GB

ICS 43.020

R 06

National Standard

of the People's Republic of China

GB/T 14951-2007

Replacing GB/T 14951-1994, GB/T 17752-1999, GB/T 17753-1999

Measurement method of fuel saving technology for automobiles

汽车节油技术评定方法

Issued on: January 24, 2007 **Implemented on: August 1, 2007**

Issued by: General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China;

Standardization Administration of the People's Republic of China.

Table of Contents

Foreword

This Standard replaces GB/T 14951-1994 *Measurement method of fuel saving technology for automobiles*, GB/T 17752-1999 *Test and evaluation methods on fuel-saving additives of auto-fuel*, and GB/T 17753-1999 *Test and evaluation methods on fuel-saving additives of auto-engine oil*.

Compared with the three standards GB/T 14951-1994, GB/T 17752-1999, and GB/T 17753-1999, this Standard has the following major changes:

— REVISE the test methods of on-road fuel consumption for automobiles (SEE Articles 5.2.2.2 and 5.2.2.3);

— ADD the contrast test contents and methods of fuel consumption per hundred kilometers and sliding distance in gear for automobiles (SEE Articles 5.2.2.4 and 5.2.2.6);

— Respectively APPLY different test methods and limits of exhaust pollutants to the in-use vehicles with different production dates, and ADD the measurement methods for exhaust pollutants from the vehicles equipped with exhaust gas processing units (SEE Article 5.2.2.7);

— DELETE the test and evaluation methods of fuel consumption, economic benefit indicators, and corresponding calculation method with regard to special working conditions and accelerating working conditions in the original standard.

Appendixes A, B, C and D of this Standard are normative.

This Standard was proposed by the Ministry of Transport of the People's Republic of China.

This Standard shall be under the jurisdiction of the National Technical Committee for Standardization of Automobile Maintenance and Repair (SAC/TC 247).

Drafting organization of this Standard: Highway Research Institute of Ministry of Transport.

Main drafters of this Standard: Han Guoqing, Feng Guiqin, Liu Li, Zhao Kan, Wang Wei, Dong Guoliang, He Yong, Hong Lanfang, and Cai Fengtian.

The previous versions replaced by this Standard are as follows:

— GB/T 14951-1994;

Measurement method of fuel saving technology for automobiles

1 Scope

This Standard specifies the evaluation indicators, test methods, test data processing, and evaluation item calculation of fuel saving technology for in-use automobiles.

This Standard applies to evaluating the application effect of various fuel saving technologies for in-use automobiles.

2 Normative references

The provisions in the following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest versions apply to this Standard.

GB/T 265 Petroleum products – Determination of kinematic viscosity and calculation of dynamic viscosity

GB/T 3142 Lubricants – Determination of load-carrying capacity (four balls method)

GB/T 3535 Petroleum products – Determination of pour point (GB/T 3535-1983, neq ISO 3016:1974)

GB/T 3536 Petroleum products – Determination of flash and fire points – Cleveland open cup method (GB/T 3536-1983, eqv ISO 2592:1973)

GB 3847 Limits and measurement methods for exhaust smoke from C.I.E. (Compression Ignition Engine) and vehicle equipped with C.I.E.

GB/T 5096 Petroleum products – Corrosiveness to copper – Copper strip test (GB/T 5096-1983, eqv ASTM D 130:1983)

GB/T 12534 Motor vehicles – General rules of road test method

GB/T 12543 Acceleration performance test method for motor vehicles

GB/T 12545.2 Commercial vehicle – Fuel consumption test method

GB 18285 Limits and measurement methods for exhaust pollutants from vehicles equipped ignition engine under two-speed idle conditions and simple driving mode conditions

GB/T 18297 Performance test code for road vehicle engines (GB/T 18297-2001, neq ISO 1585:1992, ISO 2534:1998)

GB 18352 (all Parts) Limits and measurement methods for emissions from light-duty vehicles

3 Terms and definitions

The following term and definition apply to this Standard.

3.1 Fuel saving technologies for automobile

The fuel saving technologies for automobile refer to the technologies that are able to reduce the automobile fuel consumption and have no adverse effects on other functional performances of automobiles.

