

JB

**INDUSTRY STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Wind tunnel test method of radiator of automobile and tractor
(English Translation)**

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1 Test items

1.1

The performance test of radiators includes the following three items.

- a) Heat dissipation performance test;
- b) Air resistance test (shortly referred to as wind resistance test);
- c) Water flow resistance test (shortly referred to as water resistance test).

2.1 Finished radiators and model cores must meet the requirements of product tunnel

drawings, which are approved according to the prescribed procedures.

2.2 The test water must be clean and must not contain sand, rust or other debris.

2.3 This standard stipulates the use of suction test method. The test is carried out at room temperature. The fluctuation of the inlet temperature during the test shall not exceed $\pm 5^{\circ}\text{C}$. There shall be no obstacles within a distance of $3D$ from the air inlet of the wind tunnel. The distance from the edge of the air inlet to the ground shall be greater than D .

Note: When the wind tunnel is circular, D is the inner diameter of the wind tunnel; when the wind tunnel is rectangular, D is half of the sum of the height and width.

2.4 Test equipment and instruments must be inspected and calibrated before testing.

3 Test equipment

3.1

The test equipment consists of a circulating water circuit for the wind tunnel, a circulating water heating device, a water pump, a fan, a test instrument, a control device, etc. The layout is shown in Figure 1.

4.1 Wind speed measurement. For wind speeds above 6 m/s, use a Pitot tube or probe

and an inclined micromanometer with a minimum scale value of 1 mm; for wind speeds below 6 m/s, use a Pitot tube or probe and a compensated micromanometer with a minimum scale value of 0.01 mm.

4.2 Water flow measurement can be carried out using throttling devices such as orifice

plates, nozzles or venturi tubes and a U-shaped tube column differential pressure gauge, which has a minimum scale value of 1 mm or less. The installation method of the throttling device shall comply with the provisions of JB 1041-1967 "Method for determination of water pump flow". Water flow measurement can also be carried out using a turbine flowmeter.

4.3 Wind temperature measurement uses a thermometer or thermal resistance

thermometer, which has a scale value of 0.2 °C or less. The water temperature is measured with a thermometer, which has a scale value of 0.1 °C or less. The room temperature and humidity are measured with a dry-bulb thermometer.

4.4 The wind resistance is measured with a micromanometer, which has a scale value of 1 mm or less; the water resistance is measured with a U-shaped tube column differential pressure gauge, which has a scale value of 1 mm or less or other differential pressure gauges with the same accuracy. The atmospheric pressure is measured with a mercury barometer.

5.1 Before the test, the velocity field coefficient of the wind tube is measured first; only

the central wind speed is measured during the test.

5.2 During the test, the upper and lower water chambers, the circulating water circuit, the connection between the radiator and the front and rear wind tubes must not leak water or air.

5.3 Before the test, turn on the heating device, water pump, fan; adjust the wind speed

and water flow. When the inlet water temperature reaches the specified value, remove the gas in the water circuit; wait until the working conditions are stable before the test.

5.4 The heat dissipation performance test and the water resistance and wind resistance test can be carried out simultaneously or separately.

5.5 The measurement parameters include water inlet temperature, water outlet temperature, water flow, air inlet temperature, air outlet temperature, air volume (wind speed), water resistance, wind resistance, atmospheric pressure, humidity, room temperature.

5.6 The heat dissipation performance test shall be carried out in accordance with the following provisions.

(1) The total temperature difference between liquid and gas is set to 60 °C, that is, $t_{w1} - t_{a1} = 60$ °C. The total temperature difference is allowed to vary within the range of ± 5 °C. During the test, the fluctuation of the water inlet temperature at each test point shall not exceed ± 0.2 °C.

(2) Determine the maximum water flow rate as 150% of the rated flow rate (the maximum water flow rate of the model core is calculated based on the maximum water speed in the water pipe of 1 m/s); select 5 water flow operating points within this range.

(3) Determine the maximum air volume. 25 ~ 30 m/s for high-speed vehicles, 20 ~ 25 m/s for trucks, 15 m/s for tractors and fixed power units; select 5 operating points within this range.

(4) Stabilize a water flow operating point according to the provisions of item (2) of this Article; change the air volume point by point according to the requirements of item (3) of this Article; measure the various parameters after the thermal conditions are stabilized; then change to another water flow operating point;

change the air volume in the above order; measure the various parameters.

(5) Each operating point must be measured three times; the difference between the inlet and outlet water temperatures measured three times cannot be greater than 0.1 °C; otherwise, the test shall be repeated.

5.7 Wind resistance test. Control the inlet water temperature according to Article 26

item (1). The water flow rate is the rated value. Change the air volume in sequence according to Article 26 item (3); measure the wind resistance value of each operating point.

5.8 Water resistance test. Change the water flow in sequence according to Article 26

item (2); measure the water resistance value of each operating point.

6 Results collation

6.1

The parameters and calculation results measured during the test shall be filled in the "Radiator performance test record and collation table", as follows.