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National Standard of the People's Republic of China

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Replaces GB 15744-1995, GB/T 16486-1996

The limits and measurement methods of fuel consumption for motorcycles

(IS07860: 1995 Motorcycles - Methods of measuring fuel consumption, NEQ)

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Foreword

The Appendices to this Standard are recommended, whilst the rest is mandatory.

The consistency degree of this Standard and the second edition of ISO7860, "Motorcycles – Methods of measuring fuel consumption" (English version) implemented by the International Standards Organization (ISO) on 15 December 1995 is non-equivalent.

In comparison with the abovementioned Standard ISO7860, the main revised content of this Standard are as follows:

- the international standards referenced in the original Standard have been changed in this Standard to references of the corresponding national Standards;
- the contents of operating cycles in the original Standard have been withdrawn and changed to directly use the operating cycles in GB14622-2002;
- the order of the numbering of certain clauses and articles has been readjusted;
- fuel consumption limits have been added;
- certain contents of Appendix A have been condensed.

This Standard replaces the motorcycle-related content of GB/T15744-1995, " Motorcycles and mopeds – Limits of fuel consumption", and GB/T16486-1996, "Motorcycles and mopeds - Measurement methods of fuel consumption". In comparison to GB/T15744-1995 and GB/T16486-1996, the main changes to this Standard are:

- the division of fuel consumption limits is carried out on the basis of discharge capacity, and is distinguished from the division range of the original Standard, the division methods carried out on the basis of strokes has been withdrawn;
- fuel consumption limits include both Type I test and Type II test contents;
- measuring points of Running Mode Method on measuring fuel consumption has been added, and the vehicle speed determination method specified in the Constant Speed Metering Method has been changed;
- the number of tests in the Constant Speed Metering Method and the method for calculating test results have been altered.

Appendix A and Appendix B to this Standard are normative annexes.

This Standard is proposed by China National Development and Reform Commission.

This Standard is under the jurisdiction of the National Automobile Standardisation Technical Committee.

The organisations that participated in the drafting of this Standard are:
Tianjin Motorcycle Technical Centre;
Shanghai Motorcycle Research Institute;
Zhejiang Qianjiang Motorcycle Co., Ltd.

The main drafters of this Standard are: He Wenjie, Wang Qing, Liu Xin, Ma Xiaoqiang, Quan Yifeng, Guo Zexin, Lin Xianjin, Sun Weimin.

This Standard replaces the previously issued Standards:

- GB 5377-85;

- GB/T 15744-1995;
- GB/T 16486-1996.

This Standard shall be implemented six months after its issue date; the checking for conformity of production shall be carried out 18 months after its issue date.

Limits and measurement methods of fuel consumption for motorcycles

1 Scope

This Standard specifies the limits and measurement methods of fuel consumption for motorcycles. This Standard applies to motorcycles (excluding racing motorcycles and cross-country motorcycles).

2 Normative References

The provisions of the following documents become provisions of this Standard after being referenced. For dated reference documents, all later amendments (excluding corrigenda) and versions do not apply to this Standard; however, the parties to the agreement are encouraged to study whether the latest versions of these documents are applicable. For undated reference documents, the latest versions apply to this Standard.

GB/T 1884, Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method (GB/T 1884-2000, ISO 3675:1998, EQV);

GB/T 5378-1994, General rules of running test for motorcycles and mopeds;

GB/T 5384-1996, Measurement method for the maximum speed of motorcycles and mopeds;

GB14622-2002, Limits and measurement methods for exhaust emissions from motorcycles under running mode.

3 Terms and definitions

The terms and definitions mentioned below and the terms and definitions set out in GB/T 14622-2002 apply to this Standard.

3.1 Reference speed

The driving speed when carrying out fuel consumption measurement tests (Type II test) for motorcycles.

4 Test types and test conditions

4.1 Test types

Motorcycles shall be subject to two types of test.

4.1.1 Type I test (measurement of the average fuel consumption under the condition of prescribed operating cycle)

Type I test is completed on a chassis dynamometer; the test uses operating cycles set out in section C.2 of Appendix C to GB 14622-2002. Each test includes two continuous operating cycles.

4.1.2 Type II test (measurement of the average fuel consumption at constant speed)

Type II test is completed on a road or on a chassis dynamometer, so as to measure the fuel consumption of the test-vehicle when the test-vehicle is driving at a reference speed.

4.2 Environmental conditions

The test environment should meet the following conditions:

- Relative humidity: less than 95%;

- Maximum wind velocity: below 3m/s;

- Maximum velocity of gusts: below 5m/s;

- Environment temperature: 278k ~ 303k.

4.3 Standard conditions

Standard conditions as follows:

- Atmospheric pressure: p_0=100kpa;

- Atmospheric temperature: T_0=293K;

- Relative air density: d_0=0.9197;

The relative air density during the test should be determined by means of formula (1), when compared to the air density under the standard state the differential value should not be greater than 7.5%.

$$d_T = d_0 \times \frac{P_T}{P_0} \times \frac{T_0}{T_T} \qquad (1)$$

Where:

d_T – the relative air density under test condition;

P_T – the atmospheric pressure when testing - unit is kPa (kPa);

T_T – the atmospheric temperature when testing - unit is Kelvin (K);

5 Test preparations

5.1 Test-vehicle

5.1.1 The manufacturer of the motorcycle or its authorised agent should submit information for product description in accordance with Appendix A.

