

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**e-Transporters –
Part 2-1: Safety requirements and test methods for personal e-Transporters**

**e-Transporteurs –
Partie 2-1: Exigences de sécurité et méthodes d'essai relatives aux
e-Transporteurs de personnes**



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E-TRANSPORTERS –**Part 2-1: Safety requirements and test methods for
personal e-Transporters**

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The text of this International Standard is based on the following documents:

Draft	Report on voting
125/91/FDIS	125/93/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63281 series, published under the general title *e-Transporters*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document has been developed to cope with the rapidly evolving personal e-Transporters. Personal e-Transporters have become common in public spaces and roads, some of which can reach speeds of 25 km/h or even higher, and the applications and global market size are expected to grow significantly. In order to protect the safety of persons and public facilities, besides basic safety requirements, comprehensive safety requirements and test methods such as riding safety for people and for e-Transporters are also considered. At the time of writing, this document provides general safety requirements and corresponding test methods for personal e-Transporters, which are convenient for manufacturers and test departments to use.

Standardization of electrically powered transport devices covered by the following TCs are excluded from this document:

- IEC TC 69,
- ISO TC 149,
- ISO TC 22.

E-TRANSPORTERS –

Part 2-1: Safety requirements and test methods for personal e-Transporters

1 Scope

This document specifies safety requirements and test methods for personal e-Transporters.

This document is applicable to electrically powered personal e-Transporters (PeTs) which are used in private and public areas, where the speed control and/or the steering control is electric/electronic.

The PeT can have provisions for transport of cargo and can be for private or commercial (including sharing service) use.

This document is not applicable for electric vehicles (EVs), such as electrically power assisted cycles (EPACs), e-bikes, mopeds, motorcycles and passenger cars.

This document does not apply to:

- PeTs that are considered as toys;
- PeTs that are intended for competition;
- PeTs that are intended for medical care;
- PeTs that have a rated voltage of more than 100 V DC or 240 V AC;
- PeTs without an on-board driving operator.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-14:2023, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60335-2-29, *Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers*

IEC 60335-2-114:2022, *Household and similar electrical appliances – Safety – Part 2-114: Particular requirements for personal e-Transporters*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

ISO 2248, *Packaging – Complete, filled transport packages – Vertical impact test by dropping*

ISO 6742-1, *Cycles – Lighting and retro-reflective devices – Part 1: Lighting and light signalling devices*

ISO 6742-2, *Cycles – Lighting and retro-reflective devices – Part 2: Retro-reflective devices*

ISO 12100:2010, *Safety of machinery – General principles for design – Risk assessment and risk reduction*

ISO 13849-1, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

ISO 14878:2015, *Cycles – Audible warning devices – Technical specification and test methods*

EN 17128:2020, *Light motorized vehicles for the transportation of persons and goods and related facilities and not subject to type-approval for on-road use – Personal light electric vehicles (PLEV) – Requirements and test methods*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

audible warning device

AWD

device designed for the purpose to warn people by an audible signal

Note 1 to entry: Including all types of technologies (i.e. bells, horns, electronic audible warning device).

[SOURCE: ISO 14878:2015, 3.3]

3.2

battery pack

energy storage device that includes cells or cell assemblies normally connected with cell electronics, power supply circuits and overcurrent shut-off device, including electrical interconnections, interfaces for external systems

Note 1 to entry: See A.2 of ISO 12405-4:2018 for further explanations.

Note 2 to entry: Examples of external systems are cooling, voltage class B, auxiliary voltage class A and communication.

[SOURCE: ISO 12405-4:2018, 3.2]

3.3

battery system

energy storage device that includes cells or cell assemblies or battery pack(s) as well as electrical circuits and electronics

Note 1 to entry: See A.3.2 and A.3.3 of ISO 12405-4:2018 for further explanations. Battery system components can also be distributed in different devices within the vehicle.

Note 2 to entry: Examples of electronics are the BCU and contactors.

