BS ISO 13064-1:2012

BSI Standards Publication

Battery-electric mopeds and motorcycles — Performance

Part 1: Reference energy consumption and range

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National foreword

This British Standard is the UK implementation of ISO 13064-1:2012.

The UK participation in its preparation was entrusted to Technical Committee AUE/14, Motor cycles and mopeds.

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

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Battery-electric mopeds and motorcycles — Performance —

Part 1: Reference energy consumption and range

Cyclomoteurs et motocycles électriques — Performance —

Partie 1: Consommation énergétique de référence et autonomie

Reference number
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Foreword

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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 13064-1 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*

INTERNATIONAL STANDARD **ISO 13064-1:2012(E)**

Battery-electric mopeds and motorcycles — Performance —

Part 1: Reference energy consumption and range

1 Scope

This part of ISO 13064 specifies test procedures for measuring the reference energy consumption and reference range of electric motorcycles and mopeds with only a traction battery(ies) as power source for vehicle propulsion.

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 6460-2:2007, *Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption — Part 2: Test cycles and specific test conditions*

ISO 6855-2, *Mopeds — Measurement method for gaseous exhaust emissions and fuel consumption — Part 2: Test cycles and specific test conditions*

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 13064-2:2012, *Battery-electric mopeds and motorcycles — Performance — Part 2: Road operating characteristics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13064-2 and the following apply.

3.1
reference energy consumption
quantity of electric energy from the mains needed to charge the traction battery, divided by the distance covered after the vehicle has been driven through the specified test sequence

NOTE 1 Taken from ISO 8713:2012, definition 2.62.

NOTE 2 The reference energy consumption is usually expressed in watt-hours per kilometre (Wh/km)

3.2
reference range
distance covered by an electrically propelled vehicle over a designated test sequence on a fully charged traction battery, to the end of the test sequence as defined by the end of test sequence criteria

NOTE 1 Taken from ISO 8713:2012, definition 2.63.

NOTE 2 The reference range is usually expressed in kilometres (km).

4 Test sequence

The test sequence for mopeds is defined in Annex A of this part of ISO 13064.

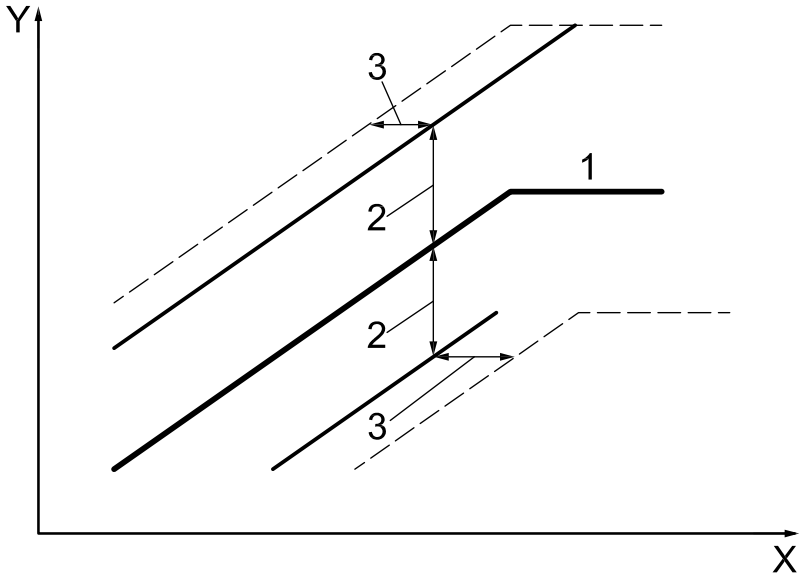
The test sequence for motorcycles is defined in Annex B of this part of ISO 13064.

The same test sequence shall be used to define energy consumption and range. Every effort shall be made to conduct the tests by following the reference curve within the tolerances given in Clause 5.

The constant speed test sequence for mopeds and motorcycles are defined in Annex C of this part of ISO 13064.

5 Tolerances

Tolerances on speed and time in the test sequence shall be as shown in Figure 1.



Key

X time, s
Y speed, km/h
1 reference curve
2 tolerance of speed, in kilometres per hour (km/h)
3 tolerance of time, in seconds (s)

Figure 1 — Reference curve and tolerances

A tolerance on speed of ± 2 km/h and a tolerance on time of ± 1 s shall be geometrically combined at each point as in Figure 1.

One deviation of up to 4 s beyond these tolerances is permitted in any drive cycle. This exception shall not be allowed to delay the determination of the end of the test sequence.

The total time-out of tolerances shall be mentioned in the test report.