5.1.2 Before the test, the test-vehicle should carry out running-in in accordance with the requirements set out in the manufacturer's technical documentation, and should be in normal operating mode.

5.1.3 Check the air-tightness of the air intake system and fuel supply system so as to ensure the mixed air is not effected by unexpected air intake.

5.1.4 The adjustment of the test-vehicle should be carried out in accordance with the requirements set out in the technical documentation. The pressure of the tyres should conform to the requirements set out in the technical documentation.

5.1.5 The test-vehicle should be examined before the test; the test-vehicle should be consistent with the description in the manufacturer's technical documentation; the test-vehicle should be able to be driven normally and started normally, either cold or warmed up.

5.1.6 Before the test, in order to achieve the normal state specified in the manufacturer's technical documentation, the test-vehicle should undergo a pre-driving warm-up. If no requirements are specified, the test-vehicle should undergo pre-driving warm-up for four

operating cycles in accordance with the operating cycle requirements set out in section C.2 of Appendix C to GB 14622-2002; if the test is carried out on a road, in order for the engine and driving system to achieve normal heat conditions, the test-vehicle should first be driven for at least 15 minutes under normal driving conditions.

5.1.7 When testing, the load mass of the vehicle and the passenger combined should meet the requirements set out in the manufacturer's technical documentation. If no special requirements are provided, the specific mass for a two-wheeled motorcycle should be the mass of one driver. The specific mass for a motorcycle and side-car should be the total mass of one driver and two passengers. Ballast is permitted to replace passengers, but the positioning of the ballast should be near the riding position of the passengers. The mass of each passenger is considered to be 75kg. The specific mass for a three-wheeled motorcycle is the maximum factory-set load mass specified in the technical documentation for the given vehicle. The mass of the fuel consumption measuring device should be obtained, and each mass mentioned above should be recorded in the test record.

5.1.8 The load distribution between the front-wheel axle and back-wheel axle should conform to the requirements specified in the manufacturer's technical documentation. When installing a measuring instrument on the test vehicle, the effect to the original load distribution should be reduced to a minimum.

5.1.9 When installing a fuel consumption measuring device and speed sensor on the sides of the motorcycle, additional air resistance should be minimised as much as possible.

5.2 Fuels and lubrication oil

The fuels specified in GB 14622-2002 should be used during the test. The density of the test fuel should be determined in accordance with the method set out in GB/T 1884; the ratio of the carbon-hydrogen should use a fixed value, and gasoline is 1.85.

The distribution of engine lubrication oil should conform to the required grades and quantities specified in the manufacturer's technical documentation.

6 Type I Test (measurement of the average fuel consumption under the condition of the prescribed operating cycle)

6.1 The operating cycle on the chassis dynamometer

The setting of the operating cycles of the motorcycle should conform to the requirements set out in section C.2, Appendix C to GB 14622-2002.

6.2 Test equipment

6.2.1 Chassis dynamometer

The main characteristics of the chassis dynamometer should conform to the requirements set out in section C.4.1, Appendix C to GB 14622-2002.

When measuring fuel consumption, the measurement system used for fuel consumption, travel distance and time should be kept simultaneously.

6.2.2 Measurement methods and measurement equipment of fuel consumption

The measurement of fuel consumption should be carried out in accordance with one of the following methods; the selection of the measurement method depends on the characteristic of each method and test type (Type I test or Type II test):

a) flow measurement method;

b) volume measurement method;

c) weight measurement method;

d) carbon balance measurement method (only applies to motorcycles with a four-stroke engine installed).

For the interpretation of the measurement methods, see section B.1 of Appendix B. Other measurement methods are permitted if the test results can be proved to be the same.

6.2.2.1 In section B.2 of Appendix B, the installation requirements and operating instruction for the fuel consumption measuring device are specified. The fuel should be supplied to the engine after having gone through a device for measuring fuel-rate that is consistent with Appendix B, with an accuracy of ± 2%, and this device should ensure that the performance of the engine is not affected. When using volume measurement system, the fuel temperature inside the device or the fuel temperature of the device outlet should be measured.

A normal fuel supply system switch over to a measurement system should be achieved by a valve system, and its switch over time should not be greater than 0.2s.

6.2.2.2 When using the carbon balance method to take measurements, the test equipment should be the same as the equipment required in GB 14622-2002.

6.3 Measurement procedures

6.3.1 The readjustment of the chassis dynamometer should conform to sections C.5.1 and C.5.2 of Appendix C to GB 14622-2002.

6.3.2 Measurements should be carried out in accordance with the procedures set out in section C.6 of Appendix C to GB 14622-2002. The operating procedures of the measuring device for fuel consumption should conform to Appendix B. When using the carbon balance method to carry out exhaust gas sampling, analysis and volume measurement, the procedures should be performed in accordance with the requirements set out in C.7 of Appendix C, GB 14622-2002.

