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Method of bench test of engine for motorcycles and mopeds

摩托车和轻便摩托车发动机台架试验方法

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1 Scope

This document describes the test conditions, performance test method, reliability test method, durability test method and effective power correction for the bench test of engines for motorcycles and mopeds, as well as the bench test method of engines for hybrid drive systems.

It also provides the content of the test report.

This document applies to spark-ignition and compression-ignition engines for motorcycles and mopeds (hereinafter referred to as the "engines").

2 Normative References

GB 4569

GB 14622

GB 18176

GB/T 21404-2022

3 Terms and Definitions

This document does not have terms or definitions that need to be defined.

4.1 Standard Environmental Conditions

The standard environmental operating conditions shall comply with the relevant provisions of Chapter 5 in GB/T 21404-2022.

5.1 Starting Performance Test

5.1.1 During the test, the engine shall be started without connecting to a dynamometer in accordance with the starting method specified in the product manual. For engines with both electric and kick-start modes, both shall be tested.

- a) For kick-start, from the start of the starting operation, until the engine begins to independently run, measure the starting time and number of starts;
- b) For electric start, from the moment the starter motor is connected, until the engine begins to independently run, measure the starting time and number of starts;
- c) If the starting test cannot be conducted on a test bench due to limitations in the engine structure and starting method, the engine is allowed to be mounted on a matching vehicle frame and tested in accordance with the test methods and requirements in 5.1.1 a) and 5.1.1 b).

Record the lubricating oil temperature, starting time, number of starts and atmospheric parameters.

NOTE 1.starting time does not include auxiliary operation time before the start, but does include starting failure time and auxiliary operation time between each start.

NOTE 2.each time the pedal is depressed, or the starter lever is rotated by more than 90° in the starting direction, it is considered a start.

5.1.2 Normal-temperature start. conducted at an ambient temperature of 278 K ~ 318 K. Before testing, place the fuel, lubricating oil, a fully charged battery (only for battery-powered starters), and the engine at the above-mentioned ambient temperature. Wait for the temperature to reach equilibrium (temperature difference not exceeding 1 K), then, carry out the test.

5.1.3 Low-temperature start. conducted at an ambient temperature of 263 K ? 2 K. Before testing, place the fuel, lubricating oil, a fully charged battery (only for battery-powered starters), and the engine at the above-mentioned ambient temperature. Wait for the

temperature to reach equilibrium (temperature difference not exceeding 1 K), then, carry out the test.

5.1.4 Hot engine start. the air-cooled engines shall be subjected to pre-heating operation, until the spark plug gasket temperature reaches 413 K, then, stop, and immediately receive the starting test; the water-cooled engines shall be subjected to pre-heating operation, until the coolant outlet temperature is within the range specified by the manufacturer. If there is no such provision, the engines shall be subjected to pre-heating operation to 353 K, then, stop, and immediately receive the starting test.

5.2 Minimum No-Load Steady Speed (Idle) Test

controlled within $483\text{ K} \pm 10\text{ K}$. The coolant outlet temperature for water-cooled engines shall be within the manufacturer's specified range. If there is no such provision, it shall be controlled within $353\text{ K} \pm 5\text{ K}$.

5.3.2 Partial-load speed characteristics

When conducting the partial-load speed characteristics test, the throttle (or fuel injection pump) is respectively fixed at 100%, 75%, 50% and 25% maximum net power at the speed corresponding to maximum net power (25% maximum net power is not required for engines with a total displacement not greater than 50 mL). Gradually increase the load and decrease the speed. Within the stable operating speed range, select no fewer than six speed points to carry out the test.

During the full-load and partial-load speed characteristics tests, measure the speed, torque, fuel consumption, spark plug gasket temperature, coolant temperature and ambient conditions.

Other parameters (lubricating oil temperature, lubricating oil pressure, etc.) may be measured as appropriate.

5.4 Universal Characteristics Test

5.4.1 Perform the universal characteristics test using one of the following two methods.

a) Speed characteristics method. based on the percentage of maximum net power at the speed corresponding to maximum net power, select at least eight throttle openings (or fuel injection pump load states). In accordance with the method of 5.3, at these selected throttle openings (or fuel injection pump load states), carry out the test;

b) Load characteristics method. within the engine's stable operating speed range, select at least eight speeds, and maintain the engine speed constant at each speed. Select at least six load points for each speed, and change the load and throttle opening (or fuel injection pump load states) to carry out the test.

5.4.2 During the universal characteristics test, measure the speed, torque, fuel consumption,

spark plug gasket temperature, coolant temperature and ambient conditions. Other parameters (lubricating oil temperature, lubricating oil pressure, etc.) may be measured as appropriate.

5.5 Cylinder Operating Uniformity Test

The single-cylinder flameout method is used to determine the power non-uniformity of each cylinder in a multi-cylinder engine.

During the test, fix the throttle (or fuel injection pump) at the maximum net power position.

After the operation becomes stable, stop one cylinder in turn. Then, reduce the load, until the speed returns to the speed corresponding to maximum net power, and measure the power.

The indicated power of each cylinder is calculated in accordance with Formula (3).

5.8 Determination of Idling Emission of Pollutants

The idling emission of pollutants from the engine shall be determined in accordance with the provisions of GB 14622 or GB 18176.

5.9 Noise Determination

Engine noise shall be determined along with the whole vehicle in accordance with the provisions of GB 4569.

6.1 Running-in

In accordance with the provisions of 4.6, perform running in, and record in detail the number, phenomena, and causes of faults occurred during the running-in period. In addition, replace the lubricating oil.

6.2 Performance Test

6.2.1 The idling emission of pollutants shall be determined in accordance with the method specified in 5.8.

6.2.2 The full-load speed characteristics shall be conducted in accordance with the method

specified in 5.3.1.