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Motorcycles — Methods of measuring fuel consumption

Motorcycles — Méthodes de mesure de la consommation de carburant



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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.

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.

International Standard ISO 7860 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 22, *Motorcycles*.

This second edition cancels and replaces the first edition (ISO 7860:1983), of which it constitutes a technical revision.

Annexes A and B form an integral part of this International Standard.

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Motorcycles — Methods of measuring fuel consumption

1 Scope

This International Standard specifies the methods of determining the fuel consumption of motorcycles.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 4106:1993, *Motorcycles — Engine test code — Net power*.

ISO 6460:1981, *Road vehicles — Measurement method of gaseous pollutants emitted by motorcycles equipped with a controlled ignition engine*.

ISO 7117:1995, *Motorcycles — Measurement of maximum speed*.

ISO 11486:1993, *Two-wheeled motorcycles — Fuel consumption measurements — Chassis dynamometer setting by coastdown method*.

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 reference speed: Running speed of the motorcycle to be tested for the fuel consumption, specified

in accordance with the classification of the motorcycle maximum speed.

4 Tests

The motorcycle shall be subjected to tests of two types.

- a) Type 1 test: measurement of average fuel consumption during conventional driving cycle.

The motorcycle is placed on a chassis dynamometer equipped with a brake and an inertia simulation system. The test includes two cycles as described in 8.1, carried out without interruption, during which the fuel consumption is measured with equipment as specified in 8.3.2 and 8.3.3.

The test method is specified in clause 8.

- b) Type 2 test: measurement of fuel consumption at constant speed.

The test is carried out either on the road or on a chassis dynamometer as specified in clause 9.

5 Atmospheric and test conditions

The atmospheric conditions shall be as follows:

- relative humidity: $\leq 95\%$
- maximum wind speed: 3 m/s
- maximum wind gust speed: 8 m/s
- air temperature 278 K to 303 K

The reference test conditions shall be as follows:

- pressure, p_0 : 100 kPa
- temperature, T_0 : 293 K
- relative air density, d_0 : 0,919 7

During the test, the relative air density, d , calculated from the following equation:

$$d = d_0 \times \frac{p}{p_0} \times \frac{T_0}{T}$$

where

p is the air pressure, in kilopascals;

T is the absolute temperature, in kelvins,

shall not vary by more than 7,5 % from the air density under reference conditions.

6 Description of test motorcycle

Full details of the motorcycle shall be provided, as specified in annex A.

7 Preparation of test motorcycle

7.1 The motorcycle shall conform in all its components with the production series, or, if it is different from the production series, a full description shall be given in the test report.

7.2 The motorcycle shall be properly run in, according to the manufacturer's requirements.

7.3 The viscosity of the oils for the moving mechanical parts and the tyre pressures shall conform to the instructions given by the manufacturer of the motorcycle, or, if different, the specification shall be given in the test report.

7.4 Before the test, all parts of the motorcycle shall be stabilized at the normal temperature for the motorcycle in use.

7.5 The mass of the motorcycle shall be the kerb mass, as defined in ISO 11486:1993, definition 3.4.

7.6 The total test mass, including the masses of the rider and the instruments, shall be measured before beginning the test.

7.7 The distribution of the load between the wheels shall conform to the manufacturer's instructions.

7.8 When installing the speed sensor and/or fuel consumption measurement equipment outside the motorcycle, care shall be taken to minimize the additional aerodynamic loss.

7.9 For the test, the following reference fuels shall be used as appropriate:

reference fuel CEC¹⁾ RF-01-A-80;

reference fuel CEC¹⁾ RF-05-T-79;

reference fuel CEC¹⁾ RF-08-A-85;

reference fuel CEC¹⁾ RF-03-A-84.

The lubrication of the engine, including engines lubricated by mixture, shall comply, as to grade and quantity of oil, with the manufacturer's recommendation.

8 Measurement of average fuel consumption of motorcycle during conventional driving cycle (Type 1 test)

8.1 Operating cycle on roller bench

8.1.1 Description of cycle

The operating cycle on the roller bench shall be that indicated in table 1 and figure 1.

8.1.2 General cycle conditions

8.1.2.1 Preliminary testing cycles should be carried out, if necessary, to determine how best to actuate the throttle, gearbox, clutch and brake controls so as to achieve a cycle approximating to the theoretical cycle within the prescribed limits.

8.1.2.2 If the acceleration of the motorcycle is sufficient, the theoretical cycle described in 8.1.1 shall be carried out.

8.1.2.3 If the acceleration of the motorcycle is not sufficient to carry out the acceleration phases within the prescribed limits of tolerances, the motorcycle shall be driven with the throttle fully open until the speed prescribed for the cycle is reached; the cycle shall then be followed normally.

8.1.3 Use of gearbox

8.1.3.1 The use of the gearbox shall be determined as indicated in 8.1.3.1.1 to 8.1.3.1.3.

1) Coordinating European Council for the development of performance tests for lubricants and engine fuels.

