भारतीय मानक ब्यूरो
(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)
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व्यापक परिचालन मसौदा

हमारा संदर्भ: सीईडी 46 /टी-18 **14 मार्च 2025**

तकनीकी समिति: भारत की राष्ट्रीय भवन निर्माण विषय समिति, सीईडी 46

प्राप्तकर्ता :

1. सिविल अभियांत्रिकी विभाग परिषद, सीईडीसी के सभी सदस्य
2. राष्ट्रीय भवन निर्माण संहिता विषय समिति, सीईडी 46 के सभी सदस्य
3. सीईडी 46 की उपसीमितियों और अन्य कार्यदल के सभी सदस्य
4. रुचि रखने वाले अन्य निकाय।

महोदय/महोदया,

निम्नलिखित मानक का मसौदा संलग्न हैं:

प्रलेख संख्या	शीर्षक
सीईडी 46 (26227) WC	**भारत की राष्ट्रीय भवन निर्माण संहिता भाग 8 भवन निर्माण सेवाएँ अनुभाग 5 लिफ्ट, स्वचालित सीढियाँ तथा चलपथ की स्थापना 5B स्वचालित सीढियाँ तथा चलपथ** [SP7(भाग 8 अनुभाग 5B) का चौथा पुनरीक्षण] (आई सी एस नंबर: 01.120: 91.040.01)

कृपया इस मसौदे का अवलोकन करें और अपनी सम्मतियाँ यह बताते हुए भेजे कि यह मसौदा प्रकाशित हो तो इस पर अमल करने में आपको व्यवसाय अथवा कारोबार में क्या किठनाइयां आ सकती हैं।

सम्मतियाँ भेजने की अंतिम तिथि: 13 अप्रैल 2025

सम्मति यदि कोई हो तो कृपया अधोहस्ताक्षरी को ई-मेल द्वारा ced46@bis.gov.in पर या उपरलिखित पते पर, संलग्न फोर्मेट में भेजें। सम्मतियाँ बीआईएस ई-गवर्नेंस पोर्टल, www.manakonline.in के माध्यम से ऑनलाइन भी भेजी जा सकती हैं।

यदि कोई सम्मति प्राप्त नहीं होती है अथवा सम्मति में केवल भाषा संबंधी त्रुटि हुई तो उपरोक्त प्रलेख को यथावत अंतिम रूप दे दिया जाएगा। यदि सम्मति तकनीकी प्रकृति की हुई तो विषय समिति के अध्यक्ष के परामर्श से अथवा उनकी इच्छा पर आगे की कार्यवाही के लिए विषय समिति को भेजे जाने के बाद प्रलेख को अंतिम रूप दे दिया जाएगा।

यह प्रलेख भारतीय मानक ब्यूरो की वैबसाइट www.bis.gov.in पर भी उपलब्ध हैं।
धन्यवाद।

भवदीय

ह/-
(द्वैपायन भद्र)
वैज्ञानिक 'ई' एवं प्रमुख (सिविल अभियांत्रिकी विभाग)

सलंग्न: उपरिलिखि

भारतीय मानक ब्यूरो
(उपभोक्ता मामले, खाद्य एवं सार्वजनिक वितरण मंत्रालय, भारत सरकार)
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WIDE CIRCULATION DRAFT

Our Reference: CED 46/T-18 **14 March 2025**

National Building Code of India Sectional Committee, CED 46

ADDRESSED TO:

1. All Members of Civil Engineering Division Council, CEDC
2. All Members of the National Building Code Sectional Committee, CED 46
3. All Members of Subcommittees, Panels and Working Groups under CED 46
4. All other interests

Dear Sir/Madam,

Please find enclosed the following draft:

Doc No.	Title
CED 46 (26227) WC	**National Building Code of India Part 8 Building Services Section 5 Installation of Lifts Escalators and Moving Walks 5B Escalators and Moving Walks** [Fourth Revision of SP 7 (Part 8 Section 5B)] (ICS No. 01.120: 91.040.01)

Kindly examine the attached draft and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as National Standard.

Last Date for comments: 13 April 2025

Comments if any, may please be made in the enclosed format and emailed at ced46@bis.gov.in or sent at the above address. Additionally, comments may be sent online through the BIS e-governance portal, www.manakonline.in.

In case no comments are received or comments received are of editorial nature, kindly permit us to presume your approval for the above document as finalized. However, in case comments, technical in nature are received, then it may be finalized either in consultation with the Chairman, Sectional Committee or referred to the Sectional Committee for further necessary action if so desired by the Chairman, Sectional Committee.

The document is also hosted on BIS website www.bis.gov.in.

Thanking you,

Yours faithfully,

Sd/-
(Dwaipayan Bhadra)
Scientist 'E' / Director and Head
(Civil Engineering Department)

Encl: As above

FORMAT FOR SENDING COMMENTS ON THE DOCUMENT

[Please use A4 size sheet of paper only and type within fields indicated. Comments on each clause/sub-clause/ table/figure, etc, be stated on a fresh row. Information/comments should include reasons for comments, technical references and suggestions for modified wordings of the clause. **Comments through e-mail to ced12@bis.gov.in shall be appreciated**.

Doc. No.: CED 46 (26227) WC **BIS Letter Ref**: CED 46/T-18

Title: National Building Code of India Part 8 Building Services Section 5 Installation of Lifts Escalators and Moving Walks 5B Escalators and Moving Walks [Fourth Revision of SP 7 (Part 8 Section 5B)] (ICS No.01.120:91.040.01)

Last date of comments: **13 April 2025**

Name of the Commentator/ Organization: _____

Clause/ Para/ Table/ Figure No. commented	Comments/Modified Wordings	Justification of Proposed Change

NOTE- Kindly insert more rows as necessary for each clause/table, etc

BUREAU OF INDIAN STANDARDS

DRAFT FOR COMMENTS ONLY

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Draft Indian Standard

National Building Code of India

Part 8 Building Services

Section 5 Installation of Lifts Escalators and Moving Walks 5B Escalators and Moving Walks

[Fourth Revision of SP 7 (Part 8 Section 5B)]

(ICS No. 01.120: 91.040.01)

National Building Code Sectional Committee, CED 46	**Last Date for Comments: 13 April 2025**

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National Building Code Sectional Committee, CED 46

FOREWORD

This Code (Part 8/Subsection 5B) covers the requirements for planning and design, installation, operation, maintenance, and inspection of escalators and moving walks to ensure safe movement of people with satisfactory performance.

This Section was first published in 1970 and was subsequently revised in 1983, 2005 and 2016. This Section covers the requirements for installation of lifts and escalators in buildings. This Section shall be read with Part 4 'Fire and Life Safety' of the Code from fire safety requirements point of view. The major changes in the first revision of 1983 were addition of outline dimensions of different types of lifts and detailed requirements of escalators in buildings. Emphasis was laid on coordination between the engineer/architect and the lift manufacturer to arrive at the number and position of lifts for attaining optimum efficiency in serving the building with safety.

The significant changes with respect to lifts incorporated in the 2005 revision, included the addition of new clauses/recommendations on the building management system; addition of new clauses on fireman's lift, infrared light curtain, safety and Braille button for blind people and updation of provisions as per the revised standards on lifts on which this Section was based.

In the 2016 revision, the erstwhile Section 5 on Lifts and Escalators was divided into two subsections namely:

5A Installation of Lifts
5B Installation of Escalators and Moving Walks

This Subsection (5B) addresses exclusively the provisions related to the installation of escalators and moving walks, which have been increasingly provided in buildings. It covers comprehensive provisions on all aspects, including requirements for planning and design, installation, operation, maintenance, and inspection of escalators to ensure the safe movement of people with satisfactory performance. This subsection also covers the provisions on moving walks.

As a result of technical developments in the subject of escalators and moving walks, the experience gained since implementation of 2016 version of the Code and feedback received as well as the revision of related Indian Standards on the subject, a need was felt to revise this Subsection. The significant modifications made in this revision of the subsection include amongst others, the following key changes:

a) The terminology has been updated and includes maintenance aspects and electrical safety system.
b) The requirements of power supply including protection devices have been elaborated, in **6.5.3**.
c) Fire protection requirements for the installations have been elaborated, in **7**.
d) Technical requirements for outdoor escalators/moving walks and semi-outdoor escalators/moving walks have been included in **9.2** and **9.3**.
e) Inspection check list has been reviewed and revised, under **14.6.2**.
f) Annex A on typical escalator site checklist/inspection list has been considerably revised.
g) Annex B on typical check list for functional tests on safety switches and devices has been revised.

The information contained in this Subsection is largely based on the following Indian Standards/ Special Publications:

IS 4591 (Part 1/Sec 1): 2020 Escalators and moving walks: Part 1/Sec 1 Safety requirements (*first revision*)

IS 4591 (Part 1/Sec 2): 2020 Escalators and moving walks: Part 1/Sec 2 Guide for planning and selection (*first revision*)

IS 4591 (Part 1/Sec 3): 2020 Escalators and moving walks: Part 1/Sec 3 Inspection and test (*first revision*)

IS 4591 (Part 2): 2022 Escalators and moving walks: Part 2 Guide for Maintenance

IS 3043: 2018 Code of Practice for Earthing (*second revision*)

IS 732: 2019 Code of Practice for Electrical Wiring Installations (*fourth revision*)

SP 30: 2023 National Electrical Code of India 2023

All standards, whether given herein above or cross-referred to in the main text of this Subsection, are subject to revision. The parties to agreement based on this Subsection are encouraged to investigate the possibility of applying the most recent editions of the standards.

Assistance has also been derived from the following publications in the revision of this Subsection:

IBC 2024 International Building Code, International Code Council, Washington, USA

CIBSE Guide D: Transportation Systems in Buildings, 2020, The Chartered Institution of Building Services Engineers, London, U.K.

For the purpose of deciding whether a particular requirement of this Subsection is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this Subsection.

Code Users are requested to share their inputs/comments on the draft particularly based on the changes listed above in the foreword; and specially on those text highlighted in yellow and blue in this draft.

Important Explanatory Note for Users of the Code

In any Part/Section of this Code, where reference is made to **'good practice'** in relation to design, constructional procedures or other related information, and where reference is made to **"accepted standard'** in relation to material specification, testing, or other related information, the Indian Standards listed at the end of the Part/Section shall be used as a guide to the interpretation.

At the time of publication, the editions indicated in the standards were valid. All standards are subject to revision and parties to agreements based on any Part/ Section are encouraged to investigate the possibility of applying the most recent editions of the standards.

In the list of standards given at the end of a Part/Section, the number appearing within parentheses in the first column indicates the number of the reference of the standard in the Part/Section. For example:

a) Good practices [8-5B(1)] refers to the Indian Standard(s) give at serial number (1) of the list of standards give n at the end of this Part/Subsection, that is, IS 732 : 2019 'Code of practice for electrical wiring installation (fourth revision)', IS 3043 : 2018 'Code of practice for earthing (second revision)' and SP 30: 2023 'National Electrical Code of India 2023'.

DRAFT FOR COMMENTS ONLY

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Draft Indian Standard

National Building Code of India

Part 8 Building Services

Section 5 Installation of Lifts Escalators and Moving Walks 5B Escalators and Moving Walks

[Fourth Revision of SP 7 (Part 8 Section 5B)]

(ICS No. 01.120: 91.040.01)

National Building Code Sectional Committee, CED 46	**Last Date for Comments: 13 April 2025**

1 SCOPE

1.1 This Code (Part 8/Subsection 5B) covers the essential requirements for planning, installation, operation, maintenance, and inspection of escalators and moving walks to ensure safe movement of people with satisfactory performance.

1.2 This Subsection gives information that should be exchanged among the architect/engineer, the consulting engineer and escalator/moving walk manufacturer from the stage of planning to installation including maintenance.

2 TERMINOLOGY

For this Subsection, the following terms and definitions apply.

2.1 General Terms Relating to Escalators and Moving Walks

2.1.1 *Angle of Inclination* – Maximum angle to the horizontal in which the steps, the pallets, or the belt move.

2.1.2 *Operational or Service Brake* – Brake that usually acts on motor shaft and used to stop an escalators/moving walk under all normal conditions or under certain fault conditions.

2.1.3 *Balustrade* – Part of the escalator/moving walk which ensures the user's safety by providing stability, protecting from moving parts and supporting the handrail.

2.1.4 *Balustrade Decking* – Transverse member of the balustrade which meets the handrail guidance profile, and which forms the top cover of the balustrade.

2.1.5 *Brake Load* – Load on the step/pallet/belt for which the brake system is designed to stop the escalator/moving walk.

2.1.6 *Comb* – Pronged section at each landing that meshes with the grooves of the steps/pallets.

2.1.7 *Comb Lighting* – Small flush light panels located in the skirt panels on both sides of the escalators/moving walk unit at both upper and lower landing and immediately adjacent to the comb teeth to illuminate the comb and step tread and assist passengers boarding and alighting the escalators/moving walk.

2.1.8 *Comb Plate* – Platform at each landing to which the combs are attached.

2.1.9 *Comb Plate Switch* – Switch in safety circuit that opens when excessive force is detected in vertical and/or horizontal direction on the comb or comb plate of escalators/moving walk.

2.1.10 *Comb Teeth* – Series of teeth which ride the grooves of the escalators/moving walk step tread as the step passes underneath and are designed to allow them to break-off if a wedging action should occur at their point of contact with step tread.

2.1.11 *Auxiliary or Emergency or Safety Brake* – Mechanically operated brake which operates automatically to stop a fully loaded escalator if the drive chain breaks. It is typically situated on one side of the main drive shaft.

2.1.12 *Emergency Stop Switch* – Separate stop button usually located in adjacent walls, columns or within the balustrade providing the facility to stop the escalator/moving walk, in the event of emergency.

2.1.13 *Inspection Door* – Means of access to equipment areas and other spaces pertaining to an escalators/moving walk installation such as machinery spaces, etc, and with access usually restricted to authorized persons.

2.1.14 *Electrical Safety Devices* – Part of a safety circuit consisting of safety switches and/or fail-safe circuits.

2.1.15 *Escalator* – Power-driven, inclined, continuous moving stairway used for raising or lowering persons in which the user carrying surface (for example, steps) remains horizontal.

NOTE – Escalators are machines even when they are out of operation and shall not be considered or used as fixed staircases.

2.1.16 *Exterior Panel* – Part of the exterior side of the enclosure of an escalator or moving walk.

2.1.17 *Handrail* – Power-driven moving rail for persons to grip while using the escalator or moving walk.

2.1.18 *Interior Panel* – Panel located between the skirting or lower inner decking and the handrail guidance profile or balustrade decking.

2.1.19 *Lower Inner Decking* – Profile that connects the skirting with the interior panel when they do not meet at a common point.

2.1.20 *Lower Outer Decking* – Profile that connects the exterior panels with the interior panel.

2.1.21 *Machinery* – Escalator or moving walk machine(s) mechanisms and associated equipment.

2.1.22 *Machinery Spaces* – Space(s) inside or outside of the truss where the machinery as a whole or in parts is placed.

2.1.23 *Maximum Capacity* – Maximum flow of persons that can be achieved under operational conditions.

2.1.24 *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 (for example, pallets, belt).

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

2.1.25 *Newel* – End of the balustrade.

2.1.26 *Nominal Speed* – Speed in the direction of the moving steps, pallets, or the belt, when operating the equipment under no load condition (that is, 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.

2.1.27 *Pit* – Recess in the floor to receive that portion of the lower landing and the lower end of the incline section which occurs below the floor line when there is no floor under the escalator such as in a basement.

2.1.28 *Rated Load* – Load which the equipment is designed to move.

2.1.29 *Rise* – Vertical distance between the upper and lower finished floor levels.

2.1.30 *Safety Circuit* – Part of the electric safety system consisting of electrical safety devices.

2.1.31 *Skirting* – Vertical part of the balustrade interfacing with the steps, pallets, or belt.

2.1.32 *Skirt Deflector* – Device to minimize the risk of trapping between the step and the skirting.

2.1.33 *Electrical Safety system* – Safety related part of the electrical control system as an arrangement of safety circuits and monitoring devices.

2.1.34 *Maintenance* — All the necessary operations to ensure the safe and intended functioning of the installation and its components after the completion of the installation, throughout its life cycle. See 15.1 for details.

2.1.35 *Maintenance Organization* — Company or part of company where competent maintenance person(s) carry out maintenance operation on behalf of the owner of the installation.

2.1.36 *Competent Maintenance Person* — Designated person, suitably trained, qualified by knowledge and practical experience, provided with necessary instructions, and supported within their maintenance organization to enable the required maintenance operations to be safely carried out.

