INTERNATIONAL STANDARD

ISO 6855-3

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

Part 3:
Fuel consumption measurement at a constant speed

Cyclomoteurs — Méthode de mesure des émissions de gaz polluants et de consommation de combustible —

Partie 3: Mesure de consommation de combustible à vitesse constante

Reference number
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Foreword

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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.

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ISO 6855-3 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 23, *Mopeds*.

ISO 6855-3 cancels and replaces ISO 6855:1983and ISO 7859:2000, which have been technically revised.

ISO 6855 consists of the following parts, under the general title *Mopeds — 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 6855 defines specific requirements for measurement of fuel consumption at a constant speed. The measurement can be carried out by referring to this part of ISO 6855 and ISO 6855-1.

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

Part 3:
Fuel consumption measurement at a constant speed

1   Scope

This part of ISO 6855 specifies the methods of measurement for fuel consumption at a constant speed on the road and on the chassis dynamometer. It is applicable to mopeds as defined in ISO 3833 equipped with a spark ignition engine (four-stroke engine, two-stroke engine or rotary piston 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 6855-1:2012, *Measurement methods for gaseous exhaust emissions and fuel consumption — Part 1: General test requirements*

ISO 7116, *Road vehicles — Measurement method for the maximum speed of mopeds*

ISO 28981, *Mopeds — Methods for setting the 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 moped is tested

4 Symbols

Table 1 — Symbols

Symbols	Definition	Unit
$F_{c,ai}$	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 condition	kPa
T_T	air temperature during the test	K
r_T	relative air density during the test	—
r_0	relative air density at the standard reference conditions	—
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
$v_{c,ai}$	moped speed during the first test	km/h
$v_{c,bi}$	moped speed during the second test	km/h
$v_{c,i}$	average moped speed of first and second tests	km/h
$v_{c,j}$	mean value of average moped speeds	km/h
v_T	target test speed	km/h

5 General requirements

5.1 Measurement of fuel consumption of a moped 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 ± 2 %, 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.

ISO 6855-1:2012, 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 moped shall be stabilized at the normal temperature for the moped 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 moped 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 ± 2 kg and be 1,75 m ± 0,02 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 moped 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 at the stabilized target test speed;

b)   the test section to measure the fuel consumption;

c)   the deceleration section to stop the test moped 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 measurement 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, r_T, shall be calculated by Formula (1):

$$r_T = r_0 \times \frac{p_T}{p_0} \times \frac{T_0}{T_T}$$ (1)

The standard reference conditions are specified in ISO 6855-1:2012, 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 6855-1:2012, Clause 5.

6.4 Measuring instruments on the test moped for the road test

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

6.5 Test method

6.5.1 The speed of the test moped shall be maintained within ± 1 km/h of target test speed during the test. The fuel consumption measurement shall be started when any reference point of the test moped 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 moped speed during the test, $v_{c,ai}$, shall be calculated from the time, $t_{c,ai}$, and test section length L_{road} as follows:

$$v_{c,ai} = \frac{L_{road}}{t_{c,ai}}$$ (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 moped speed during the test, $v_{c,ai}$, and the specific fuel consumption, $F_{c,ai}$, shall be recorded in the recording sheet specified in Annex B.

6.5.3 The procedure described in 6.5.1 to 6.5.2 shall immediately be repeated in the opposite direction. The moped 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:

$$v_{c,bi} = \frac{L_{road}}{t_{c,bi}}$$ (4)

$$F_{c,bi} = \frac{L_{road}}{V_{c,bi}}$$ (5)

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

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

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

6.5.4   At least three tests shall be performed and the mean value of average moped speeds, $v_{c,j}$, and the mean value of average specific fuel consumptions, $F_{c,j}$, shall be calculated by Formulae (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 moped speeds, $v_{c,j}$, is within ± 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 moped speeds, $v_{c,j}$, exceeds ± 1,0 km/h from the target test speed, v_T, the extreme data set of the average moped 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 moped speeds, $v_{c,j}$, is within ± 1,0 km/h of target test speed.

If the test moped cannot be stably controlled at the test target 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 28981.

7.1   Test method

7.1.1   The fuel consumption measurement by the carbon balance method

7.1.1.1   The speed of the test moped shall not differ by more than ± 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 6855-1.

7.1.1.2   The specific fuel consumption shall be calculated in accordance with ISO 6855-1:2012, 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.

7.1.2   The fuel consumption measurement by the fuel flowmeter

7.1.2.1   The fuel consumption measuring distance shall be either long enough to consume the fuel more than 10 mL or be longer than 300 m.

7.1.2.2   The speed of the test moped shall not differ by more than ± 1,0 km/h from the target test speed during the test. The specific fuel consumption shall be calculated from in accordance with ISO 6855-1:—, Clause 12.

