JG

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Porcelain enameling steel panels for building

建筑装饰用搪瓷钢板

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Foreword

This Standard was proposed by Standard-Quota Institute of Ministry of Housing and Urban-Rural Development.

This Standard shall be under the jurisdiction of Building Product and Part Standardization Technical Committee of Ministry of Housing and Urban-Rural Development.

The responsible drafting organizations of this Standard: Zhejiang Kaier Industry Co., Ltd. AND Shenzhen Xinshan Curtain Wall Technology Consulting Co., Ltd.

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This Standard was issued for first-time.

Porcelain Enameling Steel Panels for Building

1 Scope

This Standard specifies the terms and definitions, classification and mark, material, requirements, test method, inspection rules and mark, packing, transportation and storage of porcelain enameling steel panels for building.

This Standard is applicable to porcelain enameling steel panels for interior and exterior decoration of building.

2 Normative references

The articles contained in the following documents have become part of this document when they are quoted herein. For the dated documents so quoted, all subsequent modifications (including all corrections) or revisions made thereafter do not apply to this Standard. However, the parties who reach an agreement according to this Standard are encouraged to study whether the latest versions of these documents can be used. For the undated documents so quoted, the latest versions (including all modification sheets) apply to this document.

GB/T 191 Packaging - Pictorial marking for handling of goods

GB/T2518 Continuously hot-dip zinc-coated steel sheet and strip

GB/T 3880 Aluminium and aluminium alloy rolled sheet

GB 6566 Limits of radionuclides in building materials

GB 8624-2006 Classification for burning behavior of building materials and products

GB/T 9174 General specification for transport packages of general cargo

GB/T 9978-1999 Fire-resistance tests - Elements of building construction

GB/T 9989-2005 Vitreous and porcelain enamels - Determination of resistance to citric acid at room temperature

GB/T 12467.2-1998 Quality requirements for welding - Fusion welding of metallic materials - Part 2: Comprehensive quality requirements

GB/T 13790 Cold rolled sheets and strips for civil enameling

GB/T 15227-2007 Test method of air permeability, watertightness, wind load resistance performance for curtain walls

JC/T 564 Fiber reinforced calcium silicate sheet

JC/T 884 Building sealants for coloured coat steel plates

QB/T 1855-1993 Enamelled ware in non-contact with food

YB/T5131 Single hot-dip zinc-coated carbon steel sheets

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions are applicable to this Standard.

3.1

Porcelain enameling steel panel

The combination panel that the inorganic glass material is fused onto steel panel and forms firm combination with steel panel.

3.2

Composite porcelain enameling steel panel

The porcelain enameling steel panel of which the backside is adhered with back-lining material or has interlayer.

3.3

Dry process enameling

The enameling method that the dry porcelain glaze powder is coated onto the base steel panel through high-voltage static electricity.

3.4

Wet process enameling

The enameling method that the porcelain glaze powder that is floated in water (medium) is coated onto base steel panel.

3.5

Square panel

The porcelain enameling steel panel of which the front-face is plane and the shape is rectangle.

3.6

Circular panel

The porcelain enameling steel panel of which the front-face is cylindrical surface.

3.7

Orange-shaped irregular wrinkle on porcelain surface.

[GB 7410-1987, Definition 6.2.24]

3.15

Dint

Sunken or convex points of porcelain stack on porcelain surface.

3.16

Boiling

Blister, pinhole, black dot, pit or spongy blackspot on porcelain surface due to excessive boiling of the ground coating-layer in enameling process.

[GB 7410-1987, Definition 6.2.12]

3.17

Blue enamel

Black shadow of hiding ground porcelain coat due to too thin porcelain coat or snag.

[GB 7410-1987, Definition 6.2.28]

3.18

Concavity

Concave pit of steel panel body due to collision and extrusion in processing.

3.19

Dent

Smooth uneven wrinkle or wavy trace on porcelain coat surface.

3.20

Uneven color

Uneven color on porcelain surface or local color change.

