GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 91.100.25

Q 17

GB/T 36584-2018

Test methods for roofing tiles

屋面瓦试验方法

Issued on: September 17, 2018 **Implemented on: August 01, 2019**

Issued by: State Administration for Market Regulation;

Standardization Administration of PRC.

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Test methods for roofing tiles

1 Scope

This standard specifies the terms and definitions, dimensional deviation, appearance quality, bending resistance, frost resistance, rapid cooling and heat resistance, water absorption, impermeability, salt resistance, acid and alkali resistance, wind resistance, simulated rain test method of roof tiles.

This standard is applicable to plate or block roofing tile products for building roof covering and decoration.

2 Normative references

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) are applicable to this standard.

GB/T 9195 Classification and terms of building and sanitary ceramics

JGJ/T 191 Standard for terminology of building materials

ISO 3585 Borosilicate glass 3.3 - Properties

3 Terms and definitions

The terms and definitions defined in GB/T 9195 and JGJ/T 191 apply to this document.

4 Dimensional deviation and appearance quality

4.1 Dimensional deviation

4.1.1 Gauge

Steel ruler, which has an accuracy of 1 mm.

4.1.2 Measurement methods and results evaluation

4.1.2.1 Measure the length (L) and width (b) at the middle of the front side of tile, respectively, where it measures the width (b) at the tile head for the S-

4.2.2.3 Crack

4.2.2.3.1 Measure the maximum straight-line distance between the two ends of the crack. The measurement of penetrated crack length shall include the length of the continuous non-penetrated crack.

4.2.2.3.2 The measurement result is expressed by the maximum crack length of each specimen.

4.2.2.4 Impact, glaze adhesion

4.2.2.4.1 Measure the projection size of length and width of edges of tiles corresponding to the locations of bumps and glaze adhesion. If the damage is extended from one face to the other, accumulate its extended projecting size. At the destruction of the edge part, measure its projection size on the visible face and hidden faces or on the front and back side, respectively. The residual heights of the flat tile's side ribs and the rear paws are measured from the bottom of the reference plane of the tile's side ribs and the back of the tile, respectively.

4.2.2.4.2 The measurement results shall be expressed in terms of the size at the largest failure point of each specimen.

4.2.2.5 Lime burst

4.2.2.5.1 Measure the maximum diameter dimension of the lime burst.

4.2.2.5.2 The measurement results are expressed in terms of the size of the largest failure of each specimen.

4.2.2.6 Under-fire, stratification

4.2.2.6.1 Hit the specimen manually, discriminate it according to the difference in sound, or observe the side of the specimen for inspection.

4.2.2.6.2 The test results are expressed by the obvious degree of under-fire and delamination defects of each specimen.

4.2.2.7 Glaze thickness, coating thickness

4.2.2.7.1 Take 2 pieces of broken tile specimens with regular cross section. Place a 10 times magnifying glass with scale on the cross-section of the tile. Measure the thickness of the glaze layer or coating at 3 horizontal points. The spacing of the measurement point is about b/3. At least one measurement point of the corrugated tile is at the peak position.

4.2.2.7.2 The measurement result is expressed by the minimum thickness of each specimen.

5.2.1 Method 1

5.2.1.1 Equipment

5.2.1.1.1 Low temperature box or freezer: The temperature in the box (chamber) after the specimen is placed can be adjusted to -20 °C or below.

5.2.1.1.2 Water tank.

5.2.1.1.3 Specimen holder.

5.2.1.2 Preparation of specimen

Use the whole tile in the natural dry state as a specimen; the number of specimens is 5 pieces.

5.2.1.3 Test procedure

5.2.1.3.1 Check the appearance; mark bumps, glaze adhesion, missing glazes and cracks (including glaze cracks); record the condition.

5.2.1.3.2 Immerse the specimen in water at 15 °C ~ 25 °C. Take it out after 24 h. Put it in the specimen rack in the freezer which has been cooled to -20 °C ± 3 °C in advance. There shall be a distance of not less than 20 mm between the specimens and between the specimen and the freezer wall. Close the freezer door.

5.2.1.3.3 When the temperature inside the box drops to -20 °C ± 3 °C again, start time keeping. Maintain it at this temperature for 3 h. Open the freezer door; take out the specimen and melt it in water at 15 °C ~ 25 °C for 3 h. This is a freeze-thaw cycle.

5.2.1.4 Test results

It is expressed by the degree of appearance damage of each specimen.