[SOURCE: ISO 12405-4:2018, 3.3]

3.4

brake

part of the braking system where the forces opposing the movement of the e-Transporter are developed

[SOURCE: IEC 63281-1:2023, 3.16]

3.5

braking system

combination of parts consisting of the control, transmission, and brake, whose function it is to progressively reduce the speed of a moving e-Transporter, bringing it to a halt

Note 1 to entry: The braking system can have the function to keep the e-transporter stationary when halted.

Note 2 to entry: The electric motor can be a part of the system.

[SOURCE: IEC 63281-1:2023, 3.17]

3.6

charging of a battery

operation during which a secondary cell or battery is supplied with electric energy from an external circuit which results in chemical changes within the cell and thus the storage of energy as chemical energy

[SOURCE: IEC 60050-482:2004, 482-05-27]

3.7

deck

platform supporting the mass of the user standing during use

[SOURCE: EN 17128:2020, 3.40]

3.8

enclosure

housing affording the type and degree of protection suitable for the intended application

[SOURCE: IEC 60050-195:2021, 195-02-35]

3.9

electrically power assisted cycle

EPAC

cycle, equipped with pedals and an auxiliary electric motor, which cannot be propelled exclusively by means of this auxiliary electric motor, except in the walk assistance mode

[SOURCE: ISO/TS 4210-10:2020, 3.2]

3.10

e-Transporter

electrically powered transport device for use on public roads or in public spaces which provides solutions for transporting either passengers or goods, or both

Note 1 to entry: The device can be manually controlled, have automated functions, or be autonomous.

[SOURCE: IEC 63281-1:2023, 3.2]

3.11

folding system

electrical or mechanical system enabling the e-Transporter to be folded in order to change from the configuration of use (unfolded) to the configuration of storage (folded)

[SOURCE: IEC 63281-1:2023, 3.8]

3.12

footrest

surface provided to support the feet during a seating intended use

[SOURCE: EN 17128:2020, 3.41]

3.13

intended use

use of a PeT in accordance with the information for use provided in the instructions

[SOURCE: ISO 12100:2010, 3.23, modified – For the purposes of a PeT, original "machine" has been deleted and "PeT" has been added.]

3.14

leakage

escape of liquid or gas except for venting

[SOURCE: ISO 6469-1:2019, 3.15]

3.15

locking device

mechanical component that maintains part(s) of the vehicle erected in the position of use or storage (e.g., latch(es), hooks, over centre lock...) which could be deactivated or activated by action(s) on the operating device

[SOURCE: EN 17128:2020, 3.13]

3.16

locking mechanism

assembly of components consisting of one or more locking device(s) and one or more operating device(s)

[SOURCE: EN 17128:2020, 3.12]

3.17

operating device

part of the locking mechanism(s) designed to be activated by the user through one or several intentional action(s)

[SOURCE: EN 17128:2020, 3.14, modified – "positive" has been deleted and "intentional" has been added.]

3.18**passenger car**

vehicle designed and constructed primarily for the carriage of persons and their luggage, their goods, or both, having not more than a seating capacity of eight, in addition to the driver, and without space for standing passengers

[SOURCE: ISO 26262-1:2018, 3.107]

3.19**personal e-Transporter****PeT**

e-Transporter that is primarily designed for transporting person(s)

Note 1 to entry: Household appliances are excluded.

[SOURCE: IEC 63281-1:2023, 3.3, modified – Note 1 to entry has been added.]

3.20**public space**

place that is accessible to the public whether it is in the public domain or privately owned

Note 1 to entry: Examples are roads, cycle tracks, sidewalks, public squares, parks, stations, airports, hotels, hospitals, restaurants, etc.

[SOURCE: IEC 63281-1:2023, 3.1]

3.21**self-balancing personal e-Transporter**

inherently unstable personal e-Transporter that dynamically stabilizes itself in at least one direction (pitch) using a control system

[SOURCE: IEC 63281-1:2023, 3.6, modified – The word "personal" has been added to the term and to the definition.]

3.22**warning indicators and signals**

visual or audible device to

- a) inform users of the safety status of the e-Transporter
- b) alert third parties to the presence of the e-Transporter

Note 1 to entry: Examples of a visual or audible device to inform users of the safety status of the e-Transporter include lights or beeping sounds to indicate a function is working correctly, or lights or beeping sounds which operate to indicate a malfunction or condition which may become serious or which is immediately serious.