6.4 Measurement of fuel consumption

The fuel consumption value from every second continuous operating cycle is regarded as one measured value.

6.5 Determination of measurement results

6.5.1 Measure the fuel consumption continuously three times as specified in 6.4, and take the calculated average value of the three measured values as the final measurement result. Allow no longer than 60s idling speed between every second measurement; during the idling speed period, do not take any fuel consumption measurements.

6.5.2 If the maximum differential value between the measured values does not exceed 5% of the arithmetic average value, then this measurement result is valid; otherwise, re-take the measurement until the value A, which is determined by means of the formula in 6.5.3, does not exceed 5%.

6.5.3 A value is determined by means of formula (2):

$$A = K \times \frac{s}{\sqrt{n}} \times \frac{100}{\overline{FC}} \qquad (2)$$

Where: K can be found in Table 1

Table 1 k Value Table

n	4	5	6	7	8	9	10
k	3.2	2.8	2.6	2.5	2.4	2.3	2.3
$\frac{k}{\sqrt{n}}$	1.6	1.25	1.06	0.94	0.85	0.77	0.73

n - number of tests;

s - standard deviation, can be determined by means of formula (3):

$$s = \sqrt{\frac{\sum_{i=1}^{n}\left(\overline{FC} - FC_i\right)}{n-1}} \qquad (3)$$

Where:

FC_i - fuel consumption at the *i*-th time measurement, unit is litre per 100 km (L/100km);

$\overline{FC}$ - is the arithmetic average value of the n *FC* values, unit is litre per 100km (L/100km).

6.5.4 If, after 10 tests, the value A is still greater than 5%, change to another vehicle of the same model to carry out measurements.

6.5.5 The calculated result for the fuel consumption should be rounded off to two decimal places.

7 Type II test (measurement of the average fuel consumption at a constant speed)

7.1 Test conditions

7.1.1 Type II test should be carried out on road or on the chassis dynamometer.

7.1.2 See to 6.2.2.1 for the installation requirements and operating instructions for the measuring device of the fuel consumption.

7.2 Measurement methods on road

7.2.1 The driver and driving posture

7.2.1.1 The driver should wear protective clothing and a helmet; the height of the driver should be 1.75m ± 0.05m; the body weight of the driver should be 75kg ± 5kg.

7.2.1.2 Driving posture

When driving, the driver should be sitting on the designated seat, both hands controlling the steering handle, both feet on the foot support, both arms stretched out normally. During the measurement process, the driver should keep the same driving posture.

7.2.2 Test road

7.2.2.1 The test road should be an enclosed ring road of a length of more than 2000m and a minimum turning radius of more than 200m, or a straight road with a length of over 500m, on which the vehicle can be driven in both directions.

7.2.2.2 The surface of the road should be covered with asphalt, tar, concrete or other equivalent materials.

7.2.2.3 The test road should be as level as possible, the longitudinal slope of the road should not be allowed to exceed 1%; the height difference between any two points on the road should not be allowed to exceed 1m; the horizontal slope of the road should not be allowed to exceed 3%.

7.2.2.4 The test-road should be level, dry and free from obstacles.

7.2.2.5 Test distance: 500m.

7.3 Measurement methods on chassis dynamometer

When a test is carried out on the chassis dynamometer, the setting should conform to the stipulations of 6.3.1.

7.4 Test methods

7.4.1 The test should be performed in first gear, according to the reference speed provided in Table 2 so as to carry out fuel consumption measurement at a constant speed. The measurement for the maximum speed of the motorcycle should conform to the requirements set out in GB/T 5384. The best value obtained from the reference speeds of the two tests is regarded as the measured result of the Type II test.

Table 2 Reference Speed

Maximum Speed km/h	Reference Speed km/h
V > 130	120 and 90
100 < V • 130	90 and 60
70 < V • 100	60 and 45
V • 70	45

