

JIS

JAPANESE INDUSTRIAL STANDARD

**Automotive engines — Carburetors
— Test methods**

JIS D 1613^{—1996}

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Automotive engines – Carburetors – Test methods

D 1613-1996

1. Scope This Japanese Industrial Standard specifies the testing methods for performances of the carburetor to be used in general automotive engines (hereafter referred to as “carburetor”), using gasoline as fuel.

Remarks: The following standards are cited in this Standard.

JIS B 0108	Glossary of terms relating to reciprocating internal-combustion engines
JIS B 0110	Glossary of terms relating to reciprocating internal-combustion engines (attachments)
JIS D 0203	Method of moisture, rain and spray test for automobile parts
JIS D 0207	General rules of dust test for automobile parts
JIS D 1001	Road vehicles – Engine power test code
JIS D 1010	General rules of running test method of automobiles
JIS D 1011	Road vehicles – Speed of meters – Methods of calibration
JIS D 1012	Fuel consumption test methods of automobiles
JIS D 1022	Driving test method of automobiles
JIS D 1030	Analytical procedure for continuous measurement of carbon monoxide, carbon dioxide and hydrocarbon in automobile exhaust gas
JIS D 1033	Mopeds and motorcycles – Method of measuring fuel consumption
JIS D 1035	Mopeds and motorcycles – Method of acceleration test
JIS D 1040	Mopeds and motorcycles – Method of driving test
JIS D 1601	Vibration testing methods for automobile parts
JIS K 2201	Gasoline for industrial purpose
JIS K 6301	Physical testing methods for vulcanized rubber
JIS Z 2371	Methods of neutral salt spray testing

2. Definitions For the purpose of this Standard, in addition to the following definitions, the definitions of JIS B 0108 and JIS B 0110 shall apply :

- (1) reference carburetor The carburetor which imparts the characteristic reference values in determination of criteria for acceptance inspection of carburetors.
- (2) perfect starting To start driving in which the engine does not stop unless it is subjected to any particular stopping operation in starting an engine.
- (3) initial firing The first explosion in combustion chamber after commencement of cranking (driving engine by means of a starter motor) in starting operation of an engine.

- (4) idling A generic term of the no-load low speed driving of an engine which mainly designates the standard speed idling at standard engine speed and in addition, there is the lowest speed idling at the lowest engine speed which is the limit of stability.

3. Types and object of tests Types of the tests shall be classified into the test on carburetor only and the application test which is carried out by mounting the carburetor on an engine. The tests shall be performed according to the following test items.

- (1) Test on carburetor only This test is intended to examine the performances of carburetor only and carried out on the test items of Table 1.

Table 1. Test items and objects of test on carburetor only

Test item	Object	Relevant clause
(a) Flow rate test	To examine performances relating to air flow rate, test fuel flow rate or air/fuel ratio of the carburetor.	6.1
(b) Inclination test	To examine performances relating to air flow rate, test fuel flow rate or air/fuel ratio of the carburetor being tilted.	6.2
(c) Altitude test	To examine performances relating to air/fuel ratio of the carburetor when atmospheric pressure is reduced at altitude.	6.3
(d) Accelerating device test	To examine functions of accelerating device of the carburetor.	6.4
(e) Start and warming-up compensating device test	To examine functions of start and warming-up compensating device of the carburetor.	6.5
(f) Automatic device test	To examine functions of automatic devices such as automatic choke valve and automatic power valve.	6.6
(g) Operating-part test	To examine operating resistance and reliability of operating parts of the carburetor such as throttle valve and choke valve.	6.7 and Annex
(h) Fuel leakage test	To examine existence or nonexistence of fuel leakage related to the carburetor.	6.8
(i) Endurance test	To examine deterioration of performance, abrasion of structural part, loosening, smoothness of work and others after repetitive operation of moving parts of carburetor has reached specified number of movements or time.	6.9
(j) Environment resistance test	To examine change in performance, resonance, change in fuel level, abrasion, looseness, change in quality and others of the carburetor or structural components thereof under environmental conditions such as specified temperature, vibration and sprinkling atmosphere.	6.10

- (2) Application test This test is intended to know application performances of carburetors by running the applicable engine or automobile, and carried out on the test items of Table 2.

