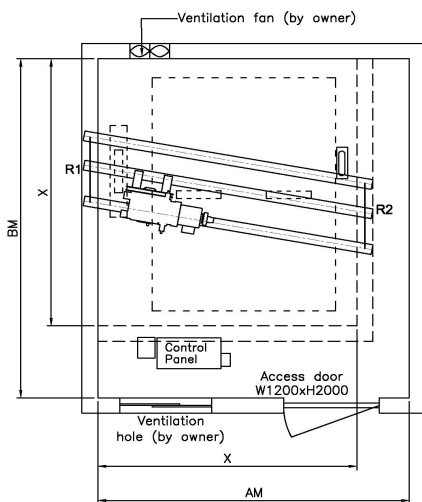
Hoistway Plan for 3-panel side opening door (3S)



Hoistway Plan for 2-panel side opening door (2U)



Machine Room Plan



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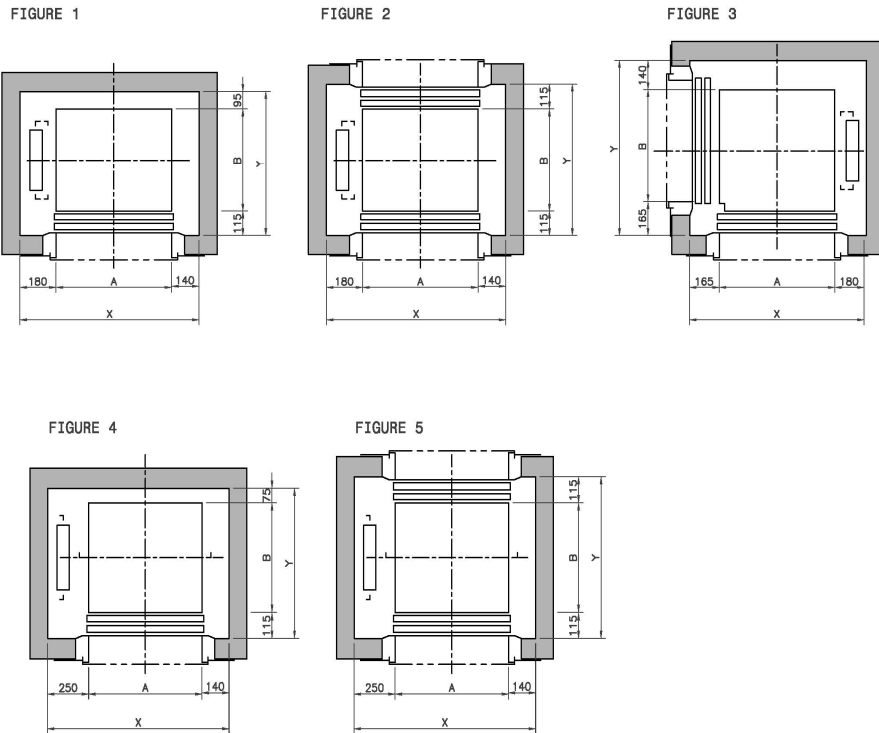
Table -4

Capacity (kg)	Speed (m/min)	Motor (kW)	Machine room (mm)	Pit depth PD (mm)	Door type	Hoistway (mm)	Min. floor height (mm)	Overhead OH (mm)	Reaction loads (kN)			
									AM x BM	Machine room		Pit
			X x Y			R1				R2	R3	R4
750	45	7.5	2600 x 3950	1250	2S	2200 x 2900	2800	4450	57.9	41.2	70.6	55.4
	60	9.5		1550				4650			71.6	55.4
1000	45	7.5	3150 x 3950	1250	2S	2600 x 2900	2800	4450	74.6	43.1	80.4	66.2
	60	9.5		1550				4650			84.8	73.1
1500	45	9.5	3600 x 4050	1250	2S	3150 x 3000	2800	4450	101	53.9	119.6	82.4
	60	13		1550				4650			129.4	88.3
2000	45	13	3600 x 4250	1250	2S	3150 x 3400	2800	4450	121.6	63.7	139.2	103
	60	18.5		1550				4650			150	109.8
2500	45	18.5	4000 x 4400	1250	3S	3600 x 3700	3300	4850	148.1	81.4	192.2	144.2
	60	22		1550				5050			206	154
	45	18.5	4000 x 4400	1250	2U	3600 x 3700	4500	4850	155.9	80.4	192.2	144.2
	60	22		1550				5050			206	154
	45	18.5	4000 x 4400	1250	3U	3600 x 3700	3950	4850	155.9	80.4	192.2	144.2
	60	22		1550				5050			206	154
3000	45	18.5	4100 x 4800	1250	3S	3750 x 4100	3300	4850	166.7	92.2	208	154
	60	26		1800				5050			223	165
	45	18.5	4100 x 4800	1250	2U	3750 x 4100	4500	4850	174.5	92.2	208	154
	60	26		1800				5050			223	165
	45	18.5	4100 x 4800	1250	3U	3750 x 4100	3950	4850	174.5	92.2	208	154
	60	26		1800				5050			223	165

5. Recommended Dimensions of Dumb Waiter

5.(a) Table Type

Hoistway Plan



Hoistway Section

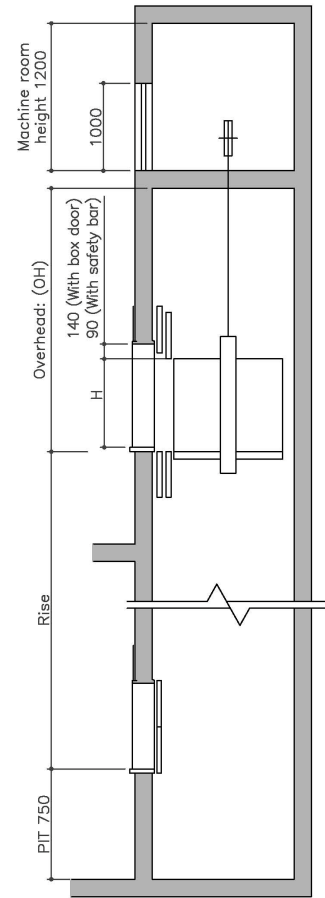


Table 5(a)

Load Capacity (kgs)	Speed (m/m)	Kind of Equipment	Figure	Dimension (mm)					OH		Motor Rating (kW)
				A	B	H	X	Y	with	with	
									Box Door	Safety Bar	
50	30	OT-50-0-30	1	550	550	750	870	760	1525	1425	0.75
		OT-50-P-30	2					780			
		OT-50-R-30	3					895			
100	30	OT-100-0-30	1	700	700	900	1020	910	1750	1650	0.75
		OT-100-P-30	2					930			
		OT-100-R-30	3					1045			
150	30.0	OT-150-0-30	4	800	800	1000	1190	990	1900	1800	0.75
		OT-150-P-30	5					1030			

5C.4.9.3.4 Minimum floor to floor height

Minimum floor to floor height for landings on same side for horizontally sliding door is $f + 750$ mm and for vertically biparting doors is $1.5 f + 250$ mm, where ' f ' is clear entrance heights in mm.

5C.4.10 Lift Wells and Lift Well Enclosures

5C.4.10.1 Lift wells

5C.4.10.1.1 No equipment except that forming a part of the lift or necessary for its operation and maintenance shall be installed in the lift well. For this purpose, the main supply lines shall be deemed to be a part of the lift and the underground cable, if laid along the lift well shaft, shall be properly clamped to the wall.

5C.4.10.1.2 Sufficient space shall be provided between the guides for the cars 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; safety gears provided shall be in accordance with good practices [8-5 (3)], cp 2 2009

5C.4.10.1.3 Lift wells, together with the whole of the contained equipment and apparatus, shall be rendered fire resistant to the greatest possible extent.

5C.4.10.1.4 Every counterweight shall travel in juxtaposition to its car in the same lift well.

5C.4.10.1.5 It is undesirable that any room, passage or thoroughfare be permitted under any lift well. If unavoidable spaces for other uses may be permitted under the lift well, with the prior approval of the lift Inspectorate Authority and the following provisions shall be made:

- a) Spring or Oil buffers shall be provided for lift car and counterweight;
- b) The pit shall be sufficiently strong to withstand successfully the impact of the lift car with rated load or the impact of the counterweight when either is descending at rated speed or at governor tripping speed;
- c) The car and the counterweight shall be provided with a governor-operated safety gear; and
- d) The forces required on the structure in the event of car buffering directly without safety gear application to be indicated in the general arrangement drawing.

5C.4.10.2 Lift Well Enclosures

5C.4.10.2.1 Lift well enclosures shall be provided and shall extend on all sides from floor-to-floor or stair-to-stair, and shall have requisite strength and in proper plumb. Liftwell enclosures are made concrete wall or Brick wall in up to 9 stop but more than 9 stop, must be do concrete wall only.

5C.4.10.2.2 The inner sides of the lift well enclosures facing any car entrances shall, as far as practicable form a smooth, continuous flush surface devoid of projections or recesses.

NOTE – This requirement may be met in existing lift wells by filling any recesses or spaces between projections or alternatively by covering them with suitable sheet material. If it is not possible to render flush any objection or tops of recesses, they should be beveled on the under side to an angle of 60° , from the horizontal by means of metal

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plates, cement rendering or other fire-resisting materials. Where a car-Levelling device is operative with car door opening, such interior surfaces shall always form a smooth flush surface below each landing level for a depth to at least the depth of the car-Levelling zone plus the distance through which the lift car may travel of its own momentum when the power is cut-off.

5C.4.10.2.3 Where an open lift well would increase the fire risk in a building, the lift well enclosure shall be fire-resisting construction (see Part 4 'Fire and Life Safety').

5C.4.10.2.4 Where wire grill or similar constructions 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 or adjoining floor or by materials or trucks being moved in the vicinity.

5C.4.10.2.5 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 50 mm, the openings in the enclosure shall be further protected by netting of square mesh of aperture not greater than one centimeter and of wire not smaller than one mm. (The provisions of this clause need not be adhered to for lift wells in factory premises, coming under the purview of Factories Act. In such cases provisions of 4.10.2.4 is sufficient.)

5C.4.10.2.6 There shall be no opening in the lift well enclosure permitting access to the lift car by passing under the counterweight.

5C.4.10.2.7 In case of a completely enclosed lift well, a notice with the word 'Lift' may be placed outside of each landing door.

5C.4.10.2.8 Indicator

Where lifts are installed in totally enclosed wells, position indicators are recommended to be provided at each floor; however, where position indicators are not provided, at least direction indicators or 'In Use' indicators shall be provided at each landing.

5C.4.10.2.9 Landing doors

Every 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 lift car is at landing and that the 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.

5C.4.10.2.10 Automatic devices for cutting off power

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

5C.4.10.3 Lift Pits

5C.4.10.3.1 A lift pit shall be provided at the bottom of every lift.

5C.4.10.3.2 Pits shall be of sound construction and maintained in a dry and clean condition. Where necessary, provision shall be made for permanent drainage and where the pit depth exceeds 1.5 m suitable descending arrangement shall be provided to reach the lift pit. And a suitable fixed ladder or other descending facility in the form of permanent brackets grouted in the wall extending to a height of 0.75 m above the lowest

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floor level shall be provided. A light point with a switch shall also be provided for facility of maintenance and repair work.

5C.4.11 Machine Rooms and Overhead Structures

5C.4.11.1 The lift machine, controller and all other apparatus and equipment of a lift installation, excepting such apparatus and equipments as function in the lift well or other positions, shall be placed in the machine room which shall be adequately lighted and rendered fire-proof and weather-proof.

5C.4.11.2 The motor generators controlling the speed of multi-voltage or variable voltage machines, secondary sheaves, pulleys, governors, floor selecting equipment may be placed in a place other than the machine room, but such position shall be adequately lighted, ventilated and rendered fire-proof and weather – proof.

5C.4.11.3 The machine room shall have sufficient floor area as well as permit free access to all parts of the machines and equipment located therein for purposes of inspection, maintenance or repair.

5C.4.11.4 The room shall be kept closed, except to those who are concerned with the operation and maintenance of the equipment. When the electrical voltage exceeds 220/230 V ac, a danger notice plate shall be displayed permanently on the outside of the door and on or near the machinery. Where standby generator is provided, it is necessary to connect fireman lift to the standby generator. Depending upon the capacity of the standby generator one or more other lifts may also be connected to the supply.

Rescue instruction with required tools and tackles if any shall be made available in the machine room.

All lift which do not have any automatic transfer facility to an alternate supply, such as generator, shall be equipped with Battery Operated Automatic Rescue Device to bring the lift to the nearest floor and open the door in the event of power failure.

5C.4.11.5 The machine room shall be equipped with an insulated portable hand lamp provided with flexible cord for examining the machinery.

5C.4.11.6 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.

5C.4.11.7 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.

5C.4.11.8 Machine room floor shall be provided with a trap door, if necessary. The size of the trap door shall be as per manufacturer's recommendation.

5C.4.11.9 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 2m clear from the floor or the platform of machine whichever is higher.

5C.4.11.10 It will be noted that generally lifts 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. In case where machine room provision on top is a limitation, either machine room less lift or basement drive or side drive lift can be considered.

5C.4.11.11 For detailed information regarding nomenclature of floors and storeys, reference may be made to Myanmar electricity rule and Regulation.

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5C.4.11.12 There should be a proper access planned for approach to the machine room taking into account need for maintenance personnel to access the machine room at all times of day and night and also the need to take heavy equipment. Any fixture such as a ladder provided should be secured permanently to the structure and should have railings to reduce the risk of falling.

5C.4.11.13 It is desirable that emergency exit may be provided in case of large machine rooms having four or more lifts.

5C.4.11.14 Where the machine room occupies a prominent position on roof of a building, provision should be made for lightning protection in accordance with good practice [8-5(7)] and Myanmar electricity Rule and Regulation.

5C.4.11.15 Wherever the machine room is placed, it should be properly ventilated. The ambient temperature of machine room shall be maintained between +5°C and +45°C.

5C.4.11.16 If located in the basement, it should be separated from the lift well by a separation wall.

5C.4.12 Essential Features Required

5C.4.12.1 Power operated car doors on automatically operated lifts shall be so designed that their closing and opening is not likely to injure a person. The power operated car door shall be provided with a sensitive device which shall automatically initiate reopening of the door in the event of a passenger being struck or is about to be struck by the door, while crossing the entrance during closing movement. The effect of the device may be neutralized:

- a) during the last 58 mm of travel of door panel in case of side opening doors
- b) when panels are within 58 mm of each other in case of center opening doors.

The force needed to prevent the door from closing shall not exceed 150 N and this measurement shall not be made in the first third of the travel of the door.

In order to achieve this it is desirable that all power operated doors have a full length (covering at least 80 percent of the car door height from the bottom) infrared light curtain safety to retract the door in the event of coming across any obstacle during closing of the door.

5C.4.12.2 Single speed and two speed drives which are poor in Levelling accuracy and energy consumption shall not be used for new lifts in view of availability of latest technology energy efficient Variable Voltage Variable Frequency drive systems with improved Levelling accuracy.

5C.4.12.3 For passenger lifts with car call button control in car and with capacities of 16 passenger and above, it is recommended to have an additional car operating panel with call buttons on the opposite side to main panel for ease of access to buttons.

5C.4.12.4 Passenger lifts shall be provided with power operated doors which are imperforate.

5C.5 DIMENSIONAL TOLERANCES

5C.5.1 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.

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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.

5C.5.2 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 opening 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 accommodated 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.

5C.5.3 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 the 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.

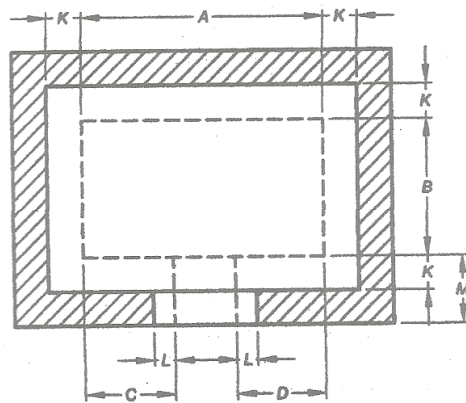


FIG. 2 LIFE WELL TOLERANCE

5C.6 PRELIMINARY DESIGN

5C.6.1 Number of Lifts and Capacity

5C.6.1.1 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 speed are not provided. In view of many variables, no simple formula is possible for determining the most suitable lifts.