7.4.2 Measurement of fuel consumption

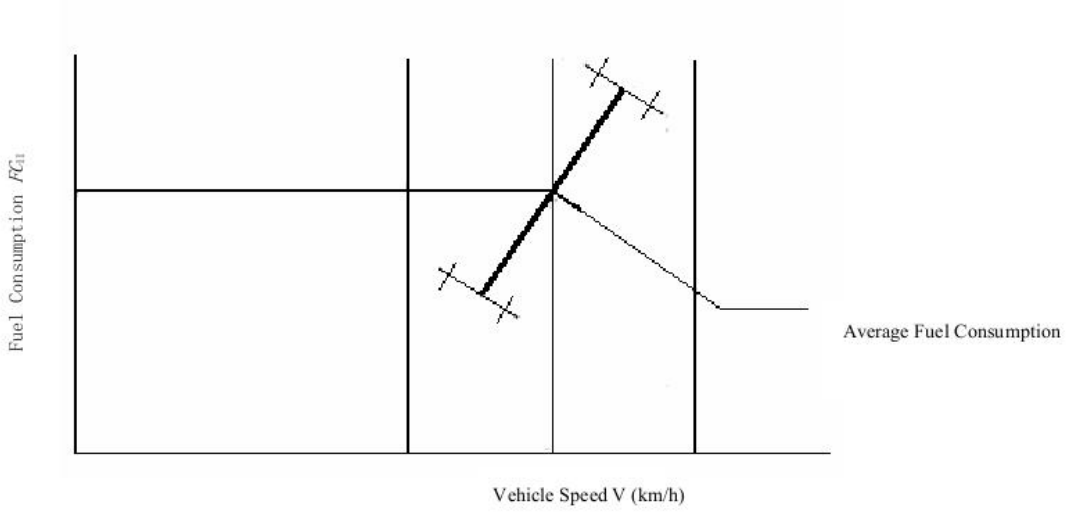
7.4.2.1 Measure the fuel consumption under a steady reference speed when carrying out 4 tests, in which the average speed of two tests is lower than the reference speed, and the average speed of other two times is higher than the reference speed. During the test process, the allowable difference of driving speed of the test vehicle should be controlled within a range of ± 2km/h.

The differential value between the average speed of each test and the reference speed is less than 2km/h.

The fuel consumption of each test should be determined by means of formula (5) and formula (6).

7.4.2.2 The difference in the fuel consumption between the two tests where the average speed is lower than the reference speed should be smaller than 5% of the average value obtained from these two tests; the same requirement applies to the two tests where the average speed is higher than the reference speed. The fuel consumption measured under the reference speed should be determined by means of linear interpolation.

7.4.2.3 If none of the pairs of calculated values meet the requirements specified in 7.4.2.2, then four more tests should be carried out. If, after ten sets of tests, the abovementioned requirements are still not met, then another motorcycle of the same model should be selected and tests carried out in the above order.



Note: X shape marks (four intersection) corresponding to the calculated values of each driving test. FC_{II} is the average fuel consumption obtained by means of the linear interpolation under the reference speed V.

Diagram 1 Calculation of average fuel consumption under a reference speed

8 Limits and the calculation methods of fuel consumption

8.1 Calculation of fuel consumption

The fuel consumption should be determined by means of the formula (4):

$$FC = 0.6 \times FC_I + 0.4 \times FC_{II} \qquad (4)$$

Where:

FC_I – for fuel consumption measured from the Type I test, the unit is litre per 100 kilometres (L/100km);

FC_{II} – for fuel consumption measured from the Type II test, which is obtained by means of the linear interpolation under the reference speed, the unit is litre per 100 kilometres (L/100km).

8.2 Calculation of fuel consumption for Type I test and Type II tests

8.2.1 If the fuel consumption value is obtained by using the volume method, then the fuel consumption *FC* should be determined by means of the formula (5):

$$FC_i = \frac{Q[1 + a(T_0 - T)]}{S} \times 100 \qquad (5)$$

Where:

FC_I - the fuel consumption at *i*-th time test, the unit is litre per 100 kilometre (L/100km);

Q - the measured fuel consumption, the unit is litre (L);

a - the coefficient of fuel volume expansion, gasoline is $0.001K^{-1}$;

T_0 - standard temperature (293k), unit is kelvin (k);

T - fuel temperature, unit is kelvin (k);

S - the set travel distance per unit volume fuel in vehicle test, unit is kilometre (km).

8.2.2 If the fuel consumption value is obtained by using the weight method, then the fuel consumption FC should be determined by means of the formula (6):

$$FC_i = \frac{m}{\mathrm{r} \times S} \times 100 \qquad (6)$$

Where:

FC_i - fuel consumption at i-th time test, unit is litre per 100 kilometres (L/100km);

m - measured value of fuel consumption, unit is kilogram (kg);

p - fuel density under standard state (293k), unit is kilogram per litre (kg/L);

S - distance travelled during vehicle test, unit is kilometre (km).

8.2.3 If the fuel consumption value is obtained using the carbon balance method, then the fuel consumption FC is determined by means of the formula (7):

$$FC_i = \frac{0.1154}{\mathrm{r}} \times \left[(0.429 \times M_{co}) + (0.866 \times M_{HC}) + (0.273 \times M_{CO_2}) \right] \qquad (7)$$

Where:

FC_I - fuel consumption at i-th time test, unit is litre per 100 kilometres (L/100km);

Mco - emission of carbon monoxide, unit is gram per kilometre (g/km);

M_{HC} - emission of hydrocarbon, unit is gram per kilometre (g/km);

M_{co2} - emission of carbon-dioxide, unit is gram per kilometre (g/km);

p - fuel density under standard state (293k), unit is kilogram per litre (kg/L);

8.2.3.1 The emission of gaseous pollutants should be determined by means of the formula (8):

$$M_j = \frac{V_{mix} \times d_j \times 10^{-6}}{S} \qquad (8)$$

Where:

M_j - emission of pollutant j, unit is gram per kilometre (g/km);

V_{mix} - volume of diluted exhaust gas, which is corrected to standard state (273.2k and 101.33kPa), unit is litre per test (L/test);

d_j - density of the pollutant j under standard state (273.2k and 101.33kPa), unit is gram per litre (g/L);

C_j - concentration of the pollutant j in the diluted exhaust gas; carry out correction in accordance with the content of pollutant in the diluted air, unit is volume concentration 10^{-6}; if the volume is expressed by percentage, then the coefficient 10^{-6} should be replaced by 10^{-2}.