2.1.37 *Manufacturer* — Entity who takes responsibility for the design, manufacture and placing on the market the machinery of escalators or moving walks.

2.1.38 *Installer* — Entity who takes responsibility for the design, manufacture, installation and placing on the market of escalator/moving walk.

2.1.39 *Installation* — Completely installed escalator or moving walk.

2.1.40 *Owner of the Installation* — Person who has the power of disposal of the installation and/or takes the responsibility for its operation and use.

2.2 Terms Related to Performance Requirements of Escalators and Moving Walks

2.2.1 *Acceleration* – Rate of change of velocity. It is expressed in m/s^2.

2.2.2 *Ride Quality* – Sound levels and vibration of the steps/pallet, relevant to passenger perception, associated with escalator or moving walk operation.

2.2.3 *Sound Pressure Level* (L_p) – Ten times the logarithm to the base 10 of the ratio of the square of the sound pressure to the square of the reference sound pressure.

NOTE – The reference sound pressure level is 20 µPa ($2x10^{-5}$ Pa).

2.2.4 *Velocity* – Rate of change of displacement. Velocity is reported as speed and direction of travel. It is given in metre per second (m/s).

2.2.5 *Vibration* – Variation with time of the magnitude of acceleration. It is expressed in metre per second square (m/s^2).

3 GENERAL

3.1 Conformity with Act and Rules

3.1.1 The installation of escalators and moving walks has been governed in states by different Acts and Rules, as applicable, which are intended to ensure safe installation and operation of the same.

3.1.2 The installation shall be generally carried out in conformity with relevant Act and Rules wherever they are in force.

3.1.3 It is the responsibility of the owner of the premises where the escalators and moving walks will be installed, to obtain necessary permission from the Authority before and after the erection of escalators and moving walks and for their subsequent operation.

3.1.4 A license for public use is a safety provision issued by state authorities under applicable Act and Rules, wherever they are in force.

3.2 Conformity with *Indian Electricity Act* and Rules

All electrical work in connection with installation of escalators and moving walks shall be carried out in accordance with the provisions of *Electricity Act:* 2003, CEA Regulation 2023 and accepted standards [8-5B(1)] as amended up to date along with the rules and regulations framed thereunder and shall also comply with the other provisions of Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code.

3.3 Conformity with Indian Standards

All materials, fittings, appliances, etc, used in electrical installation shall conform to Indian Standard specifications, wherever these exist. In case of materials for which Indian Standard specifications do not exist, the materials shall be approved by the competent authority. The installation shall best practices as in CEA Regulation 2023 and accepted standards [8-5B(1)].

3.4 Conformity with Fire Regulations

The installation shall be carried out in conformity with Part 4 'Fire and Life Safety' of the Code and the state fire acts/local fire regulations, wherever they are in force.

3.5 Safety Design Considerations and Selection of Escalator and Moving Walks

The design consideration for type and selection of escalator and moving walk shall be based on following criteria:

a) *Location* – To ensure reliability, it is important to have design specifications to suit environmental conditions.

b) *Physical requirements* – Physical factors like the vertical and horizontal distance to be spanned shall be considered. The ability of the building infrastructure to support the heavy components is also a critical physical concern.
c) *Type of segment and traffic patterns* – The design consideration depends on segment type. Some typical segments are transit systems like metro, airport, shopping malls, hotels, etc. Traffic patterns shall also be anticipated in escalator and moving walk design. The carrying capacity of an escalator system shall match the expected peak traffic demand.
d) *Safety considerations* – Escalators and moving walks shall not be subjected to abuse, misuse, and negligence. There are a few potential hazards, both from escalators and moving walks themselves and those hazards that users may bring with them, which include loose clothing, type of footwear (especially soft footwear), carried goods and trolleys. The severity of these hazards may increase when used by vulnerable groups of people, such as the old, very young and those with impaired mobility. Proper design risk assessment and control are all critical to ensure reliability and, above all safety.
e) *Aesthetic preferences* – To be suitably decided between the parties concerned.

3.6 Maintenance

The considerations relating to maintenance shall be as follows:

a) The escalator or moving walk 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. It is desirable and normal for the escalator or moving walk supplier to be entrusted with the servicing during the guarantee period of new equipment.
b) In order that the escalator or moving walk installation is always maintained in a safe condition, a proper maintenance schedule shall be drawn up in consultation with the manufacturer and rigidly followed. Provision of a logbook to record all items relating to general servicing and inspection is recommended. Any accident arising out of operation or maintenance shall be duly reported to the Authority in accordance with the rules laid down.
c) Escalators and moving walks are required by statutory regulations to be examined at regular intervals as specified by Acts and Rules, by a competent person. The company entrusted with maintenance contract shall have valid license to maintain the escalators and moving walks. The persons assigned for maintenance work shall be appropriately qualified and experienced as required by statutory Acts and Rules.
d) Companies and organizations responsible for the safe use of escalator and moving walks should ensure that their employees are adequately instructed and informed about the safe use of the escalator or moving walk and the hazards arising from their unsafe use and are familiar with emergency procedures.
e) Proper barricading shall be done to ensure that the open pits of escalator shall be reached/accessed by only the maintenance team. The maintenance service provider shall be responsible for placing of the barricades and signages before start of the maintenance work.

3.7 Energy Efficiency and Sustainability

The following technologies shall be encouraged for reducing power consumption by using energy efficient equipment and behavioural changes:

a) As an option, escalators/moving walk should not run when there are no passengers to move. In this stop mode, only the control system and the passenger detection system are kept running. Another option is to reduce the speed to match the passenger demand, thus reducing energy consumption using variable voltage variable frequency (VVVF) drives, which provide very smooth, almost imperceptible speed transitions.
b) Energy saving LED lamps for lighting in place of conventional lamps.
c) Improvement in total power factor of the motor drive of an escalator or moving walk at the isolator connecting equipment to the building's electrical supply circuit.
d) Adoption of materials and practices that are environmentally friendly and sustainable shall be promoted.

4 DESIGN GUIDELINES FOR ESCALATORS AND MOVING WALKS

4.1 Escalators are desirable where the movement of people, in large numbers at a controlled rate in the minimum of space, is involved, for example, railway stations, shopping centres/malls, airports, etc. These encourage people to circulate freely and conveniently. Inclined moving walks are preferable where trolley movement is expected between levels, like department stores, airport, etc.

Typically, horizontal moving walks are used where medium to long distance travel is involved such as airports/metro stations/exhibition halls.

4.2 As the escalators and moving walks 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.

Depending on the location of project and the expected tenancy, architect / owner to provide the expected footfall in weekdays / weekends / special occasions (holidays, sale etc.) the designer shall consider the peak footfall while providing escalators.

Figure 1 shows the brief idea about the steps to be followed for arriving at appropriate escalator and moving walk solution for an application.

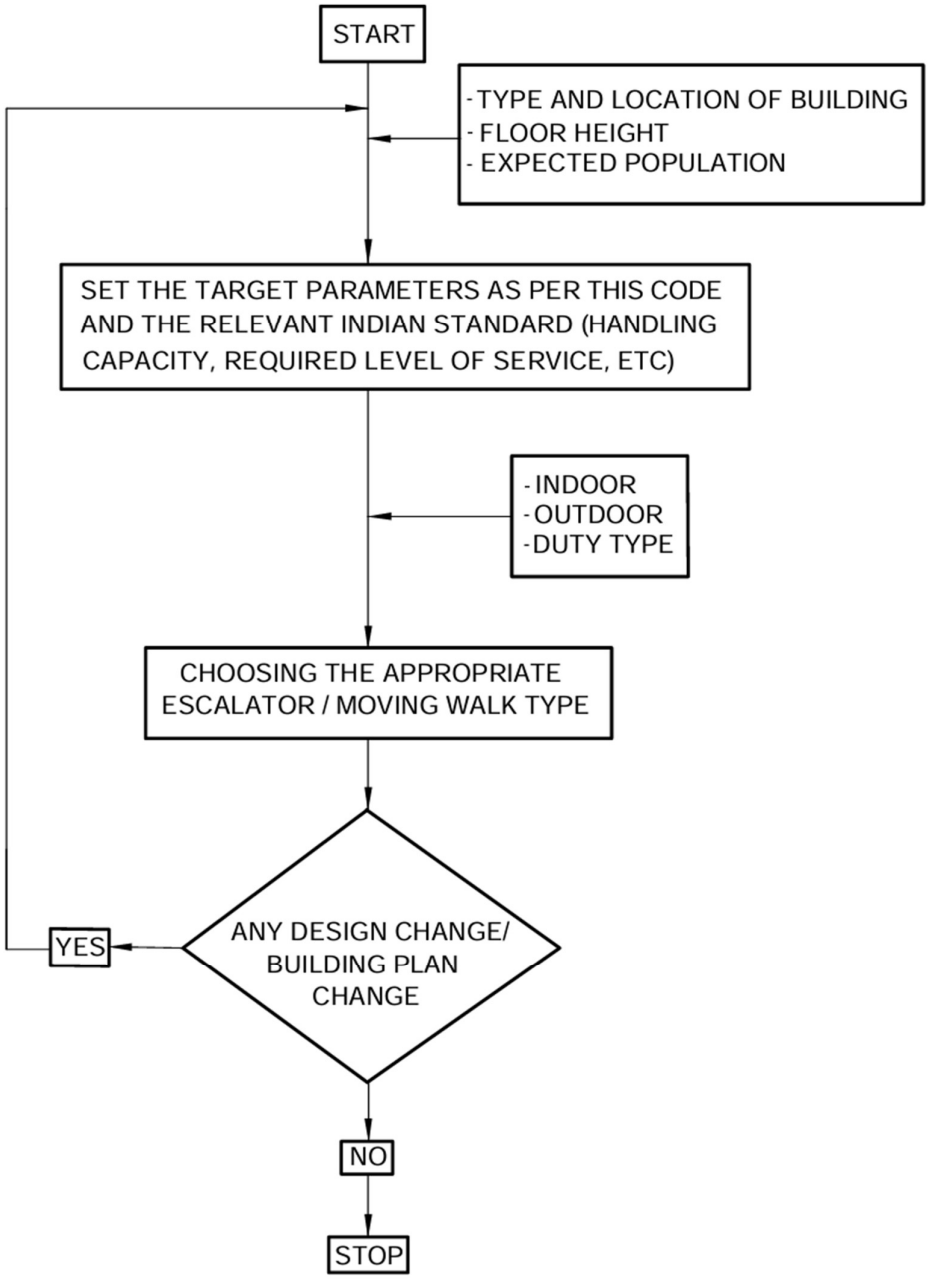


FIG. 1 TYPICAL FLOWCHART FOR PRELIMINARY DESIGN OF ESCALATORS / MOVING WALKS

Based on Fig. 1, type, and location of building, expected population, and the serving floor details are required to work on the preliminary traffic analysis for escalators and moving walks.

For normal peak periods, the recommended handling capacities for design purposes should be taken as indicated in Table 1. The handling capacity of escalator also depends on the angle of inclination, speed, step widths and the areas at the boarding and alighting levels.

Table 1 Expected Pedestrian Flow Rates
(*Clause* 4.2)

Sl No.	Duty Category	Typical Usage (Passengers/Day)	Typical Locations
(1)	(2)	(3)	(4)
i)	Light	Up to 4 000	Shops, leisure facilities, multiplexes
ii)	Medium	Up to 10 000	Department stores, shopping centres, domestic airports and railway stations
iii)	Heavy	Up to 20 000	Railway (junctions), metro stations, airports
iv)	Intensive	Over 20 000	Major railway (junctions), metro stations, international airports

4.3 The number of persons that may be theoretically carried by the escalators and moving walks in 1 hour is given in Table 2 and Table 3, respectively.

Table 2 Theoretical Capacity for Escalators
(*Clause* 4.3)

Sl No.	Step Width	Theoretical Capacity, in Persons/h		
	m	For 0.5 m/s Speed	For 0.65 m/s Speed	For 0.75 m/s Speed
(1)	(2)	(3)	(4)	(5)
i)	0.6	4 500	5 850	6 750
ii)	0.8	6 750	8 775	10 125
iii)	1.0	9 000	11 700	13 500

Table 3 Theoretical Capacity for Moving Walks
(*Clause* 4.3)

Sl No.	Step Width	Theoretical Capacity, in Persons/hour					
		Horizontal Moving Walk (0° Inclination)			Inclined Moving Walk (For 0.5 m/s speed)		
		For 0.5 m/s Speed	For 0.65 m/s Speed	For 0.75 m/s Speed	For 6° Inclination	For 10° Inclination	For 12° Inclination
	m						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	0.8	3 000	3 700	4 400	3 000	3 700	3 000
ii)	1.0	3 800	4 600	5 400	3 700	3 700	-
iii)	1.4	5 100	6 400	7 700	5 100	-	-

4.4 Though 4.3 indicates the theoretical values for escalators (*see* Table 2) and moving walks (*see* Table 3), Tables 4 and 5 indicate the practical values to be considered while calculating the required number of escalators and moving walks (based on traffic flow pattern).

Table 4 Practical Capacity for Escalators
(*Clause* 4.4)

Sl No.	Step Width	Practical Capacity, in Persons/h		
	m	For 0.5 m/s Speed	For 0.65 m/s Speed	For 0.75 m/s Speed
(1)	(2)	(3)	(4)	(5)
i)	0.6	2 250	2 925	3 375
ii)	0.8	3 375	4 388	5 063
iii)	1.0	4 500	5 850	6 750

Table 5 Practical Capacities for Moving Walks
(*Clause* 4.4)

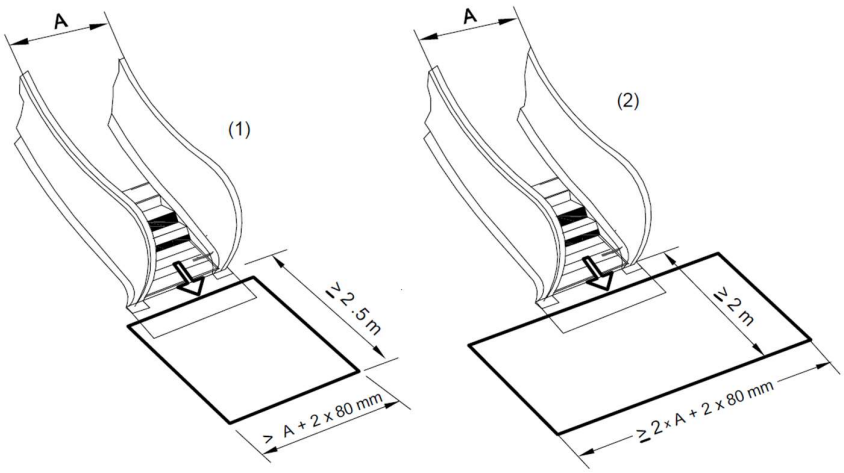
Sl No.	Step Width	Practical Capacity, in Persons/h					
		Horizontal Moving Walk (0° Inclination)			Inclined Moving Walk (For 0.5 m/s Speed)		
	m	For 0.5 m/s Speed	For 0.65 m/s Speed	For 0.75 m/s Speed	For 6° Inclination	For 10° Inclination	For 12° Inclination
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	0.8	2 880	3 648	4 320	2 880	2 800	2 800
ii)	1.0	3 600	4 560	5 350	3 600	3 600	-
iii)	1.4	5 040	6 350	7 560	5 040	-	-

5 ARRANGEMENT AND PLANNING DIMENSIONS

5.1 Escalators are typically used for short range of movement between adjacent floors. They are usually situated in an obvious circulation path making it easy for pedestrians to board them. Escalators and moving walks should only be accessed from adjacent corridors/walkways, landing and lobby areas, where people do not obstruct other pedestrian circulation routes. Space should be available to accommodate queuing at the boarding point.

It is especially important that the boarding and alighting areas adjacent to an escalator or moving walk are not part of another circulation route, to provide a safe area for passengers to board and alight at landings. The area of this space is defined as a distance between the handrails plus 160 mm, multiplied by a depth of 2.0 m to 2.5 m, depending on the configuration of escalator or moving walk.

Figure 2 illustrates the above clause with option 1 being a 2.5 m landing depth and option 2 being 2.0 m landing depth. Where successive units are installed, each successive escalator or moving walk should have its own individual unrestricted area. For succeeding escalators and moving walks the depth of an unrestricted area shall be determined in each individual case depending on, for example, type of use (persons only or persons with transport devices, number of intermediate exits, relative orientation, and theoretical capacity).