6 End of test sequence criterion

The criterion for the end of the test sequence shall be as specified in Annexes A, B or C or shall be an indication from the on-board instrumentation, given to the driver, to stop the vehicle.

7 Measurement of range and reference consumption

7.1 General

The following test method permits measurement of the range in kilometres and the electric energy consumption at the stationary external power source in watt-hours per kilometre.

7.2 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 %	1 m
Temperature	°C	±1 K	1 K
Speed	km/h	±1 %	0,2 km/h
Mass	kg	±0,5 %	1 kg
Energy	Wh	class 0,2 S[a]	class 0,2 S[a]
[a] According to IEC 60687.			

7.3 Test conditions

7.3.1 Vehicle conditions

The vehicle shall be loaded according to specification of the test.

The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer according to the test chosen (track or chassis dynamometer) when the tyres are at ambient temperature.

The viscosity of oils used for the lubrication of mechanical moving parts shall conform to the specifications of the vehicle manufacturer.

The lighting and light 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 in the operating range specified by the vehicle manufacturer.

For the traction battery conditioning, the test driver shall follow the procedure recommended by the vehicle manufacturer for keeping the temperature of the battery in the normal operating range. The vehicle shall be run in 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 in accordance with ISO 13064-2:2012, 3.1 and 3.2.

It is recommended to only use batteries that didn't go through more than 50 charge/discharge cycles.

7.3.2 Atmospheric conditions

Outdoor test steps shall be carried out at an ambient temperature between 5 °C and 35 °C.

Indoor test steps shall be carried out at 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.

For outdoor testing, the wind shall be steady. 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.

7.3.3 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.

7.4 Test procedure

7.4.1 General

The test procedure consists of the following four steps:

a) initial charging of the traction battery (see 7.4.2);

b) application of the appropriate test sequence, and measurement of the reference range and consumption at the stationary external power source (see 7.4.3);

c) charging of the traction battery and measurement of the energy consumption at the mains (see 7.4.4);

d) calculation of the reference energy consumption (see 7.4.5).

Between each step, if the vehicle moves, it shall be pushed to the next test area (without regenerative recharging).

7.4.2 Battery charge

7.4.2.1 General

The battery shall be charged according to the 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 battery charge procedure may also include a complete battery discharge, according to ISO 13064-2:2012, 9.2, to be performed before the normal overnight charging procedure.

7.4.2.2 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 stationary external power source shall be made with a plug as used for domestic appliances and as recommended by the vehicle manufacturer.

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.

7.4.2.3 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.

7.4.3 Applications of the designated test sequence and distance measuring

The time t_0 at which charging of traction battery is terminated shall be recorded. Starting within 4 h of t_0, the test sequence designated shall be applied. If the test is applied on a chassis dynamometer, the determination of vehicle road load and the reproduction on the chassis dynamometer shall be applied in accordance with ISO 11486 for motorcycles and ISO 28981 for mopeds.

The test sequence shall continue until the end of test sequence criterion is reached (see Clause 6), at which point the vehicle shall be braked until stopped.

Unless otherwise specified in Annex A, Annex B or Annex C, up to three interruptions of no longer than 15 min in total are permitted between test sequences, out of respect for human needs.

At the end of the test sequence only, the covered distance, d, in kilometres is taken as the range of the vehicle tested. The value measured shall be rounded to the nearest whole number. It shall be given together with the driving time in hours and minutes.

The average and maximum speeds reached during the test cycle, and the driving time (in hours and minutes), shall be reported.

7.4.4 Charging the traction battery and measuring energy

The vehicle shall be physically reconnected to the stationary external power source within 2 h following completion of the appropriate test sequence. The vehicle traction battery shall then be fully charged in accordance with the normal overnight charging procedure (see 7.1.1 of ISO 13064-2:2012). The energy-measuring equipment, placed between the stationary external power source and the vehicle charger, shall be used to measure the energy, E, in watt-hours, delivered from the stationary external power source, as well as the charging duration. The vehicle shall be physically disconnected from the stationary external power source after 24 h from the plug-in time.

In the case of a stationary external power source power interruption, the 24 h period shall be lengthened according to the duration of the interruption. The validity of the charge shall be agreed between the technical services of the approval laboratory and the vehicle manufacturer.

7.4.5 Calculation of reference energy consumption

The reference energy consumption, C, shall be calculated using the formula:

$$C = \frac{E}{d} \tag{1}$$

where

C is expressed in watt-hours per kilometre and is rounded to the nearest whole number;

E is the energy, in watt-hours, measured according to 7.4.4;

d is the range, in kilometres, measured according to 7.4.3.