Table 2. Test items and objects of application test

Test item	Object	Relevant clause
(a) Starting test	To examine performances of the carburetor related to perfect starting of engine.	7.1
(b) Warming-up test	To examine performances of the carburetor related to driving of engine and running of automobile in the process of warming-up driving of engine.	7.2
(c) No-load test	To examine stability of engine in the lowest speed idling and high speed idling with no-load, adjustability in standard speed idling and performances of idling speed compensator.	7.3
(d) Load test	To examine performances of the carburetor under full load and partial load of engine.	7.4
(e) Inclination test	To examine performances of the carburetor related to starting of engine and stability of idling on slope.	7.5
(f) High temperature test	To examine performances of the carburetor related to starting of engine and stability of idling at high temperature.	7.6
(g) Icing test	To examine performance of the carburetor related to icing at low temperature and high humidity.	7.7
(h) Altitude test	To examine performances of the carburetor at no-load and load test of an engine at altitude.	7.8
(i) Running test	To examine performances of the carburetor during general running of automobile.	7.9
(j) Acceleration test	To examine performances of the carburetor during accelerating running of automobile.	7.10
(k) Deceleration test	To examine performances of the carburetor during decelerating running of automobile.	7.11
(l) Turning test	To examine performances of the carburetor during turning run of automobile.	7.12
(m) Rough road test	To examine performances of the carburetor during rough road running of automobile.	7.13
(n) Exhaust gas measurement test	To examine performances of the carburetor related to emission of exhaust gas component when driving automobile at the specified driving mode.	7.14

4. Common conditions of tests

4.1 Common conditions for the test on carburetor only Common test conditions to every test item in the test on carburetor only shall be as stated below.

- (1) Adjustment of carburetor The carburetor shall be adjusted to the specified dimensions according to the method and procedure specified in the adjusting specification.

- (2) Test fuel The fuel shall be the gasoline of No. 4 or No. 5 specified in JIS K 2201 or the equivalent, unless otherwise specified.
- (3) Measuring instruments The measuring instruments shall be inspected and the necessary calibration shall be performed prior to start of the test.

4.2 Common conditions for application test Common test conditions to every test item in the application test shall be as stated below.

- (1) Adjustment of carburetor The carburetor shall be adjusted during idling after warming-up of engine by adjusting idle needle valve and idle-adjusting screw according to the specified method and procedure so that concentration (%) of carbon monoxide contained in exhaust gas becomes the specified ratio and engine speed becomes stable at the specified speed.

Adjustment of parts other than idle needle valve and idle-adjusting screw shall be made according to the specified method and procedure.

- (2) Driving of air-fuel ratio compensating actuator of the feedback controlled carburetor When an air-fuel ratio feedback controlled carburetor is tested on the test engine bench, the air-fuel ratio compensating actuator shall be driven by giving such signals as duty ratio ⁽¹⁾ and pulse signal ⁽²⁾ specified in each of engine operating conditions by use of the device which gives the same signal as that of the actual automobile.

Notes ⁽¹⁾ Duty ratio means a ratio of on-duty period to cycle period of rectangular signal to drive actuator (electromagnetic valve).

⁽²⁾ Pulse signal means a signal of short time voltage or current to drive the actuator (stepping motor).

- (3) Condition of automobile Automobile for test shall be in loaded condition specified in 2.2.1 of JIS D 1010 unless otherwise specified.
- (4) Maintenance of engine, automobile, fuel and lubricating oil Maintenance of engine, automobile, fuel and lubricating oil shall be in accordance with 3. of JIS D 1001, 2.2 of JIS D 1010 and 3.4 of JIS D 1030.
- (5) Running test site Running test site of automobile shall be selected in accordance with 2.4 of JIS D 1010.
- (6) Chassis dynamometer Chassis dynamometer shall be in accordance with the specification in Annex of JIS D 1012.
- (7) Measuring device of exhaust gas Measuring device of exhaust gas shall comply with 3. and 4. of JIS D 1030.
- (8) Test apparatus Apparatus used for the test shall be in accordance with the specification in 2.3 of JIS D 1010.
- (9) Speedometer and odometer Speedometer and odometer to be used for the test shall be calibrated as required prior to testing in accordance with JIS D 1011.

5. Measurement, calculation and unit Measurements other than those especially stated below shall be carried out in accordance with JIS D 1001, 2.5 of JIS D 1010 and 5. of JIS D 1030.

