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Energy performance of lifts, escalators and moving walks —

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

Performance énergétique des ascenseurs, escaliers mécaniques et trottoirs roulants —

Partie 2: Calcul énergétique et classification des ascenseurs

Reference number
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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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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*.

This corrected version of ISO 25745-2:2015 incorporates the following corrections: minus signs have been replaced by plus signs in Formulae (9), (10) and (11); references in the Bibliography have been updated and corrected.

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.

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.

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;

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 Table 3.

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
trip(s)
movement(s) from a starting (departure) landing to the next stopping (arrival) landing not including 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 non-running 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 Table 1 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.

Table 1 — Categorized number of trips per day

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

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 Table 1 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 Clause 8.

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.

Table 2 — Percentage of average travel distance

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

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

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):

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

where

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

E_{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_{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):

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

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):

$$E_{rav} = 2 \times E_{rm} \times s_{av} + 2 \times E_{ssc} \quad (3)$$

where

E_{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_{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):

$$E_{rav} = E_{rc} \times \frac{s_{av}}{s_{rc}} \quad (4)$$

5.2.6 Daily running energy

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

$$E_{rd} = \frac{k_L \times n_d \times E_{rav}}{2} \quad (5)$$

where

E_{rav} is the running energy consumption of an average cycle (Wh);

n_d is the number of trips per day according to the selected usage category in Table 1;

k_L is the load factor;

E_{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.

For traction lifts counterbalanced to 50 %

$$k_L = 1 - (\%Q \times 0{,}016\,4) \tag{6}$$

For traction lifts counterbalanced to 40 %

$$k_L = 1 - (\%Q \times 0{,}019\,2) \tag{7}$$

For traction lifts counterbalanced to 30 %

$$k_L = 1 - (\%Q \times 0{,}019\,7) \tag{8}$$

For hydraulic lifts with no balancing

$$k_L = 1 + (\%Q \times 0{,}007\,1) \tag{9}$$

For hydraulic lifts with 35 % counterbalancing of the car weight

$$k_L = 1 + (\%Q \times 0{,}010\,0) \tag{10}$$

For hydraulic lifts with 70 % counterbalancing of the car weight

$$k_L = 1 + (\%Q \times 0{,}018\,7) \tag{11}$$

NOTE 1 Interpolation can be used to obtain values for intermediate counterbalancing for k_L.

NOTE 2 Traction lifts with no counterweight and positive drive lifts can be considered as a hydraulic lift with no balancing and calculations carried out accordingly.

Table 3 — Average car load

Usage category	**1–3**	**4**	**5**	**6**
Rated load (kg)	Percentage of rated load (Q)			
≤800	7,5 %	9,0 %	13 %	19 %
801 to ≤1 275	4,5 %	6,0 %	8,2 %	13,5 %
1 276 to ≤2 000	3,0 %	3,5 %	5,0 %	9,0 %
>2 000	2,0 %	2,2 %	3,0 %	6,0 %

5.3 Calculation of non-running (idle/standby) energy consumption per day

5.3.1 Running time per day

The total running time per day, t_{rd}, is given, in hours (h), by

$$t_{rd} = n_d \times \frac{t_{av}}{3\,600} \tag{12}$$

where

t_{av} is the time to travel the average travel distance for the target installation, including door times (s).

The time to travel the average distance, t_{av}, is given by

$$t_{av} = \frac{s_{av}}{v} + \frac{v}{a} + \frac{a}{j} + t_d \qquad (13)$$

where

t_d is the time for the opening, remaining open, and closing of the lift doors at the landings.

The values for a and j can be obtained by measurement or from a manufacturer's standard tables. Where a, j, and t_d values are not available, they shall be measured.

5.3.2 Non-running time per day

To calculate the energy used per day when the lift is in idle/standby modes, the non-running time per day has to be determined. The time per day when the lift is not running are the periods when the car is at a landing with its doors open and users are entering or leaving the car or with its doors closed in idle mode or standby mode. This non-running time is usually 24 h less the running time and is given by Formula (14):

$$t_{nr} = 24 - t_{rd} \qquad (14)$$

where

t_{nr} is the non-running (idle and standby) time per day (h).

In cases where the lift is switched off at scheduled times, the non-running time has to be determined for this specific situation.

5.3.3 Time ratios of idle/standby modes

The daily non-running (idle/standby) energy consumption can comprise three components:

a) the time when idle between stopping and entering the 5 min standby mode;

b) the time between the 5 min standby mode and the 30 min standby mode, if occurring;

c) the time after 30 min have elapsed.