NOTE – It is recommended to do Traffic Analysis Study to ensure optimum provision of lifts for the building in consultation with lift manufactures. In view of the dynamic situation it is recommended that a computerized software is used for Traffic Analysis Study.

5C.6.1.2 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) Number of floors to be served by the lifts;
- b) Floor to floor distance;
- c) Population of each floor to be served; and
- d) 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.

5C.6.2 Preliminary Lift Planning

5C.6.2.1 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 method may be used as general guidance on preliminary lift planning for offices, bearing in mind the differences set out in 6.1.2.

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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 of the maximum flow rate required by these people.
- c) interval or the quality of service required.

5C.6.2.2 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 m² to one person per 20 m². It is essential, therefore, that some indication of the probable population density should be obtained from the building owner. If no indications is possible (a speculative development for example) population in the region of 5m² per person for general office buildings is usually assumed.

5C.6.2.3 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 passenger 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 recommended passenger handling capacity for various buildings is as follows:

Type of Building	Handling Capacity
Office – Diversified tenants	10 to 15 percent
Office – Single tenant	15 to 25 percent
Residential	7.5 percent

5C.6.2.4 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 second s	Fair
45 seconds	Poor
Over 45 seconds	Unsatisfactory

NOTE – For residential buildings longer intervals should be permissible.

5C.6.2.5 Traffic Peaks

The maximum traffic flow during the up peak period is usually used 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.

5C.6.2.6 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 2040 kg are recommended according to the requirements.

5C.6.2.7 Speed

It is dependent upon the quantity of service required and the quality of service desired (see 5C.6.2.3 and 5C.6.2.4). 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
3 to 20	1.5 m/s to 2.5 m/s
Above 20	2.5 m/s and above

5C.6.2.8 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 Code. Centre opening doors are more practicable and efficient entrance units for passenger lifts.

5C.6.2.9 Determination of Transportation or Handling Capacity During the Up Peak

5C.6.2.9.1 The handling capacity is calculated by the following formula:

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

Where

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- 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 in seconds, 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 following formula:

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

where

- T = Waiting interval in seconds,
- 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 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 exist for passengers it has been found that most suitable door width is 1000 mm and that of car width is 2000 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.

5C.6.2.9.2 An example illustrating the use of the above consideration is given below:

Gross area per floor	1100 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

$$P = \frac{14 \times 950}{9.5}$$

Upper floors 1400 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

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

$$H = \frac{300 \times Q \times 100}{T \times P} = \frac{300 \times 16 \times 100}{41 \times 1400} = 8.3 \text{ percent}$$

- b) Taking No. of lifts, N = 6

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

$$H = \frac{300 \times Q \times 100}{T \times P} = \frac{300 \times 16 \times 100}{27.6 \times 1400} = 12 \text{ percent}$$

5C.6.3 Quiet 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.

5C.6.4 Positioning of Lifts

A thorough investigation should be made for assessing the most suitable position for lift(s) while planning the building. It should take into account future expansions, if any. Though each building

has to be considered individually for purposes of location of lifts, factors influencing the locations of passenger and goods lifts are given in 6.4.2 to 6.4.4.

The location of lifts may also conform to the travel distance requirements specified in Part 4 'Fire and Life Safety'.

5C.6.4.1 Arrangement of Lifts

The lifts should be easily accessible from all entrances to the building. For maximum efficiency, they should be grouped near the centre of the building. It is preferably not to have all the lifts out in straight line and, if possible, not more than three lifts should be arranged in this manner. It has to be kept in mind that the corridor should be wide enough to allow sufficient space for waiting passengers as well as through passengers.

5C.6.4.1.1 In some cases when there are more than three lifts, the alcove arrangement is recommended. With this arrangement, the lift alcove lead off the main corridor so that there is no interference by traffic to other groups or to other parts of the ground floor. This arrangement permits the narrowest possible corridors and saves space on the upper floors. Walking distance to the individual lift is reduced and passenger standing in the center of the group can readily see all the lift doors and landing indicators. The ideal arrangement of the lifts depends upon the particular layout of the respective building and should be determined in every individual case. Some typical recommended arrangements are given in Fig. 1.

5C.6.4.2 Passenger Lifts

5C.6.4.2.1 Low and medium class flats

Where a lift is arranged to serve two, three or four flats per floor, the lift may be placed adjoining a staircase, with the lift entrances serving direct on to the landings. Where the lift is to serve a considerable number of flats having access to balconies or corridors, it may be conveniently placed in a well ventilated tower adjoining the building.

5C.6.4.2.2 Office buildings, hotels and high class flats

In general the arrangement as recommended in 6.4.1 is to be followed. However, in case this is not possible, it is desirable to have at least a battery of two lifts at two or more convenient points of a building. If this is not possible, it is advisable to have at least two lifts side by side at the main entrance and one lift each at different sections of the building for intercommunication. When two lifts are installed side by side, the machine room shall be suitably planned with sufficient space for housing the machine equipment. The positioning of lifts side by side gives the following advantages:

- a) all machine and switch gear may be housed in one machine room,
- b) the lifts can be inter-connected more conveniently from an installation point of view, and
- c) greater convenience in service owing to the landing openings and each floor being adjacent.

5C.6.4.2.3 Shops and departmental stores

Lifts in shops and stores should be situated so as to secure convenient and easy access at each floor.

5C.6.4.2.4 For buildings with more than 12 floors, it is recommended to have provision of 1 stretcher/service lift in addition to the passenger lifts.

5C.6.4.2.5 For buildings with more than 12 floors, where passenger and service lifts are provided in one lobby it is recommended to have group control for all the lifts.

5C.6.4.3 Goods Lifts

The location of lifts in factories, warehouses and similar buildings should be planned to suit the progressive movement of goods throughout the buildings, having regard to the nature of position of the loading platforms, railway sidings, etc. The placing of a lift in a fume or dust laden atmosphere or where it may be exposed to extreme temperatures, should be avoided wherever possible. Where it is impossible to avoid installing a lift in an adverse atmosphere, the electrical equipment should be of suitable design and construction to meet the conditions involved.

5C.6.4.3.1 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.

5C.6.4.3.2 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 lifts increases.

5C.6.4.3.3 A large capacity goods lift at high speed is often a very uneconomical proposition. 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.

5C.6.4.4 Hospital Bed Lifts

Hospital bed lifts should be situated conveniently near the ward and operating theatre entrances. There shall be sufficient space near the landing door for easy movement of stretcher.

It is convenient to place the passenger lifts in a hospital, near the staircases.

5C.6.5 Structural Considerations

5C.6.5.1 Lift well enclosures, lift pits, machine rooms and machine supports besides conforming to the essential requirements given in 4, should form part of the building construction and comply with the lift manufacturer's drawings.

5C.6.5.2 Machine Room

Floors shall be designed to carry a load of not less than 350 kg/m² over the whole area and also any load which may be imposed there on the by the equipment used in the machine room or by any reaction from any such equipment both during periods of normal operation and repair.

5C.6.5.3 The side wall of the lift well may be made of reinforced cement concrete at least 150 mm thick so as to provide satisfactory anchoring arrangement for fixing. Reference shall also be made to Part 6 'Structural Design, Section 5 Plain, Reinforced and Prestressed Concrete, 5A Plain and Reinforced Concrete'.

5C.6.5.4 The total load on overhead beams shall be assumed as equal to all equipment resting on the beams plus twice the maximum load suspended from the beams.

5C.6.5.5 The factor of safety for all overhead beams and supports based on ultimate strength of the material and load in accordance with 6.5.4 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 1/1500 of the span.

5C.6.6 Access to Machine Room and Lift Pits

5C.6.6.1 Access to machine room above a lift well may be either from the roof or by an internal staircase with a proper arrangement for fixing.

5C.6.6.2 Access between a secondary floor and a machine room may be by ladder. Where a machine room entrance is less than 1.5 m above or below the adjacent floor or roof surfaces, a substantial permanently attached ladder may be used. Ladders shall be fixed at least 150 mm clear of any wall, beam or obstruction and shall extend at least to the landing level. Above the landing level and for a height of at least 1.15m, either the ladder stringers shall be extended or suitable hand grips shall be provided.

5C.6.6.3 Where the machine room entrance is 1.5 m or more above or below the adjacent floor or roof surface, access shall be provided by means of stairs in accordance with the requirements given in 6.6.3.1 to 6.6.3.6.

5C.6.6.3.1 The angle of inclination of the stair shall not exceed 50° from the horizontal and the clear width of the stair shall be not less than 600 mm.

5C.6.6.3.2 The tread shall have a non-slip surface which shall be not less than 150 mm wide for open stair construction and not less than 20cm wide for closed stair construction.

5C.6.6.3.3 The rise of the stair shall not exceed 250 mm.

5C.6.6.3.4 A hand rail shall be provided on the outer stringer of all stairways fixed at a convenient height, but not less than 500 mm high measured vertically from the nosings, and not less than 1m high on landings and platforms. Such hand rail shall have at least 50 mm clearance between nearest permanent object at the corresponding side of the stair.

5C.6.6.3.5 Headroom clearance of not less than 2 m measured from the nosings of the stairway, shall be provided on every stairway.

5C.6.6.3.6 Heights of stairs over 5 m in length shall be provided with intermediate landings.

NOTE – Where compliance with any of the requirements specified in 6.6.1 to 6.6.3 is impracticable, applications for variation shall be made to the Authority, who may, vary such requirements.

5C.6.6.4 Access to a machine room in a basement may be provided from a corridor.

5C.6.6.5 Access to a machine room via the lift well shall be prohibited.

5C.6.6.6 The lift pit should be capable of being examined by a separate access. In the case of a battery of two lifts, it is possible to examine the lift pit through the adjoining one.

5C.6.7 Fire Protection

To prevent fire from spreading by means of the lift well, lift well enclosures shall conform to the requirements given in 'Fire and Life Safety'. The machine room should be constructed of a suitable grade of fire-resisting material and precautions should be taken to minimize spread of fire from the machine room into the lift well see also 5C.7.3.14.

5C.6.8 Requirements for Fireman's Lift

5C.6.8.1 For buildings having height of 15 m or more at least one lift shall meet the requirements of fireman's lift as given in 5C.6.8.2.

5C.6.8.2 The fireman's lift shall have the following minimum requirements:

- a) Lift car shall have floor area of not less than 1.44 square meters. It shall also have a loading capacity of not less than 550 kg (8 persons).
- b) Lift landing doors shall have a minimum of fire resistance of two hour.
- c) Doors shall be of automatic operation for car and landing.

5C.6.8.3 Fireman's lifts in a building having more than 15 m or more height, shall work at or above the speed of 1.0 m/s so as to reach the top floor from ground level within one minute.

5C.6.8.4 Operation Requirements of Fireman's Lift

The lift shall be provided with the following as a minimum:

- a) A two position switch at evacuation floor (normally main entrance floor) (ON/OFF), and
- b) Buzzer and 'Fireman's lift' – light in car

5C.6.8.4.1 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 from smoke detector (if provided by the Building Management System) is on. All lift(s) controlled by this switch shall cancel all existing car calls and separate from landing calls and no landing or car calls shall be registered. The buzzer and "fireman's lift" light 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 doors and return non-stop to the evacuation floor.
 - 4) If the lift is standing at a floor other than the evacuation floor, it shall close the door and start travelling non-stop to the evacuation floor.
 - 5) When at the evacuation floor the lift shall park with doors open.
 - 6) The buzzer is turned off after this return 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 switch is "ON".
- 2) The lift does not respond to landing calls but registers car calls. All heat and smoke sensitive door reopening devices are rendered inoperative.

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- 3) When the car call button is pressed the doors start closing. If the button is released before the doors are fully closed, they re-open. The car calls is registered only when the doors are fully closed.
- 4) After registering a car call the lift starts 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 doors are fully open, they re-close.
- 6) The lift returns to normal service when it stands at the evacuation floor with doors open and the switch is "OFF".

5C.6.9 Supply Cables and Switches

Each lift should be provided with a main switch or circuit breaker of a capacity determined by the lift manufacturer and the incoming supply cable should terminate in this switch. For a single lift, this switch should be fixed adjacent to the machine room entrance inside the machine room. In a machine room common to more than one lift, each main switch should be conveniently situated with respect to the lift it controls. Switches and fuses (which may form part of a distribution switch-board) should be provided for isolating the supply cables to the machine room.

5C.6.10 The detailed design considerations for different types and selection of the lifts shall be done in accordance with good practice [8-5(5)].

5C.7 POWER AND CONTROL SYSTEMS

5C.7.1 Features Associated with Power Systems

5C.7.1.1 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.

5C.7.1.2 Levelling Accuracy

The Levelling tolerances in not more than $\pm 5\text{mm}$, 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.

5C.7.1.3 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 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.

5C.7.1.4 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.

5C.7.2 Description of Operation Systems

5C.7.2.1 Methods of Control Systems

The methods of control systems are as follows:

- a) Attendant and dual control (see 5C.7.2.2), and
- b) Automatic push button operation (see 5C.7.2.2).

5C.7.2.1.1 Types of control systems

- a) Collective control (see 5C.7.2.3)
- b) Single push button collective control (see 5C.7.2.4)
- c) Down collective control (see 5C.7.2.5)
- d) Directional collective control for one car (see 5C.7.2.6)
- e) Directional collective control for two or three cars (see 5C.7.2.7)
- f) Group supervisory control (see 5C.7.2.8)

Features of control systems are described in 7.3.

5C.7.2.2 Automatic Push Button Operation

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 designed 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.

5C.7.2.3 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.

5C.7.2.4 Single Push Button Collective Control

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

5C.7.2.5 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.

5C.7.2.6 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.

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 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 the back of the car or on the landing to indicate to the entering person in which direction the car is going to depart.

5C.7.2.7 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 or floor buttons (in case of car control from floor) 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 (see 5C.7.2.8) is generally necessary in the interest of efficiency.

With this type of control the following signals are included:

- a) A landing signal light for each landing push button to indicate 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 or an indication on the landing call push button station 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.

5C.7.2.8 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 car, 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.

5C.7.3 Features of Operation Systems

5C.7.3.1 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' is by a key operated switch in the car. The operation is then from the car only and the doors remain

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open until a car call is registered for a floor destination. All landing calls are bypassed and car position indicators on the landing for this lift are not illuminated. The removal of the key when the special operation is completed restores the control to normal service.

5C.7.3.2 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.

5C.7.3.3 Motor Generator Shut Down

Lifts controlled by variable voltage system automatically shutdown when subject to an overriding 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.

5C.7.3.4 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.

5C.7.3.5 Hospital Service

Lifts for carrying beds and stretchers require a car preference switch so that 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 7.3.1. Otherwise such lifts can have the same control system as for normal passenger lift, the choice depending on the number of floors and served, the service required and the number of lifts.

5C.7.3.6 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.

5C.7.3.7 Automatically Power Closed Doors

For passenger operation when the cars arrives at a landing the door 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.

5C.7.3.8 Controlled Power Closed Doors

When there are conditions that particularly affect the safety of passengers or damage to vehicles or turcks, the closing of the door 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 attentions to a car or landing door which has been left open. This means of operation is required for some forms of good lifts.

5C.7.3.9 Safe Operation of Doors

The safety of passengers passing through lift entrances is fully covered by the provision of good practice [8-5(9)]. Myanmar Electricity (lift) Rule & Regulation, cp 2 2009, EN 81-1-1998. No modification of these provisions should be specified.

5C.7.3.10 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 buildings 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 7.3.1)

5C.7.3.11 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.

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 lift with automatically opened car and landing doors, no vision panels are required; and

5C.7.3.12 Service Switches

When switches are provided to take cars out of service, that is because the remaining cars in the groups 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.