- (1) Test fuel flow rate and fuel flow rate Measurement of test fuel flow rate and fuel flow rate shall be made at the inlet of the carburetor. When buret is used, it is recommended that measurement time is not less than 10 s for a test carburetor and not less than 20 s for the reference carburetor.

Unit of flow rate shall be expressed by liter per hour (l/h) or gram per second (g/s).

Kinetic viscosity to be appended to the flow rate shall be expressed by square millimeter per second (mm^2/s), provided that kinetic viscosity may be alternatively expressed by brand and temperature.

- (2) Air flow rate Air flow rate shall be measured at inlet or outlet of the carburetor and the unit of flow rate shall be expressed by cubic meter per minute (m^3/min) or gram per second (g/s).
- (3) Suction air pressure The suction air pressure to be applied to the carburetor under test shall be the static pressure of the suction device situated in the downstream of the outlet of the carburetor, and its measuring point shall be clearly stated.

Pressure unit shall be expressed by kilo-Pascal (kPa).

- (4) Opening of throttle valve and choke valve Opening of throttle valve and choke valve shall be expressed by angle ($^\circ$) or dimension (mm) from the fully closed position, or by percentage (%) of angle to fully opened position.
- (5) Opening of idle adjusting screw Opening of the screw means the number of revolutions of the screw returned from cut-off position, and its fraction shall be expressed in the unit of 1/8 revolution visually determined.
- (6) Tightening torque In the measurement of tightening torque of threaded part, the torque necessary for initiation of tightening or loosening torque shall be read, and be expressed in the unit of Newton centimeter (N·cm).

Distinction of tightening direction or loosening direction shall be clearly stated.

- (7) Room temperature, humidity and atmospheric pressure The room temperature, humidity and atmospheric pressure shall be measured in the test room at a place not affected by direct sunlight and other heat source, using a wet and dry bulb thermometer and a barometer, and the results shall be expressed in the units of degree ($^\circ\text{C}$), percentage (%) of relative humidity and kilo-Pascal (kPa).
- (8) Measuring items Among the measuring items specified in clauses 6. and 7., those which are given in parentheses shall be measured as required.

6. Test on carburetor only

6.1 Flow rate test

6.1.1 Test conditions The conditions in this test shall be as stated in 4.1 in addition to those shown below.

- (1) Test apparatus The flow rate test apparatus to be used in this test shall have the structure shown in the example in Fig.1. The vacuum pump shall have sufficient suction capacity covering the test range of the carburetor and have pulsation as small as possible.

- (2) Establishment of measuring points Several measuring points in engine driving conditions such as idling, partial load and full load shall be selected, and the flow rate measurement conditions in each point should preferably be determined by such parameters as suction volume, suction pressure or opening of throttle valve measured in engine test at the respective points.
- (3) Establishment of reference value Flow rate test using the reference carburetor shall be carried out, transferring the measuring points at every time of measurement, at least three times in each point, and then the reference value shall be determined as the average measured value at the same point. The range of these measured values shall be not more than $\frac{1}{4}$ of tolerance at this measuring point in the acceptance inspection.
- (4) Adjustment at measuring point corresponding to idling At the measuring point corresponding to idling, the carburetor shall be adjusted by controlling the opening of throttle valve with throttle adjusting screw so as to obtain suction volume and suction pressure corresponding to the idling established in (2), and thereafter by opening and closing idle adjusting screw so as to obtain the reference value of test fuel flow rate established in (3).
- (5) Driving of air-fuel ratio compensating actuator of feedback controlled carburetor
In the case of air-fuel ratio feedback controlled carburetor, actuators of electromagnetic valve or stepping motor for feedback control of compensating fuel or bleed air volume shall be driven by use of an apparatus which gives the same signal waveform as that given in the actual automobile and by giving the conditions of the specified duty ratio or pulse signal at each measuring point specified in clause (2).
- (6) Test fuel pressure at carburetor inlet The test fuel pressure to be supplied to the carburetor shall be the specified pressure corresponding to the pressure applied by the fuel supply system of the actual automobile.
- (7) Conditions for upgrading accuracy of flow rate test In order to upgrade the accuracy in the comparative measurement with the reference carburetor as much as possible, it is preferable to perform confirmation test by use of the reference carburetor at appropriate intervals so that the conditions of air and test fuel do not fluctuate exceeding the following range compared with the measurement conditions of the reference carburetor.