Note 2 to entry: Examples of a visual or audible device to alert third parties to the presence of the e-Transporter include, lights or reflectors which make the e-Transporter more easily visible, or an audible device to alert third parties to the presence of the e-Transporter.

[SOURCE: IEC 63281-1:2023, 3.15]

4 Risk assessment

If examination of the PeT shows that hazards not fully addressed in Clause 6 to Clause 10 in this document can arise, then a risk assessment is required. It shall be carried out and documented to achieve at least a tolerable risk by an iterative process described in the Clause 4 of ISO 12100:2010.

For the risk assessment of PeTs all requirements of ISO 12100 applying for various use cases (e.g., such as private owned use, public sharing use) shall apply. Clause 4 of ISO 12100:2010 provides requirements and guidance in performing risk assessment, including risk analysis based on hazard identification. In performing the risk assessment, the decision as to whether a risk is acceptable or not depends on the application and the intended use of the PeT.

Where appropriate, use restrictions for the PeT may be used as a means of risk reduction in the risk assessment for specific hazards.

NOTE Annex A contains a list of significant hazards that can be present as regards a PeT.

5 Test conditions

5.1 General

Unless otherwise stated in this document, all tests are conducted under the conditions stated in 5.2 to 5.5.

5.2 Test road

The test is carried out on cement or asphalt roads the surface of which shall be smooth, dry and obstacle-free with a good adhesion coefficient; the inspection road section shall be as level as possible, and any gradient greater than 0,5 % shall be documented.

The test area shall be arranged on the test road, and the width of test channel in the test area shall not be less than 1 m. The two ends of this test area shall have a traveling supporting area that is long enough and an auxiliary area for ensuring safe stopping and shall be able to support travel in both directions.

In the event that the test road is not available, a test bench or a stand that keeps the motor-driven wheel free of the ground can be used to conduct relevant tests.

5.3 Test driver

The driver shall be proficient in driving and familiar with test methods.

The driver shall be equipped with necessary protective equipment such as a helmet, knee pads and elbow pads.

The driver shall use the PeT according to the instructions specified by the manufacturer and shall keep the driving posture without significant change throughout the whole test process and avoid any operation prohibited by the manufacturer.

If the rated load of the PeT is greater than or equal to 75 kg, the total mass of the driver and equipment (e.g., helmet) shall not be less than 75 kg, otherwise, a counterweight shall be used; if the rated load of the PeT is less than 75 kg, the total mass of the driver and equipment shall be the rated load.

5.4 Test environment

The temperature shall be within the working temperature range of the PeTs; unless otherwise specified in this document, the ambient temperature specified in this document is $(25 \pm 5) ^\circ\text{C}$.

Indoor tests should be conducted at a relative humidity of 75 % or lower, while the relative humidity may exceed 75 % for outdoor tests and in that case, shall be recorded in the test report. Outdoor tests shall not be conducted during rain or snow.

Atmospheric pressure: (86 to 106) kPa.

During the test, the average wind speed shall not be greater than 3 m/s, and the instantaneous wind speed not greater than 5 m/s.

5.5 PeT under test

The PeT under test shall be in the state of normal driving condition and the battery system shall be fully charged according to the manufacturer's instructions.

The influence of test instruments installed on the PeT shall be minimized.

6 General safety requirements

6.1 Materials

6.1.1 Non-metallic materials

Non-metallic materials used in non-metallic body parts of PeTs not related to electrical circuitry shall be classified at least V-2, in accordance with IEC 60695-11-10.

Compliance is checked by inspection in accordance with IEC 60695-11-10.

This requirement is not applicable to decorative parts or to other parts that cannot be ignited or that are unlikely to spread flames generated in the equipment.

6.1.2 Metal materials

The metal enclosure of PeTs shall be corrosion-resistant, and the corrosion resistance may be achieved by appropriate electroplating or coating treatment.

Compliance is checked by verifying that after the tests of 10.2, the metal enclosure shall show no sign of corrosion.

