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Engine intake air water separation test procedure

发动机进气水分离试验方法

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Annex:

Number, name and date of implementation of 8 automobile industry standards

No.	Standard number	Standard name	Replaced standard number	Date of implementation
166	QC/T 1131-2020	Methods of detecting polycyclic aromatic hydrocarbons in automotive materials		2021-01-01
167	QC/T 1132-2020	Measurement methods of the noise of electric power train system for electric vehicles		2021-01-01
168	QC/T 1134-2020	Engine intake air water separation test procedure		2021-01-01
169	QC/T 1133-2020	Safety filter element of air filter for commercial automobile		2021-01-01
170	QC/T 770-2020	Dry air filter assembly for automobile	QC/T 770-2006	2021-01-01
171	QC/T 1135-2020	Water filter for automobile engine		2021-01-01
172	QC/T 793-2020	Air filters for motorcycles and scooters	QC/T 793-2007	2021-01-01
173	QC/T 794-2020	Internal-combustion engine industry filter paper	QC/T 794-2007	2021-01-01

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Engine intake air water separation test procedure

1 Scope

This document specifies the test method of air water separation performance, of the air/water separation device in the engine air intake system, including the technical conditions of air water separation efficiency, test equipment, test requirements, test conditions, test procedures, calculation of water separation efficiency.

This document is applicable to the device in the air intake system, which has the water separation function, the pre-filter (coarse filter) of the air filter, the air filtration device with the water separation requirement, the intake air filtration system of heavy-duty engine, the automobile air intake system. Internal combustion engine's air intake system and industrial air intake system may refer to this document.

2 Normative references

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

GB/T 28949-2012 Inlet air cleaning equipment for internal combustion engines and compressors - Performance testing

QC/T 32-2017 Test methods of air cleaners for automobiles

3 Terms and definitions

There are no terms and definitions, that need to be defined in this document.

4 Test equipment

4.1 Test bench

The typical layout of the test bench is as shown in Figure 1. Use the test devices, which are specified in Figure B.7, Figure B.12, Figure B.16 of GB/T 28949-2012,

a) The accuracy of water flow measurement is ±5% of the actual value.

b) The accuracy of nozzle pressure measurement is ±1 kPa.

c) The accuracy of water temperature measurement is ±1.0 °C.

d) When measuring the mass of the water added, separated, collected, the accuracy of the measurement shall be within ±1% of the weighing value or 1 g, whichever is greater.

6 Test conditions

6.1 In order to reduce the maintenance of the nozzle AND avoid the impact of performance changes, it shall, according to the nozzle manufacturer's specifications, select the test water OR use the water, which has a conductivity of less than 20 μs/cm; the water temperature shall be kept within ±2 °C of the air intake temperature of the tested system.

6.2 This document does not involve water evaporation for the time being. The influence of water evaporation can be reduced, by controlling the water temperature. In order to keep the consistency of the test results AND reduce the influences, which are caused by the evaporation of water entering the tested system, it shall control the temperature and humidity of the test air. Meanwhile, the temperature of the air entering the air filter and separator shall be 23 °C ± 5 °C, the relative humidity shall be 55% ± 15%, the spray water temperature shall be 20 °C ± 10 °C. It shall be confirmed that, before the start of the test OR before the water injection spray, the conditions of the environment, air intake and water meet the specified requirements.

7 Test procedure

7.1 The purpose of the test is mainly to install inertial separation and its combination devices, in the air intake piping system, AND to evaluate the air filter's air intake housing components. Normally, clean components and clean filter elements shall be used for testing.

7.2 Install the air filter and intake system, according to the schematic diagram in Figure 1.

7.3 According to the test air flow, follow the requirements of Table 2, to select the water filling rate of nozzle.

water filling rate to fill water, until the specified amount of 4000 g of water is filled.

a) It shall record the time, BETWEEN commissioning AND the start of the test of water separation efficiency, which shall not exceed 10 min.

b) If the water spraying stops for more than 10 minutes, it shall carry out the commissioning again, in accordance with the provisions of 7.9.

7.12 After filling at least 4000 g of water into the air/water separator, stop filling water.

7.12.1 After the test system continues to run for 30 s ± 2 s, close the air flow.

7.12.2 When the air flow is zero, wait for at least 5 minutes, until the drain of the test system completely stops dripping (whichever meets the requirement first).

7.12.3 Determine the amount of water filled AND the amount of water, which is separated by the tested system.

7.13 Weigh the mass of the filter element of air filter, before and after the test. Use the weighed cloth, to collect the remaining water in the housing, from which it may roughly estimate the water separation efficiency.

7.14 The water separation efficiency is calculated according to formula (1):

Water separation efficiency = (The amount of water collected by the separation device + The amount of water separated by the separation device) / Water filling amount by the water filling device x 100% …… (1)

Where:

Water filling amount - The total water amount minus the mass of water, which is collected outside the air inlet.

7.15 Repeat the steps from 7.10 to 7.13, for at least 3 times, until the repeatability of the air flow and water filling conditions meet the requirements each time. Follow the steps in 7.9, to repeatedly adjust the position of the container, to ensure the consistency of the efficiency test. The entire test, which is carried out according to the steps 7.10 ~ 7.13, shall be completed within 10 minutes; otherwise, it shall adjust the test time AND make it consistent, which is carried out according to 7.9, before the start of test according to the steps of 7.10.

7.16 The recorded test data shall include the following:

a) Air flow;

b) Water filling rate;

c) Nozzle model and manufacturer;

d) The number of nozzles used;

e) Water and air pressure;

f) Water temperature;

g) Orifice size;

h) Water droplet's size (it shall meet the manufacturer’s specifications or laboratory test requirements);

i) Room temperature and relative humidity;

j) Increased value of filter element's pressure drop;

k) The time between adjustment and efficiency test;

l) The time FROM when the air flow is stopped TO when all the water is collected and weighing;

m) The number of test runs;

n) The water separation efficiency of each test, which shall include the standard deviation and average value of all the data of the 3 tests. If necessary, the test data shall also include the initial mass and final mass of the main filter element;

o) The distance and angle between the nozzle and the air inlet.

8 Technical conditions

For the engine air intake water separation device, the water separation efficiency, which is measured according to this test method, shall not be less than 80%.

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