Annex A
(normative)

Driving cycle and end of test criterion for mopeds

A.1 General

This annex specifies the driving cycle, thus giving the test sequence to be applied with the reference curve. It is in accordance with ISO 6855-2.

A.2 Test sequence

The range shall be determined by repeating urban test cycles until the end of test criterion is met.

There shall be a 3 min soak with key off between every 4 series of basic urban cycles.

The test sequence to be applied shall consist of an urban sequence, consisting of four basic urban cycles, leading to a theoretical target test distance of 2,819 km and a duration of 7 min and 28 s.

In cases where the vehicle is fitted with a manual gear box with several gears, the test driver shall change gear in such a way as to best match the reference curve.

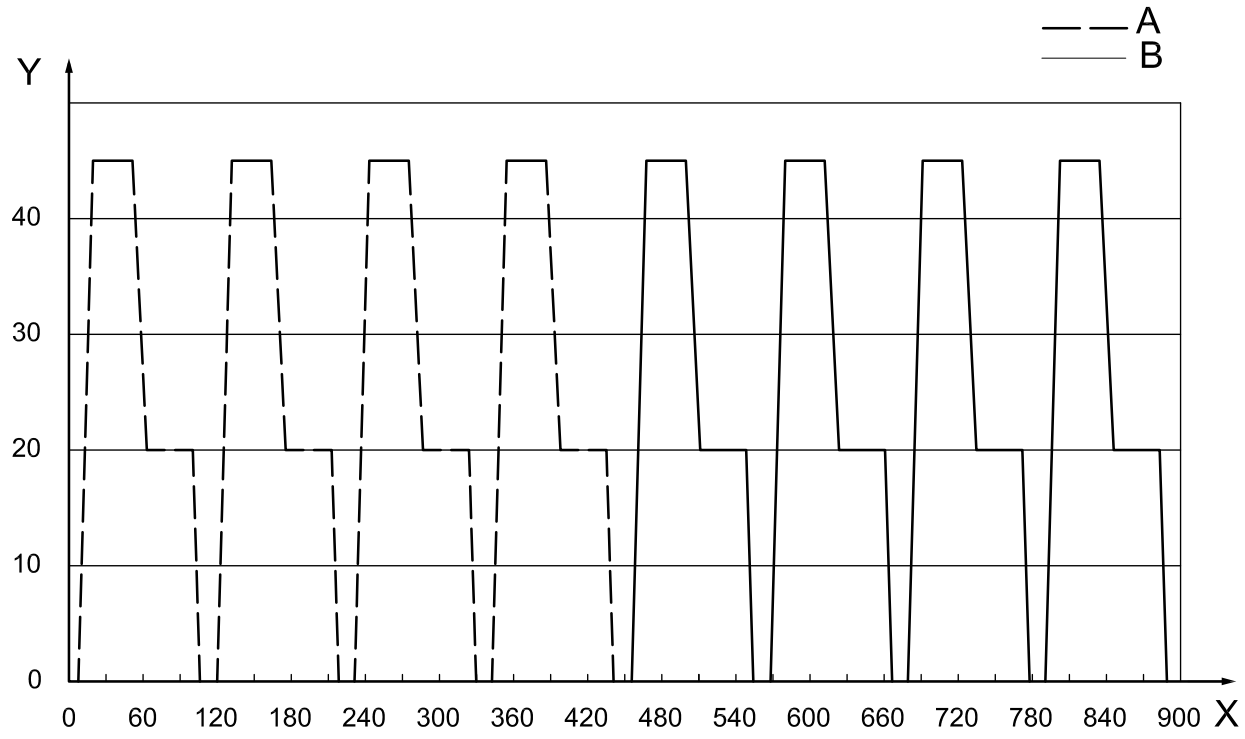
If the vehicle has several driving modes (sport, comfort, economical, etc.) that can be selected by the test driver, the one that best matches the reference curve (see Figure A.1 and Figure 1) shall be selected.

Table A.1 gives the detailed data of the basic urban cycle.

Figure A.1 shows the composition of the test sequence.

Table A.1 — Basic urban cycle

Phase	Operation	Acceleration m/s^2	Speed Km/h	Duration sec	Cumulative time sec
1	Idling	–	0	8	8
2	Acceleration	Full throttle	0 to max	57	–
3	Steady speed	Full throttle	max		–
4	Deceleration	- 0,56	max to 20		65
5	Steady speed	–	20	36	101
6	Deceleration	- 0,93	20 to 0	6	107
7	Idling	–	0	5	112
[a] Total duration of phases 2 to 4.					