The ratios of time spent where the lift is in non-running (idle and standby) modes per day shall be taken from Table 4. In specific cases, the time ratios can be determined from individual traffic simulations. In these cases, the ratios have to be documented according to Clause 8.

Table 4 — Time ratios in idle and standby modes

Usage category		**1**	**2**	**3**	**4**	**5–6**
Time ratios (%)	R_{id}	13	23	36	45	42
	R_{st5}	55	45	31	19	17
	R_{st30}	32	32	33	36	41

5.3.4 Daily non-running (idle/standby) energy consumption

The daily non running (idle/standby) energy consumption is given by Formula (15):

$$E_{\mathrm{nr}} = \frac{t_{\mathrm{nr}}}{100}\left(P_{\mathrm{id}}R_{\mathrm{id}} + P_{\mathrm{st5}}R_{\mathrm{st5}} + P_{\mathrm{st30}}R_{\mathrm{st30}}\right) \tag{15}$$

where

P_{id} is the power used in idle mode (W);

P_{st5} is the standby power used after 5 min (W);

P_{st30} is the standby power used after 30 min (W);

R_{id} is the ratio of idle time consuming P_{id} (%);

R_{st5} is the ratio of 5 min time consuming P_{st5} (%);

R_{st30} is the ratio of 30 min time consuming P_{st30} (%);

E_{nr} is the daily non-running (idle/standby) energy consumption (Wh).

NOTE If there is no change between the 5 min standby power and 30 min standby power values after the last trip made by the lift, then the time ratio R_{st30} is added to the preceding time ratio R_{st5} or if there is no change between idle and 5 min power values, then the time ratio R_{st5} is added to the preceding time ratio R_{id}.

5.4 Total energy consumption per day

The estimated daily energy consumption is given by Formula (16):

$$E_{\mathrm{d}} = E_{\mathrm{rd}} + E_{\mathrm{nr}} \tag{16}$$

where

E_{d} is the total daily energy consumption (Wh).

5.5 Total energy consumption per year

The estimated annual energy consumption is given by Formula (17):

$$E_{\mathrm{y}} = E_{\mathrm{d}} \times d_{\mathrm{op}} \tag{17}$$

where

E_{y} is the annual energy consumption (Wh);

d_{op} is the number of operating days per year.

If the lift is switched off on certain days (e.g. weekends or holidays), the number of days per year can be reduced by the number of days the lift is switched off per year.

5.6 Method for determining the daily energy consumption for energy storage systems

For systems using energy storage for normal running or non-running operation, energy consumption during a full 24 h of operation, all energy drawn by the lift system shall be either measured, calculated, or simulated applying the following conditions:

a) Energy storage devices shall be at the same state of charge at the beginning and the end of the 24 h period.

b) The lift shall carry out the number of starts per day which shall be taken from Table 1.

c) The lift shall travel the average travel distance which shall be taken from Table 2.

d) The average load in the car shall be as specified in Table 3.

e) The percentage of non-running time in idle and all standby states that occur shall be taken from Table 4.

When using the method in Clause 6, only the combined classification from Table 7 shall apply. The total daily energy consumption shall be directly compared to the classification thresholds defined in Table 7 to determine the classification of the lift.

6 Lift energy efficiency classification

6.1 Rationale

This subclause specifies a methodology for the classification of a target installation.

The classification 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-classify an installation after modernization.

This method applies whether the values are measured on an installation or are provided by simulation or calculation from a manufacturer's model data.

Normalization of the running energy consumption (for a reference cycle or an average cycle) can be achieved by dividing the running energy consumption by the rated load and twice the one-way travel distance. This normalization method gives an explicit value to the lift system with reference to the building in which it is to be installed. Normalized values of energy consumption can allow comparisons to be made between different tenders for new systems or when upgrading is being considered.

NOTE 1 The same equipment installed in different buildings can produce different values.

NOTE 2 For examples of normalization, see Formulae (18) and (19).

6.2 Performance level for running

The specific running energy for the average running cycle is given by Formula (18):

$$E_{\mathrm{spc}} = \frac{1\,000 \times k_{\mathrm{L}} \times E_{\mathrm{rav}}}{2 \times Q \times s_{\mathrm{av}}} \tag{18}$$

where

E_{spc} is the specific running energy for the average running cycle mWh/(kg·m);

k_{L} is the load factor according to 5.2.6;

Q is the rated load (kg).