A = Distance between outer edge of handrail

Option 1 >> unrestricted area >= 2.5 m from end of balustrade and width >= A+(2*80) mm

Option 2 >> unrestricted area >= 2.0 m from end of balustrade and width >= (2*A) +(2*80) mm

FIG. 2 UNRESTRICTED FREE SPACE

Where the exit of the escalator or moving walk is blocked by structural measures (for example shutters, fire protection gates, removable barriers), an additional STOP button for emergency situations shall be provided:

a) within reach from inside the escalator/moving walk at 2.00 m to 3.00 m before the steps/pallets reach the comb intersection line.
b) Between 200 mm below and 400 mm above the handrail, measured from the top of the handrail to the middle of the actuator of STOP button.

NOTE – STOP button shall be with protection to prevent nuisance activation for example shroud guard. STOP switch with cover is not permitted.

Fig. 3 illustrates the position of additional STOP button.

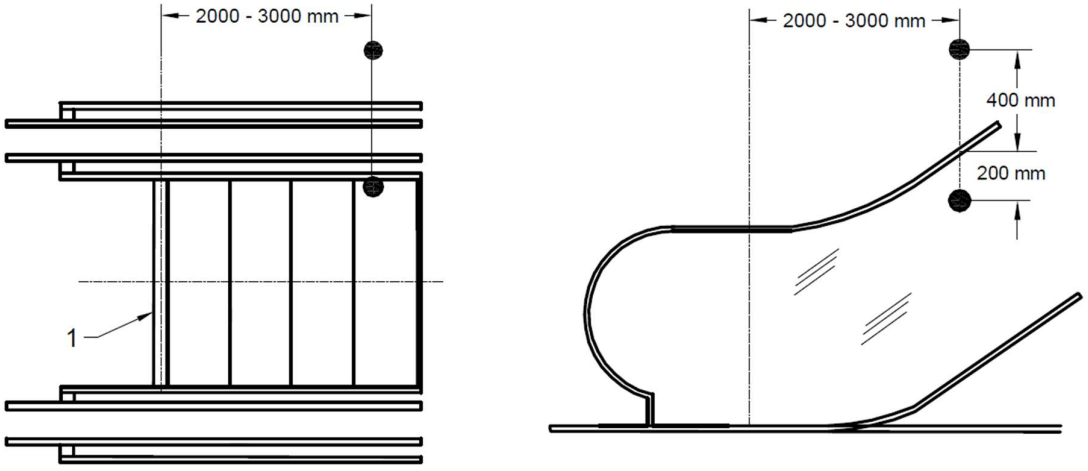


Fig. 3 LOCATION AND DISTANCE OF ADDITIONAL STOP BUTTON

The position of the shutters, fire protection gates, removable barriers, etc shall be protected with a contact in the safety circuit. As soon as the doors close, the escalator or moving walk should stop.

Escalators occupy more space than stairs to accommodate their inclination. There are few standard escalator arrangements as shown in Fig. 4. Type (a) and Type (b) provide efficient circulation by providing the shortest transition path and time from one escalator and the next. Type (b) requires larger structural opening than Type (a) and Type (c) and present users with a higher risk of falling into the void. Type (c) is typical of a store as it allows the store to lengthen the circulation route past goods for sale. This configuration also takes up free space.

Some moving walks are adopted to receive and lock on shopping/baggage trolleys. In these cases, the unrestricted area at the landing should be increased to at least 5 m and number of flat/horizontal steps at the boarding and alighting points increased. The most significant effect is the increased footprint required for the equipment. Shopping/baggage trolleys are not permitted on escalator.

To encourage pedestrian confidence and to assist efficient and safe boarding/ alighting of escalators, the start and end of escalator should present a few horizontal/flat steps. At least two flat steps are provided for escalators speeds up to 0.5 m/s; at least three flat steps for speeds above 0.5 m/s and up to 0.65 m/s for escalator having rise more than 6 m; and at least four flat steps for speeds above 0.65 m/s. In locations where it is anticipated that escalators may be used by persons with impaired mobility or heavy passenger traffic, additional flat steps should be considered.

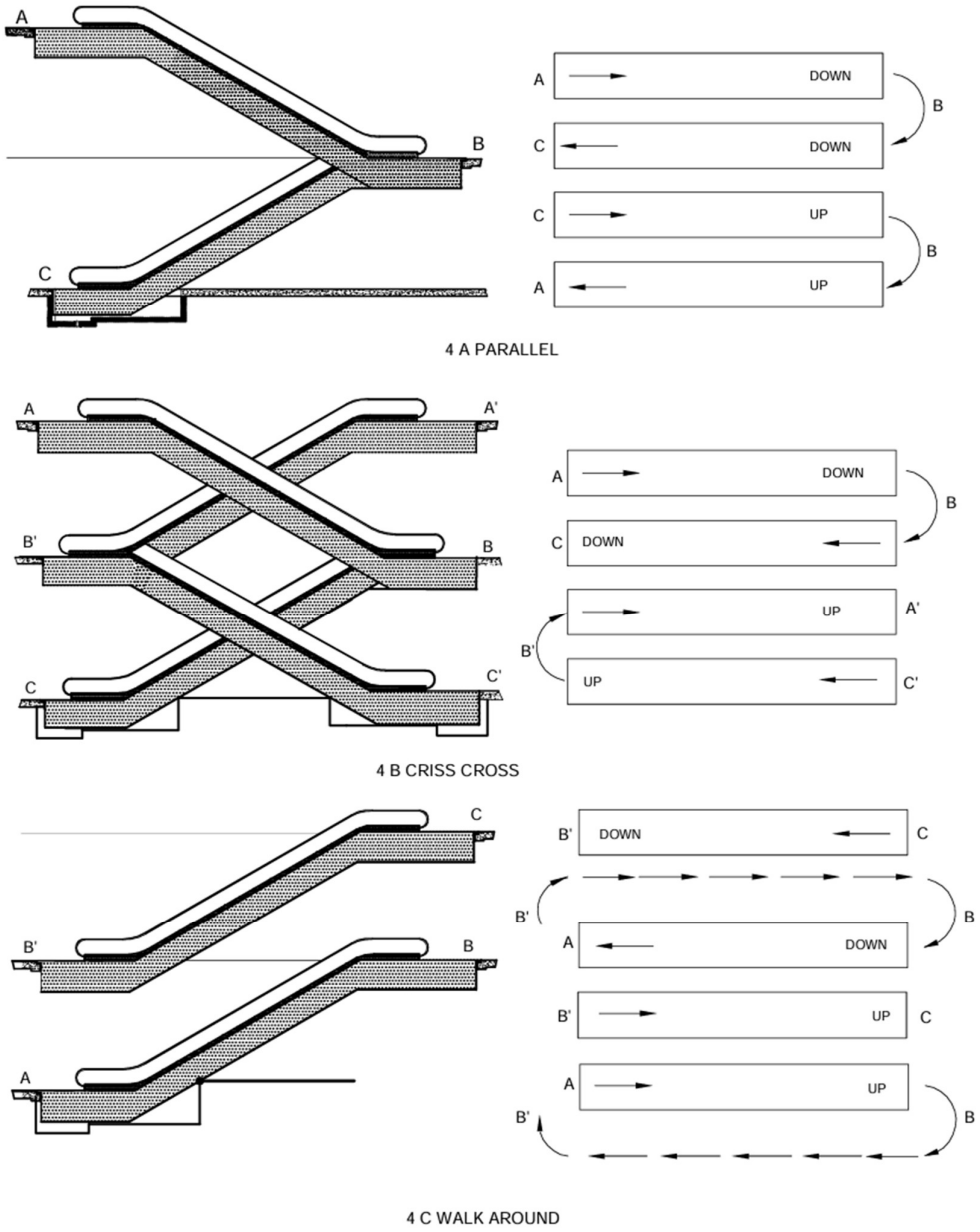


FIG. 4 ESCALATOR CONFIGURATION

5.2 Ensuring Accessibility for All Users

5.2.1 The accessibility requirements given in Part 3 'Development Control Rules and General Building Requirements' of the Code shall be complied with.

5.2.2 The location of escalators and moving walks should be considered in relation to the position of adjacent fire protected lift shafts and lobbies, staircases, and their associated areas of rescue assistance, as at the time of an emergency these become non-functional. A surface of the escalator and moving walks should contrast visually with the approach and there should be audible signals or pre-recorded messages that indicate the start and finish of the escalator to help visually impaired people.

For important reasons of safety, special warning notices and tactile warning indicators shall be provided at the top and bottom of escalators. Escalators shall not be considered as the accessible route. Persons with locomotor disability cannot use them. Hence a lift should also be installed as an alternative accessible route.

For moving walks, the maximum inclination should be up to 6º for use by people with disabilities. People with disability may find it difficult to use moving walks. Hence, alternative like an accessible battery cart, may be provided to them in appropriate cases. Moving walks shall be free of projecting objects and obstacles up to a height of 2 100 mm. A minimum level of illumination of 100 lux shall be provided on moving walks.

6 SPACE REQUIREMENT

6.1 Free Space for Users

6.1.1 The clear height above the steps of the escalator or pallets or belt of the moving walk at all points shall not be less than 2.30 m (*see* X4 in Fig. 5 and Fig. 7). 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.

6.1.2 To prevent collision, a minimum free area around the escalator or moving walk is defined as per Fig. 5. The height X12, measured from the steps of the escalator or the pallets or the belt of the moving walk shall be at least 2.10 m (*see* X12 in Fig. 5). The distance between the outer edge of the handrail and walls or other obstacles (*see* Y10 in Fig. 5) shall under no circumstances be less than 80 mm horizontally and 25 mm vertically below the lower edge of the handrail (*see* Y12 in Fig. 8). The area is permitted to be smaller, if by appropriate measures, the risk of injury is minimized.

6.1.3 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* Y11 in Fig. 5).

6.1.4 Where building obstacles may cause injuries, appropriate preventive measures shall be taken.

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, for example, as an imperforate triangle (*see* X5 in Fig. 7 and Fig. 9).

It is not necessary to comply with these requirements when the distance Y9 between the outer edge of the handrail and any obstacle is equal to or greater than 400 mm (*see* Fig. 5).

6.1.5 In the case of successive escalators and moving walks with intermediate landing without exits, they shall be electrically interlocked to run in same direction and shall have the same transportation capacity. They shall also be electrical interlocked to

stop the escalator carrying passengers into the intermediate landing without exits if the escalator carrying passengers away from the landing stops.

6.1.6 Where it is possible for people to come into contact with the outer edge of a handrail at a landing and may be drawn into a hazardous situation, such as toppling over a balustrade, appropriate preventive measures shall be taken (for example, *see* Fig. 6).

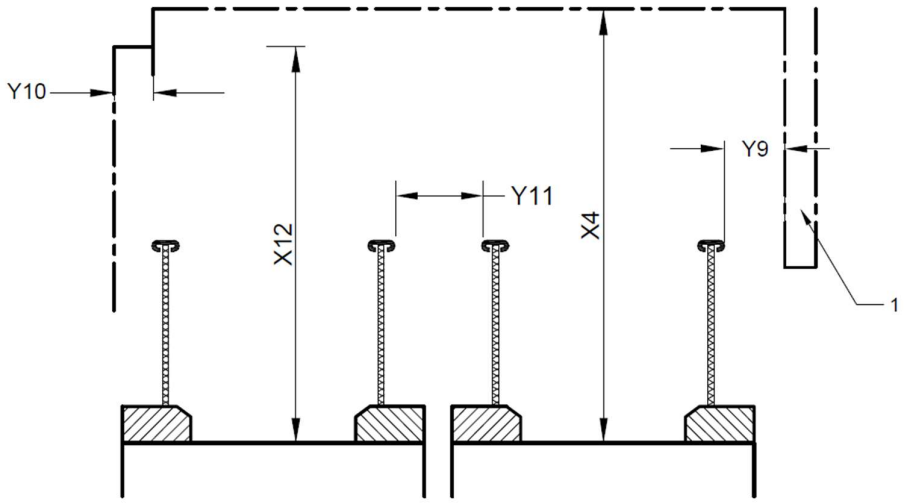
Some examples are:

a) Prevention of entry into the space by the placement of permanent barriers.
b) 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.

6.1.7 The surrounding space 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.

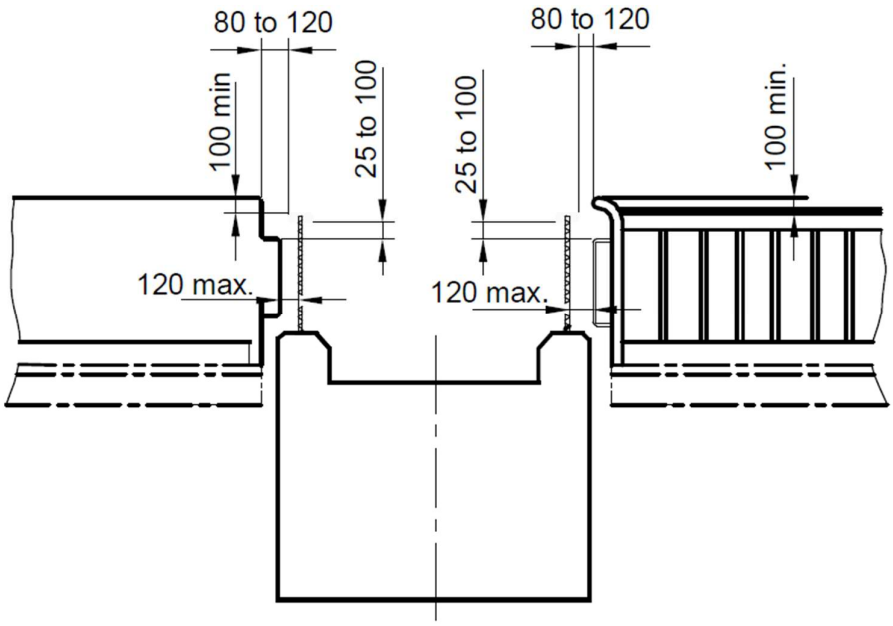
6.1.8 It is permissible to arrange the lighting in the surrounding space and/or at the installation itself. The intensity of illumination at the landings including the combs shall be related to the intensity of illumination of the general lighting in the area. The intensity of illumination shall be not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



Key
1 Obstacle (for example, Column)

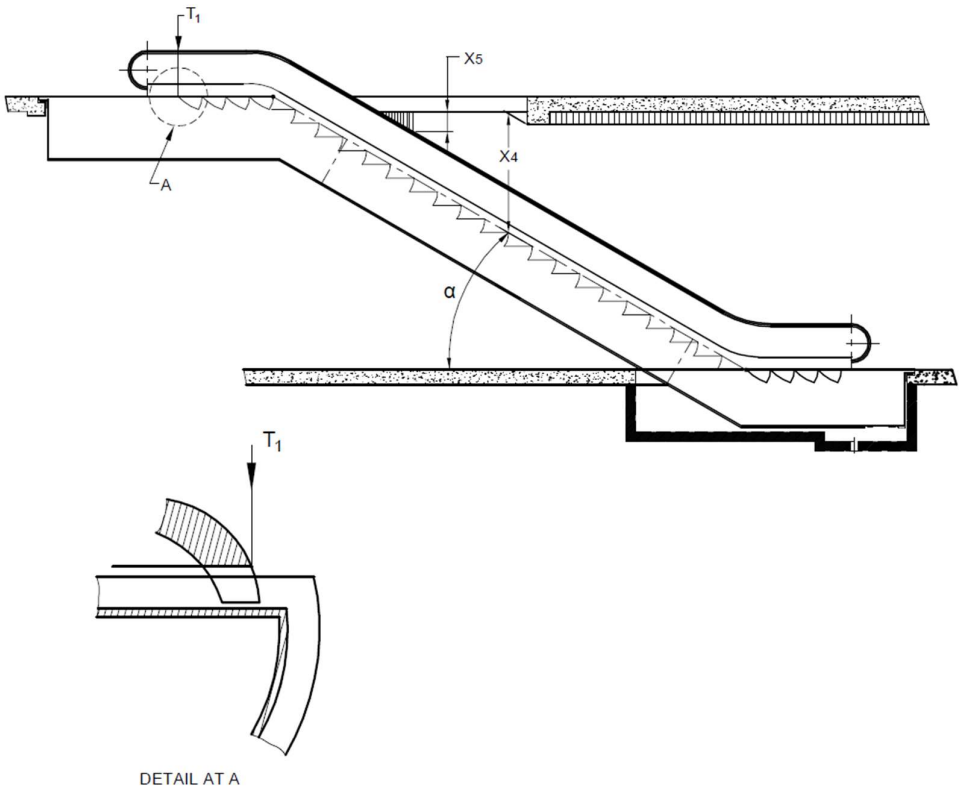
Principal Dimensions	*Ref to Clause*	*Principal Dimensions*	*Ref to Clause*
Y9 ≥ 400 mm	**6.1.4**	X4 ≥ 2 300 mm	**6.1.1**
Y10 ≥ 80 mm	**6.1.2**	X12 ≥ 2 100 mm	**6.1.2**
Y11 ≥ 160 mm	**6.1.3**		

FIG. 5 CLEARANCES BETWEEN BUILDING STRUCTURE AND ESCALATOR / MOVING WALK



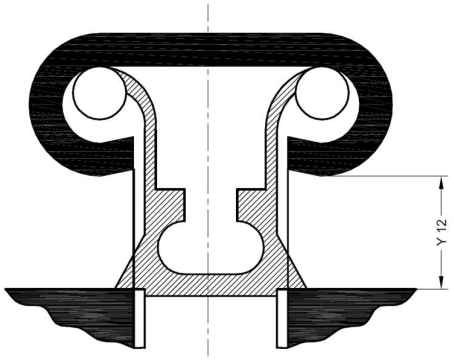
All dimensions in millimetres.