Key

X time, s
Y speed, km/h
A warming up
B sampling

Figure A.1 — Test sequence composition

A.3 End of test sequence criterion

The end of test sequence criterion shall be

— an indication given from the on-board instrumentation for the driver to stop the vehicle, or

— that the vehicle is unable to meet the reference curve from the test sequence (see Clause A.2) within the tolerances given in Clause 5 up to 30 km/h

Over 30 km/h, it is acceptable to go beyond the tolerances, provided the throttle is fully open.

Annex B
(normative)

Driving cycle and end of test criterion for motorcycles

B.1 General

This annex specifies the driving cycle, thus giving the test sequence to be applied with the reference curve. It is in accordance with ISO 6460-2:2007.

B.2 Test sequence

The range shall be determined by repeating test cycles until the end of test criterion is met.

There shall be a 5 min soak with key off between cycles.

The test sequence to be applied shall consist of the sum of an urban sequence, consisting of six basic urban cycles, leading to a theoretical target test distance of 5,964 km and a duration of 19 min 30 s and an extra-urban sequence, consisting of one extra-urban cycles, leading to a theoretical target test distance of 6,941 km and a duration of 6 min and 40 s.

Battery-electric motorcycles with maximum continuous rated power not exceeding 11kW, do not drive the extra-urban cycle.

Battery-electric motorcycles with maximum design speed lower than 110 km/h shall run the extra-urban cycle with a maximum speed no higher than 90 km/h (as shown in Figure B.1).

Tables B.1 and B.2 give the detailed data of the basic urban cycle and of the extra-urban cycle.

Figure B.1 shows the composition of the test sequence.

Table B.1 — Basic urban cycle

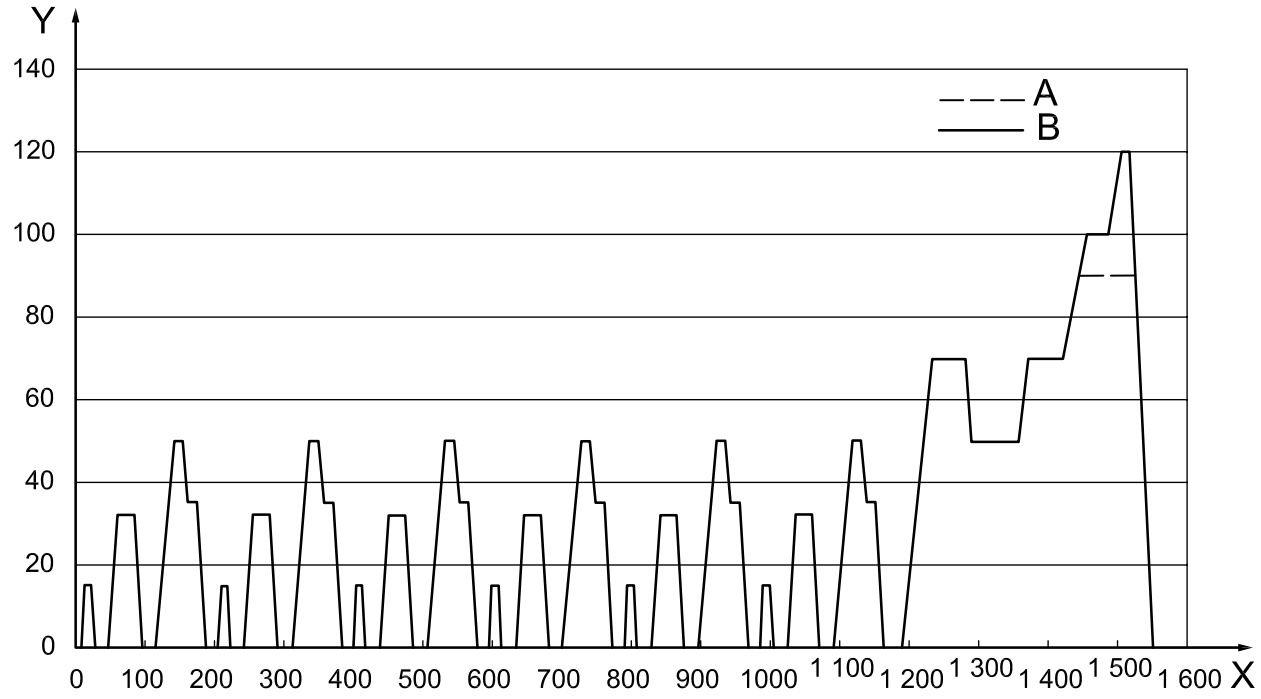
Operation No.	Operation	Phase	Acceleration m/s^2	Speed km/h	Duration of each		Cumulative time
					operation s	phase s	s
1	Idling	1	–	0	11	11	11
2	Acceleration	2	1,04	0 to 15	4	4	15
3	Constant speed	3	–	15	8	8	23
4	Deceleration	4	- 0,69	15 to 10	2	5	25
5	Deceleration, clutch disengaged		- 0,92	10 to 0	3		28
6	Idling	5	–	0	21	21	49
7	Acceleration	6	0,74	0 to 32	12	12	61
8	Constant speed	7	–	32	24	24	85
9	Deceleration	8	- 0,75	32 to 10	8	11	93
10	Deceleration, clutch disengaged		- 0,92	10 to 0	3		96
11	Idling	9	–	0	21	21	117
12	Acceleration	10	0,53	0 to 50	26	26	143