6.2 Enclosure

The enclosure of the PeT shall be designed to be opened only by tools such as pliers, screwdrivers, etc.

Compliance is checked by inspection.

6.3 Shape and appearance of PeT

6.3.1 Sharp corners and edges

To avoid sharp corners and edges that could create a potential safety hazard to persons or equipment, during the design and manufacturing of components and parts, ensure the radius or chamfer of accessible components and parts is at least 0,3 mm (radius or chamfer of more than 0,5 mm is preferred).

Compliance is checked by inspection, or measurement in case of doubt.

6.3.2 Protrusions

Tubes and rigid components in the form of projections which constitute a puncture hazard to the user and third parties shall be protected. These requirements are intended to address the hazards associated with the users and third parties falling on projections or rigid components (e.g., handlebars and levers) on PeTs possibly causing internal injury or skin puncture.

NOTE As an example, screw threads which constitute a puncture/cut hazard are required to be limited to a protrusion length of one major diameter of the screw beyond the internally threaded mating part.

Compliance is checked by inspection.

6.3.3 Accessible clearances for movable segments

To prevent crushing of fingers, the distance separating accessible moving parts from other moving parts or from fixed parts of the PeT shall either be less than 5 mm, or greater than 18 mm in any position.

This requirement does not apply to the wheel with its support systems, the clearance between the wheel and its guard, and the braking system.

Compliance is checked by inspection, or measurement in case of doubt.

6.4 Warning indicators and signals

6.4.1 General

PeTs shall have appropriate warning indicators and signals to:

- a) inform users of the safety status of the PeT, and
- b) notify and/or alert third parties to the presence of the PeT.

Depending on the function of the intended purpose, visual, audible, and tactile (or vibrating) measures shall be used independently or combined, in accordance with 6.4.2 and 6.4.3, to realize the intended purpose.

6.4.2 Warning indicators and signals for users

PeTs shall have appropriate warning indicators and signals that use visual, audible, or tactile (or vibrating) measures solely or combined, to inform users of the safety status of the PeT.

NOTE Examples of the status information of the PeT (such as power on/off) and informing of malfunction and/or notification of a failure sign (including battery power loss).

If there are any warning indicators and signals to indicate whether a function is working correctly or in the event of a malfunction, they shall be clearly distinguishable for the different status (e.g., minor error, battery power loss signal).

If there are any visual warning indicators and signals, they shall be placed in a conspicuous position on the PeT that can be easily observed by the user during normal operation.

Compliance is checked by inspection.

6.4.3 Warning indicators and signals for third parties

6.4.3.1 Lightings and reflectors

PeTs that can move faster than 6 km/h shall be fitted and configured with active front and rear lights according to ISO 6742-1, and the controls for lighting shall be marked in accordance with the symbol in Figure B.2 that is shown in Annex B of this document.

PeTs on public roads shall be fitted and configured with front, side and rear retroreflectors, reflective materials, ambient lights, or flashing lights. If retroreflectors are used, they shall meet the requirements of ISO 6742-2.

NOTE An example of reflective materials is reflective tape.

Compliance is checked by inspection, and in accordance with ISO 6742-1, and with ISO 6742-2, and Annex B of this document.

6.4.3.2 Audible warning devices

PeTs that can move faster than 6 km/h shall be able to notify their presence to third parties by being equipped with the audible warning device, which can produce a sound pressure level from 75 dB to 85 dB in accordance with ISO 14878 Class II.

The audible warning device shall only be activated by the user. The user can either directly operate the audible warning device or indirectly control it via a remote-control. If the remote-control is the only method to control the audible warning devices, the PeT shall only be able to drive if the remote-control is connected either physically and/or via wireless.

The control for the audible warning device shall be marked with the symbol in Figure B.3 that is shown in Annex B of this document.

Compliance is checked by inspection and in accordance with ISO 14878 and Annex B of this document.

6.5 Charging lock

Protective measures shall be provided to prevent the PeT from driving during the charging of a battery.

NOTE An example of the protective measures is cutting off the driving power of the wheels while charging.

Compliance is checked by the following test.