S - travel distance during test period, unit is kilometre (km).

8.2.3.2 Determination of volume

8.2.3.2.1 When using a dilution device, the constant flow of which is controlled by an orifice

plate or venturi tube to measure the volume, continuously record the parameter which demonstrates the volume flow-rate and calculate the total volume during the test.

8.2.3.2.2 When using a positive displacement pump to calculate volume, the volume of diluted exhaust gas inside of the positive displacement pump system should be determined by means of formula (9):

$$V = V_0 \times N \qquad (9)$$

Where:

V –volume of diluted exhaust gas (before the correction), unit is litre per test (L/test);

V_0 – gas volume discharged by the positive displacement pump under test conditions, unit is litre per revolution (L/r);

N –number of revolutions in each test, unit is revolution (r).

8.2.3.2.3 Correct the volume of diluted exhaust gas to standard state; the correction for volume of diluted exhaust gas is determined by means of formula (10):

$$V_{mix} = V \times K_1 \times \frac{P_p}{T_p} \qquad (10)$$

Where:

k_1 – the coefficient, $K_1 = \frac{273.2}{101.33} = 2.6961\left(K \times kPa^{-1}\right)$ (11)

P_p –absolute pressure at the inlet of the positive displacement pump, unit is kPa (kPa);

T_p – average temperature of diluted exhaust gas admitted into the positive displacement pump during the test, unit is Kelvin (K).

8.2.3.3 The corrected concentration of the pollutant inside the sampling bag should be determined by means of formula (12):

$$C_j = C_c - C_d\left(1 - \frac{1}{DF}\right) \qquad (12)$$

Where:

C_j - concentration of the pollutant j in the diluted exhaust gas after the content of the pollutant j in the diluted air is corrected; unit is volume concentration 10^{-6} or %;

C_e – measured concentration of the pollutant j in the diluted exhaust gas, unit is volume concentration 10^{-6} or %;

C_d – measured concentration of the pollutant j in the diluted air, unit is volume concentration 10^{-6} or %;

DF – dilution coefficient, determined by means of the formula (13):

$$DF = \frac{14.5}{C_{CO_2} + 0.5C_{CO} + C_{HC}} \qquad (13)$$

Where:

C_{co2} –concentration of CO_2 in the diluted exhaust gas which is inside of the sampling bag, unit is volume concentration %;

C_{co} - concentration of CO in the diluted exhaust gas which is inside of the sampling bag, unit is volume concentration %;

C_{HC} - concentration of HC in the diluted exhaust gas which is inside of the sampling bag, unit is volume concentration %;

8.2.4 Mixing fuels/lubricants

For two-stroke motorcycles that use mixed oil as lubrication, remove the consumption of the lubricant when making the calculation.

8.3 See Tables 3 and 4 for the fuel consumption limits for motorcycles.

Table 3 Fuel consumption limits for two-wheel motorcycles

Engine Displacement	>50 ~ 100	• 100 ~ 125	• 125 ~ 250	• 250 ~ 400	• 400 ~ 650	• 650 ~ 1000	• 1000 ~ 1250	• 1250
Fuel Consumption Limit L/100km	2.3	2.5	2.9	3.4	5.2	6.3	7.2	8.0

Table 4 Fuel consumption limits for three-wheeled motorcycles

Engine Displacement ml	>50 ~ 100	• 100 ~ 150	• 150 ~ 250	• 250 ~ 400	• 400 ~ 650	• 650
Fuel Consumption Limit L/100km	3.3	3.8	4.3	5.1	7.8	9.0

Appendix A

(Normative Annex)

Motorcycle Product Description

A.1 Name of manufacturer (trademark)--------

A.2 Vehicle type----------

A.3 Vehicle mass

Complete vehicle kerb mass-----kg

Rated carrying-capacity------kg

A.4 Transmission manual/ automatic gear (speed ratio) number-------

Gear ratio (manual transmission)

First gear--------

Second gear------

Third gear-------

Fourth gear-------

Fifth gear---------

Sixth gear----------

A.5 Driving speed ratio

Primary--------

Final----------

A.6 Tyre:

Front tyre specification--------mm; Back tyre specification--------mm

Tyre pressure	Specified in technical documentation	Actual
Front tyre	----------kPa	-------kPa
Back tyre	----------kPa	--------kPa

A.7 Engine

Manufacturer----------

Type----------

Cycle 2-stroke/4-stroke----------

Number of cylinders and arrangement form----------

Cylinder bore----------mm

Stroke----------mm

Displacement----------ml

Compression ratio--------

Fuel----------

Cooling system type water/ air/ others (detailed explanation)----------

Air filter type----------

Lubrication system-------

(two-stroke engine: separate type/ mixed type)

A.8 Appended Pollution Control Device

(whether is included by other projects) ------yes/no

Fuel supply type----------

Carburettor /fuel injection system

Trademark---------

Type---------

A.9 Engine performance

Idling speed---------r/min

Engine maximum power and corresponding speed----------kW (r/min)

Appendix B

(Informative Annex)

Measuring Device for Motorcycle Fuel Consumption

B.1 Measurement methods

B.1.1 Flow measurement method

The flow measurement method uses a device that enables the continuous or discontinuous measurement of the definite mass or volume of fuel that passes through the device within a certain time range.