3.21

Lack of bisque

Powder porcelain coat is damaged before enameling, so as to result in the defect that the porcelain coating is visible after enameling.

4 Classification and mark

5.2.4 When the back-lining needs to be covered, the overlay material should be aluminum sheet or galvanized steel panel with a thickness not below 0.5mm. The aluminum overlay shall conform to requirements of GB/T 3880. A single heat galvanized steel panel shall conform to requirements of YB/T 5131. Continuous heat galvanized steel panel shall conform to requirements of GB/T 2518.

5.3 Adhesive and sealing material

5.3.1 The back-lining and back-lining overlay of the combination panel should be bonded by combustion heat value adhesive, and shall conform to requirements of fireproof performance in 6.4 of this Standard.

5.3.2 The back-lining overlay of the combination panel should have edge sealing treatment through neutral sealing adhesive conforming to requirements of JC/T 884. For indoor porcelain enameling steel panel, the sealing adhesive material shall be nontoxic difficult-flammable sealing adhesive; the combustion performance shall be Level B as regulated in GB 8624-2006.

5.4 Fixed pendant

5.4.1 Fixed pendant shall be manufactured of cold-roll steel panel (the same material as that of base steel panel) of which the thickness is not below 2.0mm, and have porcelain enameling treatment together with base steel panel after being welded with the base plate.

5.4.2 If necessary, it can be made of stainless steel panel of which the thickness is not below 2.0mm. The fixed pendant is connected with the porcelain enameling steel panel through bolts or stainless steel core-pulling rivets. The base steel panel shall have holes for connection bolts or rivets before porcelain enameling.

6 Requirements

6.1 Dimensional deviation

6.1.1 The allowable dimensional deviation of square panel shall conform to regulations in Table 3.

Table 3 The allowable dimensional deviation of square panel Unit: mm

Item	Size range	Allowable deviation
Length	≤1 000	± 2.0
	>1 000	± 3.0
Width	≤1 000	± 2.0
	>1 000	± 3.0
Folding height	≤50	+ 1.0, 0
	>50	± 1.0
Diagonal-line difference	≤1 500	2.0
	>1 500	3.0

6.1.2 The allowable deviation and geometric toleration of circular panel size shall conform to regulations in Table 4.

Table 4 The allowable deviation and geometric toleration of circular panel size

Unit: mm

Item	Size range	Allowable deviation
Length	≤1 000	± 2.0
	>1 000	± 3.0
Chord length	≤1 000	± 2.0
	>1 000	± 3.0
Arch rise	≤500	± 1.0
	>500	± 2.0
Diagonal-line difference	≤1 500	2.0
	>1 500	3.0
Arc fitness (arc length)	≤1 000	1.0
	>1 000	2.0

6.1.3 The flatness of the square combination panel shall be less than the allowable deviation calculated in Formula (1).

$$D=2(L^2+L)/3 \qquad \cdots\cdots(1)$$

Where

D - deviation, unit: mm;

L - length of the longer side of porcelain enameling steel panel, unit: m.

6.1.4 The allowable size deviation, geometric deviation and flatness deviation of other types of panels can be determined by product's supply-demand sides or executed according to regulations in 6.1.1, 6.1.2 and 6.1.3 of this Standard.

6.1.5 The folding height T around porcelain enameling steel panel shall not be less than 25mm. The inner radius of all the folding knuckles shall not be less than 3mm. When the fixed pendant is connected through bolts or rivets, the diameter of the reserved hole of bolts or rivets shall not be less than 5mm. The distance between the center of the reserved hole and the panel edge shall not be less than 2 times aperture. The distance between the two adjacent holes shall not be less than 3 times aperture (see Figure 6). The allowable dimensional deviation shall conform to requirements in Table 5.

Table 5 Allowable dimensional deviation of fixed pendant Unit: mm

Item	Allowable deviation
Distance from panel edge	+1.0, 0
Hole center distance	±1.0

6.4.1 Combustion performance level of interior decoration panel shall not be below Level A2 regulated in GB 8624-2006. Combustion performance level of exterior decoration panel shall be Level B or above regulated in GB 8624-2006.