5C.7.3.13 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.

5C.7.3.14 Push Buttons and Signals

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

5C.7.3.15 In public places where blind persons are expected to use the lifts it is recommended to provide Brailey buttons.

5C.7.4 Electrical Installation Requirements

5C.7.4.1 General

The lift are 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,

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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.

- a) Power supply mains – The lift sub-circuit from the intake room should be separate from other building service.
- b) Each lift should be capable of being isolated from the mains supply. This means of isolation should be lockable.
- c) 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.
- d) 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.

5C.4.7.2 Electric Wiring and Apparatus

5C.7.4.2.1 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.

5C.7.4.2.2 All metal casings or metallic coverings containing or protecting any electric supply lines of apparatus shall be efficiently earthed.

5C.7.4.2.3 No bare conductor shall be used in any lift car as may cause danger to persons.

5C.7.4.2.4 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.

5C.7.4.2.5 Suitable caution notice shall be affixed near every motor or other apparatus in which energy is used at a pressure exceeding 250 V.

5C.7.4.2.6 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.

5C.7.4.2.7 A single trailing cable for lighting control and signal circuit shall be permitted, if all the conductors of this trailing cable are insulated for maximum voltage running through any one conductor of this cable.

5C.7.4.3 Emergency Signal or Telephone

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

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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.

The type of telephone should be stated in the enquiry.

5C.7.4.4 Earthing

5C.7.4.4.1 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 5 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 mm² {see also good practice [8-5(10)] }, cp 2 – 2009 Myanmar Electricity rule & Regulation.

5C.7.4.4.2 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 (such terminal being one specially provided for this purpose), and the earth conductor should be appropriately sized in accordance with good practice [8-5(10)], Myanmar Electricity 1985.

The size of earthing conductor shall be in accordance with Part 8 'Building Services, Section 2 Electrical and Allied Installations'.

5C.7.4.4.3 The earthing conductor shall be secured to earthing terminal in accordance with the recommendations made in good practice [8-5(10)], Myanmar Electricity rule & Regulation 1989 and also in conformity with the latest provisions of Myanmar Electricity rule & Regulation and Rules framed thereunder from time to time.

5C.7.4.4.4 The exposed metal parts of electrical apparatus installed on a lift car shall be sufficiently bonded and earthed.

5C.7.4.4.5 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.

5C.7.4.4.6 One side of the secondary winding of bell transformers and their cases shall be earthed.

5C.7.4.4.7 Where there are more than one lift in a building, there should be a separate earth pit for the lifts.

5C.7.5 Building Management Systems – Interface for Lifts

5C.7.5.1 Where more than three lifts are provided in a building and especially when these are provided at different locations in the building a form of central monitoring may be provided. Such central monitoring may be through a Building Management Systems, if provided in the building or through a display panel.

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5C.7.5.2 The following signals should be given to the building management interface from each lift.

- a) Alarm button in car,
- b) Door Zone or floor level information,
- c) Lift moving information,
- d) Power on information, and
- e) Lift position information.

5C.7.5.3 Each of these signals shall be provided through a potential free contact located in the lift machine room. The contacts shall be rated for 230 V ac/1A or 24 V dc/1A. A pair of wires should be used for each potential contact.

5C.7.5.4 The wiring between lift machine room to Building Management Systems shall be planned and carried out by the builder along with other wiring in the building.

5C.7.5.5 The building management system should ensure that any position information is read only when the lift is moving (lift moving information) or is capable of reading several times to detect a stable state.

In addition to the signals above the following signals may be added if required for the benefit of monitoring the lift performance.

- a) A summary fault output to indicate a lift in fault condition, which prevents the lift from providing service. This summary fault condition shall include the most common faults such as safety circuit open.
- b) Service or inspection mode.
- c) Attendant mode.
- d) Fire mode.
- e) Doors opening.
- f) Doors closing.
- g) Lift moving up.
- h) (In combination with lift moving and lift moving up information, lift moving down information can be sensed by the Building Management Systems).
- i) Door Reopen Request (Summary of Door Open, Light Curtain, Photocell, Safety Edge Signals).

5C.7.5.6 Where it is desired that it should be possible to control the lift from Building Management Systems, the following control signals can be provided.

- a) Normal to service/inspection mode change over.
- b) Fault Accept/Rest Input

(Using this input, the lift controller may be allowed to clear an existing fault if this is otherwise safe. It will be decided by the Lift manufacturer as to what faults can be cleared)

- a) Car call to top most floor and bottom most floor of each lift.

Where such control inputs are provided, it should be with a pass word and login feature that allows one to determine who has used these inputs and at what time. Always such inputs

should be through authorized person only. The Building Management Systems should make all changeovers effective only when lift is not moving.

5C.7.5.7 Control inputs from Building Management Systems should be through a potential free contact capable of carrying 24 V dc/1A or 230 V ac/1A. The wiring should be terminated in each lift machine room.

5C.8 CONDITIONS FOR OPTIMUM PRACTICE

5C.8.1 Lift Entrance Operation

5C.8.1.1 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 main part in the service given, and should receive careful consideration.

5C.8.1.2 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 closing though powered, to be controlled by continuous pressure button, rather than being automatically initiated {see good practice [8-5(4)] }.

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

5C.8.2 Painting at Works and on Site

Lift equipment with normally receive a protective coat of paint at works before dispatch to site. Further painting of lift equipment may 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 premise, is subject to negotiation between the lift maker and the purchaser.

Decorative finishes are a subject for separate negotiation.

5C.8.3 Special Environments

Standard equipment is suitable for use inside normal residential, commercial and industrial buildings but when 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 temperature, 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, gas plant.
- g) Explosive and inflammable atmosphere, for example gas plants and petroleum and polyester industries.

5C.8.4 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.

5C.8.5 Lighting and Treatment of Walls, Floors, Etc

5C.8.5.1 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 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.

5C.8.5.2 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 into machine rooms or on to landings.

Sufficient number of light points should be provided in the lift shaft for proper illumination.

5C.8.5.3 Should a lift entrance open out into an area expected to be weather the entrance should be protected by a suitable canopy and the ground level slope up to the entrance to prevent during rain or surface drainage from entering the lift well through the clearances around the landing doors. Any push buttons so enclosed should be of weatherproof type.

5C.8.6 Stairwell Enclosure

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 motor of the lift.

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

5C.8.7 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.

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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 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 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.

5C.9 RUNNING AND MAINTENANCE

5C.9.1 The lift installation should receive regular cleaning, lubrication, adjustment and adequate servicing by authorized competent persons at such intervals as the type of equipment and frequency of service demand. In order that the lift installation is maintained at all times in a safe condition, a proper maintenance schedule shall be drawn up in consultation with the lift manufacturer and rigidly followed. The provision of a log book to record all items relating to general servicing and inspection is recommended for all lifts. It is essential that the electrical circuit diagram of the lift with the sequence of operation of different components and parts should be kept readily available for the persons responsible for the maintenance and replacement where necessary.

5C.9.2 Particular attention may be directed for through periodical examination of wire ropes when in service. Attention should also be directed to the thorough examination of the groove of drums, sheaves and pulleys when installing a new rope. A groove deepened by rope wear is liable to lead to early failure of a new rope unless the groove is returned.

5C.9.3 Any accident arising out of operation or maintenance of the lifts should be duly reported to the Authority in accordance with the rules laid down. A notice may be put in the machine room to this effect.

5C.10 PROCEDURE FOLLOWING TEST, INCLUDING INSPECTION AND MAINTENANCE

5C.10.1 Acceptance

The purchaser should make timely arrangement for accepting the lift on completion of test, and for insurance cover. Special arrangements (see 13.4) are necessary if there is no break interval before the lift goes into normal service.

5C.10.2 Guarantee and Servicing

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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 fault, 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 internals redecoration and other similar activities, which may be undertaken within the building.

5C.10.3 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.

5C.10.4 Lift not in Immediate Use (Shut Down Maintenance)

When conditions do not permit a lift to be taken to 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.

5C.10.5 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.

5C.10.6 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.

5C.11 ESCALATORS

5C.11.1 Escalators are deemed essential where the movement of people , in large numbers at a controlled rate in the maximum of space, is involved , for example, railway stations, air-ports, etc. In exhibitions big departmental stores and the like, escalators encourage people to circulate freely and conveniently.

5C.11.1.1 As the escalators operate at a constant speed, serve only two levels and have a known maximum capacity, the traffic study is rather easy. Provided the population to be handled in a given time is known, it is easy to predict the rate at which the population can be handled.

5C.11.1.2 For normal peak periods, the recommended handling capacities for design purposes should be taken as 3 200 to 6 400 persons per hour depending upon the width of the escalator.

The number of persons that may be theoretically carried by the escalator in 1 hr. can be calculated as follows:

For determination of theoretical capacity it is assumed that one step with an average depth of 0.4 m can carry 1 person for a step width of 0.6 m, 1.5 persons for a step width of 0.8 m and 2 persons for a step width of 1.0 m.

The theoretical capacity then is:

$$3600 \times (\text{rated speed in m/s} \times k) / 0.4$$

Where

$$K = 1.15, \text{ or } 2 \text{ for } 0.6, 0.8 \text{ and } 1.0 \text{ m step widths.}$$

Some values calculated as per the above are:

Step width	Theoretical Capacity in Persons/hour		
	0.5 m/s speed	0.65 m/s speed	0.75 m/s speed
0.6 m	4 500	5 850	6 750
0.8 m	6 750	8 775	10 125
1.0 m	9 000	11 700	13 500

5C.11.2 Terms and Definitions

For the purposes of this document, the terms and definitions given the following apply.

5C.11.2.1 Angle of Inclination

maximum angle to the horizontal in which the steps, the pallets or the belt move

5C.11.2.2 Balustrade

part of the escalator/moving walk which ensures the user's safety by providing stability, protecting from moving parts and supporting the handrail

5C.11.2.3 Balustrade Decking

Transverse member of the balustrade which meets the handrail guidance profile and which forms the top cover of the balustrade

5C.11.2.4 Brake Load

Load on the step/pallet/belt which the brake system is designed to stop the escalator/moving walk

5C.11.2.5 Comb

Pronged section at each landing that meshes with the grooves

5C.11.2.6 Comb Plate

Platform at each landing to which the combs are attached

5C.11.2.7 Electrical Safety System

Safety related part of the electrical control system as an arrangement of safety circuits and monitoring devices

5C.11.2.8 Electrical Safety Devices

Part of a safety circuit consisting of safety switches and/or fail safe circuits

5C.11.2.9 Escalator

Power-driven, inclined, continuous moving stairway used for raising or lowering persons in which the user carrying surface (e.g. steps) remains horizontal

NOTE Escalators are machines - even when they are out of operation - and cannot be considered as fixed staircases.

5C.11.2.10 Exterior Panel

Part of the exterior side of the enclosure of an escalator or moving walk

5C.11.2.11 Fail Safe Circuit

Safety related electrical and/or electronic system with defined failure mode behaviour

5C.11.2.12 Handrail

Power-driven moving rail for persons to grip while using the escalator or moving walk

5C.11.2.13 Interior Panel

Panel located between the skirting or lower inner decking and the handrail guidance profile or balustrade decking

5C.11.2.14 Lower Inner Decking

Profile that connects the skirting with the interior panel when they do not meet at a common point.

5C.11.2.15 Lower Outer Decking

Profile that connects the exterior panels with the interior panel

5C.11.2.16 Machinery

Escalator or moving walk machine(s) mechanisms and associated equipment

5C.11.2.17 Machinery Spaces

Space(s) inside or outside of the truss where the machinery as a whole or in parts is placed

5C.11.2.18 Maximum Capacity

Maximum flow of persons that can be achieved under operational conditions

5C.11.2.19 Moving Walk

Power-driven installation for the conveyance of persons in which the user carrying surface remains parallel to its direction of motion and is uninterrupted (e.g. pallets, belt)

NOTE Moving walks are machines - even when they are out of operation – and should not be used as a fixed access.

5C.11.2.20 Newel

End of the balustrade

5C.11.2.21 Nominal Speed

Speed in the direction of the moving steps, pallets or the belt, when operating the equipment under no load condition (i.e. without persons), stated by the manufacturer as that for which the escalator or moving walk has been designed

NOTE Rated speed is the speed the escalator/moving walk moves under rated load conditions.

5C.11.2.22 Rated Load

Load which the equipment is designed to move

5C.11.2.23 Rise

Vertical distance between the upper and lower finished floor levels

5C.11.2.24 Safety Circuit

Part of the electric safety system consisting of electrical safety devices

5C.11.2.25 Skirting

Vertical part of the balustrade interfacing with the steps, pallets or belt

5C.11.2.26 Skirt Deflector

Device to minimize the risk of trapping between the step and the skirting

5C.11.2.27 Stand-by Operation

Mode in which an escalator/moving walk can be stopped or operated under no load condition with any speed below the nominal speed

5C.11.3 Symbols and Abbreviations

The following symbols and corresponding units of measurement of the following Table 1 are used in this standard.

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Table 1 — Symbols and corresponding units of measurement used in this standard

Symbol	Designation	Unit	Figure
b1	Distance between the handrail centre lines	m	3
b2	Width of the handrail	mm	3
b3	Horizontal distance between skirting and interior panel	mm	3
b4	Width of the horizontal part of the lower inner decking that directly joins the interior panel	mm	3
b5	Horizontal distance between the inner edge of the handrail and the top edge of the interior panel	mm	3
b6', b6"	Horizontal distance between the handrail profile and guide or cover profiles	mm	3
b7	Width of the grooves	mm	2
b8	Web width	mm	2
b9	Horizontal distance between the outer edge of the handrail and a non- continuous obstruction, e.g. roof intersection, column	mm	A.1
b10	Horizontal distance between the outer edge of the handrail and a continuous obstruction, e.g. wall	mm	A.1
b11	Horizontal distance between the handrails of adjacent escalators/moving walks	mm	A.1
b12	Vertical distance between the lower edge of the handrail and the balustrade decking	mm	3
b13	Width of the lower outer decking	mm	4
b14	Horizontal distance between the outer edges of interior panels on adjacent escalators or moving walks	mm	4
b15	Horizontal distance between the building structure (wall) and the centre line of the handrail	mm	4
b16	Horizontal distance between the centre lines of the handrails of adjacent escalators/moving walks	mm	4
b17	Horizontal distance of the anti-slide device to the outer edge of the handrail	mm	4
h1	Vertical distance between the top of the handrail and step nose or pallet surface or belt surface	m	2, 3
h2	Vertical distance between top edge of skirting or bottom edge of cover joints and the line of the step nose or the tread surface of the pallets or belt	mm	3
h3	Distance between the entry of handrail into the newel and the floor	m	2,3

Table -1 Continued

Symbol	Designation	Unit	Figure
h4	Free height above any point of step surfaces, pallets or belt over the area between both outer edges of the handrails	m	2, A.1
h5	Height of the deflector	m	2,4
h6	Clearance between the upper edge of the tread surface and the root of the comb teeth	mm	2
h7	Depth of the grooves	mm	2
h8	Mesh depth of the comb into the grooves of the tread	mm	2
h9	Vertical distance between floor and lower end of the anti-	mm	4
h10	Vertical distance between lower edge of the handrail and upper end of the access restriction device	mm	4
h11	Height of the anti-slide device	mm	4
h12	Height of the upper edge of the free space outside the handrail	mm	A.1
h13	Vertical distance between the upper and lower finished floor	m	2
L1	Root of the comb teeth	-	2
l1	Horizontal distance between supports	m	2
L2	Comb intersection line	-	2
l2	Distance between the furthest point reached by the handrail and the comb intersection line measured parallel to the tread surface	m	2
l3	Length of the straight portion of the handrail in the direction of landing measured from the comb intersection line	m	2
l4	Distance between the furthest point reached by the handrail and the point of entry into the newel measured parallel to the tread surface	m	2
l5	Length of anti-climbing device on the lower outer decking	mm	4
v	Nominal speed	m/s	-
x1	Step height	m	5
y1	Step depth	m	5
z1	Nominal width for the load carrying area (step, pallet or belt)	m	3, 5
z2	Horizontal distance between skirting	m	3
z3	Transverse distance between the supporting rollers	mm	8
α	Angle of inclination of the escalator or moving walk	°(degree)	2
β	Design angle of the teeth of the comb	°(degree)	2
γ	Cross-sectional angle of inclination of the lower inner decking	°(degree)	3
μ	Friction coefficient	-	-

5C.11.4 List of significant hazards

5C.11.4.1 General

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for escalators and moving walks and which require action to eliminate or reduce the risk.