When continuously measuring, the device presents a display related to the flow-rate; when discontinuously measuring, the device presents a display set on the basis of measuring the minimum elementary volume.

B.1.2 Volume measurement method

The volume measurement method uses an already known volume-measuring device to measure the volume of fuel consumption. This measuring device should be a “fixed” volume-measuring device or a “variable” volume-measuring device.

A “fixed” volume-measuring device enables only a fixed reading of the fuel flow. This fuel flow is already set. This flow depends on its own volume of the measuring device or the indications on the measuring device.

A “variable” volume-measuring device is an instrument with graduation marks. It enables non-fixed fuel flows to be read.

B.1.3 Weight measurement method

The weight measurement method uses a weight-measuring device to determine the mass of the fuel consumption; the device should be a “fixed” weight measuring device or a “variable” weight-measuring device.

A “fixed” weight-measuring device enables only a fixed reading of the fuel flow. This fuel flow is already set. This flow depends the measuring device itself and its characteristics.

A “variable” weight-measuring device allows non-fixed fuel flows to be read.

B.2 Installation of the measuring device

B.2.1 General points for attention

B.2.1.1 Whichever measurement method is selected, the installation of the measuring device shall not interfere with or change the state of the fuel supply from the fuel supply system of the vehicle.

Here, the pressure drop and the dimension of the cross-section of the fuel supply pipeline, and the length of the pipeline should be primarily taken into consideration.

B.2.1.2 Consider meeting the conditions specified in B.2.1.1.

a) if the flow measurement method is selected, when the pressure drop of the passing system is smaller than 100Pa, then the flow meter should be installed according to Diagrams B.1 and B.2

b) the installation of the volume measurement method and weight measurement method should be performed according to Diagram B.3, Diagram B.4, Diagram B.5 and Diagram B.6.

B.2.1.3 If it can be proved that the fuel supply system of the vehicle shall not be affected, then other installation methods may be used.

B.2.1.4 In order to reduce pressure loss, suggest:

$$d_1 \le d_2 \qquad \text{(B.1)}$$

$$d_2 = d_3 \qquad \text{(B.2)}$$

Where:

d1 – diameter of the original fuel pipe, unit is millimetre (mm);

d2 and *d3* – diameters of the fuel pipes of the measurement devices, unit is millimetre (mm)

B.2.2 Flow measurement method

B.2.2.1 the design of the flowmeter should be carried out on the basis of the pressure drop of the passing device is not greater than 100Pa.

B.2.2.2 Diagram 1 is the schematic diagram for the flow measurement system when the carburettor supplies fuel; Diagram 2 is the schematic diagram for flow measurement system when the fuel is supplied by fuel injection.

B.2.2.3 Accuracy

During the whole testing period, the accuracy of the overall testing process is within a range of ± 2%.

B.2.3 Volume measurement method

B.2.3.1 Diagram 3 is the schematic diagram for volume measurement system when the carburettor supplies fuel; Diagram 4 is the schematic diagram for volume measurement system when the fuel is supplied by fuel injection.

B.2.3.2 Test conditions (the chassis dynamometer indicated in Diagram 2 and the volume method used on a road)

B.2.3.2.1 The measuring tube should be installed on one side of the fuel tank according to the following method:

$$h_a \le h_u - h_1 + 300 \qquad \text{(B.3)}$$

The unit of the abovementioned numerical value should be mm.

B.2.3.2.2 The pressure inside the measuring tube should not be affected by the wind pressure on the air outlet of the measuring tube.

B.2.4 Weight measurement method

B.2.4.1 Diagram 5 is the schematic diagram for the weight measurement system when the carburettor supplies fuel; Diagram 6 is the schematic diagram for the weight measurement system when the fuel is supplied by fuel injection.