Fig. 6 EXAMPLE OF BARRIERS AT LANDINGS



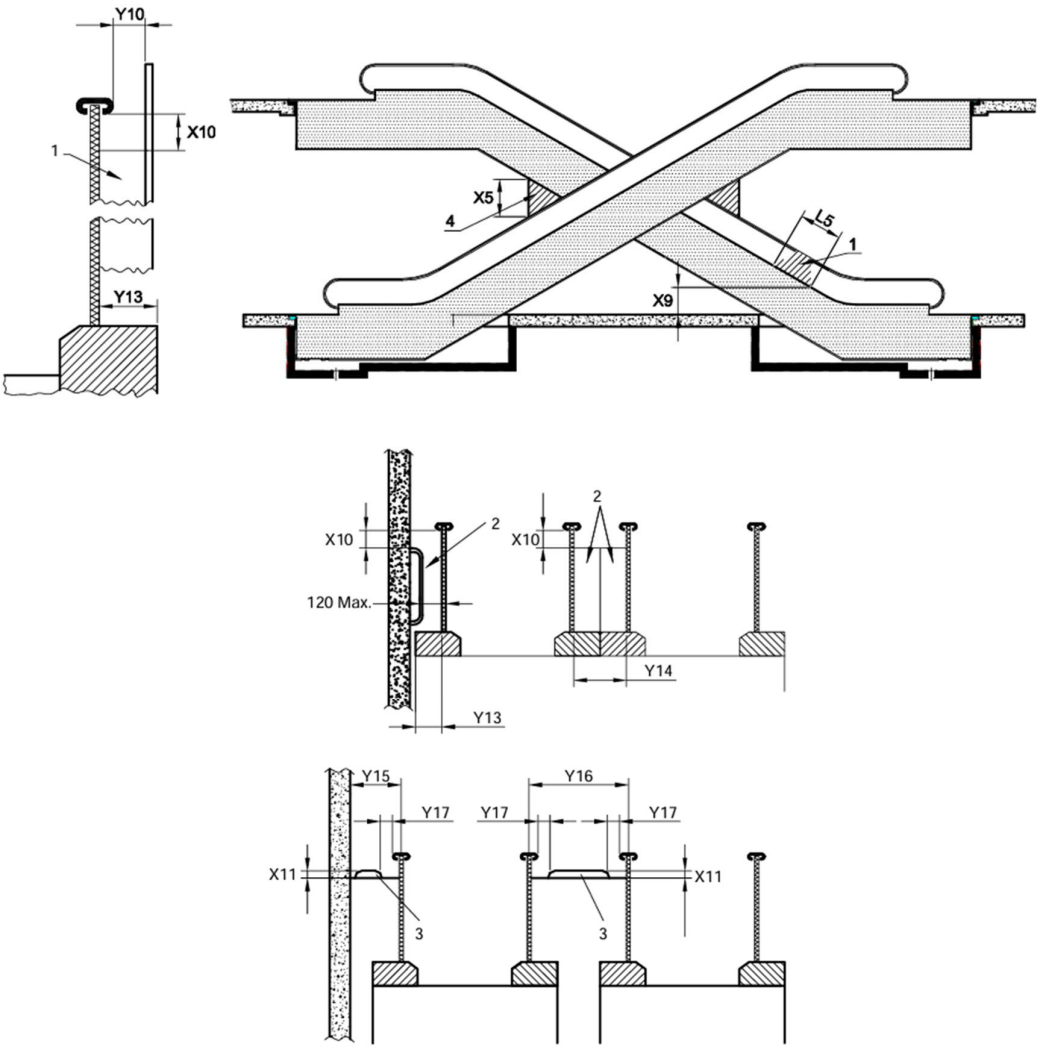
Principal Dimensions	*Ref to Clause*
X4 ≥ 2.30 m	**6.1.1**
X5 ≥ 0.30 m	**6.1.4**
α = Angle of inclination	

FIG. 7 ESCALATOR (ELEVATION), PRINCIPAL DIMENSIONS



Principal Dimensions	*Ref. to Clause*
Y12 ≥ 25 mm	**6.1.2**

Fig. 8 HANDRAIL – SECTIONAL VIEW



Key
1 Anti-climbing device (*see* **6.3**)
2 Access restriction device (*see* **6.3**)
3 Anti-slide device (*see* **6.3**)
4 Vertical deflector (*see* **6.1.4**)

Principal Dimensions	*Ref to Clause*
Y13, Y14, Y15, Y16	**6.3**
Y17 ≥ 100 mm	**6.3**
X5 ≥ 0.30 m	**6.1.4**
X9 = (1 000 ± 50) mm	**6.3**
X10 = 25 mm to150 mm	**6.3**
X11 ≥ 20 mm	**6.3**
L5 ≥ 1 000 mm	**6.3**

FIG. 9 ANTI-MISUSE DEVICE

6.2 Machinery Spaces Outside the Truss

The following shall be ensured:

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

b) Machinery spaces shall be lockable and only accessible to authorized persons.

c) Machinery spaces shall be provided with permanently installed electric lighting on the following basis:

1) Minimum of 200 lux at floor level in working areas; and
2) Minimum of 50 lux at floor level in access routes leading to these working areas.

d) 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.

e) The dimensions of machinery spaces shall be sufficient to permit easy and safe working on equipment, especially the electrical equipment. These shall be provided at least at a clear height of 2.00 m at working areas, and 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.

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.

f) The clear height for movement shall not be less than 1.80 m. The access ways to the clear spaces 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. 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; and
b) the floor of the working area.

g) In machinery spaces the clear height shall under no circumstances be less than 2.0 m.

h) 3 pin plug with socket for the maintenance propose.

j) Machinery spaces shall not accommodate equipment not related to the escalator or moving walk.

6.3 Balustrade

Balustrades shall be installed on each side of the escalator or moving walk. The dimensions of the balustrade shall be as follows:

In the inclined section the vertical height X1 from step nose or pallet surface or belt surface to top of the handrail shall not be less than 0.90 m and not exceed 1.10 m (*see* Fig. 10)

The balustrades shall have no parts on which a person will normally stand.

Appropriate measures shall be taken to discourage people from climbing on the outsides of the balustrade if there is a danger of people falling from them.

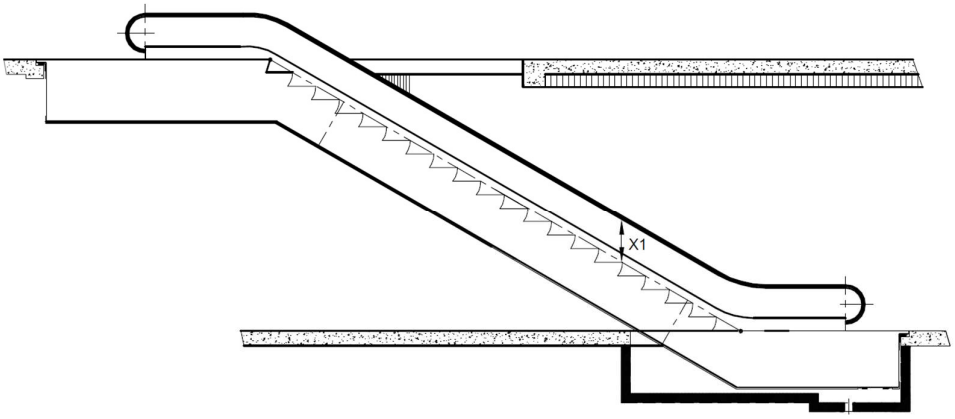
To ensure this, on escalators and moving walks, devices (*see* 1 in Fig. 9) shall be provided on the lower outer decking at a point 1 000 ± 50 mm above the floor level (*see* X9 in Fig. 9) where the bottom of the device intersects with the balustrade decking and shall extend to a length L5 of at least 1 000 mm parallel with the balustrade decking where no stepping is possible. The device shall extend to at least a height in line with the top of the handrail not conflicting with the requirements of Y10 and Y12 (*see* Fig. 5 and Fig. 8).

Where escalators or moving walks are located adjacent to walls, devices (*see* 2 in Fig. 9) to restrict access to the balustrade decking shall be provided at the top and bottom ends of these walls when the lower outer decking width Y13 exceeds 125 mm. On adjacent parallel arrangements, this protection shall be provided when the combined balustrade decking width Y14 exceeds 125 mm. The device shall extend to the height X10 (*see* Fig. 9).

All exposed fastener heads for the devices should be of the vandal resistant type.

Where handrail level balustrade decking are provided between escalators/inclined moving walks and adjacent walls, anti-slide devices (*see* 3 in Fig. 9) shall be provided on the balustrade decking when the distance Y15 between the structure of the building (wall) and the centreline of the handrail is greater than 300 mm. These devices shall consist of objects fastened to the balustrade decking, no closer than 100 mm to the handrail (*see* Y17) and spaced no greater than 1 800 mm apart. The height X11 shall be not less than 20 mm. The devices shall have no sharp corners or edges (*see* Fig. 9).

The above mentioned also applies to adjacent escalators/inclined moving walks when the distance Y16 between the centrelines of the handrails is greater than 400 mm.



Principal Dimensions 0.9 m ≤ X1 ≤ 1.10 m

FIG. 10 ESCALATOR (ELEVATION), PRINCIPAL DIMENSIONS

The placement and type of escalator may introduce hazards, particularly when exposed over a void, leading to risks of falling at two areas:

a) *Escalator and Moving Walk Landings* – There is a risk for people to come into contact with the outer edge of a handrail and be drawn into the void.
b) *Escalator and Moving Walk Balustrades* – There is a risk for people to trip or accidentally overbalance and topple into the void.

A risk assessment should be conducted to identify hazards, potential misuse, affected individuals, and necessary preventive measures. Some examples of misuse are - sitting, standing, sliding on the handrail, holding onto the handrail from outside the balustrade, being lifted onto the handrail, walking up, and sliding down the decking.

For escalators exposed over a void, falling risks increase, and additional protection beyond the handrail and balustrade may be needed. Balustrades should balance fall risk and passenger support. Balustrade with 1100 mm height offer firm grip and better fall protection than 900 mm. To mitigate falling risks, following risk mitigation measures shall be considered:

1) Avoiding voids to remove the hazard.
2) Using 1100 mm high balustrades if voids are present.
3) Installing glass enclosures, shields, or additional guard rails if high balustrades alone are insufficient.

NOTE – Based on the risk assessment carried out, fixing of external guarding, if required, shall be undertaken with professional consultation to ensure that the integrity of the escalator truss or balustrade is not compromised.

6.4 Installation

The following needs to be planned and carried out on site to ensure easy installation of escalators and moving walks.

6.4.1 *Installation Timing*

To prevent damage to the escalator during the construction phase, the timing of installation and assembly should be as close as possible to the opening date. It should, however, proceed completion of the floor to dispense with the need to take further measures to protect floor coverings. Ensure that the provisional floors along the transport route in the building may comfortably cope with the load weight.

6.4.2 *Transport to the Assembly Site*

A suitable unloading area shall be available in front of the building. The access routes to the building shall be level and negotiable by heavy duty rollers. Along the entire transport route to the assembly site, the free height shall not be less than the minimum specified in the manufacturer plan (also goes for pipes and other attachments fitted by others to the ceiling structure).

6.4.3 *Access Openings, Transport Route and Load Capacity*

Normally, escalators are moved in through openings at the side of the building at ground level. Optionally, suitable roof openings should be provided, to bring the escalators by crane. It is important that the route to the assembly location within the building is free of obstacles and level, and the ceiling can support a load. Otherwise, the appropriate weight distribution shall be catered to.

6.4.4 *Special Delivery*

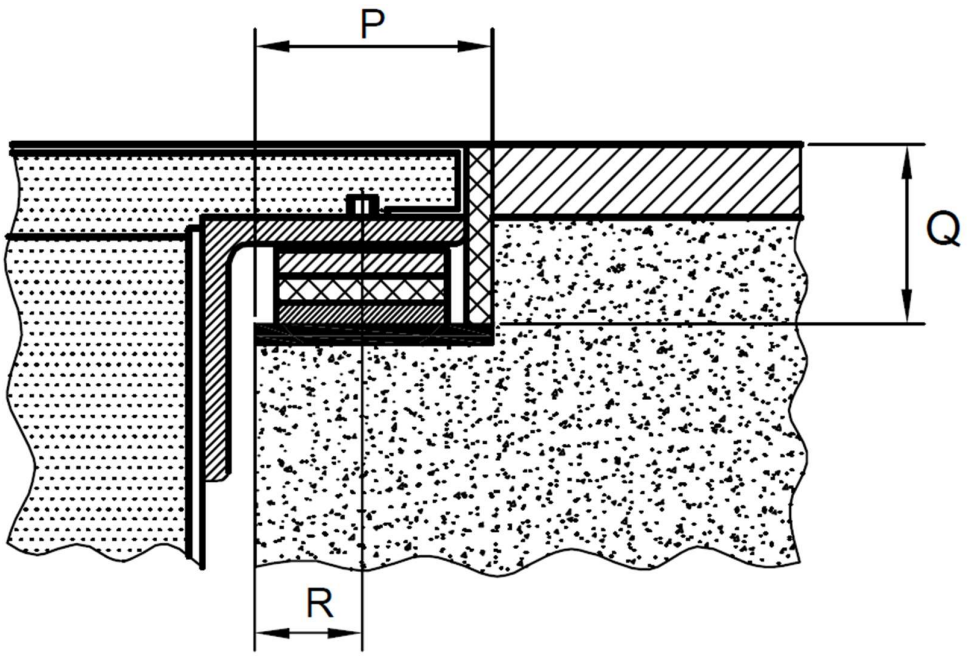
Some escalators are so long that they should be installed in sections. In this case, the escalator may have to be manufactured in split form and assembled on site.

6.4.5 *Ceiling Openings*

Manufacturer should notify the location and size of the required ceiling openings on the installation drawing. Builder shall supervise the precise implementation of these openings.

6.4.6 *Top and Bottom Supports*

While designing the support recess, the support loads shall be considered. They are shown on the installation drawing given by the manufacturer. At those locations where the supports of escalator (or moving walk) will be placed, the support shall be able to bear the weight of the escalator including traffic load. When preparing the supporting structures, the measurements indicated on manufacturer's installation plans shall be precisely adhered to (*see* Fig. 11).



NOTE - P, Q, R ARE BASED ON MANUFACTURER'S DRAWING

FIG. 11 TOP AND BOTTOM SUPPORTS

6.4.7 *Intermediate Supports*

Intermediate supports are needed on escalators with a considerable travel height (recommended above 5 000 mm) and on long moving walks. If the intermediate support is required, the manufacturer shall provide the location and load on intermediate support to the customer irrespective of the segment for which the escalator is provided, to include the additional space required in the construction plan (*see* fig. 12).