Air temperature $\pm 3.0^{\circ}\text{C}$, test fuel temperature $\pm 3.0^{\circ}\text{C}$

Air pressure $\pm 0.5\%$, specific gravity of test fuel $\pm 1.0\%$

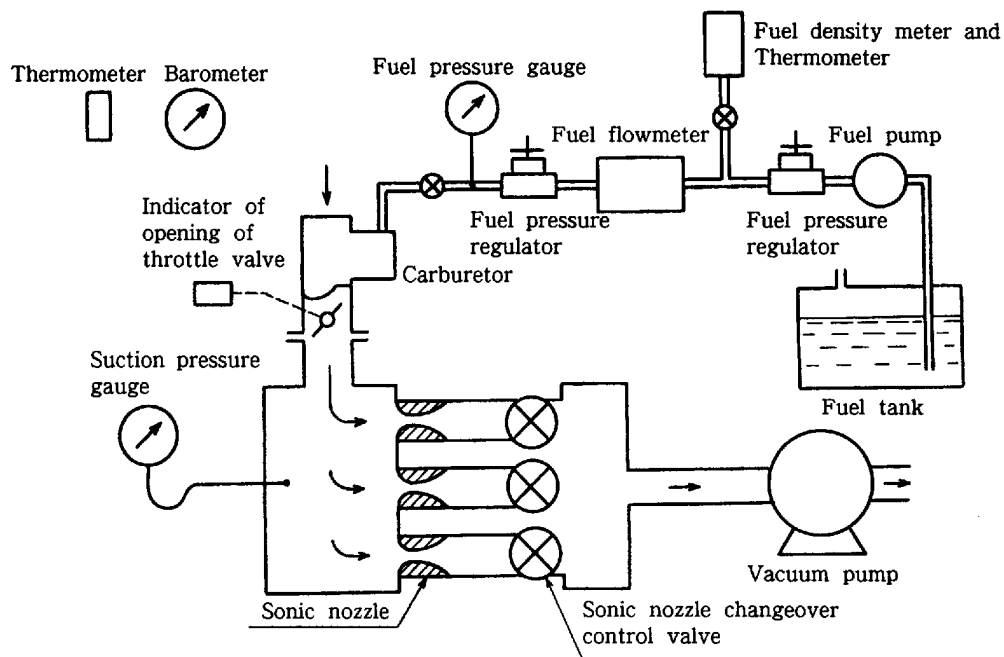
6.1.2 Test method This test shall be carried out by using flow rate test apparatus, beginning from the measuring point corresponding to idling, and the test fuel flow rate or air-fuel ratio of the carburetor shall be measured under the measurement conditions of suction volume and suction pressure or opening of throttle valve at each measuring point specified.

6.1.3 Measuring items Measuring items in this test shall be as follows.

- (1) Measuring items prior to testing Atmospheric pressure, room temperature, humidity, test fuel temperature, specific gravity of test fuel, (kinetic viscosity)
- (2) Measuring items during testing Suction pressure or opening of throttle valve, flow rate of test fuel, air-fuel ratio and test fuel pressure at carburetor inlet

In an acceptance test, it shall always be taken care of that the conditions, which can be considered to be the same as those when the reference values are established, are satisfied at least on the same measuring point in respect of the person in charge of measurement, measuring apparatus (including measuring instruments), test fuel and atmospheric condition, and the necessary measurement shall be made.

Fig. 1. Flow rate test apparatus (example)



6.2 Inclination test

6.2.1 Test conditions The conditions in this test shall be as specified in 4.1 and 6.1.1 in addition to those shown below.

- (1) Tilt angle Tilt angle of the carburetor shall be below the specified angle at intervals of 1° to 10° in longitudinal and transverse directions.
- (2) Fuel level of carburetor The fuel level of the carburetor shall be set at the value specified for the carburetor unless otherwise specified.

6.2.2 Testing method In this test, the flow rate test of 6.1 shall be carried out with the carburetor being mounted on the flow rate test apparatus at a tilt angle in longitudinal and transverse directions.

6.2.3 Measuring items Measuring items in this test shall be as follows.

- (1) Measuring items prior to testing Atmospheric pressure, room temperature, humidity, test fuel temperature, specific gravity of test fuel, (kinetic viscosity)
- (2) Measuring items during testing Suction pressure or opening of throttle valve, flow rate of test fuel, air-fuel ratio, test fuel pressure at carburetor inlet, tilt angle of the carburetor, fuel exposure angle and overflow angle of fuel passage or fuel jet