5C.11.4.2 Mechanical hazards

Mechanical hazards on escalators and moving walks and in their immediate vicinity can occur because of the design of the machine or access to it.

These include:

- contact with moving machinery parts (e.g. driving unit, handrail drive) normally not accessible to the public (see 5C.11.5.2(b), 5C.11.5.2(d), 5C.11.5.2(e), 5C.11.5.2(f), 5C.11.5.6.1, A.3.2, A.3.3);
- impact on bodies caused by collision with building structures (wall, roof, criss-cross arrangement or with persons on adjacent escalators/moving walks (see A.2.1, A.2.2, A.2.3, A.2.4);
- trapping between step and step or pallet and pallet (see 5C.11.5.4).

5C.11.4.3 Electric hazards

Electric hazardous situations can occur due to:

- contact of persons with live parts
- indirect contact
- inadequate emergency stops [see 5C.11.5.12.2(c)]
- wrong assembly of electric components
- electrostatic phenomena
- external influences on electric equipment [see 5C.11.5.12.1(d), 5C.11.5.12.1(e), 5C.11.5.12.2(d)]

5C.11.4.4 Fire hazard

Fire hazards can be generated by accumulation of combustible material inside the truss, by the isolation material for cables and overloading of drives [see 5C.11.5.2.1(d), 5C.11.5.10].

5C.11.4.5 Hazards generated by neglecting ergonomic principles in machinery design

Hazardous situation can occur because of:

- Inadequate lighting in the working places and access to them (see 5C.11.5.9.3(a), 5C.11.5.9.3(b), A.3.4, A.3.5);
- insufficient space in working places (see 5C.11.5.11.2(b), 5C.11.5.11.2(c), 5C.11.5.11.2(d), A.3.6, A.3.7, A.3.8);
- missing lifting equipment for heavy loads (see 5C.11.5.9.2.2).

5C.11.4.6 Hazards generated by break-up during operation

Even if the design of an escalator or moving walks follows the requirements of EN 115-1, there are specific hazards which can occur due to

- greater than specified user and structural loads on the truss (see 5C.11.5.2.3);
- loads greater than specified on the steps/pallets by unforeseeable misuse (see 5C.11.5.5);

5C.11.4.7 Slipping, tripping and falling hazards

Most of the dangerous situations on escalators and moving walks are caused by the slipping and falling of persons.

This is:

- falling caused by inadequate lighting at the landings (see A.2.8,A.2.9).

5C.11.5 Safety Requirements and/or Protective Measures

5C.11.5.1 General

Escalators and moving walks shall comply with the safety requirements and/or protective measures of this clause.

5C.11.5.2 Supporting structure (truss) and enclosure

5C.11.5.2.1 General

- a) All mechanically moving parts of the escalator or moving walk shall be completely enclosed within imperforate panels or walls. Except from this are the accessible steps, the accessible pallets, the accessible belt and that part of the handrail available for the user. Apertures for ventilation are permitted [see also 1.5.2.1(e)].
- b) The exterior panels shall withstand a force of 250 N at any point at right angles on an area of 25 cm² without breakage or deflection resulting in any gap. The fixing shall be designed in that way to carry at least twice the dead load of the enclosure.
- c) It is permissible to omit an enclosure of the mechanically moved parts if other measures (such as rooms with locked doors accessible to authorized personnel only) make a hazard to the public impossible.
- d) Accumulation of materials (e.g. grease, oil, dust, paper) represents a fire risk. Therefore it shall be possible to clean the inner part of the escalator/moving walk.
- e) Ventilation apertures shall be built or arranged. However it shall not be possible to pass a straight rigid rod 10 mm in diameter through the enclosure and to touch any moving part through a ventilation aperture.
- f) Any exterior panels which are designed to be opened (e.g. for cleaning purposes) shall be provided with an electric safety device).

5C.11.5.2.2 Angle of inclination

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The angle of inclination α of the escalator shall not exceed 30° , but for rises h_{13} not exceeding 6 m and a nominal speed not exceeding 0,50 m/s the angle of inclination is permitted to be increased up to 35° (see α in Figure 2).

The angle of inclination of moving walks shall not exceed 12° .

5C.11.5.2.3 Structural design

The supporting structure shall be designed in a way that it can support the dead weight of the escalator or moving walk plus a rated load of 5 000 N/m².

Based on the rated load, the maximum calculated or measured deflection shall not exceed 1/750 of the distance l_1 between the supports.

5C.11.5.3 Steps, pallets, belt

5C.11.5.3.1 General

In the user carrying area of the escalator, the step treads shall be horizontal with a tolerance of $\pm 1^\circ$ in the direction of travel.

Tread surfaces for escalators and moving walks shall provide a secure foothold.

5C.11.5.4 Dimensions

5C.11.5.4.1 General

For escalators and moving walks the nominal width z_1 shall be not less than 0,58 m and not exceed 1,10 m. For moving walks with an angle of inclination up to 6° widths up to 1,65 m are permitted.

- a) Step treads and pallets (see Figure 2, detail X and Figure 5)
- b) The step height x_1 shall not exceed 0,24 m.
- c) The step depth y_1 shall be not less than 0,38 m.
- d) The surface of the step treads and pallets shall have grooves in the direction of movement with which the teeth of the combs mesh.
- e) The step risers shall be cleated and the surface of the cleat shall be smooth. The ends of the step tread shall mesh with the cleating of the next step riser.
- f) The width b_7 of the grooves shall be at least 5 mm and not exceed 7 mm.
- g) The depth h_7 of the grooves shall be not less than 10 mm.
- h) The web width b_8 shall be at least 2,5 mm and not exceed 5 mm.
- i) The step treads and step risers or pallets shall not finish with a groove at their side edges.
- j) The edge between the surface of the step tread and the riser shall have any sharpness relieved.
- k) Belts (see Figure 2, detail X)
- l) The belts shall have grooves in the direction of travel with which the teeth of the comb mesh.
- m) The width b_7 of the grooves shall be at least 4,5 mm and not exceed 7 mm, and shall be measured at the tread surface of the belt.

- n) The depth h_7 of the grooves shall be not less than 5 mm.
- o) The web width b_8 shall be at least 4,5 mm and not exceed 8 mm and shall be measured at the tread surface of the belt.
- p) The belt shall not finish with a groove at the side edge of the belt.

Splicing of the treadway belt shall be such as to provide a continuous unbroken treadway surface.

5C.11.5.5 Structural design

5C.11.5.5.1 General

The materials shall retain their strength characteristics during their specified life cycle taking into account the environmental conditions, e.g. temperature, ultra violet radiation, humidity, corrosion.

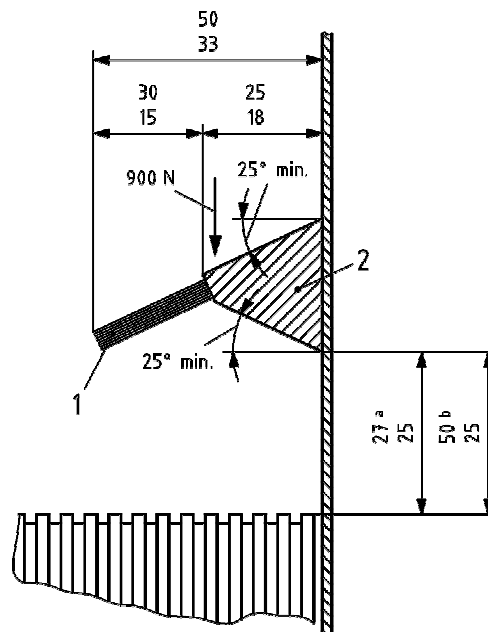
The steps, pallets and the belt shall be designed to withstand all possible loading and distortion effects, which may be imposed by the tracking, guiding and driving system during normal operation and shall be designed to support an equally distributed load corresponding to 6 000 N/m².

NOTE 6000 N/m² is derived from a static load of 5000 N/m² plus an impact factor of 1.2.

Assembled steps and pallets shall be designed such that all component parts e.g. inserts or fixings are securely attached and do not become loose during their life cycle. The inserts and fixings shall withstand the reaction force of operating the comb/comb plate electric safety device.

Key

- 1 flexible part
- 2 rigid part
- a in the inclined area
- b in the transition and horizontal areas



Dimensions in millimetres

NOTE This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure 1 Requirements on skirt deflectors

5C.11.5.6 Newel

5C.11.5.6.1 The newel including the handrails shall project horizontally beyond the comb intersection line by at least 0,60 m in longitudinal direction (see L_2 and l_2 in Figure 2 and detail X).

5C.11.5.6.2 The horizontal portion of the handrail shall continue longitudinally at the landings for a distance l_3 (see Figure 2) of at least 0,30 m past the comb intersection line (see L_2 in Figure 2 and detail X).

In the case of inclined moving walks without a horizontal section at the landings, the continuation of the handrail parallel to the angle of inclination is permitted.

5C.11.5.7 Landings

5C.11.5.7.1 Surface properties

The landing area of escalators and moving walks (i.e. comb plate and floor plate) shall have a surface that provides a secure foothold for a minimum distance of 0,85 m measured from the root of the comb teeth (see L_1 in Figure 2 and detail X).

5C.11.5.7.2 Configuration of steps, pallets and belts

- a) At the landings, the steps of the escalator shall be guided in such a way that the front edges of the steps leaving the comb and the rear edges of the steps entering the comb are moving horizontally for a length of at least 0,80 m measured from point L_1 (see Figure 2 and detail X).

At nominal speeds above 0,50 m/s and not more than 0,65 m/s or rises h_{13} above 6 m this length shall be at least 1,20 m, measured from point L_1 (see Figure 2 and detail X).

At nominal speeds above 0,65 m/s this length shall be at least 1,60 m measured from point L_1 (see Figure 2 and detail X).

A vertical difference in level between two consecutive steps of 4 mm is permitted.

- b) For escalators, the radius of curvature in the upper transition from incline to horizontal shall be:
- at least 1,00 m for nominal speeds $v \leq 0,5$ m/s (inclination of max 35°);
 - at least 1,50 m for nominal speeds $0,5$ m/s $< v \leq 0,65$ m/s (inclination of max 30°);
 - at least 2,60 m for nominal speeds $v > 0,65$ m/s (inclination of max 30°).

The radius of curvature in the lower transition from incline to horizontal of the escalator shall be at least 1,00 m up to 0,65 m/s the nominal speed and at least 2,00 m above 0,65 m/s.

- c) For belt moving walks, the radius of curvature in the transition from incline to horizontal shall be at least 0,40 m.

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For pallet moving walks, it is not necessary to determine the radius of curvature because, on account of the maximum permissible distance between two consecutive pallets, it will always be sufficiently large.

- d) At the upper landings of moving walks with an inclination of more than 6°, the pallets or belt shall move for a length of at least 0,40 m at a maximum angle of 6° before entering or after leaving the comb.

Analogous to 11.5.7.2 (a), for pallet moving walks the movement is specified as follows:

The front edge of the pallet leaving the comb and the rear edge of the pallet entering the comb shall move without changing the degree of angle over at least 0,40 m.

- e) Provisions shall be made in the area of the combs to ensure the correct meshing [see 11.5.7.2(e)] of the comb teeth with the grooves of the tread surface.

Belts shall be supported in this area in a suitable manner, e.g. by drums, rollers, sliding plates.

5C.11.5.8 Combs

5C.11.5.8.1 General

Combs shall be fitted at both landings to facilitate the transition of users. The combs shall be easily replaceable.

5C.11.5.8.2 Design

- a) The teeth of the combs shall mesh with the grooves of the steps, pallets or belt [see 11.5.8.2.(g)] The width of the comb teeth shall be not less than 2,5 mm, measured at the tread surface (see Figure 2, detail X).
- b) The ends of the combs shall be rounded off and so shaped as to minimise the risk of trapping between combs and steps, pallets or belt.
- c) The radius of the teeth end shall be not greater than 2 mm.
- d) The teeth of the comb shall have a form and inclination so that the feet of users, leaving the escalator or moving walk, should not stub against them. The design angle β shown in Figure 2, detail X shall not exceed 35°.
- e) The combs or their supporting structure shall be adjustable, to ensure correct meshing (see Figure 2, detail X).
- f) The combs shall have such a design that upon trapping of foreign bodies either their teeth deflect and remain in mesh with the grooves of the steps, pallets or belt, or they break.
- g) In the case of objects being trapped which are not dealt with by the means described in [11.5.8.2(e)] and in the case of comb/step/pallet impact the escalator or moving walk shall be stopped automatically.
- h) Mesh depth of the combs into the grooves
- i) The mesh depth h_8 of the combs into the grooves of the tread (see Figure 2, detail X) shall be at least 4 mm.
- j) The clearance h_6 (see Figure 2, detail X) shall not exceed 4 mm.

5C.11.5.9 Machinery spaces, driving station and return stations

5C.11.5.9.1 General

These rooms/spaces shall be used only for accommodating the equipment necessary for the operation and maintenance and inspection of the escalator or moving walk. Fire alarm systems, equipment for direct fire abatement and sprinkler heads, provided they are sufficiently protected against incidental damage, are permitted in these rooms provided they do not generate additional risks for maintenance operation.

5C.11.5.9.2 Dimensions and equipment

- a) In machinery spaces, especially in driving and return station inside the truss, space with a sufficiently large standing area shall be kept free from permanently installed parts of any kind. The size of the standing area shall be at least 0,30 m² and the smaller side shall be at least 0,50 m long.
- b) If the controller cabinet has to be moved or lifted for maintenance purposes, then suitable attachments for lifting shall be provided, e.g. eyebolts, handle.
- c) Where the main drive or brake is arranged between the user side of the step, pallet or belt and the return line, a level standing area in the working zone of not less than 0,12 m² shall be provided. The minimum dimension shall be not less than 0,30 m. This standing area is permitted to be fixed or removable.

NOTE: For machinery spaces, see also A.3.

5C.11.5.9.3 Lighting and socket outlets

- a) The electric lighting and the socket outlets shall be independent of the power supply to the machine being fed either by a separate cable or a branch cable which is connected before the main switch of the escalator or moving walk. It shall be possible to break the supply of all phases by means of a separate
- b) Electric lighting installations in driving and return stations and machinery spaces inside the truss shall be by means of a portable lamp permanently available in one of these places. One or more socket outlets shall be provided in each of these places.

The light intensity shall be at least 200 lx in working areas.

5C.11.5.9.4 Socket outlets shall be

Either of type 2 P+PE (2 poles + earth conductor), 250 V, directly supplied by the mains, or of a type that is supplied at a safety extra low voltage in accordance with Local Rule. 5C.11.5.11.3 Maintenance and repair stop switch. There shall be a stop switch in the driving and return station. Escalators and moving walks with the driving unit arranged between the user side of the step, pallet or belt and the return line, or outside the return stations, shall have additional stop switches in the area of the driving unit. The operation of these stop switches shall cause the disconnection of the power supply from the driving machine and allow the operational brake to become effective to stop the escalator or moving walk.

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The stop switches shall be achieve a category 0 stop. When activated it shall prevent the escalator or moving walk from starting. The switching positions shall be marked clearly and permanently.

SPECIFIC CASE A stop switch need not be provided in a machinery space if a main switch according to 5C.11.5.10 is located therein.

5C.11.5.10 Fire protection

Fire protection and building requirements differ from country to country and so far neither have been harmonized. Therefore, this standard cannot include specific requirements for fire protection and building requirements. However, it is recommended that as far as possible, escalators and moving walks are made of materials that do not create an additional hazard in case of fire.