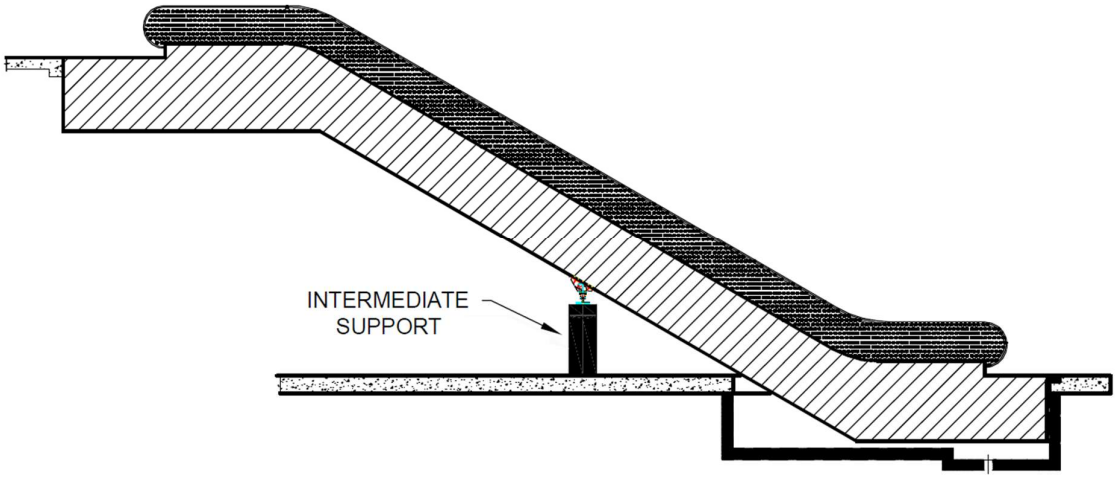


FIG. 12 INTERMEDIATE SUPPORTS

6.4.8 *Hoisting Arrangement*

It shall be ensured that pick-up points for hoisting and supporting the escalator shall be fitted securely during assembly. These should be located exactly above the centre of the supporting points. For systems with several supporting structures, plan for additional pick-up points above the intermediate supports. All pick-up points shall be capable of taking a load strain (*see* Fig. 13).

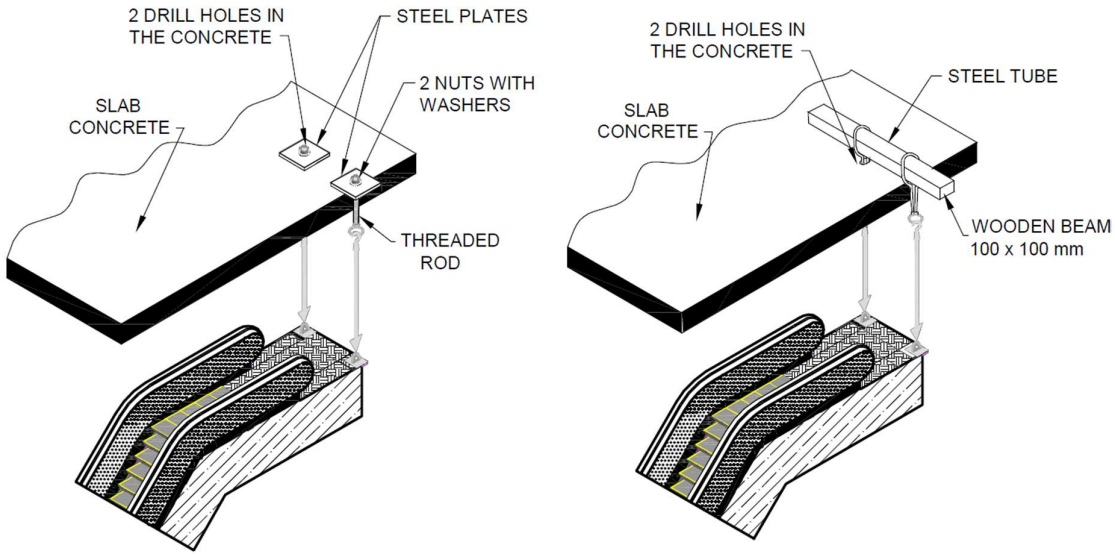


Fig. 13 PICK-UP POINTS

6.4.8.1 *Installation with a frame*

If no assembly holes can be provided, the escalators and moving walks should be lifted to their final location by means of special sturdy girder construction. In this case, ceiling load strain shall bear the capacity as per the manufacturer's instruction.

6.4.8.2 *Installation with lifting gear*

Holes with a 100 mm diameter are to be made through the ceiling, according to manufacturer instructions. These are used by installation team for fixing the lifting gear. In this way escalator or moving walk is simply lifted upwards from floor to floor. The load strain of every pick-up point shall be maintained as per the manufacturer instruction.

6.4.8.3 *Installation with crane assembly*

Where a suitable roof opening is available, or the site is located outdoor, lift the escalator or moving walk by crane and place it on the supports provided. The builder is responsible for ensuring for all local authority approvals.

6.4.8.4 Permanent hoisting hooks shall be provided by the builder in the top slab for hoisting the escalator as per the load requirement.

6.4.9 *Sprinkler Piping*

An optional safety feature is the installation of a sprinkler piping within the escalator or moving walk (*see* Fig. 14 for typical sprinkler piping arrangement).

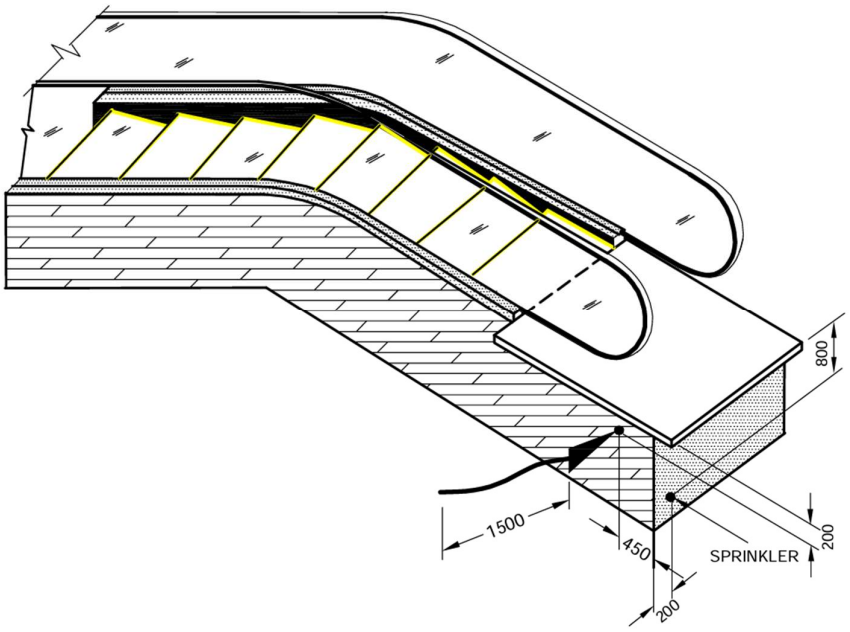


Fig. 14 TYPICAL SPRINKLER PIPING ARRAMGEMENT

6.4.10 *Oil Separator*

A type-proofed oil separator is essential for escalators and moving walks which are exposed to the weather. At the construction site, a recess shall be provided for the oil separator in the escalator pit.

6.4.11 *Railings*

In the threshold areas of the escalators, railings should be installed by the builder. The distance to the escalator handrail from railing shall be at least 80 mm. For adjacent escalators, the distance between the edges of the handrails shall be at least 160 mm (*see* Y11 in Fig. 5).

6.5 Electrical Requirement

6.5.1 The electrical installations shall be in accordance with Part 8 'Building Services, Section 2 Electrical and Allied Installations' of the Code and good practices [8-5B (2)].

6.5.2 *Power Supply*

6.5.2.1 The main power supply cables providing the electricity supply from main electrical panel of the building to escalator / moving walk equipment shall be PVC or

XLPE insulated, flame retardant type, armoured cables. The cables shall be terminated in the main switchgear panels / distribution box using cable glands such that the armour of the cables shall be positively connected to the metal body of switchgear panels / distribution box. For each escalator / moving walk, one 415 $V^{+6\ percent}_{-10\ percent}$, 3-phase, 4-wire, 50 Hz supply and one 230 $V^{+6\ percent}_{-10\ percent}$, 1-phase, 3-wire, 50 Hz supply shall be provided outside the escalator / moving walk in the vicinity of the machine or in the return stations, or in the vicinity of the control devices. Main switchgear shall be capable of breaking the supply to the motor, to the brake releasing device and to the control circuit in the live conductors.

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 switch. This switch shall not cut the supply to the socket outlets or to the lighting circuits while the escalator / moving walk is switched off for inspection and maintenance. Size of the 3-phase and 1-phase cables shall be as specified by the manufacturer.

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.

6.5.2.2 The escalator / moving walk sub-circuit from the meter room should be separate from other building services. Each equipment should be capable of being isolated from the mains supply. This means of isolation shall be with Lock Out and Tag Out facility. The electric supply cables shall run in a route safe from fire.

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

6.5.3 *Protection*

It is important that earthing should ensure efficient and fast operation of protective device, in the case of earth faults. Escalators or moving walks may be provided with or without V3F drives. Due to its principle of operation, the V3F drive produces leakage current greater than 3.5 mA. Therefore, the cross section of earthing conductor should be at least the cross section of the active conductors and at least 10 mm². As alternative, two ground conductors with the same cross section as the active conductors (if < 10 mm²) may be used in parallel.

Suitable over current protection device (MCB/MCCB) and residual current device (RCD) shall be provided outside the escalator / moving walk in the vicinity of the machine or in the return stations or in the vicinity of the control devices. These devices shall be provided by owner of the equipment and not by the manufacturer.

Protective measure of protective equipotential bonding and automatic disconnection of supply is intended to provide protection against shock and/or fire hazard. The choice of protective device depends on the earthing network that is TN-S, TN-C-S, TT.

RCD shall be required in case of fault protection against indirect contact or in case of TT network. When RCD is used, circuit shall also be protected by overcurrent protective device that is standalone RCD shall not be used.

6.5.3.1 MCB & RCD in 3-Phase circuit

a) Irrespective of whether the escalator or moving walk is with or without V3F, MCB of characteristics “D” shall be used.
b) *RCD with V3F* – Special type of residual-current circuit breaker appropriate for this application should be used:
    1) Suitable for use with a frequency converter
    2) Universal-current-sensitive (characteristic B)
    3) Short-time delayed tripping (type S)
    4) Tripping current at nominal frequency: 300 mA
    5) Tolerant against leakage currents of up to 2000 mA at higher frequencies.
c) *RCD without V3F* – RCD with below specifications shall be used:
    1) Type A or AC – details to be provided by manufacturer.
    2) Non-delayed
    3) Tripping current: 100 mA

Alternatively, RCBO which meets above specifications may be provided.

NOTE – RCD/RCBO is mandatory in case of TT network.

6.5.3.2 Over current protective device in the 1-Phase Circuit

For the lighting circuit, miniature circuit breaker (MCB) of characteristics “C" shall be provided. In addition, RCD of following specification shall be provided:

a) Pulse-current-sensitive (characteristic A)
b) Non-delayed
c) Tripping current: 30 mA
d) Rated current: 16 A.

Alternatively, RCBO which meets above specifications may be provided.

7 FIRE PROTECTION

Fire protection and building requirement differ with the application / use of building. For specific requirements for fire protection, Part 4 ‘Fire and Life Safety’ of the Code shall be referred. It is recommended that escalators and moving walks are made of non-combustible material that do not create additional hazard in case of fire.

To limit the danger caused by overheating, ventilation for the rooms / spaces that contain the motors and gears shall be provided. These areas may contain fire alarm

systems, extinguishing systems, and sprinkler heads if the equipment is adequately protected from incidental damage and do not create additional dangers for maintenance personnel to operate. In case sprinklers are used, their integration and fixation into the escalator and moving walk shall be done by taking into consideration the special needs of the machine.

Accumulation of materials (such as grease, oil, dust, paper) represent a fire hazard. Therefore, it should be possible to clean the underside enclosure. If such cleaning is not possible, other precautions (such as installation of sprinkler system) shall be provided to avoid the fire hazard. Outer and inner decking, truss, pallets / steps, track system shall be according to Class 3 of accepted standard [8-5B(3)]. In case of fire, upon receiving the signal, the escalator operation should stop immediately. It is recommended that as far as possible, escalators and moving walks are not used in case of emergency situations.

Escalator well ways may be equipped with a fire shutter(s), operated by an activation of temperature and smoke detectors, and shuts off the well way of a floor and prevent the spread of fire up through the building.

8 MINIMUM TECHNICAL AND SAFETY REQUIREMENTS

8.1 General

The safety requirements of escalators and moving walks shall comply with good practice in accordance with this Subsection. Certain escalators and moving walks are subject to special operational and environmental conditions.

8.2 Supporting Structures (Truss) and Enclosure

The truss shall be designed to safely sustain steps and running gear in its guides. All mechanically moving parts of the escalator or moving walk shall be completely enclosed within imperforate panels or walls. Exceptions 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. 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.

Angle of inclination of an escalator from the horizontal shall not exceed 30˚, but for rises not exceeding 6 m and nominal speed not exceeding 0.5 m/s the angle of inclination is permitted to be increased to 35˚.

Rise m	*Speed* m/s	*Angle of Inclination*	
		Standard	Option
≤ 6	≤ 0.5	30˚	35˚
≤ 6	> 0.5	30˚	-
> 6	≤ 0.5	30˚	-
> 6	> 0.5	30˚	-

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

8.3 Step, Pallet, or Belt

For escalators and moving walks, the nominal width shall not be 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.

8.3.1 *Step Treads and Pallets*

The step depth in the direction of travel shall not be less than 0.38 m. The step height shall not exceed 0.24 m. The surface of the step treads shall have grooves in the direction of the movement, with which the teeth of the combs mesh. They shall be sensibly horizontal in the usable area of the escalator. 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.

The width of the grooves shall be at least 5 mm and shall not exceed 7 mm. The depth of the grooves shall not be less than 10 mm. The web width shall be at least 2.5 mm but not exceed 5 mm.

8.3.2 *Belts*

The belts shall have grooves in the direction of travel with which the teeth of the comb mesh. The width of the grooves shall be at least 4.5 mm and shall not exceed 7 mm. The depth of grooves shall not be less than 5 mm. The web width shall be at least 4.5 mm but not exceed 8 mm. Splicing of tread way belt shall be such as to provide continuous unbroken tread way surface.

8.4 Driving Machine and Brake

8.4.1 A driving machine shall not drive more than one escalator or moving walk.

8.4.2 The speed of an unloaded escalator shall not deviate by more than ± 5 percent from nominal speed at nominal frequency and nominal voltage.

8.4.3 The driving machine shall be connected to main drive shaft, preferably by non-friction driving elements such as by gear wheels, shaft, coupling, multiplex chain, two or more single chains. Where friction elements are used such as trapezoidal belts (flat belts are not permitted) an auxiliary brake shall be used.

8.4.4 *Braking System*

Escalators and moving walks shall have an operational braking system by means of which they can be brought to rest with a uniform deceleration and maintained stationary; there shall be no intentional delay in the application of the braking system. If the control system starts a braking sequence immediately to bring the escalator / moving walk to a stop, this is not considered as an intentional delay. A device shall be provided to monitor the lifting of the braking system after starting the escalator / moving walk.

Operational braking shall be affected by an electro-mechanical brake or by other means. Where no electro-mechanical operational brake is used, an auxiliary brake shall be provided.

8.4.4.1 *Auxiliary brake*

Escalators and inclined moving walks shall be equipped with auxiliary brake(s) if:

a) The connection between the operational brake and the driving sprockets of the steps / pallets or the drum of the belt is not accomplished by shafts, gear wheels, multiplex chains, or more than one single chain, OR
b) The operational brake is not an electro-mechanical brake, OR
c) The rise exceeds 6 m; OR
d) Escalators or moving walks are part of a public transport/service system.

8.5 Steps and Pallets Drive

The steps of escalators shall be driven by at least two chains of which at least one shall be located on each side of the step. The pallets of moving walks may be permitted to be driven by only one chain if the parallel movement of the pallets in the usable area is ensured by other mechanical measures.

8.6 Belt Drive

The belt shall be driven by drums and be tensioned continuously and automatically. Springs working in tension are not permitted for the tensioning device. When weights are used for tensioning, they shall be safely retained should their suspension break.

8.7 Balustrade

Balustrades shall be installed to comply with the requirements of **6.3**.

If glass is used for the interior panel, it shall be toughened glass. In case of splinter free one layer safety (tempered) glass, the minimum thickness shall be 6 mm. When multi-layer glass balustrades are used, they shall be laminated toughened glass, the thickness of at least one layer shall also be not less than 6 mm.

8.8 Skirting

The skirting shall be vertical, plain, and sufficiently rigid. Where the skirting of escalators or moving walks is placed beside the steps and pallets or the belt the horizontal clearance shall not exceed 4 mm at either side, or 7 mm for the sum of clearances measured at both sides at two directly opposite points.

Where the skirting of moving walks finishes above the pallets or the belt, the clearance shall not exceed 4 mm measured vertically from the tread surface. Motion of the pallets or the belt in lateral direction shall not cause a gap between the sides of the pallets or the belt and the vertical projection of the skirting.

8.8.1 *Requirements for Skirt Deflectors*

The skirt deflectors shall be designed with rounded edges. Fastening heads and joint connections shall not extend into the path of travel. They shall consist of a rigid and a flexible part (for example, brushes and rubber profiles) and shall be mandatorily provided in the escalators.