4 Evaluation items

4.1 Economic items

4.1.1 Major items:

a) Fuel-saving amount in intercity operation mode ($\triangle Q_c$), in unit of kilogram per hundred kilometers (kg/100km);

   Fuel-saving rate in intercity operation mode (a_c), in unit of %.

b) Fuel-saving amount in downtown operation mode ($\triangle Q_s$), in unit of kilogram per hundred kilometers (kg/100km);

   Fuel-saving rate in downtown operation mode (a_s), in unit of %.

c) Fuel-saving amount in rapid operation mode ($\triangle Q_q$), in unit of kilogram per hundred kilometers (kg/100km);

   Fuel-saving rate in rapid operation mode (a_q), in unit of %.

5.1.2 Contrast tests of automobile road performance

a) Contrast test of automobile fuel consumption at constant speed;

b) Contrast test of automobile fuel consumption under multiple working conditions;

c) Contrast test of fuel consumption per hundred kilometers for automobiles;

d) Contrast test of full-throttle acceleration performance in top gear (secondary gear) for automobiles;

e) Sliding contrast test in gear for automobiles;

f) Contrast measurement for exhaust pollutants from automobiles;

g) Smoke contrast measurement for exhaust pollutants from diesel vehicles.

5.1.3 Tests for physicochemical properties of fuel-saving additives

a) Test for physicochemical properties of fuel-saving additives of fuel oil;

b) Test for physicochemical properties of fuel-saving additives of lubricating oil.

5.2 Test methods

5.2.1 Contrast tests of engine pedestal performance

5.2.1.1 Contrast test of total engine power

The contrast test of total engine power shall be conducted according to the relevant test items given in GB/T 18297.

5.2.1.2 Contrast test of engine load performance

The contrast test of engine load performance shall be conducted according to the provisions of the load performance test given in GB/T 18297. The control parameters are given in Table 1. The engine speed corresponds to five kinds of vehicle speed in top gear or secondary gear, which is measured in the running process or is calculated according to Formula (1).

$$n = \frac{i_o \times i_k \times v}{0.377 \times r} \qquad \cdots\cdots(1)$$

Where:

n – Engine speed, in unit of rotations per minute (r/min);

After using the fuel saving technologies for engine oil, the engines shall be conducted at least four pre-operation cycles. The tests can only be conducted after the aging lubricating oil treatment.

5.2.2 Contrast tests of automobile road performance

5.2.2.1 Conditions of road contrast test for automobiles

The conditions of road contrast test for automobiles shall conform to the relevant provisions of GB/T 12534.

5.2.2.2 Contrast test of automobile fuel consumption at constant speed

The contrast test of automobile fuel consumption at constant speed shall be conducted according to the provisions of GB/T 12545.2.

5.2.2.3 Contrast test of automobile fuel consumption under multiple working conditions

The contrast test of automobile fuel consumption under multiple working conditions shall be conducted according to the provisions of GB/T 12545.2.

5.2.2.4 Contrast test of fuel consumption per hundred kilometers for automobiles

The contrast test of fuel consumption per hundred kilometers for automobiles shall be conducted according to requirements specified in the Appendix A.

5.2.2.5 Contrast test of full-throttle acceleration performance in top gear (secondary gear) for automobiles

The contrast test of full-throttle acceleration performance in top gear (secondary gear) for automobiles shall be conducted according to the provisions of GB/T 12543. The test speed shall meet the following requirements:

— Passenger vehicles: 30km/h-110km/h;

— Commercial vehicles: 30km/h-80km/h.

5.2.2.6 Sliding contrast test in gear for automobiles

The sliding contrast test in gear for automobiles shall be conducted according to requirements specified in the Appendix B.

5.2.2.7 Contrast test of exhaust pollutants from automobiles

5.2.2.7.1 The contrast test of exhaust pollutants from gasoline automobiles

kilograms per hundred kilometers (kg/100km);

$\bar{G}_f$ – Integral mean value of engine fuel consumption per hour, in unit of kilogram per hour (kg/h);

v – Vehicle speed, in unit of kilometers per hour (km/h).