8.1.3.1.1 At constant speed, the rotating speed of the engine shall be, if possible, within 50 % to 90 % of the speed corresponding to the maximum power of the engine. When this speed can be reached in two or more gears, the motorcycle shall be tested with the highest gear engaged.

8.1.3.1.2 During acceleration, the motorcycle shall be tested in whichever gear is appropriate to the acceleration imposed by the cycle. A higher gear shall be engaged at the latest when the rotating speed is equal to 110 % of the speed corresponding to the maximum power of the engine. If a motorcycle reaches the speed of 20 km/h in first gear, or 35 km/h in second gear, the next higher gear shall be engaged at these speeds. In these cases no further gear-shifts into higher gears shall be allowed. If, during the acceleration phase, the gear-shifts have taken place at

these fixed vehicle speeds, the following constant speed phase shall be performed in the gear which is engaged when the motorcycle enters that constant speed phase, regardless of the engine speed.

8.1.3.1.3 During deceleration, a lower gear shall be engaged either before the engine starts to idle roughly or when the engine revolutions are equal to 30 % of the speed corresponding to the maximum power of the engine, whichever of these conditions is reached first. No change down to first gear shall be effected during deceleration.

8.1.3.2 Motorcycles equipped with automatic-shift gearboxes shall be tested with the highest gear engaged. The accelerator shall be used in such a way as to obtain the steadiest possible acceleration at which the various gears can be engaged in the normal order. The tolerances given in 8.1.4.1 shall apply.

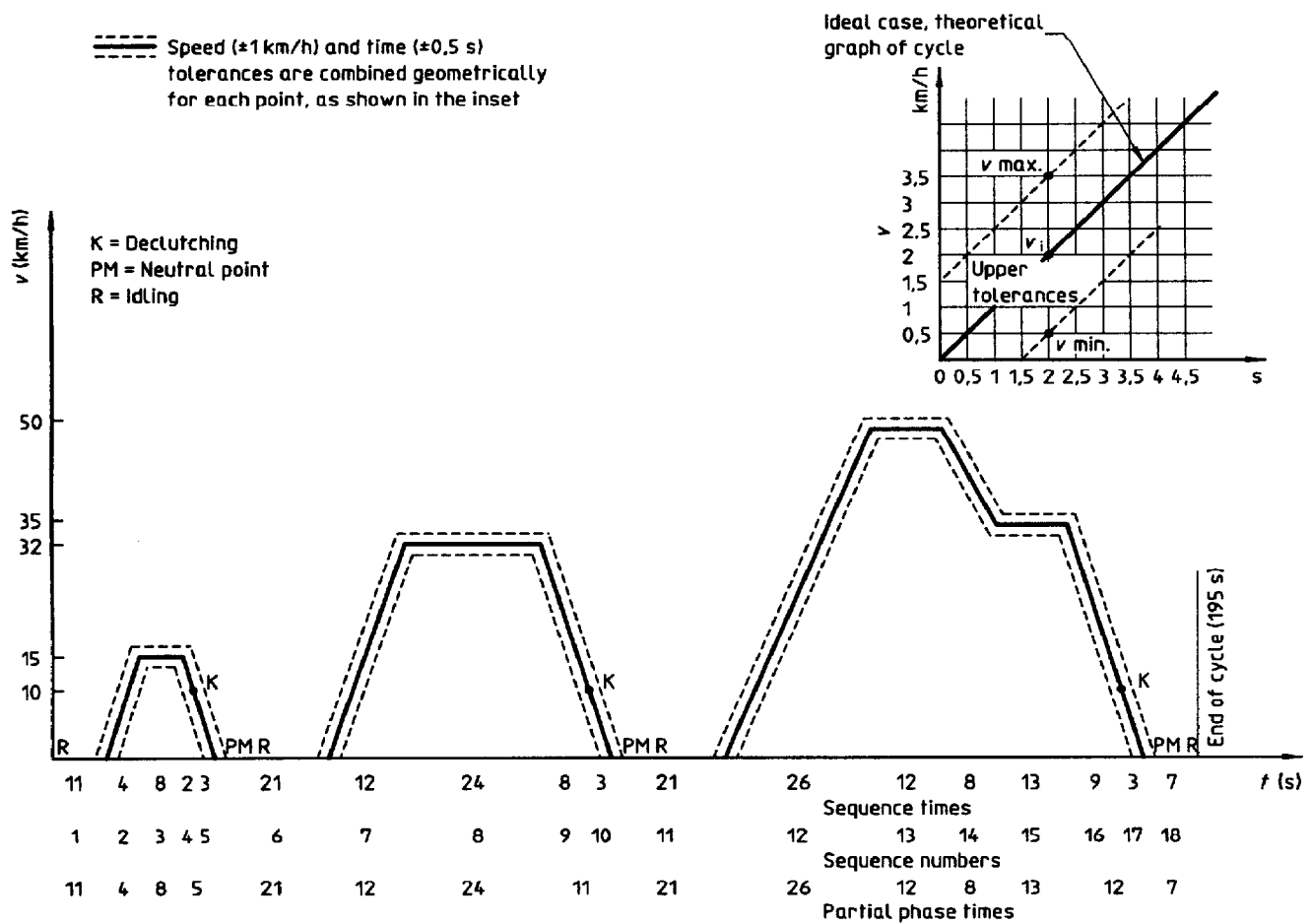


Figure 1 — Operating cycle on roller bench (Type 1 test)