Check the PeT to ensure that it can be turned on and driven normally. Turn off the PeT and charge it following the manufacturer's instructions. During the charging of a battery, turn on the PeT three times; if it cannot be turned on, the test ends; if it can be turned on, check whether it can be driven.

6.6 Functional components

6.6.1 Footrest or deck

The footrest or deck of the PeT shall comply with 15.1 of EN 17128:2020.

6.6.2 Electrical power on/off control

A control for turning the driving power on and off shall be installed. This control shall be easily noticeable, within convenient reach of the user, and clearly distinguishable. The user shall be able to activate this control voluntarily to initiate the driving power. When the user enables the driving power, the system shall prevent any error case and unintentional drive power output from the PeT.

The positioning of the electrical power on/off control shall allow the user to easily reach it, accompanied by the proper symbol given in Figure B.1.

If the PeT is only equipped with the electric brake, the PeT shall not be able to be powered off while driving.

NOTE The electrical power on/off system can be achieved mechanically such as using physical keys and locks, or electronically such as keyless start/stop using wireless technologies.

Compliance is checked by inspection, or measurement in case of doubt based on the design documentation.

6.6.3 Folding system

6.6.3.1 General

This requirement only applies to PeTs equipped with a folding system.

The folding system's design shall facilitate the locking of the PeT in a manner that is both simple and secure for use, ensuring stability and safety. The folding process shall not result in any damage to the cables.

PeTs designed for foldable storage or transportation shall incorporate one or more locking mechanism(s). These locking mechanism(s) shall adhere to the stipulations outlined in 6.6.3.3 of this document. The locking device's functionality shall remain unimpaired following testing in accordance with 7.2 of this document.

The locking mechanism shall not touch the wheels or tyres while being ridden, and the locking mechanism shall not be loosened or unlocked by unintentional contact of the user or a safety-related obstacle (e.g., contact with an extended body part of a pedestrian around the PeT) during riding.

6.6.3.2 Incomplete deployment

This requirement applies only to the PeT equipped with a folding system.

To avoid hazards due to incomplete deployment of the folding system, the PeT shall not be able to be driven if the folding system has not been properly locked.

Compliance is checked by inspection.

If it is necessary to observe the locking mechanism of the PeT by damaging it, an additional PeT sample shall be utilized for the remaining tests specified in this document.

6.6.3.3 Unintentional release of locking mechanism(s)

Unintentional release of locking mechanism(s) shall comply with 14.3.2 of EN 17128:2020.

6.6.3.4 Unintentional release of the locking mechanism by one single action

Unintentional release of the locking mechanism by one single action shall comply with 14.3.1.3 of EN 17128:2020.

6.6.4 Battery system requirements

This clause is reserved for future use.

6.6.5 Charger

The charger of the PeT shall meet the requirements of IEC 60335-2-29.

Compliance is checked in accordance with IEC 60335-2-29.

6.6.6 Ability to hold position

Self-balancing PeTs are excluded from the requirement of 6.6.6.

PeTs with inherently unstable design (e.g., an electric scooter with two wheels aligned in one line) shall be fitted with a stand which can support the PeT when left unattended. The stand shall be able to keep the PeT stable on a flat surface and on an inclined surface. The stand, once retracted, shall remain in the retracted position whilst driving so as not to disturb the PeT whilst in motion.

Compliance is checked by the following horizontal and inclined surface test. The test surface shall be in accordance with 5.1. The adhesion coefficient of the surface shall be 0,7 to 1,0.

Place the PeT on a horizontal test surface, fully extend the stand of the PeT and make the PeT rest upon the stand. If the PeT has a handlebar, the handlebar should be placed in such position that all wheels are aligned. The handlebar shall then be released gently.

Check if the PeT can keep stable by itself for 1 min.

Place the PeT on a 5° (8,725 %) inclined test surface as shown in Figure 1, fully extend the stand of the PeT and make the PeT rest upon the stand. If the PeT is equipped with a prop stand, the test shall be carried out as shown in a) and c) of Figure 1; if the PeT is equipped with a center stand, the test shall be carried out as shown in b) and c) of Figure 1.