6.4.2 Fire-resistant limit of porcelain steel panel shall reach requirements of the demander, but the lowest fire-resistant limit shall be the level of 0.5h and above.

6.5 Assembly quality of fixed pendant

6.5.1 The fixed pedant shall be firmly and reliable connected in accurate position, without defects influencing bearing force and installation.

6.5.2 The fixed pedant is connected with the base steel panel through welding. The welding material shall match with properties of the base steel panel. The welding quality shall conform to requirements of GB/T 14267.2-1998, to make it have porcelain enameling with metal at the same time after oxygen welding and argon arc welding.

6.5.3 For connection of the fixed pedant through bolts or rivets, the porcelain surface of porcelain enameling surface and reserved hole shall not be damaged.

7 Test Methods

7.1 Sampling

7.1.1 Test piece

For the test piece that is not regulated in the test method, it may adopt the product sample as the test piece for inspection. If the product sample is not suitable for test (for example, it is limited by test equipment), then corresponding samples can be produced as the samples for inspection.

7.1.2 Preparation of corresponding samples

7.1.2.1 Corresponding samples shall be plane porcelain enameling circular or square steel panel. It's diameter is (105±2) mm or side length is (105±5) mm. According to general analysis of weighing and related required weighing precision of balance, the mass (or weight) of prepared samples shall not be over 200g.

7.1.2.2 The materials (including steel panel, porcelain enameling, back-lining and adhesive) and preparation process (including pretreatment, coating, enameling) of corresponding samples shall be consistent with the corresponding products.

7.1.2.3 The surface of corresponding samples shall be smooth without porcelain defect. The side has no accumulation of porcelain glaze. The thickness of porcelain coating shall be consistent with or approximate to that of the product.

7.1.2.4 In order to make the samples suspend in weighing and enameling, a hole with a diameter of about 2.5mm can be opened in the place 3mm (from the hole center) from the edge, which shall be conducted before enameling of the sample.

7.2.5 The allowable deviation of hole size of the fixed pedant shall be inspected via Vernier caliper with a minimum scale of 0.5mm.

7.2.6 Size and allowable geometric dimensional deviation of openings and gaps on porcelain enameling steel panel surface shall be inspected via straight steel ruler and steel tap with a minimum scale of 1mm.

7.3 Surface quality

7.3.1 Porcelain coating thickness of external surface

7.3.1.1 Adopt a film thickness detector with precision of 0.5μm for inspection.

7.3.1.2 The number of detection points of each test piece shall not be less than 5. The positions are 100 from the side and the center.

7.3.2 Porcelain quality of external surface

The porcelain coating quality on the external surface shall be inspected according to Table 10.

Table 10 Inspection of porcelain enameling defect on the external surface

Inspection item	Inspection method
Color difference	Adopt spectroscopic color meter for inspection, the precision is 0.01
Other defects	Inspect through visual inspection (under outdoor natural light, observe it in front of the panel surface for more than 10s at a distance of 600mm-800mm), straight steel ruler and calipers with a minimum of 1mm.

7.4 Physiochemical properties

7.4.1 Salt water resistance

7.4.1.1 Test sample

Adopt corresponding samples as the inspection test pieces, not less than 3 pieces.

7.4.1.2 Test method

Immerse test pieces in NaCl solution with concentration of (5±1%) (mass fraction) and temperature of 33°C ~ 35°C for 45 h, take them out, use water to flush them, place them indoor vertically for 2 h, and then observe whether the porcelain surface has rust.

7.4.2 Acid resistance

Inspect it according to the method regulated in GB/T 9989-2005.

7.4.3 Alkali resistance

7.4.3.1 Sample

Adopt corresponding samples as the inspection test pieces, not less than 3 pieces.