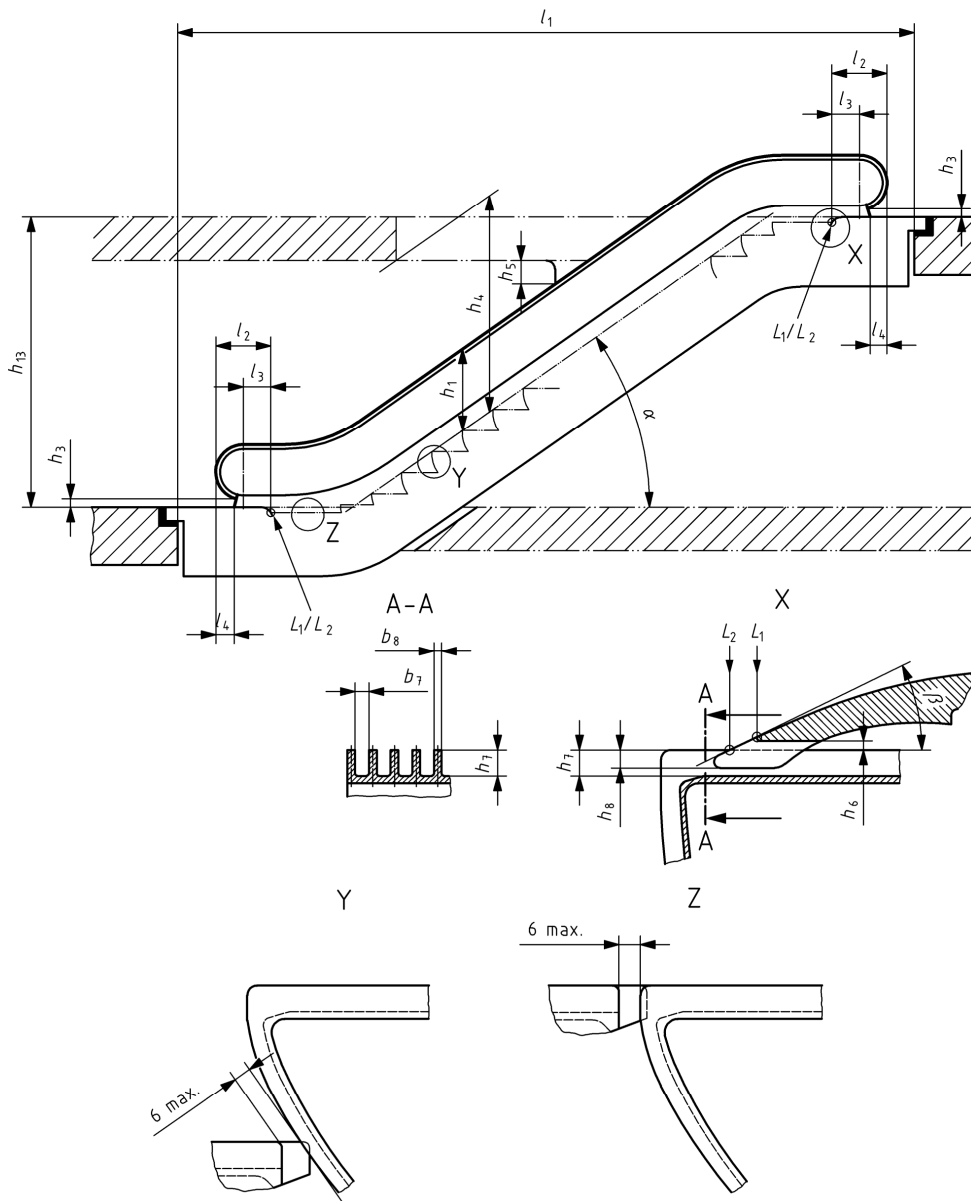


Figure 2 — Escalator (elevation), principal dimensions

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Principal dimensions	Clause	Principal dimensions	Clause
b7 5 mm to 7 mm (step treads and pallets)	11.5.4.1(f)	$h8 \geq 4 \text{ mm}$	11.5.8.2(h)
b7 4,5 mm to 7 mm (belts)	11.5.4.1(m)	h13 Rise	
b8 2,5 mm to 5 mm (step treads and pallets)	11.5.4.1(b)	L1 Root of the comb teeth	
b8 4,5 mm to 8 mm (belts)	11.5.4.1(o)	L2 Comb intersection line	
h1 0,90 m to 1,10 m	11.5.8.2(a)	l1 Distance between supports	
h3 0,10 m to 0,25 m		$l2 \geq 0,60 \text{ m}$	
$h4 \geq 2,30 \text{ m}$		$l3 \geq 0,30 \text{ m}$	
$h5 \geq 0,30 \text{ m}$		$l4 \geq 0,30 \text{ m}$	
$h6 \leq 4 \text{ mm}$	11.5.8.2(i)	α Angle of inclination	
$h7 \geq 10 \text{ mm}$ (step treads and pallets)	11.5.8.2(g)	$\beta \leq 35^\circ$	11.5.8.2(c)
$h7 \geq 5 \text{ mm}$ (belts)	11.5.8.2(b)		

NOTE - This figure has not been drawn to scale. It only serves to illustrate the requirements.

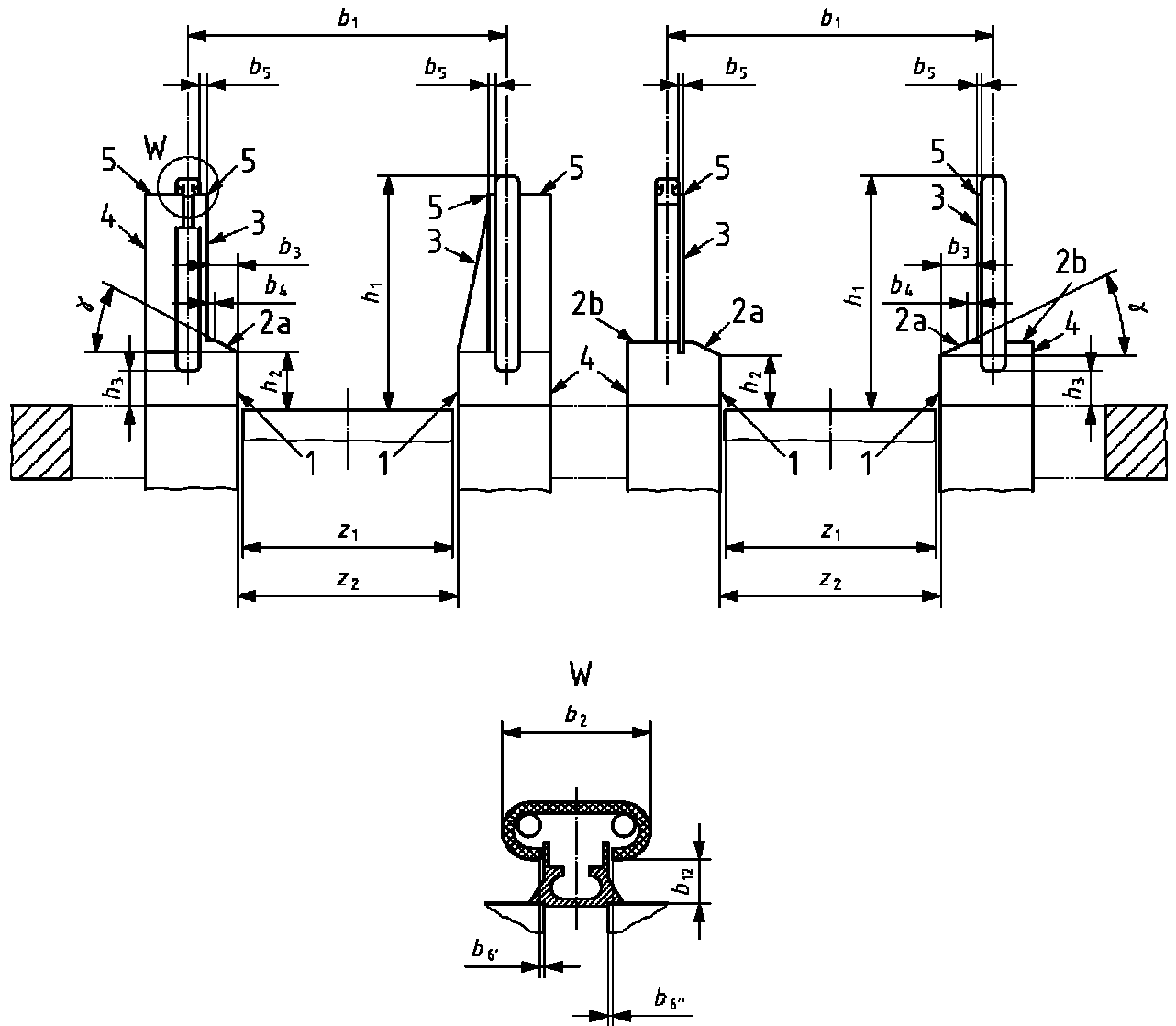


Figure 2 Escalator (elevation), principal dimensions

Key

- | | | | |
|----|---------------------|---|--------------------|
| 1 | skirting | 3 | interior panel |
| 2a | lower inner decking | 4 | exterior panel |
| 2b | lower outer decking | 5 | balustrade decking |

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Principal dimensions	Clause	Principal dimensions	Clause	Principal dimensions	Clause
$b_1 \leq z_2 + 0,45 \text{ m}$		$b_6' + b_6'' \leq 8 \text{ mm}$		$z_2 = z_1 + 7 \text{ mm};$ distance between skirting	
$b_2 \text{ 70 mm to 100 mm}$		$b_{12} \geq 25 \text{ mm}$	A. 2.2		
$b_3 < 0,12 \text{ m (if } \gamma \text{ less)}$		$h_1 \text{ 0,90 m to 1,10 m}$		$\gamma \geq 25^\circ$	
$b_4 < 30 \text{ mm}$		$h_2 \geq 25 \text{ mm}$			
$b_5 \leq 50 \text{ mm}$		$h_3 \text{ 0,10 m to 0,25 m}$			

NOTE - This figure has not been drawn to scale. It only serves to illustrate the requirements.

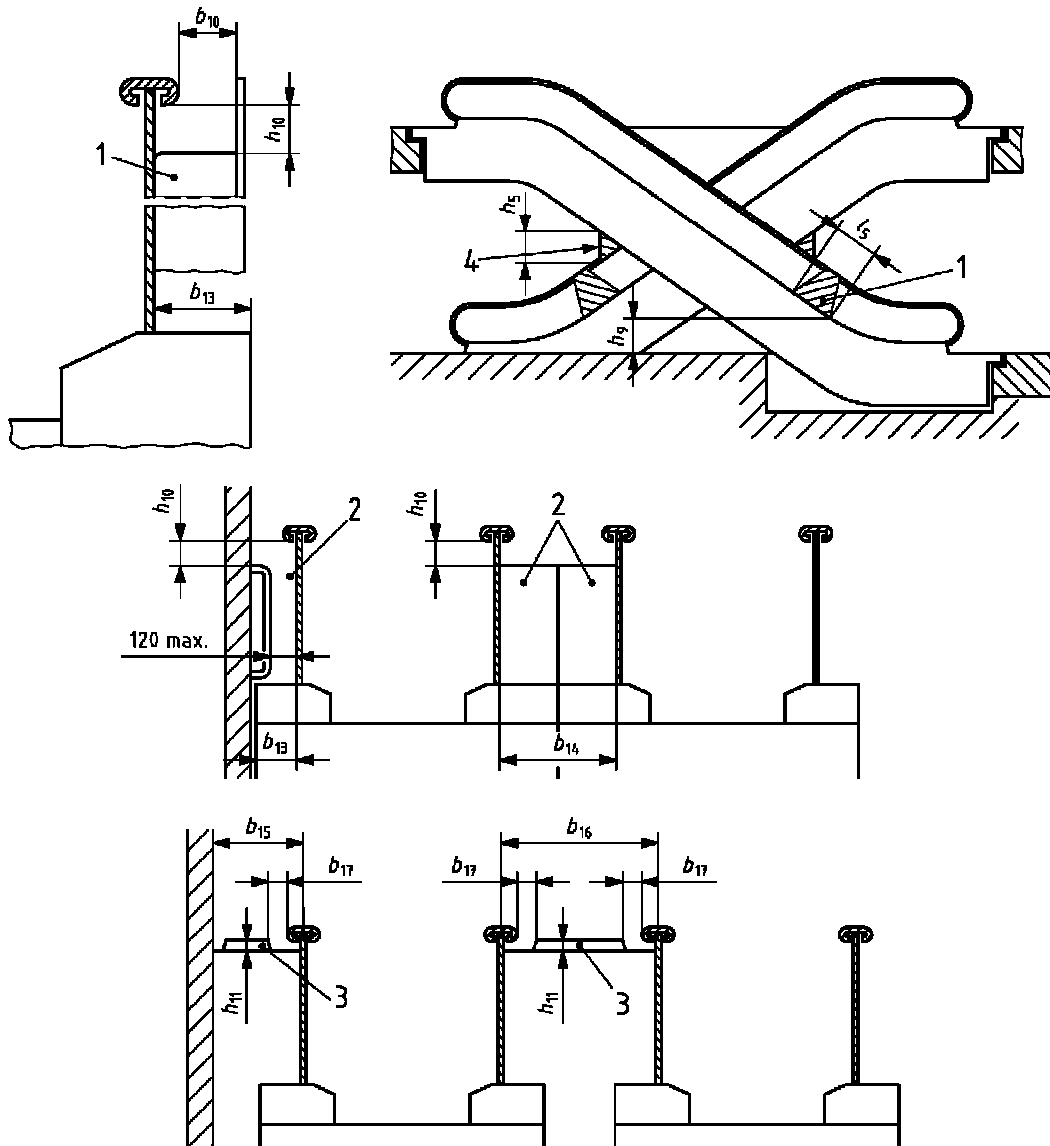


Figure 3 Escalator/moving walk (sectional view), principal dimensions

Key

- 1 anti-climbing device
- 2 access restriction device
- 3 anti-slide device
- 4 vertical deflector

(A.2.4)

Principal dimensions	Clause	Principal dimensions	Clause
b13, b14, b15, b16		h10 = 25 mm to 150 mm	
b17 ≥ 100 mm		h11 ≥ 20 mm	
h5 ≥ 0,30 m	A.2.4	l5 ≥ 1000 mm	
h9 = (1000 ± 50) mm			

NOTE - This figure has not been drawn to scale. It only serves to illustrate the requirements.

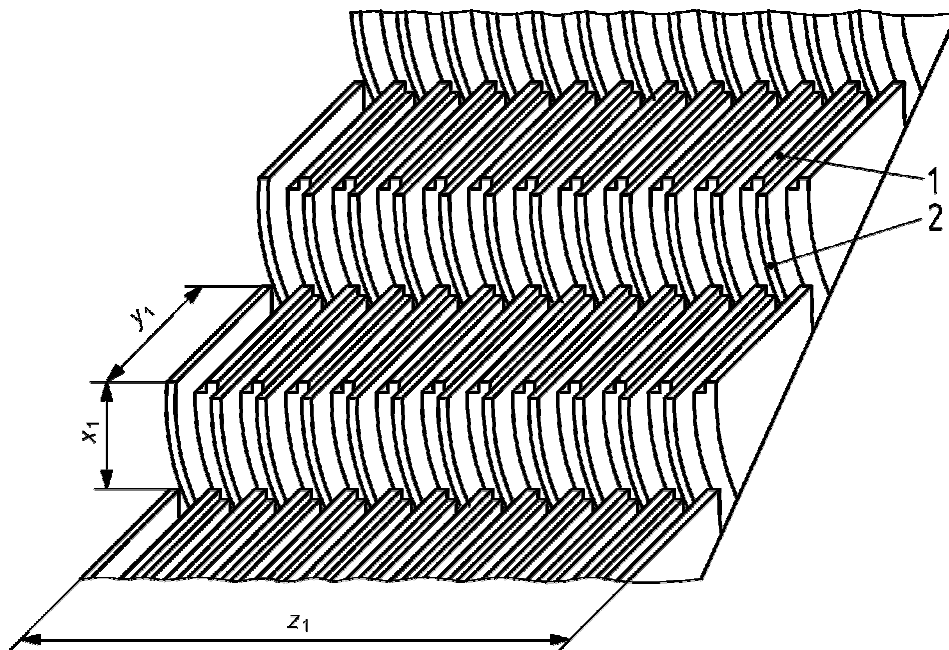


Figure 4 Anti-misuse devices

Key

- 1 step treads
- 2 step risers

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Principal dimensions	Clause
$x1 \leq 0,24$ m	11.5.4.1(b)
$y1 \geq 0,38$ m	11.5.4.1(c)
$z1$ 0,58 m to 1,10 m	11.5.4

NOTE - This figure has not been drawn to scale. It only serves to illustrate the requirements.