6.2 Road test data processing for automobiles

The road test data for automobiles shall be processed according to the provisions of GB/T 12545.2.

6.3 Economic evaluation items

6.3.1 Calculation of fuel-saving amount and fuel-saving rate in various operation modes

6.3.1.1 Fuel-saving amount in various operation modes

$$\Delta Q = \sum R_i Q_{oi} - \sum R_i Q_{ji} \qquad \cdots\cdots (4)$$

Where:

ΔQ – Fuel-saving amount in various operation modes, in unit of kilograms per hundred kilometers (kg/100km);

Q_{oi} – Fuel consumption without using fuel saving technologies, in unit of kilograms per hundred kilometers (kg/100km);

Q_{ji} – Fuel consumption when using fuel saving technologies, in unit of kilograms per hundred kilometers (kg/100km);

R_i – Weighting coefficients at different vehicle speed in different operation modes, which are shown in Table 3.

Table 3 Weighting Coefficients R_i at Different Vehicle Speed in Different Operation Modes

Operation Mode	Vehicle Speed, km/h				
	v_1	v_2	v_3	v_4	v_5
Downtown Operation	0.33	0.51	0.16		
Intercity Operation	0.04	0.33	0.41	0.18	0.04
Rapid Operation					1

6.3.1.2 Fuel-saving rate in various operation modes

$$\alpha = \frac{\Delta Q}{\sum R_i Q_{oi}} \times 100 \qquad \cdots\cdots (5)$$

Appendix A

(Normative)

Contrast test methods of fuel consumption per hundred kilometers for automobiles

A.1 Test conditions

A.1.1 Test vehicles

The test vehicles shall be in good technical conditions, and the performance shall conform to the provisions of manufacturers.

A.1.2 Test vehicle load

Unless otherwise specified, the test vehicle load shall conform to the provisions of GB/T 12545.2.

A.1.3 Test instruments

The test instruments shall meet the requirements specified in GB/T 12545.2.

A.1.4 Test road sections

The road contrast test conditions for automobiles shall meet the requirements specified in the Article 5.2.2.1. The test road section shall not be less than 15km in length. The closed ring roads (the road section to be measured shall be a complete ring) and the straight roads are optional (the test shall be conducted in two directions).

A.1.5 Test fuels

The test fuels shall conform to the provisions of vehicle manufacturers.

A.2 Test method

DRIVE at the following speeds under normal traffic conditions. Furthermore, KEEP driving at constant speed as far as possible.

— Passenger vehicles: 90km/h;

— Commercial vehicles: 70km/h.

DETERMINE the fuel consumption of each one-way distance of 10km (or a

Appendix B

(Normative)

Contrast test methods of sliding distance in gear for automobiles

B.1 Test conditions

B.1.1 Test vehicles

The test vehicles shall be in good technical conditions, and the performance shall conform to the provisions of manufacturers. Other test conditions and vehicle preparation shall conform to the provisions specified in the Article 5.2.2.1.

B.1.2 Test instruments

The accuracy of speed and driving distance recorders or corresponding recording instruments shall not be less than 0.5%.

B.1.3 Test road sections

The road conditions of the contrast test of sliding distance in gear for automobiles shall meet the requirements specified in the Article 5.2.2.1.

B.2 Test method

The test shall be conducted on straight roads. The transmissions shall be in top gear or secondary gear, so as to keep the steady speed v_1 until the vehicles enter the sliding sections. Rapidly RELEASE the throttle to start sliding. NOTE down the sliding time, distance, speed, and other parameters, until the speed decreases to v_2. Do NOT rotate the steering wheel during sliding. Respectively CONDUCT the sliding test twice to the same round-trip distance. TAKE the mean value. Where:

— Passenger vehicles: v_1 is 110km/h, while v_2 is 50km/h;

— Commercial vehicles: v_1 is 70km/h, while v_2 is 30km/h.

Appendix C

(Normative)

Test methods of the compatibility between fuel-saving additives and fuel oil for automobiles

C.1 Method summary

This method mainly includes: ADD fuel-saving additives to the reference fuel oil, so as to prepare mixed fuel oil. CENTRIFUGE the mixed fuel oil at a certain rotating speed for 30min. OBSERVE the status afterwards.

