INTERNATIONAL STANDARD

ISO

6460-3

Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption —

Part 3:
Fuel consumption measurement at a constant speed

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Motocycles — Méthode de mesure des émissions de gaz d'échappement et de la consommation de carburant —

Partie 3: Mesurage de la consommation de carburant à vitesse constante

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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 6460-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 22, *Motorcycles*.

ISO 6460-3, together with ISO 6460-1 and ISO 6460-2, cancels and replaces ISO 6460:1981 and ISO 7860:1995, which have been technically revised.

ISO 6460 consists of the following parts, under the general title *Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption*:

⎯ *Part 1: General test requirements*

⎯ *Part 2: Test cycles and specific test conditions*

⎯ *Part 3: Fuel consumption measurement at a constant speed*

Introduction

This part of ISO 6460 defines specific requirements for the measurement of fuel consumption at a constant speed. The measurement can be carried out by referring to this part of ISO 6460 and to ISO 6460-1.

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Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption —

Part 3:
Fuel consumption measurement at a constant speed

1 Scope

This part of ISO 6460 specifies the methods of measurement for fuel consumption at a constant speed on the road and on the chassis dynamometer. It is applicable to motorcycles as defined in ISO 3833 equipped with a spark ignition engine (four-stroke engine, two-stroke engine or rotary piston engine) or a compression ignition engine.

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 6460-1:2007, *Motorcycles — Measurement method for gaseous exhaust emissions and fuel consumption — Part 1: General test requirements*

ISO 7117, *Motorcycles — Measurement of maximum speed*

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

3 Terms and definitions

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

3.1
target test speed
constant speed at which the motorcycle is tested.

4 Symbols

Table 1 — Symbols

Symbols	Definition	Unit
d_T	relative air density during the test	kg/m^3
d_0	relative air density at the standard reference conditions	kg/m^3
$F_{c,ai}$	specific fuel consumption of the first test	km/L
$F_{c,bi}$	specific fuel consumption of the second test	km/L
$F_{c,i}$	average specific fuel consumption of first and second tests	km/L
$F_{c,j}$	mean value of average specific fuel consumptions	km/L
L_{road}	test section length to measure the fuel consumption	km
p_T	total barometric pressure during the test	kPa
p_0	total barometric pressure at the standard reference conditions	kPa
T_T	air temperature during the test	K
T_0	air temperature at the standard reference conditions	K
$t_{c,ai}$	time during the measurement of fuel consumption of the first test	h
$t_{c,bi}$	time during the measurement of fuel consumption of the second test	h
$V_{c,ai}$	measured volume of consumed fuel during the first test	L
$V_{c,bi}$	measured volume of consumed fuel during the second test	L
$v_{c,ai}$	motorcycle speed during the first test	km/h
$v_{c,bi}$	motorcycle speed during the second test	km/h
$v_{c,i}$	average motorcycle speed of first and second tests	km/h
$v_{c,j}$	mean value of average motorcycle speeds	km/h
v_T	target test speed	km/h

5 General requirements

5.1   Measurement of fuel consumption of a motorcycle based on the constant speed method shall be performed on a road or on a chassis dynamometer.

5.2   Fuel shall be supplied to the engine by a device capable of measuring the quantity of fuel supplied with an accuracy of ± 1 %, and which does not interfere with the supply of fuel to the engine. Where the measuring system is volumetric, the temperature of fuel in the device or in the outlet of the device shall be measured.

5.3   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.

5.4   ISO 6460-1:2007, Annex A, gives the description and the methods of use of the appropriate devices. The carbon balance method can also be applied for the measurement of fuel consumption on the chassis dynamometer.

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

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

5.7   The test shall be performed at a constant speed in the highest gear. A lower gear may be selected in case the test motorcycle cannot be run stably: the gear used shall be reported in test results.

6   Road measurement method

6.1   Rider and riding position

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

6.1.2   The rider in the conditions given in 6.1.1 shall have a mass of 75 kg $\pm$ 5 kg and be 1,75 m $\pm$ 0,05 m tall.

6.1.3   The rider shall be seated on the seat provided, with his/her feet on the footrests and his/her arms normally extended. This position shall allow the rider at all times to have proper control of the motorcycle during the test.

The position of the rider should remain unchanged during the whole measurement: the description of the position shall be indicated in the test report or shall be replaced by photograph(s).

6.2   Test track

6.2.1   The total length of test track shall be the sum of the following sections:

a)   the acceleration section to reach the stabilized target test speed;

b)   the test section to measure the fuel consumption;

c)   the deceleration section to stop the test motorcycle safely.

6.2.2   The test section shall be either long enough to consume the fuel of at least 10 mL or be longer than 300 m. The length of the test section shall be measured within the tolerance of 0,1 %.

6.2.3   The test road shall be flat, level, straight and smoothly paved. The road surface shall be dry and covered with asphalt, concrete or similar material, and free of obstacles or wind barriers that might impede the measurement of the fuel consumption. The slope of the surface shall not exceed 0,5 % between any two points at least 2 m apart.

6.3   Ambient conditions for the road test

During data collecting periods, 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 fuel consumption masurement is representative.

