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Energy performance of lifts, escalators and moving walks —

Part 3: Energy calculation and classification of escalators and moving walks

Performance énergétique des ascenseurs, escaliers mécaniques et trottoirs roulants —
Partie 3: Calcul énergétique et classification des escaliers mécaniques et trottoirs roulants

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 178, *Lifts, escalators and moving walks*.

ISO 25745 consists of the following parts, under the general title *Energy performance of lifts, escalators and moving walks:*

— *Part 1: Energy measurement and verification*

— *Part 2: Energy calculation and classification for lifts (elevators)*

— *Part 3: Energy calculation and classification for escalators and moving walks*

Introduction

This International Standard has been prepared in response to the rapidly increasing need to ensure and to support the efficient and effective use of energy. This International Standard provides

a) a method to estimate energy consumption of escalators and moving walks on a daily and an annual basis for escalators and moving walks,

b) a method for energy classification of new, existing, or modernized escalators and moving walks,

c) guidelines for reducing energy consumption that can be used to support building and environmental and energy classification systems.

This International Standard is intended to be a reference for the following parties:

— building developers/owners to evaluate the energy consumption of escalators and moving walks;

— building owners and service companies when modernising installations including reduction of energy consumption;

— the installers and maintenance providers of escalators and moving walks;

— consultants and architects involved in specification of escalators and moving walks;

— inspecting authorities and other third parties providing energy classification services.

The total energy consumption over the entire life cycle of escalators and moving walks consists of the energy to manufacture, install, operate, and dispose of the lifts. However, for the purpose of this International Standard, only operating energy (running and standby) performance is considered.

In the preparation of this International Standard, Technical Committee ISO/TC 178/ WG 10 has initiated extensive research, which included the measuring and modelling of over 300 typical escalator and moving walk installations. The results of this research have been used to provide the numerical values shown in Table 3 and Table A.3.

This International Standard is suitable for national/regional jurisdictional energy performance purposes.

Energy performance of lifts, escalators and moving walks —

Part 3: Energy calculation and classification of escalators and moving walks

1 Scope

This part of ISO 25745 specifies

a) generic tools for estimating energy consumption of escalators and moving walks, and

b) a consistent method for energy performance classification of existing, modernized, or new escalators and moving walks.

This part of ISO 25745 considers the energy performance during the operational portion of the life cycle of escalators and moving walks. It does not cover energy consumption and classification of the ancillary equipment, such as the following:

a) lighting with the exception of comb plate lighting, step gap lighting, and traffic light;

NOTE 1 Comb plate lighting, step gap lighting, and traffic light are considered essential for the operation of the equipment and are therefore not defined as ancillary equipment.

b) cooling and heating and machine room ventilation;

c) alarm devices and emergency battery supplies equipment, etc.;

d) environmental conditions;

e) consumption through the power sockets.

NOTE 2 There can be other electrical loads not associated with the escalator or moving walk, which shall not be included.

This part of ISO 25745 considers all escalators and inclined moving walks up to a rise of 8 m and horizontal moving walks with a length up to 60 m.

NOTE This represents about 85 % of worldwide installed units.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 25745-1, *Energy performance of lifts, escalators and moving walks — Part 1: Energy measurement and verification*

3 Terms, definitions and symbols

For the purposes of this document, the following terms, definitions and symbols (see Table 1) apply.

3.1 Terms and definitions

3.1.1
ancillary energy
energy used by the ancillary equipment

3.1.2
ancillary equipment
equipment such as lighting, fans, heating, alarm devices, emergency battery supplies, etc.

3.1.3
auto start condition
condition when escalator/moving walk is stationary and powered up and ready to start initiated by passenger detection

3.1.4
energy
power consumed over time

3.1.5
load condition
condition when escalator/moving walk is running with one or more passengers

3.1.6
no load condition
condition when escalator/moving walk is running at nominal speed without passengers

3.1.7
nominal speed of escalator/moving walk
speed in the direction of the moving steps, pallets, or the belt, when operating the equipment under no load condition (i.e. without persons), stated by the manufacturer as that for which the escalator or moving walk has been designed

3.1.8
power-off condition
power supply to the unit is turned off by the main switch, e.g. during the night

3.1.9
running-in period
required time to get mechanical components to best performance

3.1.10
slow speed condition
condition when escalator/moving walk is running at reduced speed without passengers

3.1.11
standby condition
condition when the escalator/moving walk is stationary and powered on and can be started by authorized personnel

3.2 Symbols (in alphabetical order)

Table 1 — Symbols and abbreviations

Symbol	Term	Definition	Unit	Assumptions
A		Length depending part of handrail drag force normalized to horizontal	N/m	
B		The constant part of handrail drag force normalized to horizontal	N	