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

8   Presentation of results

The results shall be reported by Annex B.

Annex A
(normative)

Determination method of fuel consumption

A.1 General

A.1.1 To determine the consumption at a steady target test speed (see Figure A.1), four tests shall be made:

— two at an average speed less than the target test speed, and

— two at an average speed exceeding the target test speed.

Two tests shall not be made toward the same direction, i.e. the test shall be made one direction and be repeated in the opposite direction. During each test run, the speed shall be kept steady within ± 1 km/h

The average speed for each test shall not differ from the reference speed by more than 2 km/h

The fuel consumption for each test run shall be calculated from the equations in ISO 6855-1:2012, Clause 12.

A.1.2 The difference between the two lower calculated values shall not be greater than 5 % of their mean value and the same condition shall apply for two higher calculated values. The value of the fuel consumption at the appropriate target test speed shall be calculated by liner interpolation as shown in Figure A.1.

A.1.3 If the condition in A.1.2 is not achieved for either pair of calculated values, then the four test runs shall be repeated. If after 10 attempts the required consistency has still not been achieved, then another moped shall be selected to be tested in accordance with this procedure.
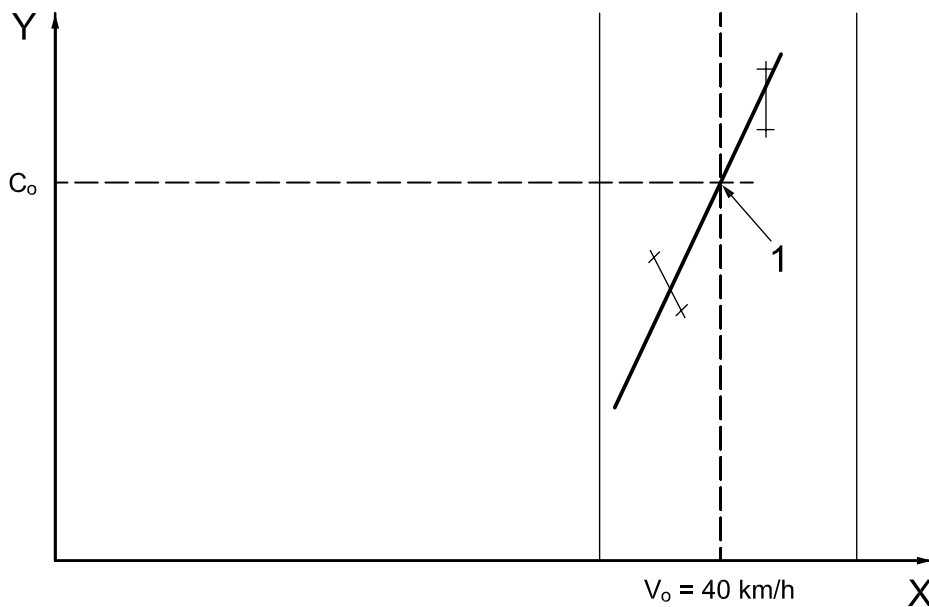
Key

X   speed, km/h

Y   fuel consumption

1   calculated average fuel consumption at target test speed

C_o valve calculated for consumption at target test speed over test distance

V_o target test speed

Figure A.1 — Example of calculation for target test speed of 40 km/h

Annex B
(normative)

Presentation of results of fuel consumption

B.1 Moped

Category: two wheeler/three wheeler   (*delete as applicable*)

Trade name (-mark): ....

Model: ....

Engine model: ....

Cycle: two-stroke/four-stroke   (*delete as applicable*)

Number and layout of cylinders: ....

Engine displacement: .... cm^3

Gear-box: manual/automatic   (*delete as applicable*)

Number of gear ratios (speeds): ....

Drive ratios: — primary: ....   — final: ....

Maximum speed, measured in accordance with ISO 7116: .... km/h

Mileage accumulated at test: .... km

Moped mass: — kerb : .... kg — reference: .... kg

Rider mass: .... kg

Instrument mass: .... kg

Test moped mass: .... kg

Equivalent inertia mass: .... kg

Others, if there is any alteration: ....

B.2 Target test speed

Target test speed: .... km/h

B.3 Test fuel

Test fuel: _____

Fuel density: _____ g/mL _____ at K

Octane number or cetane number: _____

Hydrogen/carbon atom number ratio: _____

Oxygen/carbon atom number ratio: _____

Mixed with lubrication oil: yes/no   (*delete as applicable*)

If yes, the volume ratio of fuel to lubrication oil: _____

B.4 Test

Test: on chassis dynamometer/ on road   (*delete as applicable*)

B.5 Test on the chassis dynamometer

If the test is carried out on road, B.5 shall be omitted.