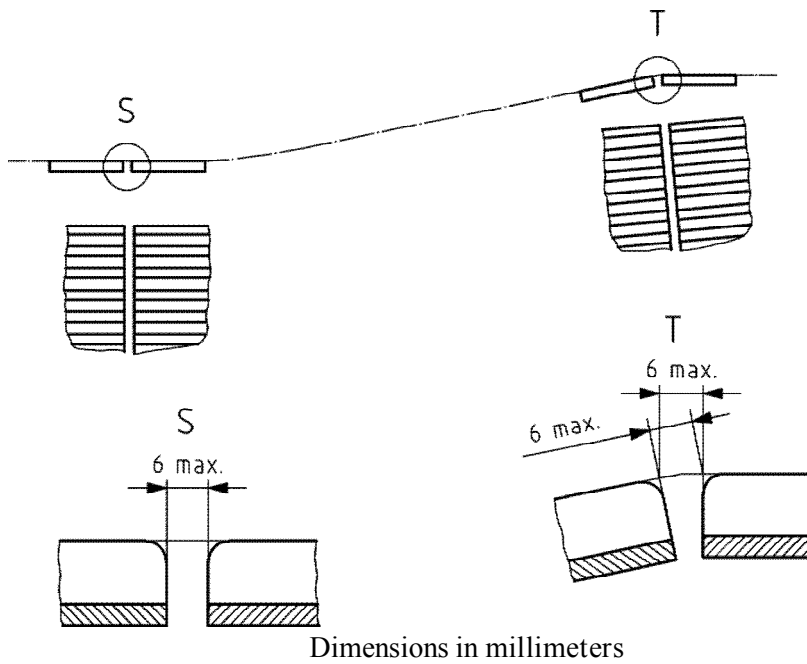


Figure 5 Steps, principal dimensions

Dimensions in millimetres

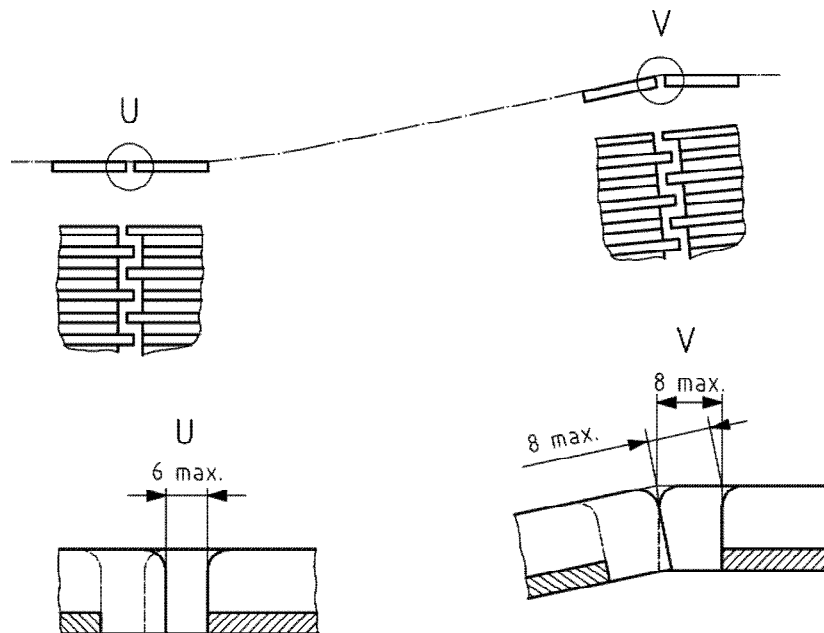


Figure 6 Pallets, clearance and mesh depth (pallet type moving walk without meshed front and rear edges) in lower and upper landing and transition curves

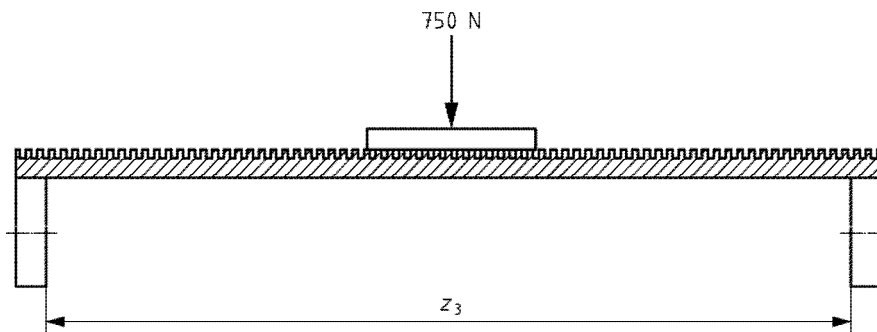


Figure 7 Pallets, clearance and mesh depth (pallet type moving walk with meshed front and rear edges) in lower and upper landing and transition curves

Symbol for quantity/Designation	Clause
z3 Transverse distance between the supporting rollers	

NOTE This figure has not been drawn to scale. It only serves to illustrate the requirements.

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Figure 8 Belt (sectional view), single force

5C.11.5.11 Electric installations and appliances

5C.11.5.11.1 General

a) Introduction

The electric installation of escalators or moving walks shall be so designed and manufactured as to ensure protection against hazards arising from the electric equipment or which may be caused by external influences on it, provided the equipment is used in applications for which it was made and is adequately maintained.

Therefore, the electric equipment shall:

- (i) comply with the requirements stated in Myanmar Electrical Regulations;
- (ii) where no harmonised standards as referred to in a) exist, comply with the requirements of the International Electrotechnical Commission (IEC)

b) Limits of application

The requirements of this standard relating to the installation and to the constituent components of the electric equipment apply:

- i) to the main switch of each independent power circuit (e.g. machine, heating system) of the escalator or moving walk and dependent circuits;
- ii) to the switch for the lighting circuit of the escalator or moving walk and dependent circuits.

The escalator or moving walk shall be considered as a whole, in the same way as a machine with its incorporated apparatus.

- c) The electricity supply to the input terminals of the switches refers to in (b) and the electricity supply to the lighting of the machinery spaces, driving and return stations are not laid down by this standard.

5C.11.5.11.2 Voltage limit for control and safety circuits

For control and safety circuits, the value in direct current or the r.m.s. value in alternating current between conductors or between conductors and earth shall not exceed 250 V.

- a) Conductor for neutral and earth-continuity
- b) Contactors, relay contactors, components of fail safe circuits
- c) Contactors and relay contactors
- d) To stop the driving machine the main contactors shall belong to the following categories .
 - i) AC-3 for contactors of alternating current motors;
 - ii) DC-3 for contactors of direct current machines.
- e) Relay contactors shall belong to the following categories ,
 - i) AC-15 for contactors in alternating current control circuits;
 - ii) DC-13 for contactors in direct current control circuits.

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- f) Components of fail safe circuits
- g) When devices according to 5C.11.5.11.2 (e) are used as relays in a fail safe circuit, the assumptions of also apply.
- h) If the relays used are such that the break and make contacts are never closed simultaneously for any position of the armature, the possibility of partial attraction of the armature is permitted to be disregarded
- i) Devices connected after electric safety devices shall meet the requirements of 5C.11.5.12.2 (c) with regard to the creep distances and air gaps (not with regard to the separation distances).

This requirement does not apply to the devices mentioned in 5C.11.5.11.2(c).

5C.11.5.11.3 Main switches

- a) In the vicinity of the machine or in the return stations, or in the vicinity of the control devices, there shall be a main switch capable of breaking the supply to the motor, to the brake releasing device and to the control circuit in the live conductors.

This switch shall not cut the supply to the socket outlets or to the lighting circuits necessary for inspection and maintenance (see 11.5.9).

When separate supplies are provided for auxiliary equipment such as heating, balustrade lighting and comb lighting, it shall be possible to switch them off independently. The corresponding switches shall be located close to the main switch and be marked unambiguously.

- b) The main switches as defined in 11.5.11.3 (a) shall be capable of being locked or otherwise secured in the "isolated" position, with the use of a padlock or equivalent, to ensure no inadvertent operation by others . The control mechanism of the main switch shall be easily and rapidly accessible after opening of the doors or trap doors.
- c) Main switches shall be capable of interrupting the highest current involved in normal operating conditions of the escalator or moving walk.
- d) Where the main switches of several escalators or moving walks are positioned together it shall be possible to easily identify to which escalator or moving walk they refer.

5C.11.5.12 Electric safety devices

5C.11.5.12.1 General requirements

- a) The electric safety devices for the (events escalator or moving walk listed in Table 6) shall prevent the driving machine from starting or cause the immediate stopping of the driving machine and consist of:
 - i) either one or more safety switches satisfying 11.5.12.2 directly disconnecting the supply to the contactors or their relay contactors, or
 - ii) fail safe circuits satisfying consisting of:
 - 1) either one or more safety switches satisfying 11.5.12.2 not directly disconnecting the supply to the contactors or their relay contactors, or

- 2)
 - 2) or contacts not satisfying the requirements of 11.5.12.2 or
 - 3) or other components in accordance with the requirements of Annex B.
- b) No electric equipment shall be connected in parallel with an electric safety device with the exception of:
 - i) electric safety devices in case of inspection mode;
 - ii) connections to different points of the safety circuit for information about the status of electric safety devices; the devices used for that purpose shall fulfil the requirements of Annex B.
 - c) The effects of internal or external inductance or capacitance shall not cause failures of fail safe circuits.
 - d) An output signal emanating from a fail safe circuit shall not be altered by an extraneous signal emanating from another electric device placed further down the same circuit, which would cause a dangerous condition to result.
 - e) The construction and arrangement of the internal power supply units shall be such as to prevent the appearance of false signals at the outputs of electric safety devices due to the effects of switching. In particular, voltage peaks arising from the operation of the escalator or moving walk or other equipment on the network shall not create inadmissible disturbances in electronic components.

5C.11.5.12.2 Safety switches

- a) The operation of a safety switch shall be by positive mechanical separation of the contacts. This positive mechanical separation shall even occur if the contacts are welded together.

Positive mechanical separation is achieved when all contacts are brought to their open position in such a way that for a significant part of the travel there are no resilient elements (e.g. springs) between the moving contacts and the part of the actuator to which the actuating force is applied.

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

- b) The safety switch shall be provided for a rated insulation voltage of 250 V if the enclosure provides a degree of protection of at least IP, or 500 V if the degree of protection of the enclosure is less than IP 4X.
 - i) AC-15 for safety switches in alternating current circuits;
 - ii) DC-13 for safety switches in direct current circuits.
- c) If the protective enclosure is not at least of type IP 4X the air gaps shall be at least 3 mm and creep distances at least 4 mm.

After separation the distance for contacts shall be at least 4 mm.
- d) In the case of multiple breaks, the individual distances for breaking contacts shall be at least 2 mm after separation.

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- e) Debris from the conductive material shall not lead to short-circuiting of contacts.

The starting switch(es) shall be located within reach of a stop switch according to 5C.11.5.12.2(b). For remote starting devices the requirements above shall apply.

NOTE For the obligation of the maintainer to observe a complete revolution of the step/pallet band before making the escalator/moving walk available to the public after maintenance.

NOTE An average speed against for a walking person of 1 m/s should be taken into account.

The requirements protection of electric faults shall be met. Constructional measures may be necessary to prevent circumvention of the control elements.

- f) Stop switch for emergency situations, manually operated
- g) Stop switch for emergency situations shall be provided to stop the escalator or moving walks in the event of an emergency. They shall be placed in conspicuous and easily reachable positions at least at or near each landing of the escalator or moving.

The distances between stop switches for emergency situations shall not exceed:

- 30 m on escalators;
- 40 m on moving walks.

If necessary, additional stop switches shall be provided to maintain the distance.

For moving walks intended to transport shopping trolleys and baggage carts (C-2).

- h) Stop switch for emergency situations shall be electric safety devices according to electric safety devices.
- i) Stopping initiated by monitoring or electric safety devices [see 5C.11.5.12.1(a)]

Annex A (normative)**Building interfaces****A.1 General**

The requirements in A.2 and A.3 are important for the safety of users and maintenance personal.

If it is not possible for the manufacturers of the escalator or moving walk to fulfill these requirements (or some of them) due to the fact that e.g. they are not installing the escalator or moving walk, those requirements that are not fulfilled have to be part of the instruction handbook as an obligation for the owner. Recommendations do not use escalators as regular staircases or emergency exits. Provide the staircases from user in case of emergency each floor.

A.2 Free space for users

A.2.1 The clear height above the steps of the escalator or pallets or belt of the moving walk at all points shall be not less than 2,30 m (see h_4 in Figures 2 and A.1).

The clear height shall extend to the end of the newel.

NOTE - The clear height of 2,30 m should also be applied to the unrestricted area.

A.2.2 To prevent collision, a minimum free area around the escalator or moving walk is defined as per Figure A.1. The height h_{12} , measured from the steps of the escalator or the pallets or the belt of the moving walk shall be at least 2,10 m. The distance between the outer edge of the handrail and walls or other obstacles (see b_{10} in Figure A.1) shall under no circumstances be less than 80 mm horizontally and 25 mm vertically below the lower edge of the handrail (see b_{12} in Figure 3). The area is permitted to be smaller, if by appropriate measures, the risk of injury is minimized.

A.2.3 For escalators arranged adjacent to one another either parallel or criss-cross, the distance between the handrails shall be not less than 160 mm (see b_{11} in Figure A.1).

A.2.4 Where building obstacles can cause injuries, appropriate preventive measures shall be taken.

In particular, at floor intersections and on criss-cross escalators or moving walks, a vertical deflector of not less than 0,30 m in height, not presenting any sharp cutting edges, shall be placed above the handrail level and extend at least 25 mm below the lower edge of the handrail, e.g. as an imperforate triangle (see h_5 in Figures 2 and 4).

It is not necessary to comply with these requirements when the distance b_9 between the outer edge of the handrail and any obstacle is equal to or greater than 400 mm (see Figure A.1).

14.A.2.5 At the exit(s) of each individual escalator or moving walk a sufficient unrestricted area shall be available to accommodate persons. The width of the unrestricted area shall at least correspond to the distance between the outer edges of the handrails plus 80 mm on each side. The depth shall be at least 2,50 m measured from the end of the balustrade. It shall be permissible to reduce it to 2,00 m if the width of the unrestricted area is increased to at least double the distance between the outer edges of the handrails plus 80 mm on each side.

For succeeding escalators and moving walks the depth of an unrestricted area shall be determined in each individual case depending on e.g. type of use (persons only or persons with transport devices, number of intermediate exits, relative orientation and theoretical capacity).

A.2.6 In the case of successive escalators and moving walks without intermediate exits, they shall have the same capacity.

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A.2.7 Where it is possible for people to come into contact with the outer edge of a handrail at a landing and can be drawn into a hazardous situation, such as toppling over a balustrade, appropriate preventative measures shall be taken (for an example, see Figure A.2).

Some examples are:

- prevention of entry into the space by the placement of permanent barriers;
- increasing the height of the building structure of the fixed balustrade in the hazard area by at least 100 mm above the handrail level and positioned between 80 mm and 120 mm from the outer edge of the handrail.

