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**Temperature measurement methods and thermocouple
installation requirements for automotive brakes**

汽车制动器温度测量方法及热电偶安装要求

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Temperature measurement methods and thermocouple installation requirements for automotive brakes

1 Scope

This document specifies the terms and definitions, measurement devices, thermocouple installation, infrared thermometer installation, measurement methods for automotive brake temperature measurement.

This document applies to temperature measurement during automotive brake testing.

2 Normative references

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

GB/T 5620 Road vehicles - Vocabulary and definition for braking of automotive vehicles and their trailers

GB/T 16839.1 Thermocouples - Part 1: EMF specifications and tolerances

GB/T 30429 Industrial thermocouple assemblies

JB/T 5582 Specification of industrial sheathed thermocouple assemblies

3 Terms and definitions

The terms and definitions as defined in GB/T 16839.1 and GB/T 5620, as well as the following terms and definitions, apply to this document.

3.1

Contact thermometry

A temperature measurement method, in which the temperature detection element is in contact with the measured object and reaches thermal equilibrium.

Note: Commonly used contact thermometry includes thermocouple temperature

measurement method, resistance temperature measurement method, etc.

3.2

Non-contact thermometry

A temperature measurement method, in which the temperature detection element does not come into contact with the object being measured.

Note: Commonly used non-contact thermometry includes radiation thermometry, spectral thermometry, etc.

3.3

Embedded thermocouple

A thermocouple, whose measuring end is embedded inside the object being measured.

3.4

Rubbing thermocouple

A thermocouple whose measuring end is always in contact with the surface of the object being measured.

3.5

Infrared thermometry

A measuring instrument, that uses the radiation flux of a thermal radiator in the infrared band to measure temperature.

Note: A measuring instrument, which is used in non-contact thermometry.

4 Measuring devices

4.1 Measuring device for contact thermometry

4.1.1 Contact temperature measurement devices shall meet the following requirements:

- a) The electromotive force specifications and tolerances of the thermocouples, which are selected according to the temperature range and environmental conditions, shall comply with the provisions of GB/T 16839.1;
- b) The embedded thermocouples shall comply with the provisions of GB/T 30429; the requirements for rubbing thermocouples can refer to JB/T 5582.

4.1.2 See Appendix A for the structural types of commonly used thermocouples.

4.2 Measuring device for non-contact thermometry

Non-contact temperature measurement device (infrared thermometer) shall meet the following requirements:

- a) Able to continuously record the temperature of the object being measured;
- b) Prevent dust, smoke, etc. from contaminating the lens;
- c) Able to withstand an ambient temperature of no less than 70 °C.

4.3 Display and recording device

The device that displays and records the dynamic temperature of the brake shall meet the following requirements:

- a) Has self-calibration (automatic compensation) function;
- b) The indication error shall be less than 3% of the measured value;
- c) Dynamic response time shall not be greater than 0.2 s.

5 Thermocouple installation

5.1 Embedded thermocouple

5.1.1 Installation on the brake lining assembly

5.1.1.1 For the brake shoe assembly, the installation position of the thermocouple measuring end shall be near the maximum stress point of the brake lining of the leading shoe assembly. Where there are ribs, heat sinks, grooves or rivet holes, the deviation shall be more than 5 mm.

5.1.1.2 For the lining pad assembly, the installation position of the thermocouple measuring end shall be located at the center of the length and width of the brake lining pad. When the brake lining is grooved, it shall be adjusted, along the center of the friction track on the working surface, until the spin-out side is more than 7.5 mm away from the edge of the groove. When it is necessary to measure the temperature of the brake lining in contact with the piston and it is not possible to perform the above arrangement, it shall be adjusted along the center of the friction track on the working surface, until the spin-out side is more than 5 mm away from the edge of the active diameter of the piston and lining pad assembly.

5.1.1.3 Process a through hole, at the corresponding installation position (the hole diameter is determined according to the outer diameter of the thermocouple measuring

connected to a current collector (slip ring) or telemetry system, to transfer the signal from the rotating component to the fixed component.

7.1.1.4 When it is necessary to use compensation wires, attention shall be paid to the matching of the materials of the compensation wires and thermocouples.

7.1.2 Non-contact thermometry

7.1.2.1 According to the specific installation environmental conditions and test conditions during automobile brake testing, install the measuring device according to the requirements of Chapter 6.

7.1.2.2 Connect the temperature measuring instrument. Adjust the connecting wire according to the length of the connection distance.

7.1.3 Before measurement, calibrate the measuring device (including display and recording device) used.

7.2 Temperature measurement

7.2.1 Temperature measurement of brake lining assembly and brake drum (disc)

Turn on the recording instrument to record the temperature changes of the object being measured during the braking process. If necessary, record the temperature changes within a certain period of time, after the brake drum (disc) stops rotating.

7.2.2 Brake fluid temperature measurement

Turn on the recording instrument. Record the temperature changes of the brake fluid during the test. Continue recording continuously after the test is completed (the braking action is released), until the temperature begins to drop significantly.

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Contact: Wayne Zheng, Sales@ChineseStandard.net

Linkin: <https://www.linkedin.com/in/waynezhengwenrui/>

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