8.9 Handrails

Each balustrade shall be provided with a handrail moving on the top of each balustrade, in the same direction and at the same speed, within tolerance of $^{+2}_{0}$ percent, as the steps, pallets or belt. Each moving handrail shall extend at normal handrail height not less than 300 mm beyond the line of point of comb plate teeth at the upper and lower landings. Hand or finger guards shall be provided at the points where handrails enter the balustrade.

The width of handrail shall be between 70 mm and 100 mm. The handrail shall be a minimum of 80 mm horizontally and 25 mm vertically away from adjacent surfaces (*see* Fig. 6). The handrail shall be guided and tensioned in such a way that it does not leave its guides during normal use.

8.10 Landing

The landing area (that is, comb plate and floor plate) of escalator shall have a surface that provides a secure foot hold (combs are exempted from this) for a minimum distance of 0.85 m measured from the root of the comb teeth.

8.10.1 *Configuration of Steps, Pallets, and Belts*

8.10.1.1 At the upper and lower landing, 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 T1 (*see* Fig. 7 and detail A).

8.10.1.2 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.

8.11 Comb Plates

There shall be a comb plate at the entrance and at the exit of every escalator. The comb plate teeth shall be meshed with and set into the tread surface so that the points of the teeth are always below the upper surface of the treads. The comb plates shall be adjustable. Combs shall be easily replaceable.

8.12 Speed Governor

8.12.1 Where speed control devices are used for this purpose, they shall have switched off the escalator before the speed exceeds 1.2 times the nominal speed. This requirement may not be applied if the design prevents the excessive speed.

8.12.2 Escalators and inclined ($\alpha \geq 6°$) moving walks shall be equipped in such a way that they stop automatically by the time the steps and pallets or the belt change from the pre-set direction of travel.

8.12.3 For operation and safety devices, electrical work, precautions and tests, reference may be made to good practice [8-5B(3)].

8.13 Inspection Control

Escalators or moving walks shall be equipped with inspection controls to permit operation during maintenance or repair or inspection by means of portable and manually operated control devices. At least one portable control device shall be provided for each escalator or moving walk.

8.14 Information for Use

8.14.1 *General*

All escalators and moving walks are required to be provided with documentation that shall include an instruction handbook relating to use, maintenance, inspection, periodic checks and rescue operations. Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use (setting, teaching/programming, operation, cleaning, fault finding and maintenance) of the escalator and moving walk, and, if necessary, de-commissioning, dismantling and disposal.

8.14.2 *Signals and Warning Devices*

8.14.2.1 *Plates, inscriptions, and notices for use*

a) *General* – All signs, inscriptions and notices for use shall be of durable material, placed in a conspicuous position and written in clearly legible characters in English as well as in local language.

b) *Safety signs near the entrances of escalators or moving walks* – The following mandatory action signs and prohibition signs for the user shall be fixed in the vicinity of the entrances:

    1) Small children shall be held firmly (*see* Fig. 15);
    2) Pets shall be carried (*see* Fig. 16);
    3) Use the handrail (*see* Fig. 17);
    4) Push chairs not permitted (*see* Fig. 18); and
    5) Soft footwear prohibited (*see* Fig. 19).

When required by local conditions, prohibition signs, for example, 'Transportation of bulky and heavy loads not permitted' and mandatory action signs like 'Use permitted only with footwear', shall be necessitated.

The minimum diameter of the signs shall be 80 mm.

"SMALL CHILDREN SHALL BE HELD FIRMLY"
Fig. 15 MANDATORY ACTION SIGN

"PETS SHALL BE CARRIED"
Fig. 16 MANDATORY ACTION SIGN

"USE THE HANDRAIL"
Fig. 17 MANDATORY ACTION SIGN

"PUSH CHAIRS NOT PERMITTED"
Fig. 18 PROHIBITION SIGN

"SOFT FOOTWARE PROHIBITED"
Fig. 19 PROHIBITION SIGN

Stop devices shall be colored red either on the device itself or in its immediate vicinity and be marked with the inscription 'STOP'.

During maintenance, repair, inspection or similar work, the access to the escalator or moving walk shall be barred to unauthorized persons by devices which shall bear the notice 'No Access' or the 'No Entry' indicator and be available in immediate area.

NOTE – The safety sign (*see* Fig. 20) shall be affixed prominently near the entrances of escalators or moving walks which are inclined above 6°:

FIG. 20 WHEEL-CHAIR USERS NOT PERMITTED

c) *Instructions for hand winding devices* – If a hand winding device is provided, operating instructions for use shall be available in the vicinity. The direction of travel of the escalator or moving walk shall be indicated clearly.

d) *Notices on the access doors to machinery spaces outside the truss, driving and return stations* – On access doors to machinery spaces outside the truss, and driving and return stations, a notice shall be fixed with the inscription reading, 'MACHINERY SPACE – DANGER' and 'ACCESS PROHIBITED TO UNAUTHORIZED PERSONS'.

9 SPECIAL TECHNICAL REQUIREMENTS

If escalators or moving walks are intended to be operated under special conditions, such as directly exposed to the weather or explosive atmosphere, or in exceptional cases serve as emergency exits, appropriate design criteria, components, material and instructions for use should be used that satisfy the particular conditions.

9.1 Escalators or Moving Walks for Public Transport

For escalators and inclined moving walks for public transport which,

a) are part of a public transport system including entrance and exit points; or
b) are suitable for intensive use, regularly operating for approximately 140 h/week with a load reaching 100 percent of the brake load for a total duration of at least 0.5 h during any time interval of 3 h.

It is recommended to install auxiliary brakes also for rises less than 6 m. Auxiliary brakes shall be mandatory for public transport. The load conditions and additional

safety features should be agreed to between the manufacturer and the owner reflecting the traffic levels which exist.

9.2 Semi Outdoor Escalator / Moving Walk

Semi-outdoor escalators and moving walks are installed outside the building while they have roofs above them to protect them from rain and snow. Wherever possible, the escalator / moving walks should be placed above the road level, with a ramp, to prevent water on the road directly entering the escalator / moving walk. These escalator / moving walk shall have:

a) Aluminium Die-Cast Step
b) Outdoor Type Handrail
c) Three-Layered Protective Truss Painting
d) Float Switch at Lower Machine Room
e) Cooling Fan in Control Panel Box
f) Control Box of IP54 Protection Rating
g) Inverter with enclosure of IP54 Protection Rating
h) Safety Switch IP65 Protection Rating
j) Comb Heating (temperature below 4°C) (If Applicable)
k) Step / Pallet band Heating (temperature below 0°C) (If Applicable)
m) Lubrication: Lifetime lubricated and sealed step chain roller bearings
n) Water drainage system

9.3 Outdoor Escalator / Moving Walk

Fully outdoor escalators and moving walks are installed outside the building without any roof or overhead covers. Wherever possible, the escalator / moving walk should be placed above the road level, with a ramp, to prevent water on the road directly entering the escalator or moving walk. These escalator / moving walk shall have:

1) Aluminium Die-Cast Step
2) Extrude Aluminium Floor Plate Panel
3) Outdoor Type Handrail
4) Hot-Dip Galvanized Truss (minimum thickness of 85 microns)
5) Zinc plated track and handrail guide
6) Galvanized Steel Drive Chain Cover
7) Float Switch at Lower Machine Room
8) Control Panel Box Cooling System
    i) With inbuilt cooling fan; or
    ii) With external cooling fan
9) Control Box of IP54 Protection Rating
10) Inverter with enclosure of IP54 Protection Rating
12) Safety Switches of IP65 Protection Rating
13) Stainless Steel Materials Grade 304 or higher
14) Class E insulation of Electromagnet
15) Class F insulation of Motor
16) Comb Heating (temperature below 4°C) (If Applicable)
17) Step / Pallet band Heating (temperature below 0°C) (If Applicable)
18) Lubrication-Life time lubricated and sealed step chain roller bearing.

19) Water Drainage system
20) Provision of galvanized drip pans below the step chain throughout the length of chain with catch tray at return station
21) Automatic lubrication system with lubrication reservoir of adequate capacity.
22) Provision of hose/pipe to drain water from Oil/Water separator.
23) Provision for prevention of flooding of return station
24) Stainless steel fasteners, wherever provided.

9.4 Measures to Prevent Access of Shopping Trolleys and Baggage Carts

9.4.1 *General*

If there is a reasonably foreseeable risk that shopping trolleys and/or baggage carts may be taken onto escalators or moving walks, adequate measures shall be taken to eliminate risks and access shall be prevented, if the following conditions are given:

a) *For escalators* – Where shopping trolleys or baggage carts are available in the area around; and where shopping trolleys or baggage carts are in an area not close to the escalator, but it is reasonably foreseeable that they are taken onto the escalator.
b) *For moving walks* – Where shopping trolleys or baggage carts are not intended to be used on a moving walk.

9.4.2 *Barriers*

If barriers are used, the following requirements shall be fulfilled:

a) Barrier shall be installed at the entrance only. An installation at the exit is not permitted in the unrestricted area.
b) Design of the barrier shall not create another risk.
c) Free entrance width between ends of the newels and barriers and between barriers itself, shall be at least 500 mm and less than the width of the type of shopping trolley or baggage cart to be used.
d) Height of the barrier shall be between 900 mm and 1 100 mm.
e) Barrier and its fixation should withstand the following load: At a height of 200 mm a horizontal force of 3 000 N applies. This force results from an impact of a chassis of a shopping trolley/baggage cart loaded with 160 kg moving with a speed of 1.00 m/s.
f) Barrier shall be fixed preferably at the building structures. It is also permitted to fix it at the floor plate. In that case, when the defined forces apply, there shall be no permanent deformation and increased/additional gaps.
g) If the escalator/moving walk is dedicated to operating in both directions, the presence of the removable barrier shall be electrically monitored preventing wrong positioning of the barrier resulting in operation towards the barrier, except when under maintenance condition.

9.4.3 *Fixed Devices*

Where fixed devices such as guiding barriers and/or traffic columns are necessary in the unrestricted area, their design shall not create another risk. The following requirements shall be complied with:

a) Guiding barriers or traffic columns shall have a minimum horizontal distance (radius) of 500 mm to any point of the handrail and shall be positioned outside of the centre line of the handrail.
b) Minimum horizontal distance (radius) to any point of the handrail may be reduced to 300 mm, provided that the guiding barriers or traffic columns are positioned outside of the centre lines of the handrails and an additional barrier is installed between the guiding barriers or traffic columns and the vertical centre line of the balustrade newel.
c) The additional barrier shall have a lateral distance between 80 mm and 120 mm of the handrail outer edge and shall close at least the area between the actual lowest point of the handrail entry into the newel and the balustrade decking profile and shall have filled inlets with gaps less than 25 mm.
d) Minimum horizontal distance (radius) to any point of the handrail may be reduced to 180 mm, provided that the guiding barrier or traffic column is positioned outside of the outer edge of the handrail and an additional barrier is installed between the guiding barrier or traffic column and the vertical centre line of the balustrade newel.
e) The additional barrier shall have a lateral distance between 80 mm and 120 mm of the handrail outer edge and shall close at least the area between the actual lowest point of the handrail entry into the newel and the balustrade decking profile and shall have filled inlets with gaps less than 25 mm.
f) Minimum horizontal distance (radius) to any point of the handrail may be reduced to 100 mm, provided that the guiding barrier or traffic column is of a round shape and is positioned outside of the outer edge of the handrail and an additional barrier is installed between the guiding barrier or traffic column and the vertical centre line of the balustrade newel.

   The additional barrier shall have a lateral distance between 80 mm and 120 mm of the handrail outer edge and shall close at least the area between the actual lowest point of the handrail entry into the newel and the balustrade decking profile and shall have filled inlets with gaps less than 25 mm.

In addition, the following specific requirements shall apply:

1) Devices and its fixation shall withstand a horizontal force of 1 kN/m applied to the top of the device.
2) Barrier shall be fixed preferably at the building structures. It is also permitted to fix it at the floor plate. In that case, when the defined forces apply, there shall be no permanent deformation and increased/additional gaps.
3) Height of traffic columns shall be at least the height of the handrail level.
4) Height of guiding barriers shall be at least the height of the balustrade decking.
5) If fixed devices are placed inside the unrestricted area, the size of the unrestricted area shall remain the same and in this case be extended in the length.
6) Guiding barriers and traffic columns are not considered as structural measures that block the exit.

NOTE – For fixed devices in the immediate environment of the unrestricted area these requirements also apply.

9.5 Escalators and Moving Walks Subject to Seismic Conditions

9.5.1 *Structural Requirements*

The requirements given below are applicable:

a) *General* – Escalators and moving walks, if specified to meet specified seismic conditions, shall comply with the relevant safety requirements and/or protective measures as listed below.
b) *Pit/support* – Pit and support conditions are to be secured in that way that the escalator and moving walk under seismic condition is not subjected to constraint. One support should be executed as fixed support and the other supports are to be executed as movable support in horizontal direction. The supporting conditions need to be simply statically determinate.
c) Escalator and moving walk shall be retained on the supports in vertical direction by adequate measures so that the unit shall not jump off the supports under seismic conditions.
d) *Arrangement* – The length and the movability of the escalator and moving walk should be chosen in accordance with the building movement between two storeys of the building. The minimum allowable compensation length of the movable support of the escalator and moving walk has to be chosen same as the maximum allowed storey drift of the building.
e) *Mechanical safety devices for escalators and moving walks* – If the design of the escalator and moving walk does not allow the safe situation in the pit or support an additional safety device need to be applied so that the escalator and moving walk should not fall off the support.

9.5.2 *Design Requirements*

It is assumed that negotiations have been made for each contract between the customer and the supplier/installer about the peak ground acceleration to be considered. The building designer or owner shall provide the design acceleration which shall be documented in the information. Client and supplier/contractor should agree on one common acceleration value. The acceleration value need to be communicated between all participants of the contract. The following to be considered in addition to the above:

a) The design of the truss for the escalators and moving walks shall be sufficiently executed for the ambient seismic condition. The structural design shall provide a dissipation capacity to withstand a design-relevant earthquake of the region where it is located.
b) *Drive and control unit* – Machinery [including control cabinet(s) and drive system, machine, main switch(es), and means for emergency operations], free-wheeling switch shall be designed and anchored to prevent overturning and displacement due to the forces imposed on them including forces generated by the design acceleration.
c) *Electrical installation and other equipment* – In case the building where the escalator and moving walk will be installed is equipped with a seismic detector/sensor, the electrical system of the unit shall provide an interface for

the connection and shall stop the escalator and moving walk in case of seismic activity.

9.6 Escalator/Moving Walk Interface with Building Management System (BMS)

Where required, a means to interface, monitor and control be provided by the escalator/moving walk manufacturer, which should become the part of building management system. Following information and controls, but not limited to these, may be provided either through potential free contacts or building automation interface device suitable for providing necessary escalator/moving walk information over accepted communication protocols:

a) *Monitoring signals:*

1) Power status,
2) Running up/down (Escalator),
3) Running forward/backward (Moving Walk),
4) Under maintenance,
5) Under fault, and
6) Emergency 'STOP' pressed.

b) *Remote operation* – Escalator or moving walk shall not be started or stopped from remote monitoring station using remote signal, unless the escalator/moving walk operation is visible/monitored from the remote station.

10 PERFORMANCE REQUIREMENTS FOR ESCALATORS AND MOVING WALKS

10.1 It is necessary to have uniformity in the definition, measurement, processing and expression of vibration and noise signals that comprise escalator and moving walk ride quality. The aim of such uniformity is to benefit escalator and moving walk users by reducing variability in the results of ride quality measurements caused by differences in the methods of acquiring and quantifying the signals. Experience indicates that passenger perception and sound pressure levels measured while travelling on an escalator or moving walk may be influenced by the presence of extraneous noise and vibration sources and by acoustic characteristics of the environment in which the unit is installed and operated. Additionally, the proximity of the escalator or moving walk to strong reflecting surfaces such as walls, ceilings or diagonally opposite units may also influence the sound pressure level measured. These influences may cause a sound pressure level measurement to significantly overestimate the sound level emitted exclusively by the unit. To address this issue, this Subsection defines the methodology for measuring vibration and sound pressure level that corresponds to passenger perception and additionally defines the methods that should be used, if further understanding of the result is required to quantify vibration and noise emitted by the unit as compared to the background or environmental contributions.