Table 1 *(continued)*

Symbol	Term	Definition	Unit	Assumptions
C		Constant part of step band reversal drag force	kN	
CF	Correction factor	Correction factor for efficiency η applied to units in downward direction	-	Number of users/N day ≤ 10 000 or non-regenerative drive technology: CF = 0 N/day > 10 000: CF = 0,5
D		Pitch length of step or pallet	m	Default value = 0,405
$E_{\text{ancillary}}$	Energy	Total energy consumption of ancillary system	kWh	
$E_{\text{auto start}}$	Energy	Energy consumption in auto start condition	kWh	
E_{load}	Energy	Energy consumption due to the transport of passengers	kWh	Negative for down running; Positive for up running
E_{main}	Energy	Total energy consumption of unit w/o ancillary energy	kWh	
$E_{\text{no load}}$	Energy	Energy consumption under no load condition	kWh	
$E_{\text{slow speed}}$	Energy	Energy consumption in slow speed condition	kWh	
E_{standby}	Energy	Energy consumption in standby condition	kWh	
E_{total}	Energy	Total energy consumption of unit incl. Ancillary energy	kWh	
H	Rise	Vertical distance between the upper and lower finished floor levels	m	
L	Length	Distance between the comb intersection lines	m	
m	Weight of passenger	Average weight of passenger	kg	75 kg/person
m_{chain}	Mass	Mass of chain band per meter	kg/m	
$m_{\text{SB/PB}}$	Mass	Mass of a step/pallet	kg	
N	Number of passengers	Number of transported persons in observation period	-	
$P_{\text{no\_load\_control}}$	Power	Total reference power consumption to operate no load condition	kW	
$P_{\text{no\_load\_handrail}}$	Power	Total reference power consumption of a handrail system in no load condition	kW	
$P_{\text{no\_load\_ref}}$	Power	Total reference power consumption in no load condition	kW	
$P_{\text{no\_load\_spec}}$	Power	Total calculated or measured power consumption of the specified unit in no load condition	kW	
P_{standby}	Power	Total reference power consumption to operate in standby condition	kW	

Table 1 *(continued)*

Symbol	Term	Definition	Unit	Assumptions
$P_{\text{no\_load\_step/pallet}}$	Power	Total reference power consumption of a step/pallet system in no load condition	kW	
$t_{\text{ancillary}}$	Time	Time period of activated ancillary system	h	
$t_{\text{auto start}}$	Time	Time period of auto start condition in observation period		
$t_{\text{nominal speed}}$	Time	Time period under nominal speed in observation period	h	
$t_{\text{power off}}$	Time	Time period in power off condition in observation period	h	
$t_{\text{slow speed}}$	Time	Time period of slow speed condition in observation period	h	
t_{standby}	Time	Time period of standby condition in observation period	h	
t_{total}	Time	Time period of the energy consumption in observation period	h	
a	Angle of inclination	Maximum angle to the horizontal in which the steps, the pallets, or the belt move	degree	
η	Efficiency	Efficiency due to load conditions	—	Average value due to different load conditions
$\eta_{\text{no load}}$	Efficiency	Efficiency under no-load conditions	—	
μ	Friction coefficient	Friction coefficient due to load conditions	—	Average value due to different load conditions
$\mu_{\text{SB/PB}}$	Friction coefficient	Friction coefficient of step/pallet band	—	Average value due to different load conditions
v	Speed	Nominal speed of escalator or moving walk	m/s	

4 Estimation of energy consumption

The measured or calculated power consumption is used for determining the energy consumption. Energy consumption is power consumption multiplied with a defined time period.

Calculation methods to estimate energy consumption of escalators and moving walks are given in Annex A. Formulas are provided for a situation where a more complete or appropriate method is not available. Energy consumption estimated by the formulae is based on average factors. Energy calculations using these methods are only estimations and can differ from real energy consumption, which is mainly affected by traffic topology, technology, and load factors.

NOTE There can be a deviation between a calculated value and a measured value in a specific installation. This can be due to assumptions made. Where the difference is greater than 20 %, an investigation should be carried out.

Two methods for estimation of energy consumption are provided:

— calculation method based on default values for planning purposes;

— calculation method based on power measurement.

The scope and contents of reporting of the results are shown in Annex A.

All information according to Table A.3 and Table A.4 shall be reported. Additional information about applied technologies is recommended.

5 Energy performance classification

5.1 General

This section specifies a methodology for the energy performance classification of an escalator or moving walk.

The energy performance classification is obtained by executing the following steps:

a) Normalizing the calculated or measured power consumption of a single unit:

— calculation of the reference power consumption (5.2);

— calculation or measurement of the power consumption of the specified unit (5.3);

— calculation of the energy performance ratio (5.4).

b) Normalizing of operation mode power consumption of a single unit:

— calculation of the reference operation mode performance ratio (5.5).

c) Consideration of ancillary power performance:

— consideration according to 5.6 item c).

The classification methodology applies to in-service escalators and moving walks whether the values are measured on an installation or provided by the manufacturer. It can also be used to re-classify an installation after modernisation.

5.2 Classification of the reference power consumption

The result of this calculation $P_{no\_load\_ref}$ is the power consumption of a unit running in no load condition as a total of

— power consumption of the handrail system,

— power consumption of the step band system, and

— power consumption of the control system (reference value according to Table 2).

$$P_{no\_load\_ref} = P_{no\_load\_handrail} + P_{no\_load\_step/pallet} + P_{no\_load\_control} \quad (1)$$

The values for handrail and step band system are calculated using the following Formulae (2) and (3):

$$P_{no\_load\_handrail} = \frac{2 \times \cos(\alpha) \times (A \times \frac{H}{\tan(\alpha)} + B) \times v}{1000 \times \eta_{no\_load}} [\text{kW}] \quad (2)$$

NOTE 1 In case of flat moving walk, $H/\tan\alpha = L$ (length of the moving walk).

$$P_{no\_load\_step/pallet} = \frac{\left[\left(2 \times \left(\frac{m_{SB/PB}}{D} + 2 \times m_{chain} \right) \times \frac{9{,}81[m/s^2]}{1000} \times \mu_{SB/PB} \times \frac{H}{\tan(\alpha)} + C \right) \times v \right]}{\eta_{no\_load}} [\text{kW}] \quad (3)$$