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Energy performance of lifts, escalators and moving walks —

Part 2:

Energy calculation and classification for lifts (elevators)

iTeh STPerformance énergétique des ascenseurs, escaliers mécaniques et trottoirs roulants — Stance 2: Calcul énergétique et classification des ascenseurs

<u>ISO 25745-2:2015</u> https://standards.iteh.ai/catalog/standards/sist/0ee21509-fb68-440d-a7cfa3cdc55c1876/iso-25745-2-2015



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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 ASO'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*.

This corrected version of ISO 25745-2:2015 indopporates the following corrections: minus signs have been replaced by plus signs in/Formulae (9);a(10) and (11);treferences in the Bibliography have been updated and corrected. a3cdc55c1876/iso-25745-2-2015

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 on a daily and an annual basis for lifts, and
- b) a method for energy classification of new, existing, or modernised lifts.

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

- building developers/owners to evaluate the energy consumption of various lifts;
- building owners and service companies when modernising installations including reduction of energy consumption
- the installers and maintenance providers of lifts;
- consultants and architects involved in specification of lifts.
- inspectors and other third parties providing energy classification services.

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

In the preparation of this International Standard, Technical Committee ISO/TC 178, Subcommittee WG10 has initiated extensive research, which included over 4 500 simulations of typical lift installations. The results of this research have been used to provide the numerical values shown in Tables 2 to 4.

This International Standard only considers traction, hydraulic and positive drive lifts, but can be used as a reference for alternative technologies of standards/sist/0ee21509-fb68-440d-a7cf-

a3cdc55c1876/iso-25745-2-2015 This International Standard can be used in relationship with national/regional jurisdictional energy performance purposes.

It is assumed that whenever the energy performance of a lift is assessed to this International Standard, all components of the lift have been designed in accordance with usual engineering practice and calculation codes, are of sound mechanical and electrical construction, are made of materials with adequate strength and of suitable quality, are free of defects, are kept in good repair and working order. and have been selected and installed so that foreseeable environmental influences and special working conditions have been considered.

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Energy performance of lifts, escalators and moving walks —

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

1 Scope

This part of ISO 25745 specifies the following:

- a) a method to estimate energy consumption based on measured values, calculation, or simulation, on an annual basis for traction, hydraulic, and positive drive lifts on a single unit basis;
- b) energy classification system for new, existing, and modernized traction, hydraulic, and positive drive lifts on a single unit basis;

This part of ISO 25745 applies to passenger and goods passenger lifts with rated speeds greater than 0,15 m/s and only considers the energy performance during the operational portion of the life cycle of the lifts.

NOTE 1 For other types of lifts (e.g. service lifts, lifting platforms, etc.), this part of ISO 25745 can be taken as a reference.

This part of ISO 25745 does not **cover energy aspects, which affect** the measurements, calculations, and simulations, such as the following:

- a) hoistway lighting: <u>ISO 25745-2:2015</u> hoistway lighting: <u>//standards.iteh.ai/catalog/standards/sist/0ee21509-fb68-440d-a7cf-</u>
- b) heating and cooling equipment in the lift car;
- c) machine room lighting;
- d) machine room heating, ventilation, and air conditioning;
- e) non-lift display systems, CCTV security cameras, etc.;
- f) non-lift monitoring systems (e.g. building management systems, etc.);
- g) effect of lift group dispatching on energy consumption;
- h) environmental conditions;
- i) consumption through the power sockets;
- j) lifts whose travel includes an express zone.

NOTE 2 An express zone is unlikely to affect the average car load but can significantly affect the average travel distance.

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 and definitions

For the purposes of this document, the terms and definitions given in ISO 25745-1 and the following apply.

NOTE For symbols, see Annex C.

3.1

average cycle

cycle of one up and one down trip each covering the average travel distance of the target installation including two complete door cycles

3.2

express zone

section of the lift well where there are no landing entrances whose length is more than three average floor heights

3.3

load factor

ratio between the running energy used by a car carrying an average load and the running energy with an empty car

Note 1 to entry: The average load that a car carries is given in <u>Table 3</u>.