A.2.8 The surrounds of the escalator or moving walk shall be illuminated, especially in the vicinity of the combs.

NOTE - Information should be exchanged between the manufacturer and the customer.

A.2.9 It is permissible to arrange the lighting in the surrounding space and/or at the installation itself. The intensity of illumination at the landings including the combs shall be related to the intensity of illumination of the general lighting in the area. The intensity of illumination shall be not less than 50 lx at the comb intersection line measured at floor level.

A.3 Machinery spaces outside the truss

A.3.1 A safe access for persons to machinery spaces shall be provided.

A.3.2 Machinery spaces shall be lockable and only accessible to authorised

A.3.3 Machinery spaces shall be provided with permanently installed electric lighting on the following basis:

- a) a minimum of 200 lx at floor level in working areas;
- b) a minimum of 50 lx at floor level in access routes leading to these working areas.

A.3.4 Emergency lighting shall be installed to allow the safe evacuation of all personnel working in any machinery space.

NOTE - Emergency lighting is not intended for continuation of maintenance or other activities.

A.3.5 The dimensions of machinery spaces shall be sufficient to permit easy and safe working on equipment, especially the electrical equipment.

In particular there shall be provided at least a clear height of 2,00 m at working areas, and:

- a) a clear horizontal area in front of the control panels and the cabinets. This area is defined as follows:
 - 1) depth, measured from the external surface of the enclosures: at least 0,70 m;
 - 2) width, the greater of the following values: 0,50 m or the full width of the cabinet or panel;
- b) a clear horizontal area of at least 0,50 m x 0,60 m for maintenance and inspection of moving parts at points where this is necessary.

A.3.6 The clear height for movement shall not be less than 1,80 m.

The access ways to the clear spaces mentioned in A.3.6 shall have a width of at least 0,50 m. This value may be reduced to 0,40 m where there are no moving parts.

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This full height for movement is taken to the underside of the structural roof beams and measured from both:

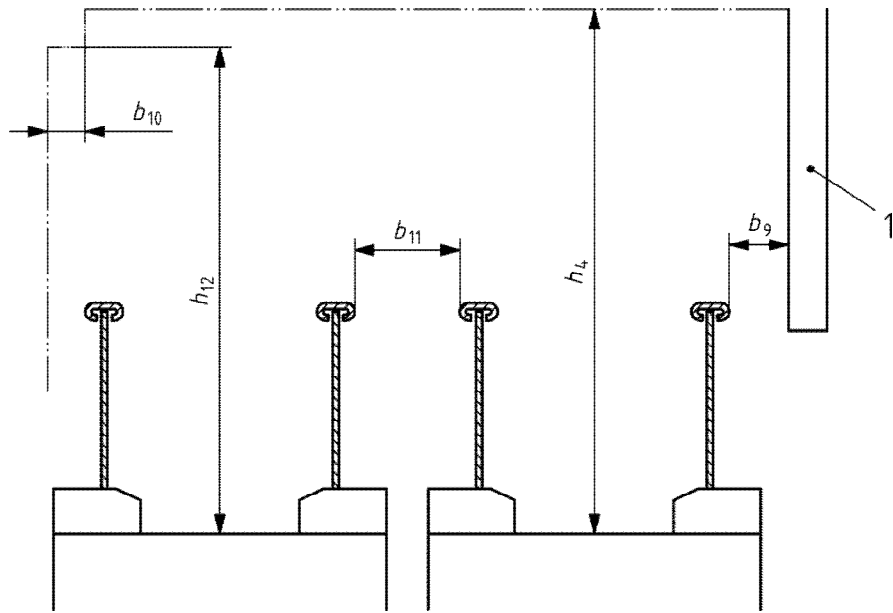
- a) the floor of the access area;
- b) the floor of the working area.

A.3.7 In machinery spaces the clear height shall under no circumstances be less than 2,0 m.

A.4 Electric power supply

Agreements shall be made between the owner and the manufacturer about electric supply and electric protection requirements (e.g. electric shock, short circuit; overload).

The installation shall with the requirements of the national rules of the country where it is installed.



Key

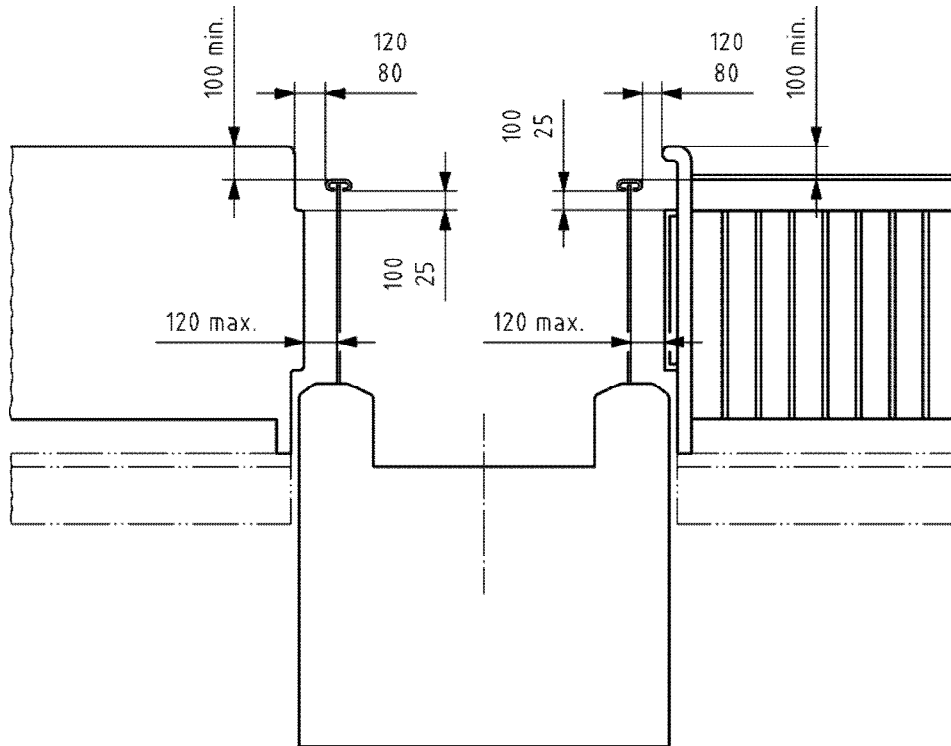
- 1 obstacle (e.g. column)

Principal dimensions	Clause	Principal dimensions	Clause
$b_9 \geq 400 \text{ mm}$	A.2.4	$h_4 \geq 2300 \text{ mm}$	A.2.1
$b_{10} \geq 80 \text{ mm}$	A.2.2	$h_{12} \geq 2100 \text{ mm}$	A.2.2
$b_{11} \geq 160 \text{ mm}$	A.2.3		

NOTE This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure A.1 Clearances between building structure and escalator/moving walk units

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NOTE This figure has not been drawn to scale. It only serves to illustrate the requirements.

Figure A.2 Example of barriers at landings

Annex B (informative)

Design guide-line for safety circuits

This design guide-line gives recommendations to avoid dangerous situations in the case when information is collected from the safety circuit for control purposes, for remote control, alarm control, etc.

Some dangerous situations are recognised coming from the possibility of bridging one or several electric safety devices by short circuiting or by local interruption of common lead (earth) combined with one or several other failures. It is good practice to follow the recommendations given below:

- Design the board and circuits with distances in accordance with specifications Connectors Terminals Plugs and Printed Circuit Board.
- Organise common lead so that the common lead for the control of the escalator/moving walk comes behind the electronic components. Any rupture will cause a non-operation of the control (danger exists that changes in wiring occur during the life of the escalator/moving walk).
- Make always calculations about the "worst case" condition.
- Always use outside (out of element) resistors as protective devices of input elements; internal resistor of the device should not be considered as safe.

- Use only components according to listed specifications.
- Consider backwards voltage coming from electronics. Using galvanically separated circuits can solve the problems in some cases.
- The "worst case" calculation cannot be avoided, whatever the design. If modifications or add-ons are made after the installation of the escalator/moving walk, the "worst case" calculation, involving new and existing equipment, must be carried out again
- Some failure exclusions can be accepted, according to electronics & electrical components.
- Failures outside the environment of the escalator/moving walk need not be taken into consideration.
- "An interruption of the earth from the main supply of the building to the controller collection earth bar (rail). can be excluded, providing the installation is made in accordance with local electrical rules and regulations.

Annex C (normative)

Requirements on escalators and moving walks intended to transport shopping trolleys and baggage carts

C.1 Escalators

The use of both shopping trolleys and baggage carts on escalators is unsafe and shall not be permitted.

The principle reasons why the use of these products is considered to be unsafe are foreseeable misuse, overloading and width restriction.

Where shopping trolleys and/or baggage carts are available in the area around escalator installations, suitable barriers shall be provided to prevent access.

Outline guidance is given as follows:

Shopping trolleys or baggage carts which are chosen for use on an escalator must be specified between the shopping trolley or baggage cart manufacturer and the escalator manufacturer. If non-specified shopping trolleys or baggage carts are available in the escalator area, there is a serious risk of misuse. It is necessary to prevent access to the escalator entrance.

The width of the shopping trolley or baggage cart and its contents should be at least 400 mm less than the nominal step width. Passengers should be able to leave the escalator, even if shopping trolleys or baggage carts are on the escalator.

The escalators should be supplied with a horizontal step run of 1,6 m at both landing areas, minimum transition radii of 2,6 m at the upper landing and 2,0 m at the lower landing, and limiting the rated speed to 0,5 m/s and the inclination to 30°.

Combs should be designed with an angle β of max. 19° combined with a diameter of the shopping trolley or baggage cart roller of at least 120 mm diameter.

Additional stops for emergency situations at handrail level (taking into account A.2.2) with a distance between 2,0 m and 3,0 m before the step reaches the comb intersection line should be provided. The stop for emergency situations near the transition curve should be reachable from inside the escalator and the stops for emergency situations at exit(s) shall be reachable from outside of the escalator.

Shopping trolleys or baggage carts should conform to the escalator design:

- The shopping trolley or baggage cart design should ensure a safe and correct loading.
- The maximum weight for a shopping trolley or baggage cart should be 160 kg when loaded.
- Shopping trolley or baggage cart should automatically lock themselves on the inclined part of escalators.
- Shopping trolley or baggage cart should be fitted with a braking or blocking system.
- Shopping trolley or baggage cart should have deflectors (bumpers) to reduce the risk of clamping.
- For safe exit from the escalator, it is necessary that the rear rollers of the shopping trolley or baggage cart are able to push the front rollers over the comb. The front rollers and/or blocking system should easily release from the steps

- Deflectors and guiding devices should be added to the surrounding area to ensure correct alignment of shopping trolley or baggage cart when entering the escalator.
- Safety signs about safe and correct use of the shopping trolley or baggage cart should be added.

C.2 Moving walks

The use of suitably designed shopping trolleys and baggage carts on moving walks is permitted.

Shopping trolleys or baggage carts which are chosen for use on a moving walk shall be specified between the baggage cart manufacturer and the moving walk manufacturer. If non-specified shopping trolleys or baggage carts are available in the moving walk area, there is a serious risk of misuse. It is necessary to prevent access to the moving walk entrance.

The width of the shopping trolley or baggage cart and its contents shall be at least 400 mm less than the nominal pallet/belt width. Passengers shall be able to leave the moving walk, even if shopping trolleys or baggage carts are on the moving walk.

For moving walks with an inclination greater than 6°, the rated speed shall be limited to 0,5 m/s.

Combs shall be designed with an angle β of max. 19° combined with a diameter of the shopping trolley or baggage cart roller of at least 120 mm diameter.

Additional stops for emergency situations at handrail level (taking into account A.2.2) with a distance between 2,0 m and 3,0 m before the pallet reaches the comb intersection line shall be provided. The stop for emergency situations near the transition curve shall be reachable from inside the moving walk and the stops for emergency situations at exit(s) shall be reachable from outside of the moving walk.

Shopping trolleys or baggage carts shall conform to the moving walk design:

- The shopping trolley or baggage cart design shall ensure a safe and correct loading.
- The maximum weight for a shopping trolley or baggage cart shall be 160 kg when loaded.
- Shopping trolley or baggage cart shall automatically lock themselves on the inclined part of moving walks.
- Shopping trolley or baggage cart shall be fitted with a braking or blocking system.
- Shopping trolley or baggage cart shall have deflectors (bumpers) to reduce the risk of clamping.
- For safe exit from the moving walk, it is necessary that the rear rollers of the shopping trolley or baggage cart are able to push the front rollers over the comb. The front rollers and/or blocking system shall easily release from the pallet.
- Deflectors and guiding devices shall be added to the surrounding area to ensure correct alignment of shopping trolley or baggage cart when entering the moving walk.
- Safety signs about safe and correct use of the shopping trolley or baggage cart should be added.

D.2 Testing and assessing anti-slip properties

The procedure for testing anti-slip properties is governed by local rules.

Your attention is drawn to the fact that the intermediary medium of oil in the test procedure is not used to give the test a particularly adverse operating condition. The use of a specific, defined oil is

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used as a constant test parameter with which, as has been proved, better differentiation of the test results is achieved.

NOTE– This procedure is based on the people carrying out the test treading on the covering to be tested on an inclined plane. It is used as an aid to deciding whether the respective covering is suitable for use on escalators and moving walks.

The average inclination angle determined from a range of measurements is critical for classifying the covering in one of five assessment groups. The assessment group is used as a benchmark for the level of anti-slip properties where coverings in assessment group R 9 meet the lowest anti-slip requirements and those in assessment group R 13 the highest. The allocation of assessment groups to the angle ranges is shown in TableD.1.

Table D.1 Allocating the overall average values of the inclination angles to the anti-slip assessment groups

Overall average value	Assessment group
from 6° to 10°	R 9
over 10° to 19°	R 10
over 19° to 27°	R 11
over 27° to 35°	R 12
greater than 35°	R 13

The assessment of the anti-slip properties of coverings with surface profiles arranged in a specific direction, e.g. a step covering with lengthwise grooves or cover plates with transverse grooves, shall be based on average values that take into consideration the place the coverings are laid and the direction the users walk on them.

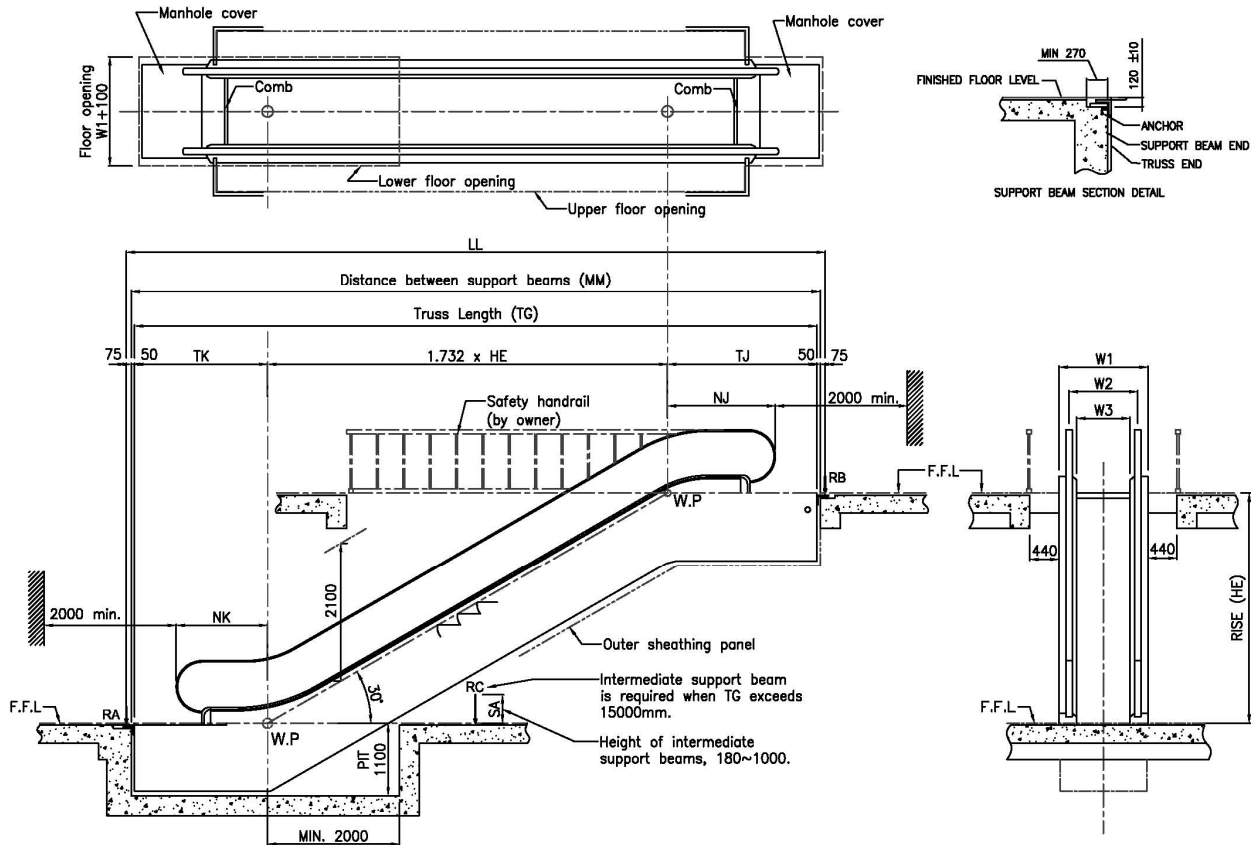
Coverings that meet at least assessment group R 9 are considered anti-slip for indoor installations and at least assessment group R 10 for outdoor installations.