Check if the PeT can keep stable by itself for 1 min for each placement method in the transverse direction and longitudinal direction, i.e., the total observing time is 4 min.

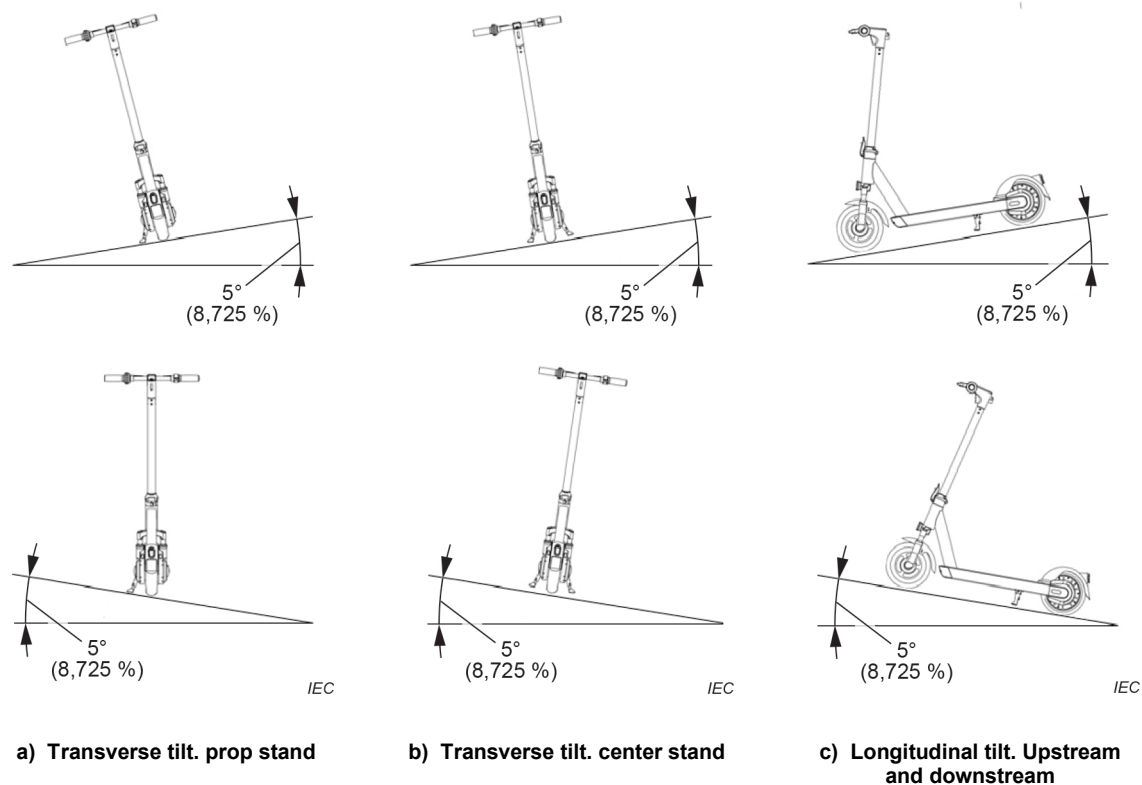


Figure 1 – Placement method for the inclined surface test

6.7 Main safety-related performance requirements

6.7.1 Maximum design speed

The manufacturer shall declare the maximum design speed of the PeT.

The maximum design speed is checked by the following test. The requirements for the test driver are in accordance with 5.3 of this document. During the test, the acceleration of the PeT shall be smooth and without shocks.

- a) If the test is performed on a test bench, put the PeT on the bench and bring it to the maximum achievable speed and maintain the speed for 60 s at least. Measure the maximum speed by measuring the speed collected from the test bench. Maximum speed is determined as the mean value of 60 s.
- b) If the test is performed on a test road, it shall be prepared as shown in Figure 2. The PeT shall accelerate in the auxiliary driving area, reach and maintain the highest achievable speed before reaching the testing area, and pass through the 5 m testing area at the highest achievable speed.