10.2 Measurement of Escalator and Moving Walk Ride Quality

Escalator and moving walk should be measured in both running directions except where the unit is designed to operate in one direction only. The measurements should be carried out under following conditions where, escalator and moving walk shall:

a) Be assembled completely, adjusted and operating in accordance to the requirement;
b) Have reached normal operating temperature;
c) Be measured in unloaded condition;
d) Be measured after starting sequence has been completed. If the unit operates at different speeds, all the speeds shall be measured;
e) Have finished star/delta changeover, if used, before starting the measurement;
f) Have vibration measurements made by aligning the axis of transducer to the axis of entire escalator or moving walk; and
g) Have the noise measured at measuring distance to the floor/surface of steps and pallets of 1.55 m ± 0.075 m.

11 ESCALATOR AND MOVING WALK ENQUIRY OR INVITATION TO TENDER

11.1 A period of two to four weeks is normally sufficient for return of tenders. This should be extended if large numbers of escalators/moving walks or special requirements are involved. The enquiry documents should be kept to the essential minimum and should be strictly confined to material relevant to the escalators/moving walk works and to the project concerned.

When enquiring for and ordering the escalators/moving walks, the particulars given below should be furnished:

a) Type(s) of escalator/moving walk;
b) Number of escalators/moving walks;
c) Location of escalators/moving walks (indoor or outdoor);
d) Capacity/usage type (persons per hour/heavy duty, medium duty, light duty);
e) Angle of inclination, in degree;
f) Rise (travel), in mm;
g) Nominal speed, in m/s;
h) Step width, in mm;
j) Number of flat steps (2 or 3 or 4);
k) Balustrade details;
m) Construction, design, finishes details;
n) Escalator/moving walk lighting details;
p) Electric supply: power volts ac/dc; phase; cycles; wire system;
q) Proposed date for commencement on site;
r) Additional items, if required;
s) Details of maintenance, schedule and circuit diagram where so specified; and
t) Details of voice announcements, visual contrast, tactile indicators and warning signage.
u) Number of horizontal steps/pallets

11.2 Additional Items

The enquiry should state any additional items required beyond those specified in good practice [8-5B(3)], such as interface requirements, seismic design, etc.

11.3 Finishes

Finishes should be specified at the enquiry stage or provisional sums should be included for them. Finishes to be considered may include step lighting, handrail colour, handrail lighting, balustrade material, step colour, truss cladding details (weight to be considered).

11.4 Inclusions and Exclusions

Several peripheral items are associated with escalators/moving walk installation, of which some should always be provided by the builder, and some are best included by the manufacturer. The requirements vary to some extent with the type of installation.

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

The escalators/moving walk manufacturer should include items, such as:

a) tracks,
b) drive unit,
c) controller,
d) broken chain detection switch,
e) stop switches at both ends,
f) balustrade,
g) handrail,
h) steps/step drive assembly,
j) saree/skirt guard,
k) step demarcation lights,
m) missing steps,
n) comb plate,
p) flat steps,
q) comb plate switches/skirt switches,
r) floor plate (anti-slip material),
s) truss,
t) guarantee of equipment, and
u) scaffolding for installation.

The escalators/moving walk manufacturer should exclude the supply and fixing of the items or as per the contract conditions as follows:

1) Hoisting hook/beam fixing,
2) Truss cladding,
3) Temporary guarding,

4) Cutting and making goods,
5) Working lights/permanent electricity supplies, and
6) Site painting of steel work.

For more detailed discussion of the requirements for site preparation and work by other trades, reference should be made to relevant provisions of the Code and other good practices.

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

11.5 Site Programme

The enquiry should indicate as accurately as possible the contract programme as it affects the manufacturer, in particular the target date for completion, construction schedule, site preparedness, the availability of crane for hoisting, co-ordination details (with other contractors like BMS interfacing, CCTV interfacing, etc).

12 ACCEPTANCE OF TENDER AND SUBSEQUENT PROCEDURE

12.1 Order

The owner places an order with the selected contractor for supply and installation of escalator/moving walk.

12.2 The general arrangement drawings supplied by owner with the tender documents,

a) are provided for the supplier's guidance and information when tendering;
b) should the arrangement and dimensions shown be inadequate to properly install the equipment as specified then necessary amendments shall be issued by client; and
c) any amendments issued after the commencement of contract shall be subject to the agreement and approval.

12.3 Layout Drawing

The contractor shall furnish proposed layout giving particulars such as dimensions, steel work requirements and loading imposed on structure. Such drawings shall include following details:

a) Position and sizes of all holes and cuttings,
b) Loads on beams and structure,
c) Escalator/moving walk pits and associated equipment,
d) Requirement of end supports, intermediate support(s) with location and load,
e) Hoisting facilities and access requirement for delivery of equipment,
f) Builder's work, and
g) Power and ventilation requirement.

12.4 Approval of Layout Drawing

The contractor shall commence actual production of equipment after approval of drawings submitted by contractor. Where the contract provides for the purchaser's choice of decorative finishes, colours, etc, the decisions should be communicated as early as possible, and preferably not later than the time of approval of drawings.

12.5 Programme of Works

The contractor shall submit a detailed programme showing intended method and stages together with period estimated for each stage. The programme shall include following:

a) Date of commencement and completion of every stage of the works in line with the building construction programme.
b) Date of expected completion of builder's work requirements;
c) Date of delivery of equipment and materials to site;
d) Date of requirement of temporary and permanent electricity supply; and
e) Date of completion, commissioning and testing.

The contractor shall ensure the work in accordance with the criticality of adherence of installation dimensions and supports as indicated in layout.

12.6 Electricity Supply to Escalators/Moving Walk

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

13 COORDINATION OF SITE WORK

13.1 Preparatory Work on Site

13.1.1 It is expected for the escalator/moving walk supplier to make periodic visits to the site to check progress on the construction and discuss relevant matters with the owner. The contractor should assure himself that all building work has been completed in accordance with his requirements. Immediately before the time for erection to commence, the contractor should check that site conditions are fit to permit erection to proceed.

13.1.2 Building works to be completed before the erection work, includes the following:

a) Providing adequate access to the well-way to allow for setting the equipment in place.
b) If the project is not ready for placement at the time of delivery, providing dry storage area located close to well-way.
c) Providing protection of all floor openings adjacent to and in the general area of escalator/moving walk.
d) Providing safety compliant stairwell access to floors.

e) Providing clear unobstructed workspace adjacent to well-way.
f) Providing safety compliant overhead and floor opening protection.
g) Providing barricades to prevent the entrance of unauthorized personnel to construction area.
h) Drying and cleaning of pit and floor openings with proper dimensions.
j) Providing properly located supports of adequate strength for the truss at the landings including intermediate supports, if required.
k) Providing suitable floor fill and patching of flooring including floor covering, adjacent to the landing plates of the escalator/moving walk; all floor finishing to be completed after installation of the landing plates.
m) Providing flooring with little slope in direction outwards of the escalator to prevent ingress of water, etc, into the escalator.

13.2 Delivery of Material

The contractor should advise the owner when equipment is ready for dispatch, so that the owner is able to make arrangements on site to receive and unload as near as possible to the well-way.

13.3 Storage

Adequate provision should be made by the owner for storage, protection and preservation against loss, deterioration of or damage to all material on the site. Attention is drawn to the adverse effect of damp conditions on electrical equipment.

13.4 Site Meetings

The contractor shall coordinate his proposed programme of work with that of the building contractor and all other contractors and sub-contractors to adhere to the latest overall construction programme and to achieve efficient and safe working on site. In large sites, regular meetings of all parties are beneficial for successful progress of work. *See also* Part 0 'Integrated Approach – Prerequisite for Applying Provisions of the Code' of the Code.

13.5 Service of Other Trades

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

13.6 Connecting to Power Supply

The contractor should give prior notice to the owner of the date the power supply is required, so that suitable arrangements for connection can be made. During erection, necessary electrical power shall be provided for illumination, operation of required tools and hoist and for starting, testing and adjustment.

14 INSPECTION AND ACCEPTANCE PROCEDURES

14.1 General

Escalators and moving walks shall be inspected, before their first use; after major modifications; and at regular intervals. Such inspections and tests should be made by a competent person.

14.2 Constructional Inspection and Acceptance Inspection and Test

14.2.1 The constructional inspection and acceptance inspection and test shall be carried out at the jobsite on completion of the escalator or moving walk. During inspection and tests, precautions shall be taken so that escalators or moving walks are not set in motion without the knowledge and consent of the person(s) performing such work.

For the constructional inspection and acceptance inspection and test, the data specified in **14.4** should form part of a pre-completed test sheet. Furthermore, layout drawings, description of the equipment and wiring diagrams (current flow chart with legend or explanations, and a terminal connection chart) which permit a check of compliance with the safety requirements, shall be provided.

The constructional inspection comprises the examination of the completed installation for conformity with the required data and about proper workmanship as specified hereunder.

14.2.2 The acceptance inspection and test comprises,

a) overall visual inspection;
b) functional test;
c) test of electric safety devices regarding their effective operation; and
d) test of the brake(s) of the escalator or moving walk under no load, for compliance with the prescribed stopping distances.

Measurement of the insulation resistance of the different circuits between conductors and earth shall also be done. For this measurement, the electronic components shall be disconnected. This includes a test of the electric continuity of the connection between the earth terminal(s) in the driving station and the different parts of the escalator or moving walk, liable to be live accidentally.

14.3 Inspection and Test after Major Modifications

A major modification is a change of the location, a change of the speed, of the electric safety devices, of the braking system, of the drive, of the control, of the step band, of the truss and of the balustrades. Wherever applicable, the principles set forth for the constructional inspection and acceptance inspection and test should apply to the new environmental conditions, modified components and other components which are affected.

The replacement of parts with parts of same design is not considered to be a major modification.

14.4 Specific Data, Test Reports and Certificates

The following documentation should be held by the manufacturer:

a) stress analysis of the truss or equivalent certificate by a stress analyst;
b) proof by design calculation of sufficient breakage resistance of the parts directly driving the steps, pallets or the belt, for example step chains, racks;
c) calculation of the stopping distances for loaded moving walks together with adjustment data;
d) proof testing of steps or pallets;
e) proof of the breaking strength of the step chain/pallet chain/belt;
f) proof of sliding coefficients for skirting;
g) proof of anti-slip properties of tread surfaces (steps, pallets, floor and comb plates without combs);
h) proof of stopping distances and deceleration values;
j) proof of electromagnetic compatibility.
k) est certificate for handrail breaking strength (for public service escalators and public service passenger moving walks).

14.5 Escalator Site Checks and Inspection List

Suitable site checklist/inspection list may be used. A typical list is given at Annex A.

14.6 Escalator Commissioning and Acceptance Tests

14.6.1 *Escalator Details*

Typical details to be provided are given below:

a) Name of station :

b) Location :

c) Escalator No. and job No. :

d) Drawing No. :

e) Rise :

f) Type of balustrade : SS / Glass - Tick (√)

g) Manufacturer's Sl No. :

14.6.2 *General Inspection*

A typical general inspection list is given below:

Sl No.	*Item*	*Method/Requirement*	*Result*
(1)	(2)	(3)	(4)
i)	All unwanted material have been removed	Visual check	
ii)	Escalator (including steps, handrails, floor plate, cladding, etc) has been cleaned	Visual check	
iii)	Proper barricading of the area has been done prior to testing	Visual check	
iv)	Emergency signage to be fixed at the emergency stop; safety labels placed at top/bottom newel end	Visual check	
v)	Check provision of 'Danger Sign' plate on the escalator control panel	Visual check	
vi)	Wedge guard/deflector fixed for obstacles such as walls, pillars, floor intersection or criss-cross arrangement of escalators/moving walks	Visual check	
vii)	Clear height of 2.3 m above steps throughout the length of escalator	Measurement check	
viii)	Access restriction guard fixed between parallel escalators	Visual check	
ix)	Permanent barriers at entry and exit with gaps according to code requirement	Measurement check	
x)	Connection of hose/pipe to oil/water separator	Visual check	
xi)	Power cables and earthing provided at drive station	Visual check	

14.6.3 *Electrical Test*

A typical check list of electrical tests is given below:

Sl No.	*Item*	*Test Procedure*	*Recommended Result*	*Instrument/ Sl No.*	*Measured Value*	*Result*
(1)	(2)	(3)	(4)	(5)	(5)	(7)
i)	Insulation resistance test	Shall be tested between lines connected together and earth at 500 V d.c.	> 0.5 MΩ (Mega Ohm)			

14.6.4 *Functional Tests on Safety Switches and Devices*

A typical check list is given at Annex B

15 OPERATION AND MAINTENANCE

15.1 General

The installation shall be maintained in good working order in accordance with the installer's instructions. To this effect, regular maintenance of the installation shall be carried out to ensure the safety of installation. The safety of an installation shall consider the ability to be maintained without causing injury or damage to health.

Regular maintenance of the installation shall be carried out to ensure the reliability of the installation. The access and the associated environment shall be maintained in good working order in accordance with the installer's instructions.

The instructions for maintenance of an installation shall be provided by the manufacturer, when placed on the market, after risk assessment.

In order that the aim of the maintenance instructions should be achieved, they shall be formulated so that they should be clearly and easily understood by competent maintenance person. The competent maintenance person within the maintenance organization shall be continuously updated.

The installer/manufacturer shall provide maintenance instructions intended for the owner of the installation (*see* **15.3.2**) including the information intended for the maintenance organization (*see* **15.3.3**).

NOTE – The owner of the installation should be informed that the qualification of the maintenance organization is in conformity with the regulation applicable in the location in which the installation operates.

Maintenance includes:

a) Lubrication, cleaning etc;
b) Checks;
c) Passenger rescue operations;
d) The operations of setting and adjustment; and
e) Repair or changing of components which may occur due to wear and tear, and do not affect the characteristics of the installation.

However, cleaning of the external parts of the escalator or moving walk shall not be considered as maintenance;

The following shall not be considered as maintenance operations:
1) changing of major component, such as the machine, even if the characteristics
2) of the new component are the same as the original,
3) replacement of installation,
4) modernization of the installation including changing of any characteristics of the installation (such as load, speed, etc); and
5) rescue operation carried out by fire brigade.

15.2 Elements to be considered for Maintenance Instructions

When preparing the content of the maintenance instructions (*see* **4.3** and **5**) the following elements shall be considered:

a) Specifications and the intended use of the installation (type of installation, performance, etc);
b) Environment in which the installation and its components are installed (weather conditions, vandalism, etc);
c) Any restriction of use;
d) Result of risk assessment (*see* **5**) for every working area and for every task undertaken;
e) Specific maintenance instructions provided by the manufacturer of safety components; and
f) In case of components other than safety components, where maintenance is necessary, the maintenance instructions provided by the manufacturer of these components.

15.3 Information to be Included in the Maintenance Instructions

15.3.1 *General*

The maintenance instructions shall contain information relating to the tasks of both the owner and the maintenance organization, respectively.

15.3.2 *Information to the Owner of the Installation*

The information relating to the tasks of the owner of the installation shall include the following:
a) Need for the owner to keep the installation in a safe operating condition. To fulfil this, the owner shall use a maintenance organization complying with the requirements of this Subsection.

NOTE – It is recommended to inform the owner of the installation about the need to use a maintenance organization with adequate and proper insurance cover provided by an insurance company.

b) Need for the owner to take care of applicable regulation(s) and other requirements, where relevant, and their implications on maintenance.
c) Need for planned maintenance to be carried out by a maintenance organization, at the latest when the installation is put into service or if the installation is to remain unused for a long period of time before first being put into service.
d) Importance for the owner of the installation to have the same maintenance organization in the case of several installations having common well/spaces and/or machine room.
e) Need for the owner to put the installation out of service in case of dangerous situations.
f) Need for the owner of the installation to inform the maintenance organization,
    1) Immediately about any perceived abnormal operation of the installation or abnormal change in its direct environment;
    2) Immediately after putting the installation out of service in the case of a dangerous situation;
    3) After any rescue intervention by their authorized and instructed person(s);
    4) Before any modification related to the installation and/or its environment or use;

NOTE – The owner of the installation should obtain from the company carrying out the relevant modification the maintenance instructions for the maintenance organization.

    5) Before any authorized third-party inspection or works other than maintenance works are carried out on the installation;
    6) Before taking the installation out of service for a prolonged period; and
    7) Before putting the installation back into service after a prolonged period of non-operating time.

g) Need for the owner of the installation to take into consideration the consequences of the risk assessment carried out by the maintenance organization.
h) Need for the owner of the installation to make sure that the risk assessment for maintenance is carried out:
    1) If the maintenance organization is replaced;
    2) If the use of the building and/or the installation changes;
    3) After a major modification of the installation or of the building; and
    4) If it is the case, after an accident involving the installation.

j) Need for the building owner to ensure, through a risk assessment, that:
    1) their premises are safe and free from risk to health as far as is practicable. This includes access to the premises and installation equipment, and articles or substances used according to the regulation for the use of work equipment at the workplace;

2) the persons using the premises are informed about any remaining risks; and
3) any action to be done as a consequence of risk assessment carried out.