The specific running energy for the average running cycle of the target lift is assigned to an energy performance level according to Table 5.

Table 5 — Performance levels for running

Specific running energy for the average running cycle (mWh/kgm)	≤0,72	≤1,08	≤1,62	≤2,43	≤3,65	≤5,47	>5,47
Performance level	**1**	**2**	**3**	**4**	**5**	**6**	**7**

6.3 Performance levels for idle/standby

Energy performance levels for idle, P_{id}, standby P_{st5} and standby P_{st30} are assigned according to Table 6.

Table 6 — Performance level for idle/standby

Idle/standby power (W)	≤50	≤100	≤200	≤400	≤800	≤1600	>1600
Performance level	**1**	**2**	**3**	**4**	**5**	**6**	**7**

6.4 Classification of energy performance of the lift

The energy performance of the lift shall be classified by comparing the daily energy consumption calculated according to 5.4 or 5.6 with threshold values calculated from performance levels for running in accordance with Table 5 and non-running (idle and standby) in accordance with Table 6.

Where the exact number of trips (n_d) is known from measurement or specification, the threshold values to be applied in Table 7 shall be calculated using this value for n_d.

Where the exact number of trips (n_d) is not known, but an estimated or anticipated usage category is known, the threshold values to be applied in Table 7 shall be calculated using the median value for n_d taken from Table 1.

Table 7 — Classification of energy efficiency

Energy efficiency class	Energy consumption per day (Wh)
A	$E_d \le 0,72 \times Q \times n_d \times s_{av}/1\,000 + 50 \times t_{nr}$
B	$E_d \le 1,08 \times Q \times n_d \times s_{av}/1\,000 + 100 \times t_{nr}$
C	$E_d \le 1,62 \times Q \times n_d \times s_{av}/1\,000 + 200 \times t_{nr}$
D	$E_d \le 2,43 \times Q \times n_d \times s_{av}/1\,000 + 400 \times t_{nr}$
E	$E_d \le 3,65 \times Q \times n_d \times s_{av}/1\,000 + 800 \times t_{nr}$
F	$E_d \le 5,47 \times Q \times n_d \times s_{av}/1\,000 + 1\,600 \times t_{nr}$
G	$E_d > 5,47 \times Q \times n_d \times s_{av}/1\,000 + 1\,600 \times t_{nr}$

NOTE A classification obtained by calculation in a planning phase can vary by one class up or below when in operation.

7 Specific running energy for the reference cycle

The specific running energy (E_{spr}) for the reference cycle can be calculated using the energy (E_{rc}), measured according to ISO 25745-1 and is given by Formula (19):

$$E_{spr} = \frac{1\,000 \times E_{rc}}{2 \times Q \times s_{rc}} \tag{19}$$

where

E_{spr} is the specific running energy for reference cycle mWh/(kg·m).

8 Reporting

The results of the energy assessment shall be documented and shall include the following:

— name of manufacturer;

— location of lift;

— type of lift;

— drive system type;

— rated load (kg);

— rated speed (m/s);

— average acceleration (m/s^2);

— average jerk (m/s^3);

— travel height (m);

— number of stopping floors;

— number of trips per day;

— usage category;

— idle power (W);

- — standby power (P_{st5}) (W);
- — standby power (P_{st30}) (W);
- — time(s) to reach standby mode(s);
- — time(s) to recover from standby mode(s);
- — operating days per year;
- — estimated annual energy consumption (kWh);
- — specific running energy for the average cycle mWh/(kg·m);
- — classification of lift (A-G);
- — specific running energy for the reference cycle mWh/(kg·m);
- — date of evaluation.

Annex A
(informative)

Specific usage category

Table A.1 — Number of trips per day (and operating days per year)

