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

GB/T 27698.2-2023

Replacing GB/T 27698.2-2011

**Test methods for the performance of heat exchangers and heat
exchange elements - Part 2: Heat exchangers**

热交换器及传热元件性能测试方法 第2部分：热交换器

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1 Scope

China's national standard for testing the performance of complete heat exchangers. It is Part 2 of GB/T 27698 and describes the test procedures, the processing of the test data and the requirements for the test report, applying to tubular heat exchangers including shell and tube units, plate heat exchangers including welded and brazed plate units, and spiral plate heat exchangers. Where Part 1 fixes what is common to every test in the series - the rig, the instrumentation, the steady-state criteria and the treatment of uncertainty - this part specifies the tests themselves, and it divides them by what the fluids are doing rather than by what the exchanger looks like. A liquid-to-liquid exchanger with no phase change is tested in turbulent flow, and separately at low flow rate, because the two regimes obey

different relationships and an exchanger characterised only in turbulence tells a designer nothing about its behaviour at part load. A condenser is tested with vapour on one side. An evaporator is tested in flow boiling. And pool boiling, where the surface is submerged in a stagnant liquid, is tested separately again, because the mechanism has nothing in common with the others. Each of those five procedures has its own arrangement, its own measurements and its own data processing, and the standard also fixes the product model and sample parameters that must be recorded for each of the three exchanger families - what has to be known about the unit for a result to be attributed to it. Issued and in force since 6 August 2023, it replaces GB/T 27698.2-2011.

This document describes the performance test procedures, test data processing and test report requirements for heat exchangers. This document applies to the performance test of tubular heat exchangers (including shell and tube heat exchangers), plate heat exchangers (including welded plate heat exchangers and brazed plate heat exchangers), and spiral plate heat exchangers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. GB/T151, Heat exchanger

GB/T 27698.1, Test methods for the performance of heat exchangers and heat exchange elements - Part 1: General requirements NB/T 47004.1, Plate heat exchangers - Part 1: Plate-and-frame heat exchangers NB/T 47004.2, Plate heat exchangers - Part 2: Welded plate heat exchangers NB/T 47045, Brazed plate heat exchangers NB/T 47048, Spiral plate heat exchanger

3 Terms and definitions

For the purpose of this document, the following terms and definitions, as well as those given in GB/T 27698.1, apply.

3.1 standard condition The operating condition set to characterize the performance of the heat exchanger.

4.2 Plate heat exchangers

4.2.1 The number of plates in the plate heat exchanger sample shall be determined by considering the uniformity of fluid distribution within the measured flow rate range, and the number of plates installed shall not be less than 9.

4.2.2 When testing plate heat exchangers, the product model and the following parameters shall be clearly stated:

- a) Plate corrugation form (corrugation angle, corrugation depth, corrugation spacing, mixing angle);
- b) Plate geometric dimensions (length, width, corner hole diameter, longitudinal and transverse center distance);
- c) Heat transfer area of a single plate;
- d) Spacing between plates;
- e) Flow channel cross-sectional area;
- f) Plate thickness;
- g) Plate material;
- h) Number of plates;
- i) Clamping dimensions;
- j) Process combination;
- k) Design temperature;
- l) Design pressure. The above structure and design data shall be determined in accordance with the requirements of GB/T 27698.1 and NB/T 47004.1, NB/T 47004.2 as well as NB/T 47045.

4.2.3 When the product model or any of the parameters

4.2.2 changes, the performance test shall be repeated.

4.3 Spiral plate heat exchangers

4.3.1 When testing spiral plate heat exchanger, the product model and the following parameters shall be clearly stated:

- a) Layout and geometric dimensions of spacing columns;
- b) Spacing between plates;
- c) Equivalent diameter;
- d) Flow cross-sectional area;
- e) Flow channel length;
- f) Heat transfer plate material;
- g) Heat transfer plate thickness;
- h) Heat transfer area (based on the neutral surface of the heat transfer plate);

- i) Design temperature;
- j) Design pressure. The above structure and design data shall be determined in accordance with the requirements of GB/T 27698.1 and NB/T 47048.

4.3.2 When the product model or any of the parameters

4.3.1 changes, the performance test shall be repeated.

5.1 Liquid-liquid turbulence performance test without phase change

5.1.1 Before testing, the reliability of the test sample, pipeline and measuring instruments shall be checked.

5.1.2 After starting operation, the gas in the test sample shall be exhausted in time, so that the test sample can be operated under the condition of being fully filled with test fluid and adjusted to the standard condition according to Table 1.

5.1.3 After running stably for 30 minutes under standard conditions, the following test requirements should be followed:

- a) The fluid flow rate on both sides remains the same, the flow rate changes within the range of Table 1, and the change interval meets the requirements of Table 1;
- b) The fluid on one side (hot side or cold side) is fixed at the flow rate under standard conditions; the flow rate of the fluid on the other side varies within the range of Table 1, and the variation interval meets the requirements of Table 1;

5.4.2 After starting operation, the non-condensable gas in the test sample shall be discharged in time and adjusted to the standard condition.

5.4.3 After running stably for 30 minutes under standard condition, the following test requirements should be followed:

- a) Keep the steam temperature entering the pre-heater and the test sample inlet at 1 °C ~ 3 °C superheat, and the condensate temperature slightly lower than the saturation temperature corresponding to the outlet steam pressure, but within the range of 2 °C; obtain the steam flow rate by measuring the condensate;
- b) The flow rate of the cold fluid varies within the range of Table 1, and the variation interval meets the requirements of Table 1;
- c) The inlet dryness of the cold fluid of the test sample is adjusted by the pre- heater, and the minimum inlet dryness is 0;
- d) The average dryness of the cold fluid of the test sample changes according to the use range, and the change interval increases with the increase of dryness;
- e) When each test condition is stable for more than 5 minutes, carry out data collection