
**Battery-electric mopeds and
motorcycles — Performance —**

**Part 2:
Road operating characteristics**

Cyclomoteurs et motocycles électriques — Performance —

Partie 2: Caractéristiques d'utilisation sur route

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13064-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 23, *Mopeds*.

ISO 13064 consists of the following parts, under the general title *Battery-electric mopeds and motorcycles — Performance*:

— Part 1: Reference consumption and range

— Part 2: Road operating characteristics

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Battery-electric mopeds and motorcycles — Performance —

Part 2: Road operating characteristics

1 Scope

This International Standard specifies the procedures for measuring the road performance of electric motorcycles and mopeds with only a traction battery(ies) as power source for vehicle propulsion.

The road performance comprises road operating characteristics such as speed, acceleration and hill climbing ability.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 11486, *Motorcycles — Methods for setting running resistance on a chassis dynamometer*

ISO 28981, *Mopeds — Methods for setting the running resistance on a chassis dynamometer*

ISO 13064-1:2012, *Battery-electric mopeds and motorcycles — Performance — Part 1: Reference energy consumption and range*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13064-1 and the following apply.

3.1

complete battery-electric moped (motorcycle) kerb mass

total unladen mass of the battery-electric moped (motorcycle), including traction batteries, cooling liquid, window-washer fluid, lubricating oil, tool kit, spare wheel (if mandatory) and on-board charger and portable charger or part of it, if provided as standard equipment by the manufacturer

3.2

maximum design total mass

maximum vehicle mass as specified by the battery-electric moped (motorcycle) manufacturer

3.3

test mass of a battery-electric vehicle

complete battery-electric vehicle kerb mass increased by a uniform figure of 75 kg, which represents the mass of a rider

3.4

tyre rolling radius

effective radius of a tyre when it is deformed by the mass of the vehicle loaded to its test mass

3.5 range at 80 % maximum speed

Total distance the vehicle can cover when running at 80 % maximum speed

NOTE For the relevant test procedure, see 9.1.

3.6 maximum speed

highest average speed which the vehicle can maintain twice over a distance of 200 m

NOTE For the relevant test procedure, see 9.3.

3.7 acceleration ability

shortest time required to accelerate the vehicle from standstill over a given distance

NOTE For the relevant test procedure, see 9.5.

3.8 hill starting ability

maximum slope on which the vehicle can start moving over a minimum distance of 10 m

NOTE For the relevant test procedure, see 9.6.

3.9 speed uphill

highest average speed which the vehicle can maintain on a given slope over a distance of 200 m

NOTE For the relevant test procedure, see 9.7.

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4 Principle

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All road operating characteristics (3.5 to 3.9) shall be tested in the test sequence according to Clause 8 with the charged states of the battery for each test resulting from the previous procedure.

However, if any test is conducted individually, start the test procedure for range and maximum speed (9.1 and 9.3) with a battery state between 100 % and 90 % of fully charged.

For acceleration (9.5), hill starting ability (9.6) and speed uphill (9.7), the test procedure shall be started with a battery state between 65 % and 50 % of fully charged.

5 Parameters, units and accuracy of measurements

Table 1 specifies parameters and their units, accuracy and resolution.

Table 1 — Parameters, units and accuracy of measurements

Parameter	Unit	Accuracy	Resolution
Time	s	±0,1 s	0,1 s
Distance	m	±0,1 %	0,1 m
Temperature	°C	±1 K	1 K
Air pressure	kPa	±1 kPa	1 kPa
Speed, constant	km/h	±1 % or ±0,1 km/h ^a	0,2 km/h
Mass	kg	±0,5 %	1 kg

^a Whichever is the greater.

6 Test conditions

6.1 Vehicle conditions

The vehicle shall be loaded according to the specification for each test.

The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer when the tyres are at ambient temperature.

The viscosity of oils for the mechanical moving parts shall conform to the specification of the vehicle manufacturer.

The lighting, signalling and auxiliary devices shall be off, except those required for testing and usual day-time operation of the vehicle.

All energy storage systems available for other than traction purposes (electric, hydraulic, pneumatic, etc.) shall be charged up to their maximum level specified by the vehicle manufacturer.

The vehicle shall be clean, and the windows and air entries, not needed for the correct operation of the vehicle and the drive system, shall be closed by the normal operating controls.

If batteries are to be operated at temperatures above ambient temperature, the driver shall follow the procedure recommended by the vehicle manufacturer to keep the battery temperature within its operating range.

The vehicle shall be run properly in accordance with the manufacturer's requirements, and in any case not less than 100 km before the test with those batteries that are installed in the test vehicle.

The mass of the vehicle used in the test shall be the test mass of an electric vehicle in accordance with 3.1 and 3.3.

The traction battery shall be in the state of charge required for the test to be performed.

6.2 Atmospheric conditions

Outdoor test steps shall be performed at an ambient temperature between 5 °C and 35 °C. Indoor test steps shall be performed at a room temperature between 20 °C and 30°C. The atmospheric pressure shall be between 91 kPa and 104 kPa. The relative humidity shall be less than 95 %. The tests shall be performed in the absence of rain and fog.