Usage category	1	2	3	4	5	6
Usage intensity/ frequency	Very low	Low	Medium	High	Very high	Extremely high
Number of trips per day (n_d) **typical range**	50 (<75)	125 (75 to <200)	300 (200 to <500)	750 (500 to <1 000)	1500 (1 000 to <2 000)	2 500 (≥2 000)
Typical buildings and usage **(operating days per year)**	Residential building up to 6 dwellings (360 d) Residential care home (360 d) Small office or administrative building with few operations (260 d) Suburban railway stations (360 d)	Residential building up to 20 dwellings (360 d) Small office or administrative building with 2 to 5 floors (260 d) Small hotels (360 d) Office car parks (260 d) General car parks (360 d) Main line railway stations (360 d) Library (312 d) Entertainment centres (360 d) Stadia (intermittent)	Residential building with up to 50 dwellings (360 d) Medium-sized office or administrative building with up to 10 floors (260 d) Medium-sized hotel (360 d) Airports (360 d) University (260 d) Small hospital (360 d) Shopping centre (360 d)	Residential building with more than 50 dwellings (360 d) Large office or administrative building with more than 10 floors (260 d) Large hotel (360 d)	very large office or administrative building over 100 m height (260 d)	very large office or administrative building over 100 m height (260 d)
Typical rated speed	0,63 m/s	1,00 m/s	1,60 m/s	2,50 m/s	5,00 m/s	5,00 m/s

Annex B
(informative)

Example calculation

B.1 Lift parameters

Traction lift

Rated load	1 500 kg
Rated speed	2,50 m/s
Travel	75 m
Number of floors	20
Counterbalancing	50 %
Acceleration	1,0 m/s^2
Jerk	1,25 m/s^3
Door operation time	8,0 s

B.2 Data determined by measurement, simulation or calculation

Daily trips	750 (category 4)
Idle power	500 W
Standby$_5$ power	300 W
Standby$_{30}$ power	120 W
Reference cycle energy	170 Wh
Short cycle distance	50 m
Short cycle energy	120 Wh

B.3 Data from tables

Average travel distance	44 % (from Table 2)
Average car load	3,5 % (from Table 3)
Load factor (k_L)	0,94 (see 5.2.6)

B.4 Calculation

$s_{av} = 0{,}44 \times 75 = 33$ m

E_{rm} = (170-120)/(75-50)/2 = 1 Wh/m

E_{ssc} = (170-2 × 1 × 75)/2 = 10 Wh

E_{rav} = 2 × 1 × 33 + 2 × 10 = 86 Wh

E_{rd} = 0,94 × 750 × 86/2 = 30,315 Wh

t_{av} = 33/2,5 + 2,5/1 + 1/1,25 + 8 = 24,5 s

t_{rd} = 750 × 24,5/3,600 = 5,10 h

t_{nr} = 24-5,10 = 18,90 h

E_{nr} = 18,90 × (500 × 45+300 × 18+120 × 37)/100 = 6,112 Wh

E_d = 30,315 + 6,112 = 36,427 Wh

Threshold values for classification:

A: E_d ≤ 0,72 × 1 500 × 750 × 33/1 000 + 50 × 18,90 = 27,675 Wh

B: E_d ≤ 1,08 × 1 500 × 750 × 33/1 000 + 100 × 18,90 = 41,985 Wh

C: …

B.5 Lift has class B

E_y = 36,427 × 365 = 13,296 kWh (365 days operation)

E_{spc} = 1 000 × 0,94 × 86/(2 × 1 500 × 33) = 0,82 mWh/kg·m

E_{spr} = 1 000 × 170/(2 × 1 500 × 75) = 0,76 mWh/kg·m

Annex C
(informative)

Symbols

a is the average acceleration (m/s^2)

d_{op} is the number of operating days per year

E_d is the total daily energy consumption (Wh)

E_{nr} is the daily non running (idle/standby) energy consumption (Wh)

E_{rav} is the running energy consumption of an average cycle (Wh)

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

E_{rd} is the daily running energy consumption (Wh)

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

E_{sc} is the running energy of the short cycle (Wh)

E_{spc} is the specific running energy for an average cycle mWh/(kg·m)

E_{spr} is specific running energy for the reference cycle mWh/(kg·m)

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

E_y is the annual energy consumption (Wh)

J is the average jerk (m/s^3)

k_L is the load factor

n_d is the number of trips per day

P_{id} is the power used in idle mode (W)

P_{st5} is the standby power used after 5 min (W)

P_{st30} is the standby power used after 30 min (W)

Q is the rated load (kg)

R_{id} is the ratio of idle time consuming P_{id} (%)

R_{st30} is the ratio of 30 min time consuming P_{st30} (%)

R_{st5} is the ratio of 5 min time consuming P_{st5} (%)

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

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

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

t_{av} is the time to travel the average travel distance, including door times (s)

t_d is the time for the opening, opened and closing times of the lift doors at the landings

t_{nr} is the non-running (idle and standby) time per day (h)

t_{rd} is the running time per day (h)

v is the rated speed (m/s)

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