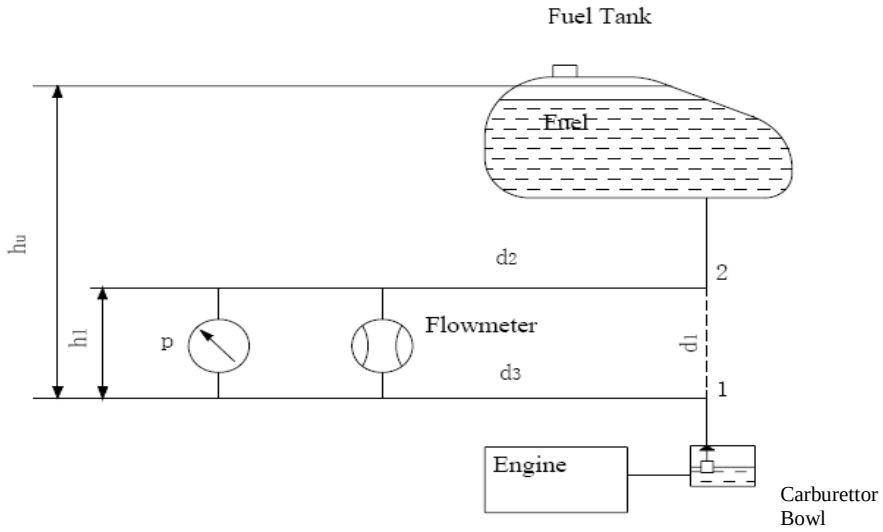
B.2.4.2 Requirements for graduation marks

Accuracy: • 1%

Resolution capacity: 0.1g

B.2.4.3 Density measurement (mass/volume)

Measurement accuracy of 1g/cm^3 and change to standard state.



h_u – fuel upper limit, mm;

h_l – fuel lower limit, mm;

p – pressure loss after passing flowmeter, Pa;

I – carburettor fuel intake;

2 – fuel tank outlet;

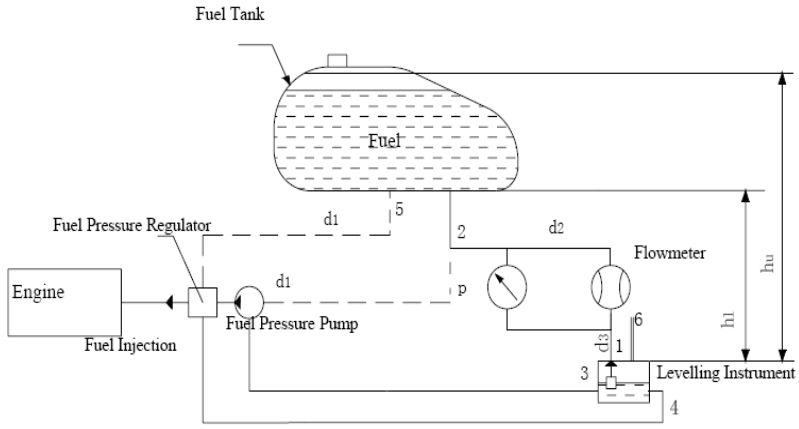
d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm;

d_3 - diameter of measurement device fuel pipe, mm.

Diagram B.1 Flow Measurement Method

(Fuel Measurement System when carburettor supplies fuel)



h_u – fuel upper limit, mm;

h_l – fuel lower limit, mm;

p – pressure loss after passing flowmeter, Pa;

d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm;

d_3 - diameter of measurement device fuel pipe, mm;

1 – levelling instrument fuel inlet;

2 – fuel tank outlet;

3 – levelling instrument fuel outlet;

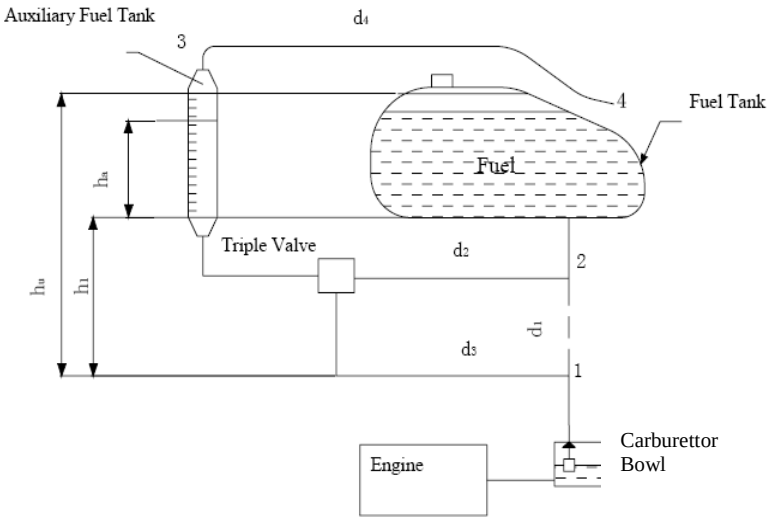
4 - levelling instrument fuel inlet;

5 – fuel tank inlet;

6 – levelling instrument air outlet pipe.