Regarding the access ways to areas reserved for maintenance persons, the need for the owner of the installation to inform the maintenance organization, about,

i) The access ways to be used and fire evacuating procedures from the building;
ii) The place where the keys of the reserved areas shall be found;
iii) If necessary, the persons who shall accompany the maintenance persons to the installation; and
iv) If necessary, personal protective equipment to be used in the access ways, and, possibly, where this equipment shall be found.

The information shall be made available also on site to the maintenance organization.

k) Need for the owner of the installation to ensure that the name and the telephone number of the maintenance organization are always available to the user of the installation, permanently affixed and clearly visible.
m) Need for the owner of the installation to ensure that the keys of machine room doors (trap doors) and of inspection and emergency doors (trap doors), if any, are permanently available in the building and are used only by persons authorized to gain access.
n) Need for the owner of the installation to provide, in all circumstances, safe access to the building and to the installation for the maintenance organization involved in the rescue of persons.
p) Need for the owner of the installation to keep the access to working areas and working rooms safe and free for the maintenance persons and to inform the maintenance organization about any hazard or change in the workplace and/or the access ways (lighting, obstructions, ground conditions, etc).
q) In addition to those examinations and tests (for escalators/moving walk) which the owner of the installation entrusts to the maintenance organization, the need for the owner to carry out periodically, in their own interests, include the following:
    1) A full travel in both directions, when they exist, to assess any changes in the quality of the ride or damage to the equipment.
    2) Typical items to be checked to ensure that they are in place, undamaged and functioning correctly are,
        i) all lighting and indicators;
        ii) emergency stopping device;
        iii) handrails;
        iv) skirting/deflector devices;
        v) combs;
        vi) safety signs/pictograms;
        vii) approximation of speed between handrail and steps/pallets;
        viii) steps/pallets;
        ix) balustrade and panels;
        x) head guard and decking;
        xi) safe and unobstructed access to entry and exit areas.

15.3.3 *Information for the Maintenance Organization*

The information relating to the tasks of the maintenance organization shall include the following:

a) Need to carry out the work of maintenance in conformity with the maintenance instructions and based on systematic maintenance checks. After these checks, the maintenance organization shall decide in conformity with the maintenance instructions what is required to be done. A list of typical examples of maintenance checks to maintain the installation is shown in Annex C.

> NOTE – Due to the fact that the components may be different in design and operation, it is therefore not possible to give specific guidelines in this Subsection.

b) Need to update the original maintenance instructions, if the installation changes its intended use and/or the environmental conditions existing on the completion of the installation.

> NOTE – The maintenance organization should be provided by the owner of the installation with the relevant maintenance instructions where modifications are carried out on the installation.

c) Need for the maintenance organization to ensure that a risk assessment for any working area and for any maintenance operation has been carried out considering the installer's maintenance instructions and all information supplied by the owner of the installation.
d) Need for the maintenance organization to inform the owner of the installation about any work to be carried out as a consequence of a risk assessment especially for the access and/or the environment related to the building/installation.
e) Need to carry out a maintenance plan so that preventive maintenance is suitable for the installation and maintenance time is as short as reasonably practicable, without reducing the safety of persons, in order to minimize the non-operational time of the installation.
f) Need to adapt the plan for maintenance to take account of any predictable failures, for example, those due to misuse, mishandling, deterioration, etc.
g) Need to carry out maintenance operations by competent maintenance persons and provided with the necessary tools and equipment.
h) Need to maintain the competency of maintenance persons.
j) Need to carry out the maintenance periodically. In determining the frequency of maintenance interventions, the following non-exhaustive list should be considered:
    1) Operating time and any non-operating periods of time;
    2) Age and condition of the installation;
    3) Location and type of building in which the installation is installed, as well as the needs of the users; and
    4) Local environment where the installation is situated, as well as external environmental elements, for example, weather conditions (rain, heat, cold, etc) or vandalism.
k) Need to provide a 24 h, all year-round call-out service for rescue of persons.

m) Need to keep records of the result of each intervention due to a failure of the installation. These records shall include the type of failures to detect any repetition. They shall be available to the owner of the installation on request.
n) Need to put out of service the installation, if the maintenance organization is aware of a dangerous situation, detected during the maintenance, which cannot be eliminated immediately, and to inform the owner of the installation of the need to keep it out of service until repaired.
p) Need to be organized to provide the necessary spare parts for any repair.
q) Possible need for attendance of a competent maintenance person(s), given reasonable notice, for any inspection carried out by an authorized third party or for building maintenance works to be carried out in the areas reserved for the maintenance organization.
r) Need to inform in due time, the owner of the installation about necessary progressive upgrading of the installation.
s) Need to organize rescue operations, even with sub-contractor(s), and to make provision for circumstances such as fire, panic, etc.

15.4 Maintenance Contract

It is recommended that the maintenance is carried out by original equipment manufacturer (OEM). Any maintenance contract should include the following at a minimum, to ensure that escalators/moving walk is always maintained/operated in the safe working condition:

a) All batteries used for emergency operations,
b) All safety switches/devices,
c) Handrail system components including handrails,
d) Operational and auxiliary brake, and
e) Combs.

15.5 Risk Assessment

15.5.1 *General*

Before an installation is placed on the market, it is necessary that the installer/manufacturer carries out a risk assessment. Every risk shall be limited as much as reasonably possible by means of safety measures and suitable instructions. The instructions can never replace a safety measure which can be provided to reduce the risk.

It is necessary to determine the different intervention procedures of the maintenance operations and to determine the appropriate safety measures for each of these procedures.

The use of diagnostic systems may support fault finding, improve the maintainability of the installation and reduce the exposure of maintenance persons to hazards.

Safety in maintenance operations of the installation is ensured by adopting safety measures and providing instructions. Safety measures on the installation and in the

building shall be provided by the installer and by the owner of the installation, respectively.

For any working area, it is necessary to identify the list of the specific hazards related to health and safety and to carry out a risk assessment for any maintenance operation, including access to the working area.

For this purpose, the following should be considered:

a) Presence of one or more maintenance persons in a working area;
b) Foreseeable actions of persons other than maintenance persons (for example, person switching on or off power circuits and dependent circuits or lighting circuits or trying to use the installation during maintenance operations, etc); and
c) Possible states of the installation (normal or abnormal due to a foreseeable failure of its component parts, external disturbances, disturbance of its power supply, etc).

Annex D gives a list of examples of elements to be considered in any risk assessment for maintenance operations. However, several methods are available for the systematic assessment of risk.

15.5.2 *Information for the Maintenance Organization*

For safe maintenance and to provide relevant instructions, it is first necessary to identify the maintenance operations.

Maintenance operations are,

a) those operations considered necessary for a correct and safe functioning of the installation and its components after the completion of the installation; and
b) those operations considered necessary during the 'life' of some components, determining, as far as possible, the time or condition after which the functioning or the integrity of the component is no longer ensured even if correctly maintained.

In carrying out specific maintenance operations, if it is necessary to neutralize some safety functions (for example, an electric safety device), the hazard identification shall be considered for such a situation.

It is necessary to inform and warn the maintenance persons about: (a) residual risks, that is, those for which risk reduction by design and safeguarding techniques are not there or not completely effective; and (b) risks that arise from the necessary removal of certain guards to carry out specific maintenance operations. The maintenance instructions and warnings shall prescribe the procedures and operating modes intended to overcome these risks and, if it is necessary, to specify personal protective equipment, instruments, tools and provisions to be used.

15.6 Markings, Signs, Pictograms and Written Warnings

If the risk assessment of the maintenance organization indicates that additional specific warnings are required for the purpose of maintenance, these shall be affixed directly on the installation/component or, in the close vicinity, when this is not possible. Markings, signs, pictograms, and written warnings shall be readily understandable and unambiguous. Readily understandable signs and pictograms shall be used in preference to written warnings.

Signs or written warnings carrying only the words 'DANGER' shall not be used. Information affixed directly on the installation/component shall be permanent and legible.

Any markings, signs, pictograms, and written warnings affixed on the installation shall be renewed if they become illegible.

15.7 Format of the Maintenance Instruction Handbook

The maintenance instruction handbook for any installation shall contain at the front at least the following:

a) Type of installation, with its serial number, to which the instructions apply;
b) Title of the handbook;
c) Date of issue;
d) Name and address of the installer/manufacturer; and
e) Name of the publisher, when different from the installer/manufacturer.

In the handbook,

1) all units used shall be SI units;
2) all pages shall be numbered; and
3) all references to other documents shall be in full.

Warnings shall state the hazard, the related risks, and the appropriate safety measure.

Type and size of print shall ensure the best possible legibility. Safety warnings and/or precautions shall be emphasised using colours or symbols and/or large print.

Documents giving instructions for maintenance shall be produced in durable form (that is, they shall be able to survive frequent handling) or triplicate copies shall be provided.

15.8 Maintenance Record and Annual Inspection

Maintenance organization is required to maintain a logbook at the equipment to record of maintenance and repair work carried out on the equipment. In addition, the layout diagram and latest wiring diagram is required to be maintained at the equipment by maintenance organization. Maintenance organization is required to carry out annual inspection of the installation and certify that escalator is in safe for operation. Owner of the installation is responsible for ensuring that any deficiencies found during the annual inspection are rectified before the equipment is put back in service.

ANNEX A
(*Clause* 14.5)

CHECK LIST FOR INSPECTION OF ESCALATOR/MOVING WALK AT SITE

1	Escalator/Moving Walk - External	OK	Not OK	NA
1.1	General Fire Protection			
1.2	Geometry			
1.3	Handrails			
1.4	Entrance and exit ends			
1.5	Lighting			
1.6	Caution signs			
1.7	Comb-plate			
1.8	Deck barricade			
1.9	Steps/Pallets and upthrust device			
1.10	Operating devices			
1.11	Skirt obstruction devices			
1.12	Handrail-speed monitoring devices			
1.13	Speed			
1.14	Balustrades			
1.15	Ceiling intersection guards			
1.16	Step/pallet/skirt clearance panels and performance index			
1.17	Outdoor protection			
2	**Escalator/Moving Walk - Internal**			
2.1	Machinery space access, lighting, receptacle and condition			
2.2	Stop switch			
2.3	Controller and wiring			
2.4	Drive machine and brake			
2.5	Speed governor			
2.6	Broken drive chain and disconnected motor device			
2.7	Reversal stop switch			
2.8	Broken step/pallet chain switch			
2.9	Step/pallet upthrust device			
2.10	Missing step/pallet device			
2.11	Step/pallet level device			
2.12	Step/pallet, step/pallet chains and trusses			
2.13	Handrails			
2.14	Name plate			
2.15	Response to smoke detector			
2.16	Log Card			
2.17	Pit Cleanliness			
2.18	Inspection box			

ANNEX B
(*Clause* 14.6.4)

TYPICAL CHECK LIST FOR FUNCTIONAL TESTS ON SAFETY SWITCHES AND DEVICES

Sl No.	Check Point	Method	Value Required	Measured Value	Result
(1)	(2)	(3)	(4)	(5)	(6)
i)	Emergency stop switch	Push the button	OK/NOT OK	Top:	
			OK/NOT OK	Intermediate level:	
			OK/NOT OK	Bottom:	
ii)	Direction key switch (Start switch)		OK/NOT OK	Top:	
			OK/NOT OK	Bottom:	
iii)	Traffic bollard		OK/NOT OK		
iv)	Traffic light working	Check for correct movement indication. (Up/Down) visual check	OK/NOT OK	Top:	
			OK/NOT OK	Bottom:	
v)	Provision of comb light	Visual check	OK/NOT OK		
vi)	Sprinkler:				
	a) Connected to main system		Yes/No/NA		
	b) Number of sprinkler heads provided		Yes/No/NA		

ANNEX C
[(*Clause* 15.3.3(a)]

TYPICAL EXAMPLES OF MAINTENANCE CHECKS TO MAINTAIN THE INSTALLATION

C-1 ESCALATORS AND MOVING WALKS

Sl No.	Component	Checks
(1)	(2)	(3)
i)	Controller	Check cabinet is clean, dry and free from dust
ii)	Gear box	Check gear and associated parts Check lubrication
iii)	Drive motor	Check bearings for wear Check lubrication
iv)	Brake	Check braking system Check parts for wear
v)	Auxiliary brake	Check braking system Check parts for wear
vi)	Intermediate gear box	Check gear and associated parts Check lubrication
vii)	Main drive chain	Check for tension and wear Check lubrication
viii)	Step/pallet chain	Check for tension and wear Check lubrication
ix)	Step/pallet	Check step/pallet and step/pallet wheels for integrity
x)	Conveyor belt	Check for condition and tension
xi)	Drive belt	Check for condition and tension
xii)	Clearances	Check step to step and step to skirting clearances
xiii)	Combs	Check condition Check meshing with steps, pallets or belt
xiv)	Comb plate	Check clearances and operation
xv)	Handrails	Check for free running and condition Check tension Check synchronization between step/pallet band and the handrail
xvi)	Track system	Check for condition and wear Check fixings
xvii)	Safety devices	Check operation
xviii)	Deflector devices	Check condition
xix)	Lighting	Check operation
xx)	Display	Check operation
xxi)	Signs/pictograms	Check condition
xxii)	Balustrade	Check condition of panels Check fixings of interior claddings

ANNEX D
(*Clause* 15.5.1)

EXAMPLES OF ELEMENTS TO BE TAKEN INTO ACCOUNT THE RISK ASSESSMENT FOR MAINTENANCE OPERATIONS

D-1 ESCALATORS/MOVING WALKS

Elements	Machinery Spaces	On Step/ Pallet Band	Inside Step/ Pallet Band	Upper and Lower Landing	Control Cabinet	Machine Room (External Drives)
Access and entry	R	R	R	R	R	R
Inadequate lighting (including access)	R	R	R	R	R	R
Falls/slips	R	R	R	R	R	R
Falling on machine	NR	R	NR	R	NR	NR
Falling over balustrade	NR	R	NR	R	NR	NR
Contact with moving machinery	R	R	R	R	R	R
Indirect contact with machinery	R	R	R	R	R	R
Crushing and shearing (step to step or comb/step to skirting)	R	R	R	NR	NR	NR
Gaps in balustrade	NR	R	NR	NR	NR	NR
Intersection between floors and/or escalators	NR	R	NR	NR	NR	NR
Persons on the step band	NR	R	NR	R	NR	NR
Safety switches and emergency stopping device(s)	R	R	R	R	R	R
Inspection control	R	R	R	R	R	R
Intersection between fixed and moving parts	NR	R	NR	NR	NR	NR
Unintentional start/stop	R	R	R	R	R	R
Machine moving (other than on power)	R	R	R	R	R	R

Elements	Machinery Spaces	On Step/ Pallet Band	Inside Step/ Pallet Band	Upper and Lower Landing	Control Cabinet	Machine Room (External Drives)
More than one maintenance person working	R	R	R	R	R	R
Manual operation	R	NR	R	R	R	R
Falling objects	R	R	R	R	NR	R
Unexpected water/dirt	R	R	R	R	R	R
Contamination by oil and grease	R	R	R	R	NR	R
Dangerous substances	R	R	R	R	R	R
Fire	R	NR	R	NR	R	R
Missing step/pallet	R	R	R	R	NR	NR

'R' = Relevant and 'NR' = Not relevant

LIST OF STANDARDS

The following list records those standards which are acceptable as 'good practice' and 'accepted standards' in the fulfilment of the requirements of the Code. The latest version of a standard shall be adopted at the time of enforcement of the Code. The standards listed may be used by the Authority for conformance with the requirements of the referred clauses in the Code.

In the following list, the number appearing in the first column within parentheses indicates the number of the reference in this Part/Section.

	IS No.	*Title*
(1)	732 : 2019	Code of practice for electrical wiring installation (*fourth revision*)
	3043 : 2018	Code of practice for earthing (*second revision)*
	SP 30 : 2023	National Electrical Code of India 2023
(2)	732 : 2019	Code of practice for electrical wiring installation (*fourth revision*)
	3043 : 2018	Code of practice for earthing (*second revision)*
(3)	12777 : 1989	Method for classification of flame spread of products
(4)	4591	Escalators and moving walks:
	Part 1 / Sec 1 : 2020	Safety requirements *(first revision)*
	Part 1 / Sec 2 : 2020	Guide for planning and selection *(first revision)*
	Part 1 / Sec 3 : 2020	Inspection and Test *(first revision)*
	Part 2 : 2022	Guide for maintenance