The wind speed and the direction of the wind shall be measured continuously or with adequate frequency at a location where the wind force during the measurement is representative. The wind conditions shall be within the following limits:

- a) average wind speed: 3 m/s;
- b) maximum wind speed for gusts: 5 m/s.

6.3 Track conditions

6.3.1 General conditions

The measurements shall be taken on a track, which may be either a straight track (see 6.3.2) or a loop track (see 6.3.3). The surface of the track shall be flat, level, and smoothly paved. The road surface shall be dry and free of obstacles or wind barriers that might impede the measurements.

6.3.2 Straight track

The test track shall be long enough to allow the vehicle to attain its maximum speed.

The test track shall have not more than 0,5 % longitudinal slope and not more than 3 % transverse slope.

The length of the launching track shall be long enough to achieve a stable speed ahead of the measuring zone.

In order to reduce the influence of factors such as road slope and wind direction/speed, the acceleration and the speed tests shall be executed in both directions of the test track in direct sequence, taking care to use the same stretch of the track.

When conditions preclude performing the test in both directions, a single direction test shall be carried out as in 6.3.4.

6.3.3 Loop track

The test track shall have not more than 0,5 % longitudinal slope and not more than 3 % transverse slope.

The loop track may vary from a perfect circle to straight sections linked by approximately circular sections.

The measuring zone shall be located on the straight part of loop track. The straight track length before the measuring zone shall be long enough to allow the vehicle to reach the maximum speed before the measuring zone.

In case of circular tracks, the radius of test track shall be large enough to allow the vehicle to attain the maximum speed.

The effects of centrifugal forces may be compensated by the transverse profile of the curves in such a way that the vehicle holds a normal line without any action on the handlebar and without extra weight shift effort by the rider.

When conditions preclude performing the test in both directions, a single direction test shall be carried out as in 6.3.4.

6.3.4 Single direction test

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Testing in one direction only shall be permitted if, because of the characteristics of the test track layout, it is not possible for the vehicle to reach its maximum speed in both directions.

The following conditions shall be fulfilled:

- a) the track shall conform to the requirements of 6.3.1 or 6.3.2;
- b) the variation in altitude shall not exceed 1 m between any two points;
- c) the run shall be repeated twice in immediate succession;
- d) the average wind speed components parallel to the track shall not exceed 2 m/s.

6.4 Rider and riding position

6.4.1 The rider shall wear a close-fitting suit (one-piece) or similar clothing, a protective helmet, eye protection, boots and gloves.

6.4.2 The rider in the conditions given in 6.4.1 shall have a mass of 75 kg ± 2 kg, including the weight of any additional testing equipment. It is recommended the rider to be 1,75 m ± 0,02 m tall.

6.4.3 The rider shall take the normal and safe riding position which is appropriate for attaining the maximum speed of the moped (motorcycle) to be tested. The position shall allow the rider at all the times to have proper control of the moped (motorcycle) during the test. The position of the rider should remain as stable as possible in order to avoid any influences on the test results.

6.5 Driving selection mode

In case of two or more manually selectable driving modes, tests shall be conducted for each single mode, and at least the worst case shall be mentioned in the test report. If the manufacturer can provide evidence that proves what is the worst case mode, it is allowed to only test such mode.

7 Preconditioning of the vehicle

7.1 Battery charge

7.1.1 General

The battery shall be charged according to charging method recommended by the vehicle manufacturer. In case this is not available, or upon the request by the vehicle manufacturer, the battery shall be charged according to the following procedure. Upon the request by the vehicle manufacturer, the preconditioning may also include a complete battery discharge, according to 9.2, to be performed before the normal overnight charging procedure (7.1.2).

7.1.2 Normal overnight charging procedure

The charging of the battery shall be carried out at an ambient temperature between 20 °C and 30 °C using the on-board charger, if fitted, or an external charger as recommended by the vehicle manufacturer.

The electrical connection with the public network shall be made with a plug as recommended by the vehicle manufacturer (e.g. plug used for domestic appliances, dedicated plug).

The procedure excludes all types of special charging, for example battery refreshing or service charging.

The vehicle manufacturer shall be in the position to attest that during the test no special charging has been performed.

7.1.3 End-of-charge criteria

The end of charge criteria correspond to the indication that the battery is fully charged given by the standard instrumentation recommended by the vehicle manufacturer. The charging time shall not exceed 12 h.

7.1.4 Fully charged battery

A battery is fully charged when charged according to the overnight charging procedure and the end of charge criteria.

7.2 Warm-up

The vehicle shall be driven according to the manufacturer's specifications in order to warm up the motor and transmission gears.

8 Test sequence

The test sequence is arranged such that all road performances can be performed within two days. It shall be performed according to the following sequences.

a) First part:

preconditioning (see Clause 7);

test: range at 80 % of the maximum design speed (see 9.1);