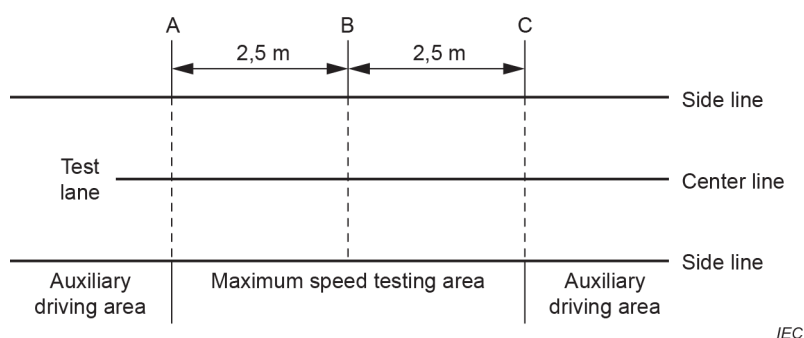


Figure 2 – Road test example

- c) The maximum speed of the PeT in one test is determined in accordance with Formula (1), Formula (2), and Formula (3). The difference between v_1 and v_2 shall be no greater than 5 % of the lower value, otherwise, the test result is disregarded, and an additional test shall be carried out.

$$v_1 = \frac{3,6L}{t_1} \quad (1)$$

$$v_2 = \frac{3,6L}{t_2} \quad (2)$$

$$v = \frac{v_1 + v_2}{2} \quad (3)$$

where

- v_1 is the calculated speed passing through the A to B area in kilometres per hour (km/h);
- v_2 is the calculated speed passing through the B to C area in kilometres per hour (km/h);
- t_1 is the recorded time passing through the A to B area in seconds (s);
- t_2 is the recorded time passing through the B to C area in seconds (s);
- L is the length 2,5 m of the A to B or B to C section of the test area, in meters (m);
- v is the maximum speed of the PeT in one test in kilometres per hour (km/h).

- d) Repeat b) and c) for 5 times in one direction and another 5 times in the opposite direction. Pick up 4 results of " v " with the highest 2 results from each direction respectively. Among the 4 results, the difference between the highest result and the lowest result shall be no greater than 10 % of the lowest result, otherwise, more tests shall be carried out until this requirement is met.
- e) The maximum speed of the PeT is determined to be the arithmetical average of the 4 results selected in d).

6.7.2 Brake performance

The PeT shall be equipped with at least two independent braking systems, each of which shall be able to bring the PeT safely to a halt. Having two or more independent braking systems using the same brake lever is considered to comply with the requirement.

The requirements for the test driver are in accordance with 5.3 of this document. If the brake is actuated by hand, the braking actuation force shall be less than or equal to 200 N when measured at 25 mm from the end of the hand lever; if the brake is actuated by foot, the vertical braking actuation force on the brake pedal shall be less than or equal to 700 N.

Compliance is checked by inspection and measurement.

For PeTs that can move faster than 6 km/h, the mean fully developed deceleration (MFDD) shall be at least 1,7 m/s².

Compliance is checked by the following test and MFDD is calculated by Formula (4).

$$MFDD = \frac{v_b^2 - v_e^2}{25,92 \cdot (S_e - S_b)} \quad (4)$$

where

MFDD is the mean fully developed deceleration, in (m/s²);

v_b is the vehicle speed at 0,8 v_1 , in (km/h);

v_e is the vehicle speed at 0,1 v_1 , in (km/h);

v_1 is the vehicle speed when user actuates the control, in (km/h);

S_b is the distance travelled between v_1 and v_b , in (m);

S_e is the distance travelled between v_1 and v_e , in (m).

a) Preparation

- 1) The PeT shall be in normal driving condition as instructed by the manufacturer. Each brake system is tested one time to make sure that it is in good working condition. The PeT is placed in the middle of the test road.
- 2) The load, including the driver, is adjusted to the rated load according to the manufacturer. The driver shall be in a position as for normal riding and shall maintain the same position throughout the test.

b) Brake performance test.

- 1) The driver brings the PeT to the maximum achievable speed and actuates all brake systems.
- 2) Record all necessary parameters and calculate the MFDD.
- 3) Repeat b)1) and b)2) 5 times, calculate the arithmetic average of MFDD.