7.4.8.3 Debugging of test device

Before test, debug the test device so as to make the test device to reach the following requirements:

a) The hanging points shall be hard enough and adjustable to meet different impact heights. The diameter of the steel wire rope hanging objects shall be stainless steel wire rope with a diameter of 5mm. In the maximum falling height, the horizontal contained angle between the hanging steel wire rope and horizontal surface of the hanging points shall not be less than 14°;

b) When the impact object and the hanging steel wire rope are in free state, the distance between the outer edge of the tire and test piece surface shall be more than 5mm but less than 15mm. The geometric center of the impact object shall be located in the range of 50mm where the measured impact point is the circular center.

c) The release device of the impact object shall be able to locate the lifting height of the impact body accurately, keep the central line of the impact body and the central line of the hanging steel wire rope in the same straight line, and guarantee the impact object can fall freely after being released.

7.4.8.4 Requirements for test piece

Conduct spot inspection of 3 actual products with the biggest area or appointed by the demander from the tested products for inspection one by one.

7.4.8.5 Test procedures

7.4.8.5.1 In the test process, the test samples shall be normal vertical state and face the impact object;

7.4.8.5.2 Determine the falling height according to impact energy of the product and Formula (2):

$$H = E/9.8\,m \qquad \cdots\cdots(2)$$

Where

E - impact energy, unit: N·m;

m - mass of impact object, unit: kg;

H - effective falling height of impact object, unit: m.

7.4.8.5.3 The error of falling height is ±20mm; multiple repeating impact due to elastics shall be avoided;

7.4.8.5.4 Measure residual deformation of the test piece after impact;

7.4.8.5.5 Dismantle the panel from the frame and place it horizontally, and detect porcelain crack according to the method regulated in 5.9 of QB/T 1855-1993.

7.4.8.6 Result judgment

It is judged to be unqualified if one of the three does not conform to the following situations:

a) After the impact force disappears, panel deformation shall be able to recover and have no obvious permanent deformation;

b) After the impact force disappears, the porcelain coating shall have no crack.

7.4.8.7 Test report

Test report shall include the following information:

a) Test basis;

b) Entrusting organization of test pieces;

c) Test type, specification and size, material, shape and structure, and all related detailed information of fixing position;

d) Storage and test conditions of the laboratory;

e) Detailed situation of damage in the laboratory;

f) Expression of test results;

g) Name and site of the laboratory;

h) Signature of detectors;

i) Test date.

7.4.9 Resistance to wind pressure

7.4.9.1 Principle

Install the porcelain enameling steel panel onto the pressure box, exert static pressure wind load standard value to the panel to make it have bending deformation, and inspect its damage.

7.4.9.2 Test device

It shall meet regulations in 4.3.2 of GB/T 15227-2007.

7.4.9.3 Requirements of test piece

Conduct spot inspection of 3 actual products with the biggest area or appointed by the demander from the tested products for inspection one by one.

7.4.9.4 Test procedure

7.4.9.5 Result judgment

The middle panel shall be judged to be unqualified if it does not conform to one of the following situations:

a) The porcelain coating has no obvious deformation after deformation test;

b) Under wind load, the relative deflection of the short side of the panel shall be less than L/60; after wind load disappears, the panel shall have no obvious permanent deformation;

c) Back-lining has no fracture or craze;

d) Fixed pendants are not loose.

7.4.9.6 Test report

The test report shall contain the following information:

a) Test basis;

b) Entrusting organization of test pieces;

c) Test type, specification and size, material, shape and structure, and all related detailed information of fixing position;

d) Storage and test conditions of the laboratory;

e) Detailed situation of damage in the laboratory;

f) Expression of test results;

g) Name and site of the laboratory;

h) Signature of test personnel;

i) Test date.

