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**Test method of thermal cycling and condensation resistance of
curtain walls**

建筑幕墙热循环和结露检测方法

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1 Scope

This document specifies the general requirements, test principle, test apparatus, test piece and installation, test method and test report for the test method of thermal cycling and condensation resistance of curtain walls.

This document applies to the laboratory test of thermal cycle and condensation of curtain walls. The test objects are limited to the curtain wall test pieces themselves and the connection structure between them and the structure.

2 Normative references

GB/T 15227

GB/T 31433

GB/T 34327

3 Terms and definitions

For the purpose of this document, the terms and definitions defined in GB/T 34327 and the following apply.

3.1 thermal cycle

Process of simulating the cyclical changes of specific natural climate conditions outside the test piece.

NOTE. The simulated conditions include air temperature and solar thermal radiation illumination.

3.2

Key.

- 1 - outdoor side insulation box; 2 - guide plate;
- 3 - infrared radiation heating device;
- 4 - outdoor side air circulation system;
- 5 - outdoor side air temperature control device;
- 6 - indoor side air temperature and humidity control device;
- 7 - indoor side air circulation system;
- 8 - indoor side insulation box; 9 - test piece;
- 10 - test piece installation support device; 11 - connection structure.

Figure 1 -- Schematic diagram of test apparatus

6.2.1 The indoor weather simulation device and the outdoor weather simulation device

can use a fixed or temporarily built box. The opening size shall cover the tested part of the test piece, and the depth size shall be able to accommodate refrigeration, heating and air circulation devices.

6.2.2 The test piece installation support device shall have the rigidity and strength that meet the test requirements, and be fixed on a support structure that has the rigidity and strength that meet the test requirements.

6.2.3 The inner surface of the indoor weather simulation device box and the outdoor weather simulation device box shall be made of airtight and non-absorbent materials.

6.2.4 The temperature and relative humidity of the air shall be controlled by the air temperature and humidity control device. The airflow organization shall be reasonable, and the airflow direction shall be parallel to the surface of the test piece to avoid direct air blowing on the surface of the test piece. The wind speed shall not be greater than 1 m/s. The uniformity of the air temperature in the box of the indoor weather simulation device and the box of the outdoor weather simulation device shall be controlled within $\pm 3\text{ }^{\circ}\text{C}$. The fluctuation range of the relative humidity in the box of the indoor weather simulation device shall be controlled within $\pm 10\%$.

6.2.5 The air temperature control device shall have the ability to adjust the test indicator requirements within the specified time.

6.2.6 The maximum intensity of the infrared radiation heating device shall not be less than 1000 W/m^2 and can be evenly adjusted. The distance from the test piece should be 1000 mm.

6.2.7 The measuring device and measurement point arrangement shall meet the following requirements.

- a) the accuracy of the temperature sensor shall be within $\pm 2\text{ }^{\circ}\text{C}$;
- b) the accuracy of the humidity sensor shall be within $\pm 5\%$;
- c) the temperature sensors for the air temperature in the box shall be arranged in representative areas of the box, at least the four corners and the center of the box close to the test piece. The sensors shall be shielded from radiation and the distance from the test piece shall not be less than 80 mm;
- d) the humidity sensor for the indoor side air relative humidity shall be arranged near the return air outlet of the box;
- e) the temperature sensors for the internal and external surface temperatures of the test piece shall be arranged on the surface of the panel and profile, the induction head together with the lead shall be close to the measured surface, and the lead length shall not be less than 100 mm; the total hemispherical emissivity of the adhesive material shall be close to the value of the measured surface;
- f) the temperature measurement points on the test piece shall be arranged on the supporting members and the panel members; for bar members, they shall be arranged at

the two ends and the middle, and for panels, they shall be arranged at the midpoints of the two long sides and the center of the panel.

7.1 Test piece

7.1.1 The test piece shall represent the performance of typical parts of the curtain wall, including typical vertical joints, horizontal joints and openable fields. The proportion of the openable fields to the total area of the test piece shall be close to the actual project.

7.1.2 The material, specification and model of the test piece shall be consistent with the corresponding information provided by the test client.

7.1.3 The width of the test piece shall include at least one vertical load-bearing member that bears the design load. The height of the test piece shall include at least one floor height, and there shall be two or more vertical connections with the load-bearing structure.

7.1.4 The full-glass curtain wall test piece shall have a full span height and a width of at least 3 glass horizontal divisions or 4 glass ribs.

7.1.5 The height of the unitized curtain wall test piece shall not be less than 2 floor heights, and the width shall not be less than 3 horizontal divisions.

7.1.6 The test piece of double-skin curtain walls shall meet the following requirements.

Within the specified time, by simulating the annual cyclical changes of outdoor weather air temperature, solar radiation, and indoor temperature and humidity environment, observe whether there are functional disorders, component damage, and whether condensation occurs at low temperatures.

8.4.2 Test method and selection

For those with only outdoor air temperature requirements, the "air temperature method" (method 1) is used; for those with test piece surface temperature requirements, the "surface temperature method" (method 2) is used.

8.4.3 Air temperature method (method 1)

Before the thermal cycle test, adjust the indoor side air temperature and relative humidity to the indoor side indicator values and maintained for not less than 1 h. Then proceed as follows.

- a) steadily increase the outdoor side air temperature to the specified outdoor maximum air temperature T_{max} in 0.5 h ~ 1 h, and the maintenance time shall not be less than 2 h.
- b) steadily reduce the outdoor side air temperature to the indoor air temperature T_{in} in 0.5 h ~ 1 h.
- c) steadily reduce the outdoor side air temperature to the specified outdoor minimum air