3.4

short cycle

cycle during which the empty car is run for a travel distance of at least one-quarter of the total travel height with the travel distance centred around the mid-point of the travel height and back to the starting point over a sufficient distance for the lift car to reach stable rated speed in both directions including two complete door cycles

3.5

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trip(s)https://standards.iteh.ai/catalog/standards/sist/0ee21509-fb68-440d-a7cf-movement(s) from a starting (departure)fanding.oto7the2-next stopping (arrival) landing notincluding re-levelling

4 Data collection and analysis tools

The energy values (running energy, idle, 5 min standby, and 30 min standby power) used to estimate annual energy consumption can be obtained using the energy measurement methodologies as specified in ISO 25745-1 or by calculation or simulation.

Energy measurements can be taken during commissioning of a new lift or during the life of an existing lift or on a test facility.

Running energy measurements can be achieved by

- a) running the empty lift car between one terminal landing and the other terminal landing and then back to the first terminal landing, including the energy used during the two door operations, in accordance with the reference cycle as specified in ISO 25745-1, and
- b) running the empty lift car from a defined landing to a predetermined point in the lift well and then back to the defined landing (short cycle), including the energy used during the two door operations, in accordance to the measurement procedures specified in ISO 25745-1.

Each cycle comprises two trips.

The running energy of the short cycle shall be determined with the travel centred on the mid-point between the defined landing and the predetermined point, in order to reduce inaccuracies due the influence of suspension means, travelling cables, etc. The travel of the short cycle shall be at least 1/4 of the total travel height. However, the lift shall always reach rated speed during the cycle. For lifts with two stops, no short running cycle evaluation is needed because the lift always runs the full travel height.

Measurement b) allows a test facility to be arranged to match the terminal to terminal travel distance of a target installation with a specified rated speed.

The determination of the 30 min standby power is only necessary if any lift energy consuming components switch to a lower energy level after a time exceeding 5 min.

The standby power values shall be determined taking into account the manufacturer's powering down sequence times of the energy consuming components when the lift is in operation. The transition times from standby modes shall be indicated in the documentation of the installation.

NOTE Some manufacturers can have a number of standby states depending on their powering down sequence and recovery times.

5 Calculation of energy consumption

5.1 Methodology

This subclause specifies a methodology for the calculation of annual energy consumption.

This calculation methodology can be applied to new lifts and existing lifts and can only be applied to single units. It can also be used to re-assess an installation after modernization.

This method applies whether the values are measured or are provided from a manufacturer's model data.

In the case of groups of lift installations, each unit shall be considered as an individual unit. The energy used by a shared component in a group shall be equally distributed between the individual units.

The following sections indicate the calculation process. An example calculation is shown in Annex B.

The methodology shown in 5.2 to 5.5 applies to lifts, which draw all power for normal running and nonrunning operation, directly from the mains supply. For systems, which draw all or partial power from energy storage systems during normal running or non-running operation, the method for calculating the daily energy consumption is outlined in 5.6. Counterweights which store the energy of one lift run are not considered as an energy storage system.

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

5.2 Calculation of running energy per day

5.2.1 Usage and number of starts per day

The usage of an individual lift shall be categorized according to <u>Table 1</u> by the estimated number of trips per day. The approximate number of trips per day can be obtained from observations or a trip counter. Where this data is not available, it can be estimated for the specific usage category according to Annex A.

Usage category	1	2	3	4	5	6
Usage intensity/ frequency	Very low	Low	Medium	High	Very high	Extremely high
Number of trips	50	125	300	750	1 500	2 500
per day (n _d)	(<75)	(75 to <200)	(200 to <500)	(500 to <1 000)	(1 000 to <2 000)	(≥2 000)
(typical range)						

Table 1 — Categorized number of trips per day

NOTE The number of trips is categorized in order to achieve comparable results for energy assessments carried out by different parties.

For lift applications in which the traffic pattern and the number of starts per day are well known, e.g. in existing buildings, a specific number of starts per day deviating from <u>Table 1</u> can be agreed between involved parties for the assessment of the annual energy consumption and classification of the lift. In this case, the selected number of starts has to be documented as required in <u>Clause 8</u>.