B.5.1 Chassis dynamometer

Chassis dynamometer with: polygonal function/coefficient control/F^* polygonal digital setter/f^*_0, f^*_2 coefficient digital setter   (*delete as applicable*)

Road-load curve fitting equation $f = a + bv^2$: a _____ N b _____ N/(km/h)^2

Cooling fan wind speed is proportional to the roller speed: yes/no   (*delete as applicable*)

B.5.2 Test conditions

Test room dry-bulb temperature: start _____ K   end _____ K

Test room wet-bulb temperature: start _____ K   end _____ K

Test room mean humidity: _____ %

Test room mean pressure: _____ kPa

Gear: _____

The distance to measure the fuel consumption: _____ km

B.5.3 Fuel consumption measurement system

Fuel consumption measurement: carbon balance method/fuel flow measurement method   (*delete as applicable*)

B.5.3.1   Carbon balance method

If the test is carried out by the fuel flow measurement method, B.5.3.1 shall be omitted.

B.5.3.1.1   Sampling and analysing systems

Exhaust gas emission analyser: ....

CVS system: positive displacement pump/the critical flow venturi   (*delete as applicable*)

If other sampling system is used, detailed description: ....

Pressure at exhaust pipe outlet: .... Pa

Hydrogen/carbon atom number ratio in exhaust gas: ....

Oxygen/carbon atom number ratio in exhaust gas: ....

B.5.3.1.2   Test results

First run   Sampling volume: .... m^3/min

Dilution factor: ....

Diluted exhaust mixture volume: .... L/km

Concentration in diluted exhaust mixture A	Concentration in dilution air B	Quantity
CO: .... ppm	.... ppm	.... g/km
THC: .... ppmC	.... ppmC	.... g/km
NO_X: .... ppm	.... ppm	.... g/km
CO_2: .... %	.... %	.... g/km

Fuel consumption: L

Second run   Sampling volume: .... m^3/min

Dilution factor: ....

Diluted exhaust mixture volume: .... L/km

Concentration in diluted exhaust mixture A	Concentration in dilution air B	Quantity
CO: .... ppm	.... ppm	.... g/km
THC: .... ppmC	.... ppmC	.... g/km
NO_X: .... ppm	.... ppm	.... g/km
CO_2: .... %	.... %	.... g/km

Fuel consumption: L

Third run   Sampling volume: .... m³/min

                   Dilution factor: ....

                   Diluted exhaust mixture volume: .... L/km

Concentration in diluted exhaust mixture A		Concentration in dilution air B		Quantity
CO:	ppm	....	ppm	.... g/km
THC:	ppmC	....	ppmC	.... g/km
NO$_X$:	ppm	....	ppm	.... g/km
CO$_2$:	%	....	%	.... g/km

                   Fuel consumption: L

Specific fuel consumption: .... km/L .... L/100 km

B.5.3.2   Fuel flow measurement method

If the test is carried out by the carbon balance method, B.5.3.2 shall be omitted.

B.5.3.2.1   Fuel consumption measurement method

Fuel consumption measurement method: volumetric method / gravimetric method / flowmeter method
(*delete as applicable*)

Other method: ....

B.5.3.2.2   Test results

First run   Fuel consumption: L

Second run   Fuel consumption: L

Third run   Fuel consumption: L

Specific fuel consumption: .... km/L .... L/100 km

B.6 On road test

If the test is carried out on chassis dynamometer, B.6 shall be omitted.

B.6.1 Fuel consumption measurement method

Fuel consumption measurement method: volumetric method/gravimetricmethod/flowmeter method
(*delete as applicable*)

Other method: ....

B.6.2 Test conditions

Date: _____/_____/_____

Place of the test: _____

Test room dry-bulb temperature: start _____ K   end _____K

Test room wet-bulb temperature: start _____ K   end _____K

Climate: _____

Mean humidity: _____ %

Mean atmospheric pressure: _____ kPa

Wind speed (parallel/perpendicular): _____/_____ m/s

Gear: _____

The test section length to measure the fuel consumption: _____ km

The description of the riding position: _____

B.6.3 Test results

		Fuel consumption	Specific fuel consumption	Time	Moped speed during the test
First run	First:	_____ l	_____ km/L	_____ s	_____ km/h
	Second:	_____ l	_____ km/L	_____ s	_____ km/h
	Average:	_____ l	_____ km/L	_____ s	_____ km/h
Second run	First:	_____ l	_____ km/L	_____ s	_____ km/h
	Second:	_____ l	_____ km/L	_____ s	_____ km/h
	Average:	_____ l	_____ km/L	_____ s	_____ km/h
Third run	First:	_____ l	_____ km/L	_____ s	_____ km/h
	Second:	_____ l	_____ km/L	_____ s	_____ km/h
	Average:	_____ l	_____ km/L	_____ s	_____ km/h

Mean value of average test moped speeds: _____ km/h

Specific fuel consumption: _____ km/L _____ L/100 km

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