5.2.2 Method 2

5.2.2.1 Equipment

5.2.2.1.1 Drying box: The working temperature is 110 °C ± 5 °C. It may also use other drying systems that can obtain the same test results.

5.2.2.1.2 Water tank (water): The temperature shall be maintained at 20 °C ± 5 °C.

5.2.2.1.3 Freezer: It can freeze at least 5 specimens and keep the specimens from contact with each other.

a distance of not less than 20 mm between the specimens and between the specimens and the oven wall. Close the oven door.

5.3.3.4 Make the oven reach the pre-heated temperature again within 5 min and start timekeeping. Hold at this temperature for 45 min. Open the oven door. Take out the specimen and immediately immerse it in a water sink with flowing cold water. Quench it for 5 min. This is a rapid cooling and heating cycle.

5.3.4 Test results

The test result is expressed by the degree of appearance damage of each specimen.

Note: This test is recommended for glazed tiles.

5.4 Water absorption

5.4.1 Equipment

5.4.1.1 Oven: The working temperature is 110 °C ± 5 °C. It may also use other drying systems that can obtain the same test results.

5.4.1.2 Dryer.

5.4.1.3 Vacuum container and vacuum system: A vacuum container with a sufficiently large volume capable of containing the required number of specimens and a vacuum system capable of evacuating to 10 kPa ± 1 kPa and maintaining it for 30 min.

5.4.1.4 Suede or other suitable material.

5.4.1.5 Balance: The weighing accuracy is 0.01% of the mass of the tested specimen.

5.4.1.6 Deionized water or distilled water.

5.4.2 Specimen preparation

Take the whole tile in the natural dry state or half of the tile after the bending resistance test as the specimen. Cut the minimum side length of 100 mm × tile thickness in the middle part as the specimen. The number of specimens is 5.

5.4.3 Test procedure

5.4.3.1 Wipe the specimen clean and put it in a drying box to dry to constant mass (that is, the difference between two consecutive masses every 24 h is less than 0.1%), as the drying mass m_0. During the test, place the specimens in a desiccator which contains silica gel or other desiccants to cool it to room temperature. It shall not use acidic desiccants. Each specimen is weighed and

Take the whole tile in the natural dry state or half of the tile after the bending resistance test as the specimen. Cut (50 ± 2) mm × (25 ± 2) mm × tile thickness from the visible surface of the specimen as the test specimen. The number of specimens is 5.

5.6.3 Test procedure

5.6.3.1 Check the appearance of the cleaned specimen. Remove loose materials on the surface. Mark the cracks (including glaze cracks), bumps, glaze adhesion, glaze missing. Record the defects.

5.6.3.2 Dry the specimen and sodium chloride: Place the specimen and an appropriate amount of solid sodium chloride in a glass dish. Place it in a specimen rack in a blast drying box heated in advance to 115 °C ± 3 °C. The drying time of the specimen is greater than 12 h, to make it reach to constant weight (the interval between the two consecutive weighing is 2 h; the difference between weighing does not exceed 0.2% of the last weighing). The drying time of sodium chloride is at least 4 h. Then remove the specimen and solid sodium chloride. Place it in an environment or thermostat with a controlled temperature of 19 °C ± 3 °C to cool it for 1 h ~ 2 h to room temperature.

5.6.3.3 Weigh 140 g of dry sodium chloride. Prepare 1000 mL of sodium chloride solution which has a concentration of 14%. Divide it into five 200 mL plastic beakers with lids.

5.6.3.4 Dip the cooled specimens into the plastic beaker solution. The solution surface shall be more than 10 mm higher than the specimen. Cover the lid. Place it in an environment or incubator that can control the temperature of 19 °C ± 3 °C again. The soaking time is 1.75 h ~ 2.5 h. Then remove the specimen from the plastic beaker. Drain the solution for 1 min ~ 10 min. Place it in the glass dish on the specimen rack in the blast drying oven at 115 °C ± 3 °C. In this way, the drying of specimen is used as the starting point, before the specimen is placed in the desiccator after the end of immersion in solution is used as the end point, which form a cycle.