Table 1 — Operating cycle on roller bench

Operation No.	Operation	Phase	Acceleration m/s ²	Speed km/h	Duration of each operation s	Duration of each phase s	Cumulative time s	Distance covered m
1	Idling	1	0	0	11	11	11	0
2	Acceleration	2	1,04	0 to 15	4	4	15	8
3	Constant speed	3	0	15	8	8	23	34
4	Deceleration	4	-0,69	15 to 10	2	5	25	7
5	Deceleration, clutch disengaged		-0,92	10 to 0	3		28	4
6	Idling	5	0	0	21	21	49	0
7	Acceleration	6	0,74	0 to 32	12	12	61	54
8	Constant speed	7	0	32	24	24	85	214
9	Deceleration	8	-0,75	32 to 10	8	11	93	48
10	Deceleration, clutch disengaged		-0,92	10 to 0	3		96	4
11	Idling	9	0	0	21	21	117	0
12	Acceleration	10	0,53	0 to 50	26	26	143	183
13	Constant speed	11	0	50	12	12	155	167
14	Deceleration	12	-0,52	50 to 35	8	8	163	95
15	Constant speed	13	0	35	13	13	176	127
16	Deceleration	14	-0,68	35 to 10	9	12	185	64
17	Deceleration, clutch disengaged		-0,92	10 to 0	3		188	4
18	Idling	15	0	0	7	7	195	0
Total								1 013

8.1.4 Tolerances

8.1.4.1 A tolerance of ± 1 km/h on the theoretical speed shall be allowed during acceleration, during steady speed and during deceleration. If the motor-cycle decelerates more rapidly without the use of the brakes, the requirements of 8.4.5.3 shall apply.

Speed tolerances greater than those prescribed shall be accepted during phase changes provided that the tolerances are never exceeded for more than 0,5 s on any one occasion.

8.1.4.2 The time tolerance shall be $\pm 0,5$ s.

8.1.4.3 The speed and time tolerances shall be combined as indicated in figure 1.

8.2 Test equipment

8.2.1 Roller bench

The main characteristics of the roller bench shall be as follows:

- number of points of contact between tyre(s) and roller(s): one to each driven wheel;
- roller diameter: ≥ 400 mm;
- roller surface: metallic, polished or knurled.

The dynamometer shall meet the following conditions:

- a) constant simulation of the road load power within ± 3 % for speeds from 20 km/h to 50 km/h;
- b) constant maintenance of the absorbed power as set throughout the test period within ± 2 % at the set speed of 50 km/h;
- c) when used to determine fuel consumption, the measurement systems for the fuel consumed, for the distance covered and for time shall be simultaneously engaged.

NOTE 1 It can be assumed that the power lost between the tyre(s) and the roller(s) equals the loss between the tyre(s) and the road.

8.2.2 Fuel consumption device

8.2.2.1 One of the following methods may be used to measure the fuel consumption, depending on the characteristics of each method and on the type of test

to be performed (conventional driving cycle or constant speed):

- a) volumetric method;
- b) gravimetric method;
- c) flowmeter method;
- d) carbon balance method (for four-stroke engines only).

Other methods may be used if it can be proved that the results given are equivalent.

8.2.2.2 Fuel shall be supplied to the engine by a device capable of measuring the quantity of fuel supplied with an accuracy of ± 2 % in accordance with annex B, and which does not interfere with the supply of fuel to the engine. When the measuring system is volumetric, the temperature of the fuel in the device or in the device outlet shall be measured.

Switching from the normal supply system to the measuring supply system shall be effected by a valve system and shall take no more than 0,2 s.

8.2.2.3 For the carbon balance method, the test equipment shall be in compliance with ISO 6460.

8.2.2.4 Annex B gives the description and the methods of use of the appropriate devices.

8.3 Preparation for test

8.3.1 Dynamometer setting

The dynamometer should be set by one of the methods described in ISO 11486, according to the type of dynamometer. If it is not possible to carry out this power measurement, the brake shall be adjusted in accordance with table 2.

8.3.1.1 Dynamometer with fixed load curve

In the case of a dynamometer with hydraulic or aerodynamic absorption, the setting can be done only at one speed point. The absorber should be set to the value $F_{\text{pa}}(v_0)$ at the reference speed of 50 km/h. The accuracy shall be ± 5 %.

The power absorbed, P_a , by the brake and the internal frictions of the bench shall be

$0 \leq P_a \leq kv_{12}^3 + 0,05 kv_{12}^3 + 0,05 P_{v50}$ for speeds less than or equal to 12 km/h;

$P_a = kv^3 \pm 0,05 kv^3 \pm 0,05 P_{v50}$ (without being negative) for speeds greater than 12 km/h.