5.2.2 Average travel distance

The average travel distance (s_{av}) for the target installation shall be selected from Table 2 as percentage of the one-way travel distance of the reference cycle according to ISO 25745-1.

Usage category	1-3	4	5	6	
Number of stopping floors	Percentage average travel distance				
2	100 %				
3	67 %				
> 3	49 %	44 %	39 %	32 %	

Table 2 — Percentage of average travel distance

NOTE For lift applications in which the traffic patterns are well known, a specific percentage of the average travel distance can be agreed between the involved parties for the assessment of the annual energy consumption. In this case, the selected percentage should be documented in Annex B.

5.2.3 Average running energy per metre NDARD PREVIEW

The average running energy consumption per metre of travel shall be determined when the lift is running at rated speed.

The average running energy consumption per metre of travel is determined by Formula (1):

$$E_{\rm rm} = \frac{1}{2} \left(\frac{E_{\rm rc} - E_{\rm sc}}{s_{\rm rc} - s_{\rm sc}} \right)^{\rm https://standards.iteh.ai/catalog/standards/sist/0ee21509-fb68-440d-a7cf-a3cdc55c1876/iso-25745-2-2015}$$
(1)

where

 $E_{\rm rc}$ is the running energy consumption of reference cycle according to ISO 25745-1 (Wh);

 $E_{\rm sc}$ is the running energy consumption of the short cycle (Wh);

*s*_{rc} is the one-way travel distance of reference cycle according to ISO 25745-1 (m);

 $s_{\rm sc}$ is the one-way travel distance of the short cycle (m).

NOTE s_{rc} and s_{sc} are the one-way travel distances in each direction and need to be counted twice for the running distance of the complete cycle.

5.2.4 Start/stop energy consumption

The start/stop energy consumption includes the energy consumed to accelerate a lift up to rated speed, decelerate it from rated speed level at the destination landing, to open and close its doors and the idle energy used while standing at the landings minus the energy which would have been used to travel at rated speed during the distance of the acceleration and deceleration phases of the trip.

The start/stop energy consumption for each trip is given by Formula (2):

$$E_{\rm ssc} = \frac{1}{2} \left(E_{\rm rc} - 2 \times E_{\rm rm} \times s_{\rm rc} \right) \tag{2}$$

(3)

5.2.5 Running energy of an average cycle with empty car

The running energy consumption of an average cycle for the target installation is given by Formula (3):

$$E_{\rm ray} = 2 \times E_{\rm rm} \times s_{\rm ay} + 2 \times E_{\rm ssc}$$

where

 $E_{\rm rm}$ is the average running energy consumption per metre of travel (Wh/m);

 s_{av} is the one-way average travel distance for target installation (m);

 $E_{\rm ssc}$ is the start/stop energy consumption for each trip (Wh).

NOTE The running energy of the average cycle can be determined directly by measurement, calculation, or simulation. In this case, the above evaluation is not required.

If the travel distance for a short cycle does not allow the rated speed to be reached, then running energy consumption of an average cycle for the target installation is given by Formula (4):

$$E_{\rm rav} = E_{\rm rc} \times \frac{s_{\rm av}}{s_{\rm rc}} \tag{4}$$

5.2.6 Daily running energy

The daily running energy consumption is given by Formula (5). VIEW

$$E_{\rm rd} = \frac{k_{\rm L} \times n_{\rm d} \times E_{\rm rav}}{2} \qquad (standards.iteh.ai) \tag{5}$$

where

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 $a_{3cdc55c1876/iso-25745-2-2015}$ *E*_{rav} is the running energy consumption of an average cycle (Wh);

- $n_{\rm d}$ is the number of trips per day according to the selected usage category in <u>Table 1</u>;
- $k_{\rm L}$ is the load factor;
- $E_{\rm rd}$ is the daily running energy consumption (Wh).

NOTE The average travel distance is that expected for the target installation. A cycle is two trips accounting for the division by 2 in the denominator.

The value for the load factor (k_L) shall be calculated using Formulae (6) to (11) below, where the value for percentage average car load (%Q) is taken from Table 3.