5.6.3.5 From the first cycle, the selection of the specimen's drying time is alternately performed by overnight drying greater than 12 h and short-term drying 2.5 h ± 0.5 h. The short-term drying method shall not be used continuously, but continuous overnight drying is allowed. After that, start the tenth cycle, the twentieth cycle, until the end of the fortieth cycle. Each time it shall check the specimen. If it finds that particles other than the marking position have fallen, remove these particles and place them in the corresponding numbered glass dish and take record. Add the appropriate amount of 14% sodium chloride solution prepared in advance to supplement the loss. Every ten cycles completed, use the fresh solution.

5.7.4 Test procedure

Apply a 3 mm thick sealing material to the edge of the cylinder. Invert the cylinder on a clean part of the specimen surface. Seal the periphery. Inject the test solution from the opening. The level of the liquid surface is 20 mm ± 1 mm. The test solution shall be one of the solutions listed in 5.7.1. Store the test device at a temperature of 20 °C ± 2 °C. Make the test solution contact the specimen for 4 days. Gently shake the device once a day, to ensure that the liquid level of the test solution does not change. After 2 d, change the solution once. After another 2 d, remove the cylinder and use a suitable solvent to thoroughly wash the sealing material on the specimen.

5.7.5 Grading after test

5.7.5.1 Overview

Tested specimens shall be completely dry before evaluation. In order to determine the applicability of the pencil test, use a pencil to draw a few lines on the untreated portion of the specimen and use a damp cloth to wipe the test marks. If the pencil traces cannot be wiped off, these tiles will be recorded as "not suitable for the standard grading method". It can only use the visual grading method for evaluation.

5.7.5.2 Standard grading method

For specimens that passed the pencil test, the evaluation and grading are continued according to the following steps.

5.7.5.2.1 Preliminary visual grading

5.7.5.2.1.1 Observe the apparent difference between the measured surface and the untreated surface, such as changes in reflectance or glossiness, with the naked eye (usually glasses that can be worn) at a standard distance of 25 cm from different angles.

5.7.5.2.1.2 The light source can be daylight or artificial light source (about 300 lx); but avoid exposure to direct sunlight.

5.7.5.2.1.3 If no visible change is found after observation, perform the pencil test. If there are visible changes, perform the reflection test.

5.7.5.2.2 Pencil test

Use a pencil to draw a few lines on the surface of the specimen and the non-treated surface. Use a soft wet cloth to wipe the pencil lines. If it can be wiped off, it is grade A; otherwise it is grade B.

5.7.5.2.3 Reflection test

5.8.4.2 Keep the ambient temperature at 23 °C ± 5 °C during the test. When the test plate is installed in place, turn on the fan immediately. Adjust the wind speed at the air outlet to the specified grade, which is 97 km/h for type A, 147 km/h for type B, 177 km/h for type C. The allowable fluctuation range of wind speed is ± 5%. The test time is 2 h. During the test, the observer shall pay attention to the blowing of the specimen. It shall record any damage or shedding of the entire specimen plate. Meanwhile record the time of occurrence. If damage occurs during the test, stop blowing and record the elapsed time. Mark the position where the damage occurred.

5.8.5 Test results

5.8.5.1 If any part does not detach from the test plate during this test, meanwhile the specimen does not fall off or be damaged, the test is passed. If the specimen assembled on the specimen plate is not fixed and blown off, or any free part of the specimen in the test is blown up to 90°, it is considered that the test fails.

5.8.5.2 It is expressed by the damage degree of the specimen and the specimen plate after blowing. If both test plates pass the test, the product is considered to have passed the wind resistance test.

5.9 Simulated rain

5.9.1 Equipment

5.9.1.1 Tiled frame and support: The area of the frame is not less than 1 m^2 or 4 tiles can be laid in the length and width directions, respectively; the support is kept sufficiently rigid, so that the frame slope is 30° ± 1°; the height is sufficient for the observer to make observation from the back side of the tile on the frame.

5.9.1.2 Simulated rain shower device: It consists of a rain pipe and a sprinkler nozzle controlled, water-supplied, supported by flow adjustment. The inner diameter of the rain pipe is about 15 mm. The pipe wall has a small hole of about 2 mm. The water output of the rain shower pipe 2 times the amount of water coming out of the water outlet.

5.9.1.3 Flowmeter, thermometer, stopwatch.

5.9.2 Specimen preparation

Take the whole tile in the natural dry state as the specimen. The number of specimens shall satisfy the laying area of not less than 1 m^2 or 4 pieces in the length direction × 4 in the width direction.

5.9.3 Test procedure

5.9.3.1 According to the specimen manual, lay the specimen on the tiled frame according to the field construction method. It shall not use nails.

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