The ambient conditions shall be within the following limits:

a)   maximum wind speed: 3 m/s;

b)   maximum wind speed for gust: 5 m/s;

c)   average wind speed, parallel: 3 m/s;

d)   average wind speed, perpendicular: 2 m/s;

e)   maximum relative humidity: 95 %;

f) air temperature: 278 K to 308 K.

The relative air density during the test, d_T, shall be calculated by Equation (1):

$$d_T = d_0 \times \frac{p_T}{p_0} \times \frac{T_0}{T_T}$$

(1)

The standard reference conditions are specified in ISO 6460-1:2007, Clause 5.

The relative air density during the test shall not differ by more than 7,5 % from the standard relative air density in ISO 6460-1:2007, Clause 5.

6.4   Measuring instruments on the test motorcycle for the road test

When installing the measuring instruments on the test motorcycle, care shall be taken to minimize their effect on the distribution of the load between the wheels. When installing the speed sensor outside the motorcycle, care shall be taken to minimize the additional aerodynamic loss.

6.5   Test method

6.5.1   The speed of test motorcycle shall be maintained within ± 2 km/h of target test speed during the test. The fuel consumption measurement shall be started when any reference point of the test motorcycle crosses the start line of the test section and be finished when the same reference point crosses the finish line of the test section.

The time during the measurement of fuel consumption, $t_{c,ai}$ (the period between start and end of measuring the fuel consumption) shall be measured within the tolerance of ± 0,5 % and the motorcycle speed during the test, $v_{c,ai}$, shall be calculated from the time, $t_{c,ai}$, and test section length, L_{road}, as follows:

$$v_{c,ai} = \frac{t_{c,ai}}{L_{road}}$$

(2)

The specific fuel consumption, $F_{c,ai}$, shall be calculated from the measured volume of consumed fuel, $V_{c,ai}$, and test section length, L_{road}, as follows:

$$F_{c,ai} = \frac{L_{road}}{V_{c,ai}}$$

(3)

6.5.2   The motorcycle speed during the test, $v_{c,ai}$, and the specific fuel consumption, $F_{c,ai}$, shall be recorded on the recording sheet specified in Annex B.

6.5.3   The procedure described in 6.5.1 and 6.5.2 shall immediately be repeated in the opposite direction. The motorcycle speed during the test, $v_{c,bi}$, and the specific fuel consumption, $F_{c,bi}$, shall be obtained from the time during the measurement of fuel consumption, $t_{c,bi}$, and the measured volume of consumed fuel, $V_{c,bi}$, as follows:

$$v_{c,bi} = \frac{t_{c,bi}}{L_{road}}$$

(4)

$$F_{c,bi} = \frac{L_{road}}{V_{c,bi}}$$

(5)

The average motorcycle speed, $v_{c,i}$, and the average specific fuel consumption, $F_{c,i}$, shall be calculated by Equations (6) and (7):

$$v_{c,i} = \frac{v_{c,ai} + v_{c,bi}}{2} \tag{6}$$

$$F_{c,i} = \frac{F_{c,ai} + F_{c,bi}}{2} \tag{7}$$

6.5.4 At least three tests shall be performed and the mean value of average motorcycle speeds, $v_{c,j}$, and the mean value of average specific fuel consumptions, $F_{c,j}$, shall be calculated by Equations (8) and (9):

$$v_{c,j} = \frac{1}{n}\sum_{i=1}^{n} v_{c,i} \tag{8}$$

$$F_{c,j} = \frac{1}{n}\sum_{i=1}^{n} F_{c,i} \tag{9}$$

6.5.5 If the mean value of average motorcycle speeds, $v_{c,j}$, is within $\pm$ 1,0 km/h of target test speed, v_T, the tests are acceptable and the mean value of average specific fuel consumptions shall be adopted as the results of the fuel consumption measurement.

6.5.6 If the mean value of average motorcycle speeds, $v_{c,j}$, exceeds $\pm$ 1,0 km/h from the target test speed, v_T, the extreme data set of the average motorcycle speed, $v_{c,i}$, and the average specific fuel consumption, $F_{c,i}$, shall be neglected and an additional test shall be carried out.

The additional tests shall be performed until the mean value of average motorcycle speeds, $v_{c,j}$, is within $\pm$ 1,0 km/h of target test speed.

If the test motorcycle cannot be stably controlled at the target test speed, the specific fuel consumption may be obtained by the determination method specified in Annex A.

6.5.7 The mean value of average specific fuel consumptions, $F_{c,j}$, shall be rounded to one decimal place.

7 Chassis dynamometer measurement method

The chassis dynamometer shall be set in accordance with ISO 11486.

7.1 Test method

7.1.1 Fuel consumption measurement by the carbon balance method

7.1.1.1 The speed of test motorcycle shall not differ by more than $\pm$ 1,0 km/h from the target test speed during the test. The sampling, analysing and measuring the gaseous exhaust emissions shall be performed in accordance with ISO 6460-1.

7.1.1.2 The specific fuel consumption shall be calculated in accordance with ISO 6460-1:2007, Clause 12.

7.1.1.3 At least three tests shall be performed and the mean value of specific fuel consumptions shall be calculated. The mean value of specific fuel consumption shall be rounded to one decimal place.