Diagram B.2 Flow Measurement Method

(Fuel Measurement System when fuel is supplied by fuel injection,)



h_u – fuel upper limit, mm;

h_l – fuel lower limit, mm;

h_a – maximum measuring height of the measuring tube, m;

d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm;

d_4 – diameter of air outlet tube of measuring tube, mm;

1 – carburettor fuel intake;

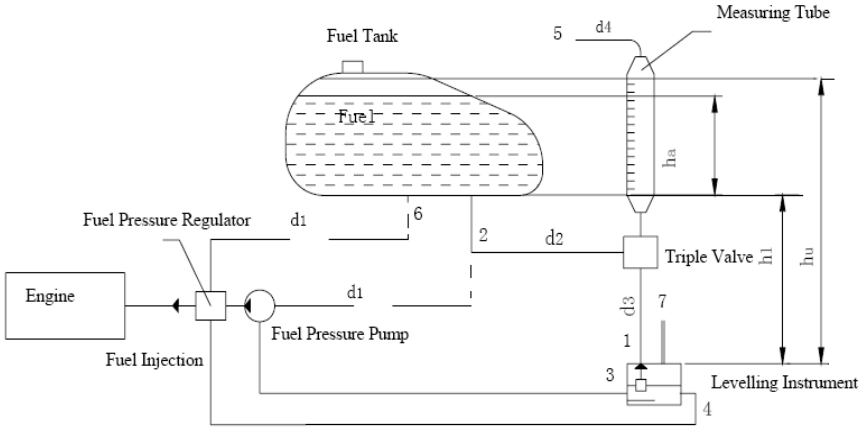
2 – fuel tank outlet;

3 – air outlet of measuring tube;

4 – air outlet end of measuring tube;

d_3 - diameter of measurement device fuel pipe, mm.

Diagram B.3 Volume Measurement Method
(Fuel Measurement System when carburettor supplies fuel)



h_u – fuel upper limit, mm;

h_l – fuel lower limit, mm;

h_a – maximum measuring value of the measuring tube, mm;

d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm

d_3 - diameter of measurement device fuel pipe, mm

d4 – diameter of air outlet tube of measuring tube, mm;

1 – levelling instrument fuel inlet;

2 – fuel tank outlet;

3 – fuel outlet of levelling instrument;

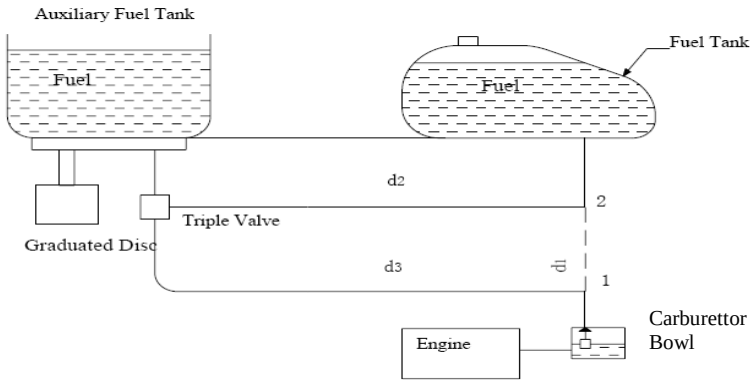
4 – fuel inlet of levelling instrument;

5 - air outlet end of measuring tube;

6 – fuel tank inlet;

7 – air outlet tube of levelling instrument.

Diagram B.4 Volume Measurement Method
(Fuel Measurement System when fuel is supplied by fuel injection)



d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm;

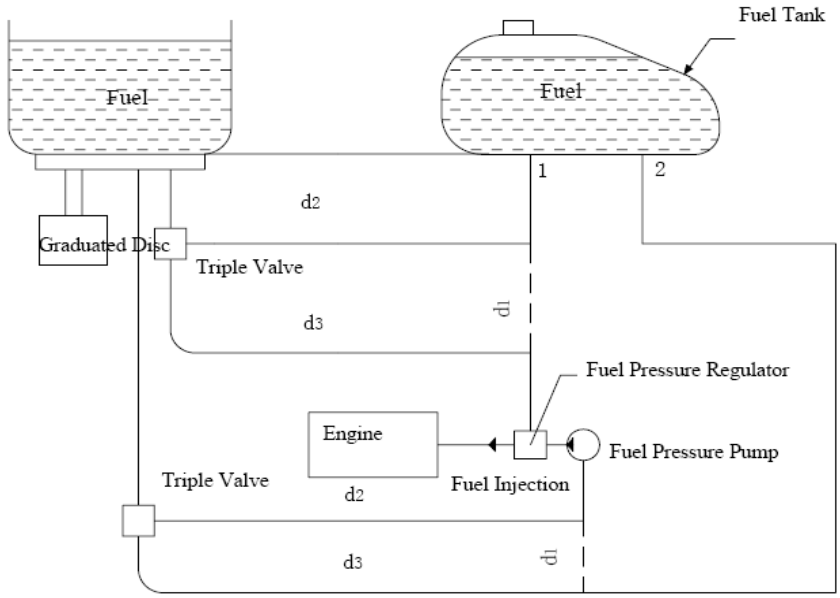
d_3 - diameter of measurement device fuel pipe, mm;

1 – carburettor fuel intake;

2 – fuel tank outlet.

Diagram B.5 Weight Measurement

(Fuel Measurement System when carburettor supplies fuel)



d_1 – diameter of original fuel pipe, mm;

d_2 – diameter of measurement device fuel pipe, mm;

d_3 - diameter of measurement device fuel pipe, mm;

1 – fuel tank inlet;

2 – fuel tank outlet.

Diagram B.6 Weight Measurement Method

(Fuel Measurement System when the fuel is supplied by fuel injection)