8.2.2.1 Dimension deviation, outer surface porcelain thickness and fixed pendant assembly quality inspection

The samplings of dimension deviation, surface quality and fixed pendant assembly quality inspection are conducted on the basis of the rules shown in Table 12. For each test result, if the number of unqualified products does not exceed Ac_1, then the inspected batch of products is judged as qualified; if the number of unqualified products is larger than or equal to Re_1, then the inspected batch of products is judged as unqualified. If the number of unqualified products is larger than Ac_1 and less than Re_1, then extract the second sample-panels to conduct inspection. For the test result, if the number of unqualified products of the two-time samples is less than or equal to Ac_2, then the inspected batch of products is judged as qualified; if it is larger than or equal to Re_2, then the inspected batch of products is judged as unqualified. However, the supplier's inspection from one by one is permitted, and the qualified product is delivered.

8.2.2.2 The surface quality inspection

The inspection of porcelain-face enameling defect shall be conducted from one by one. When it is inspected to be unqualified, that single-item is unqualified.

8.2.2.3 Physiochemical performance inspection

For each batch and each item, according to the requirements of the test method, extract 3 samples (real samples or accompanying test samples) to conduct test; when the batch number is less than 3, it shall conduct inspection to all. If there is no unqualified item of each sub-item's inspection result, then the single sub-item of physiochemical performance of this batch of products is judged as qualified; if the number of unqualified items is larger than or equal to 2, then the singe sub-item of physiochemical performance of this batch of products is judged as unqualified. If the number of samples' unqualified item is 1, then extract second 3 samples to conduct test. If the number of unqualified products in the two-time samples is less than or equal to 2, the singe sub-item of physiochemical performance of this batch of products is judged to be qualified; if the number is later than or equal to 3, then the singe sub-item of physiochemical performance of this batch of products is judged to be unqualified. For the products of which the length, width of panel and appearance dimension is smaller than the type inspection product AND the products with same product combination type and same material, the soft heavy impact resistance inspection and wind load resistance inspection can adopt the result of type inspection as the result of exit-factory inspection.

Table 12 Dimension deviation, external surface porcelain thickness, fixed pendant assembly quality, sampling inspection method

Unit is piece

Batch range	Sample (times)	Sample size	Total sample size	Acceptance number		Rejection number	
				Ac_1	Ac_2	Re_1	Re_2
≤300	1	15	15	0		2	
	2	15	30		1		3
301-500	1	20	20	0		3	

qualified, the type inspection is judged to be qualified. If one of these items is unqualified, it shall draw double samples to conduct tests; when there is still one test result unqualified, then the type inspection is judged to be unqualified.

b) For soft heavy impact resistance, wind load resistance, and fireproof performance, it shall draw samples according to the rules of test method. Once the test result is unqualified, the type inspection is judged to be unqualified, and no second test is conducted.

e) For comprehensive judgment, when each inspection item result is qualified, the type inspection is judged to be qualified.

9 Mark, Packing, Transportation and Storage

9.1 Mark

9.1.1 The porcelain enameling steel panel shall be pasted with clear trademark or name of production factory.

9.1.2 The packing mark shall conform to regulations of GB/T 191. It shall include factory name, factory address, trademark, product mark, quantity, batch number, color number and production date.

9.1.3 For the panels having requirements for installation sequence and direction, MARK the installation sequence number or direction on the side or back of each porcelain panel.

9.2 Packing

The product packing shall conform to regulations of GB/T 9174. Each object shall be packed by soft material in boxes. The packing shall be firm, with words such as “upwards, carry and place gently, rainproof, damp-proof and collision avoidance”. The packing box shall have certification, instructions for use and other quality certification documents and technical materials.

9.3 Transportation

Handle and place the product gently during transportation. It is strictly prohibited to load and unload wildly in case of damage. Rainproof and damp-proof measures shall be taken during transportation and storage.

9.4 Storage

Products shall be stored according to variety, specification, batch number and color number. The maximum horizontal stacking height shall not be more than 5 layers; the maximum vertical stacking height shall be 2 layers; and it is not allowed to bear other external load. There must be flexible lining between layers. The lining thickness shall not be below 2mm. Avoid to contact with harmful medium.

Reference

[1] GB 7410-1987 Terms of vitreous and porcelain enamels

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