Table B.1 *(continued)*

Operation No.	Operation	Phase	Acceleration m/s^2	Speed km/h	Duration of each		Cumulative time
					operation s	phase s	s
13	Constant speed	11	–	50	12	12	155
14	Deceleration	12	- 0,52	50 to 35	8	8	163
15	Constant speed	13	–	35	13	13	176
16	Deceleration	14	- 0,68	35 to 10	9	12	185
17	Deceleration, clutch disengaged		- 0,92	10 to 0	3		188
18	Idling	15	–	0	7	7	195

Table B.2 — Extra-urban driving cycle

Operation No.	Operation	Phase	Acceleration m/s^2	Speed km/h	Duration of each		Cumulative time
					operation s	phase s	s
1	Idling	1	–	0	20	20	20
2	Acceleration	2	0,47	0 to 70	41	41	61
3	Steady speed	3	–	70	50	50	111
4	Deceleration	4	- 0,69	70 to 50	8	8	119
5	Steady speed	5	–	50	69	69	188
6	Acceleration	6	0,43	50 to 70	13	13	201
7	Steady speed	7	–	70	50	50	251
8	Acceleration	8	0,24	70 to 100	35	35	286
9	Steady speed	9	–	100	30	30	316
10	Acceleration	10	0,28	100 to 120	20	20	336
11	Steady speed	11	–	120	10	10	346
12	Deceleration	12	- 0,69	120 to 80	16	34	362
13	Deceleration		- 1,04	80 to 50	8		370
14	Deceleration, clutch disengaged		- 1,39	50 to 0	10		380
15	Idling	13	–	0	20	20	400



Key

X time, s
Y speed, km/h
A for motorcycles with a permitted maximum speed of 110 km/h.
B UDC/EUDC

Figure B.1 — Test sequence composition

B.3 End of test sequence criterion

The end of test sequence criterion shall be

— an indication given from the on-board instrumentation for the driver to stop the vehicle, or

— that the vehicle is unable to meet the reference curve from the test sequence (see Clause B.2) within the tolerances given in Clause 5 up to 70 km/h.

Over 70 km/h, it is acceptable to go beyond the tolerances, provided the throttle is fully open.

Annex C
(normative)

Constant speed test and end of test criterion

C.1 General

This annex specifies the test conditions for constant speed measurements.

C.2 Test sequence

The test sequence shall be determined by driving at constant speed until the end of test criterion is met.

A maximum of two stops, of maximum 5 min each, with key off are allowed during constant speed driving.

The actual speed during the test shall not deviate from the target test speed by more than ± 2 km/h

The average speed, the number of soak stops and the total soaking time shall be recorded in the report.

C.3 End of test sequence criterion

The end of test sequence criterion shall be

— an indication given from the on-board instrumentation for the driver to stop the vehicle, or

— that the vehicle is unable to meet the target test speed within the tolerance given in Clause C.2.

C.4 Chassis dynamometer settings

When the test is applied on a chassis dynamometer, the determination of vehicle road load and the reproduction on the chassis dynamometer shall be applied in accordance with ISO 11486 for motorcycles and ISO 28981 for mopeds.

C.5 Rider and riding position in case of actual on-road test

C.5.1 The rider shall wear a close-fitting suit (one-piece) or similar clothing, a protective helmet, eye protection, boots and gloves.

C.5.2 The rider in the conditions given in C.5.1 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.

C.5.3 The rider shall take the normal and safe riding position. 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.

C.6 Track conditions in case of actual on-road test

The measurements shall be taken on a loop track. 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. The longitudinal slope in the measuring zone shall not exceed ± 0,5 %.

Bibliography

[1] ISO 8713:2012, *Electrically propelled road vehicles — Vocabulary*

[2] IEC 60687:1992[1)], *Alternating current static watt-hour meters for active energy (classes 0,2 S and 0,5 S)*

1) Cancelled and replaced by IEC 62052-11 and IEC 62053-22.

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