NOTE – If, at the landings of escalators and moving walks and their allocated floors, there are different assessment groups, it should be taken care that neighbouring floors shall only differ by one in their assessment groups.

The part of the test related to the area below the surface of cleated profiles is not used to assess the anti-slip properties of coverings on escalators and moving walks.

Standard Installation of Escalator for 30 ° Inclination Angle

All dimension in millimeters



Attach Figure-1

Dimensions (mm)

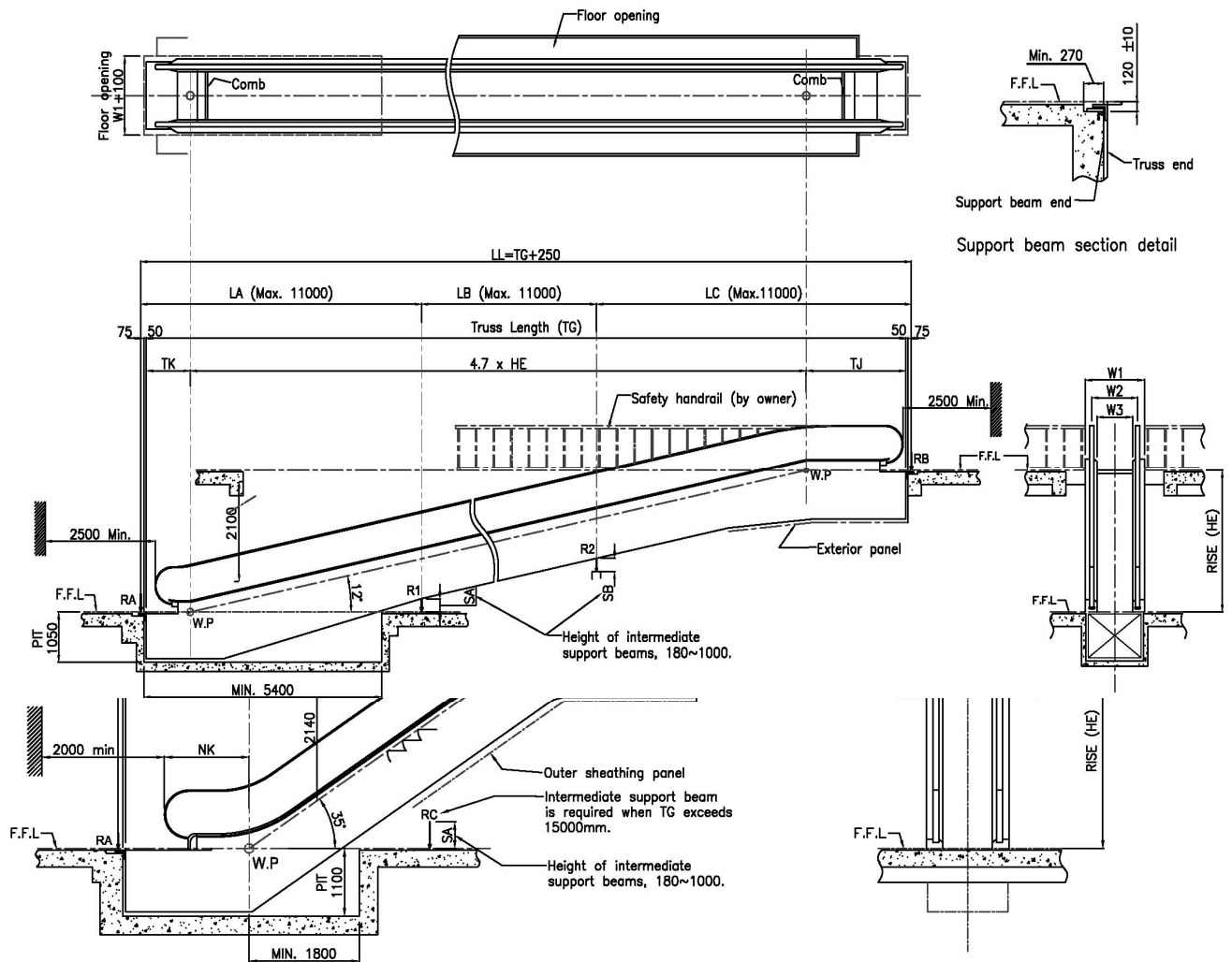
Type	Step width (mm)		
	600	800	1000
W1 (Escalator width)	1150	1350	1550
W2 (Between Moving Handrails)	840	1040	1240
W3 (Between Skirt Panels)	610	810	1010

Horizontal Steps	NK	NJ	TJ	TK
1.5 Steps (Nominal)	1385	1635	2265	2015
3 Steps	1975	2260	2890	2605

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Standard Installation of Escalator for 35° Inclination Angle

All dimension in millimeters



Attach Figure-2

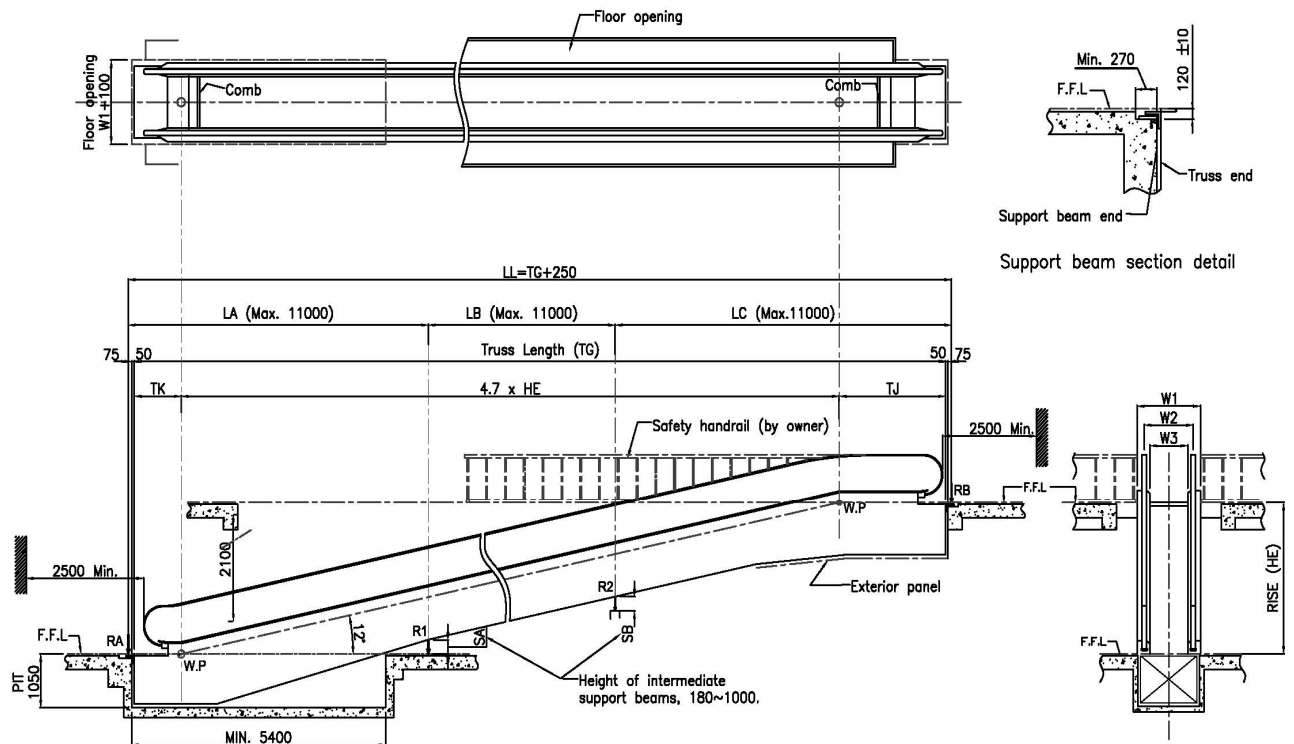
Dimensions (mm)

Type	Step width (mm)		
	600	800	1000
W1 (Escalator width)	1150	1350	1550
W2 (Between Moving Handrails)	840	1040	1240
W3 (Between Skirt Panels)	610	810	1010

Horizontal Steps	NK	NJ	TJ	TK
2 Steps	1630	1900	2530	2260

Standard Installation of Moving Walk for 12 ° Inclination Angle

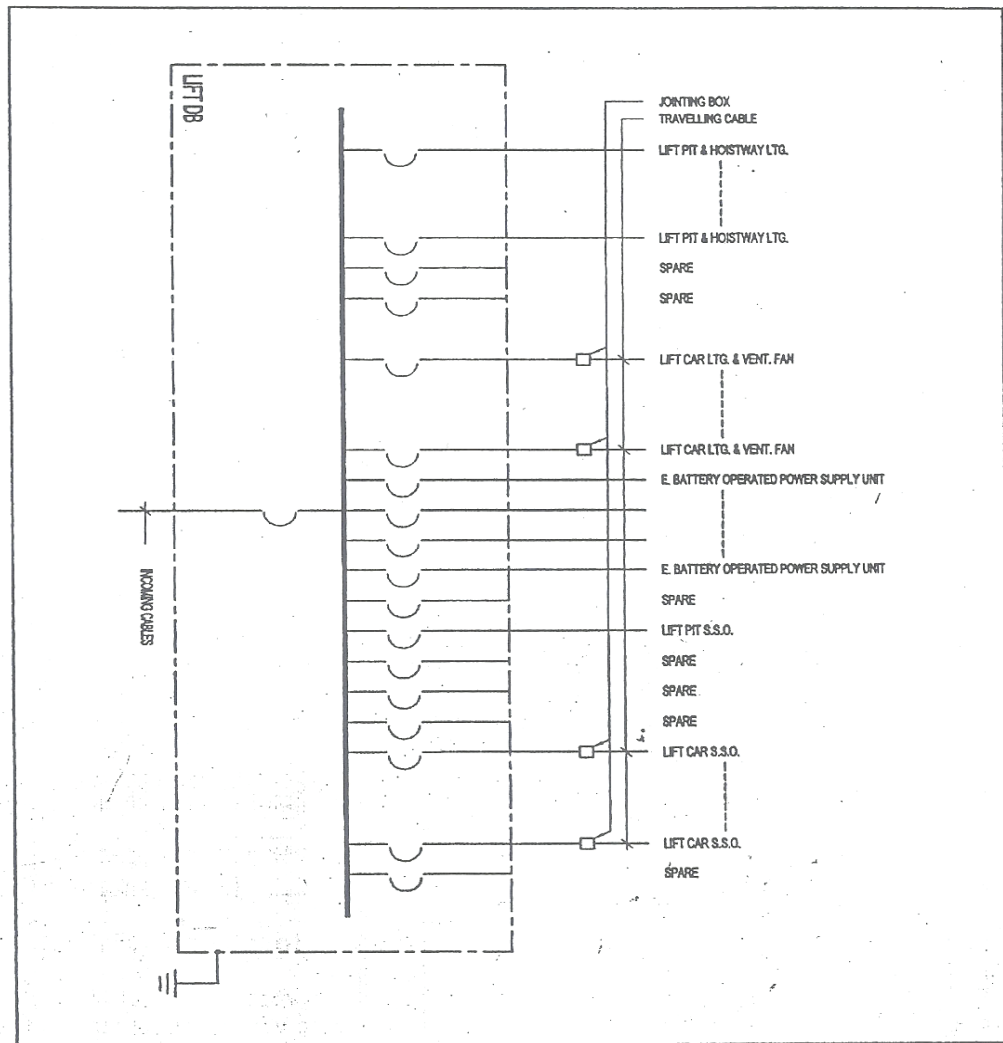
All dimension in millimeters



Attach Figure-3

Dimensions (mm)

Type	1200
W1 (Escalator width)	1550
W2 (Between Moving Handrails)	1280
W3 (Between Skirt Panels)	1010
TK	990
TJ	2321 (HE ≤ 5400) 2675 (5400 ≤ HE ≤ 6500)



Attach Figure – 5

Typical example of lift distribution board in lift machine room

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IS No.	Title
(1) 14665 (Part 1) : 2000 (Part 3/Sec 1 & 2) 2000 (Part 4/Sec 1 to 9): 2001	Electric traction lifts: Guidelines for outline dimensions of passenger, goods, service and hospital lifts Safety rules, Section 1 Passenger and goods lifts, Section 2 Service lifts Components, Section 1 Lift Buffers, Section 2 Lift guide rails and guide shoes, Section 3 Lift carframe, car, counterweight and suspension, Section 4 Lift safety gears and governors, Section 5 Lift retiring cam, Section 6 Lift doors and locking devices and contacts, Section 7 Lift machines and brakes. Section 8 Lift wire ropes, Section 9 Controller and operating devices
(2) 14665 (Part 4/Sec 1 to 9) 2001	Electric traction lifts: Components, Section 1 Lift buffers, Section 2 Lift guide rails and guide shoes, Section 3 Lift carframe, car, counterweight and suspension, Section 4 Lift safety gears and governors, Section 5 Lift retiring cam, Section 6 Lift doors and locking devices and contacts, Section 7 Lift machines and brakes, Section 8 Lift wire ropes, Section 9 Controller and operating devices
(3) 14665 (Part 3/Sec 1&2): 2000	Electric traction lifts: Part 3 Safety rules, Section 1 Passenger and goods lifts, Section 2 service lifts
(4) 14665 (Part 2/Sec 1&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
(5) 962 : 1989	Code of practice for architectural and building drawings (second revision)
(6) 2309 : 1989	Code of practice for the protection of buildings and allied structures against lightning (second revision)
(7) 1950 : 1962	Code of practice for sound insulation of non-industrial buildings
(8) 14665 (Part 3/Sec 1&2) : 2000	Electric traction lifts: Part 3 Safety rules – Section 1 Passenger and goods lifts, Section 2 Service lifts
(9) 3043 : 1987	Code of practice for earthing
(10) 4591 : 1968	Code of practice for installation and maintenance of escalators
(11) SS550: 2009	Code of practice for Installation, operation and maintenance of electric passenger and goods lift
(12) EN 81 – 1 1998	European Standard

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|---------------------|--|
| (13) 1985 | Myanmar Electricity Regulation |
| (14) EN 115 : 1995 | European Standard |
| (15) CP – 15 – 2004 | Code of practice for installation operation and maintenance of escalator and passenger conveyors |