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**Road vehicles - Spark-plugs application test methods**

道路车辆 火花塞匹配性试验方法

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# Road vehicles - Spark-plugs application test methods

## 1 Scope

This document specifies the application test method for spark plugs of spark ignition engines of road vehicles.

This document applies to ignition engine spark plugs.

## 2 Normative references

The contents of the following documents constitute the essential provisions of this document through normative references in the text. Among them, for dated references, only the version corresponding to the date is applicable to this document; for undated references, the latest version (including all amendments) is applicable to this document.

GB/T 6791 Road vehicles - Spark-plugs and their cylinder head housing - Basic characteristics and dimensions

GB/T 18297 Performance test code for road vehicle engines

QC/T 430 Road vehicles Editorial nominating method for the type designation of spark-plugs

## 3 Terms and definitions

The following terms and definitions apply to this document.

### 3.1

#### Heat-rating value

A number used to indicate the heat dissipation capacity of the spark plug.

Note: Refer to QC/T 430, the larger the number, the higher the heat-rating value, and the stronger the heat dissipation capacity of the spark plug.

### 3.2

#### Ignition angle

The engine crank angle (crank angle) corresponding to the ignition moment.

### 3.9

#### **Available voltage of ignition coil**

The secondary output voltage of the ignition coil, which is measured under the condition that the secondary of the ignition coil is connected to a specific load capacitance in open circuit.

## **4 Test method**

### **4.1 Basic ignition performance test**

#### **4.1.1 Purpose of the test**

Select the structural features of the ignition end of the spark plug, such as ignition position, electrode structure, etc., through texts.

#### **4.1.2 Test sample**

The test sample shall meet the requirements of the engine performance test.

#### **4.1.3 Test equipment**

The test equipment shall comply with the engine performance bench, which is specified in GB/T 18297.

#### **4.1.4 Test procedure and method**

**4.1.4.1** Define the type of parameters to be measured in the test, such as power, torque, fuel consumption, etc., as well as the sequence of the spark plug test.

**4.1.4.2** Check the status of the engine and bench system; confirm that the correct fuel is used.

**4.1.4.3** Install the spark plug correctly, according to the torque specified in GB/T 6791. Start the engine, after confirming that the ignition system is connected normally.

**4.1.4.4** Measure the defined engine-related performance parameters.

#### **4.1.5 Evaluation of test results**

Compare the data obtained using spark plugs with different structural features to determine the appropriate spark plug firing tip structural features.

### **4.2 Electrode temperature measurement test**

#### **4.2.1 Purpose of the test**

**4.2.4.4** During the test, it should gradually increase the engine speed with 500 r/min as an increment. Start monitoring the electrode temperature, after the engine runs stably for 2 minutes at each speed point. Keep monitoring for 1 minute. Record the maximum electrode temperature at each speed condition.

**4.2.4.5** The measurement points shall include the working condition points that have a significant impact on the electrode temperature, such as the maximum torque point and maximum power point of the engine.

**4.2.4.6** For each working condition point, it shall record the ignition angle, air-fuel ratio, power, torque of the engine.

**4.2.4.7** Shut down after the first cylinder test.

**4.2.4.8** Replace the temperature measuring spark plugs to the remaining cylinders, in sequence. Repeat the test steps from 4.2.4.3 to 4.2.4.7 above.

**4.2.4.9** If the side electrode temperature measuring spark plug is used, special methods (such as changing the thickness of the outer gasket) shall be used, to make the orientation of the side electrode of the spark plug relatively consistent, after being installed on each cylinder.

**4.2.4.10** When conditions permit, multiple temperature-measuring spark plugs can also be used, to conduct electrode temperature-measuring tests on all cylinders at the same time.

**4.2.4.11** After the electrode temperature test on each cylinder, compare the electrode temperature at each measurement point on all cylinders, to find out the cylinder with the highest electrode temperature.

**4.2.4.12** Test the electrode temperature under partial load conditions for the cylinder, which has the highest electrode temperature.

#### **4.2.5 Evaluation of test results**

According to the test results, determine the cylinder and working condition point with the highest electrode temperature.

### **4.3 Ionic current test**

#### **4.3.1 Test purpose**

Confirm that the heat-rating value of the recommended spark plug matches the engine.

#### **4.3.2 Test sample**

Spark plugs with a recommended heat-rating value, spark plugs with a higher heat-rating value than the recommended heat-rating value, spark plugs with a lower heat-

Let the engine run stably for 2 minutes, at each speed point. Continuously monitor the number of post-ignitions or pre-ignition conditions for 2 min, under knocking open-loop control conditions. Record the number of post-ignitions or pre-ignition conditions. If pre-ignition is detected, the test is terminated.

**4.3.4.4** The measurement points shall include the working condition points, which have important influence on self-ignition, such as the maximum torque point and maximum power point of the engine.

**4.3.4.5** At each operating point, it shall record the ignition angle, air-fuel ratio, power, torque of the engine.

**4.3.4.6** If necessary, the ignition angle and engine load may be properly adjusted, at certain working conditions, then monitor the post-ignition or pre-ignition working conditions again, after the working conditions have been adjusted.

**4.3.4.7** Shut down after the ionic current test is over.

**4.3.4.8** Replace the test sample with a spark plug with a lower heat-rating value than the recommended. Then repeat the above test steps from 4.3.4.3 to 4.3.4.7.

#### **4.3.5 Evaluation of test results**

Under the test conditions of the initial ignition angle, it can be confirmed that the heat-rating value of the recommended spark plug matches the engine, if any of the following items are met:

- When judging by the post-ignition rate, the spark plug's post-ignition rate of the recommended heat-rating value shall not be greater than 40%;
- When judging by the pre-ignition working condition, the spark plug with at least one heat-rating value grade lower than the recommended heat-rating value shall not have pre-ignition.

### **4.4 Ignition voltage test**

#### **4.4.1 Test purpose**

Confirm the matching of spark plug's required ignition voltage and coil supply voltage.

#### **4.4.2 Test sample**

Spark plugs or equivalent spark plugs, that have passed the specified durability test.

Note: There shall be no visible deposits on the firing end of the spark plug.

#### **4.4.3 Test equipment**

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Contact: Wayne Zheng, [Sales@ChineseStandard.net](mailto:Sales@ChineseStandard.net)

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