C.2 Sample

Fuel-saving additives for automobiles.

C.3 Instruments and materials

C.3.1 Drying oven: It is able to control the temperature at 105°C ± 3°C.

C.3.2 Flask: 250mL (× 2), equipped with a stopper.

C.3.3 Centrifuge tube: 50mL.

C.3.4 Centrifugal machine: It is able to rotate two or more centrifuge tubes under speed control. The speed shall be able to generate the relative centrifugal force within the range of 600 to 700 on the end of the centrifuge tube. The rotating speed *n* (r/min) shall be calculated according to the formula below:

$$n = 1\,337\ \sqrt{rcf/d} \qquad \cdots\cdots (C.1)$$

Where:

rcf – Relative centrifugal force;

d – The rotation diameter between the bottom ends of two corresponding tubes during rotation, in unit of millimeter (mm).

C.3.5 Thermostatic bath: It is able to control the temperature at 50°C ± 3°C.

C.3.6 Low-temperature bath: It is able to control the temperature at -40°C ± 3°C.

C.3.7 Reference fuel oil: It refers to the fuel oil meeting the test requirements.

Appendix D

(Normative)

Stability test methods on fuel-saving additives of auto-engine oil

D.1 Method summary

This method mainly includes: ADD fuel-saving additives of engine lubricating oil to the reference lubricating oil, so as to prepare mixed lubricating oil. CENTRIFUGE the mixed lubricating oil at a certain rotating speed for 30min. OBSERVE the status of the mixed lubricating oil afterwards.

D.2 Sample

Fuel-saving additives of auto-engine oil.

D.3 Instruments and materials

D.3.1 Drying oven: It is able to control the temperature at 105°C ± 3°C.

D.3.2 Flask: 250mL (× 2), equipped with a stopper.

D.3.3 Centrifuge tube: 50mL.

D.3.4 Centrifugal machine: It is able to rotate two or more centrifuge tubes under speed control. The speed shall be able to generate the relative centrifugal force within the range of 600 to 700 on the end of the centrifuge tube. The rotating speed *n* (r/min) shall be calculated according to the formula below:

$$n = 1\,337\sqrt{rcf/d} \qquad \text{(D.1)}$$

Where:

rcf – Relative centrifugal force;

d – The rotation diameter between the bottom ends of two corresponding tubes during rotation, in unit of millimeter (mm).

D.3.5 Thermostatic bath: It is able to control the temperature at 93°C ± 3°C.

D.3.6 Reference lubricating oil: It refers to the engine lubricating oil meeting the test requirements.

D.3.7 Petroleum ether: Analytical reagent, 90°C~120°C.

D.4 Preparations

USE tap water to clean the flask and the centrifuge tube. USE distilled water to clean them afterwards. DRY them for backup.

D.5 Test steps

D.5.1 ADD 200mL of reference lubricating oil and 20mL of petroleum ether to the flask. ADD the additives according to the ratio specified in the product instructions to the flask afterwards, so as to prepare mixed lubricating oil.

D.5.2 PLUG the stopper. Vigorously SHAKE the flask for 1min. PLACE the flask in the drying oven at 105°C ± 3°C afterwards. KEEP it at constant temperature for 8h.

D.5.3 TAKE out the flask. COOL down to room temperature.

D.5.4 Vigorously SHAKE the flask for 1min. Rapidly POUR the mixed lubricating oil into two clean centrifuge tubes, until it comes up to the scale mark of 50mL.

D.5.5 PUT the centrifuge tubes containing mixed lubricating oil in the thermostatic bath at 93°C ± 3°C for 5-minute heating. Carefully PLACE the centrifuge tubes on the symmetric positions in the centrifugal machine, so as to balance the centrifugal machine.

D.5.6 START the centrifugal machine for 30-minute operation at the rotating speed when the relative centrifugal force comes up to 600 to 700. TAKE out the centrifuge tubes afterwards. OBSERVE whether there exists stratification or precipitates in the mixed lubricating oil.

END

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------