GB

NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

ICS 91.100.15

CCS Q 13

GB/T 14684-2022

Replacing GB/T 14684-2011

Sand for construction

建设用砂

Issued on: April 15, 2022 **Implemented on: November 01, 2022**

Issued by: State Administration for Market Regulation;

Standardization Administration of PRC.

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Sand for construction

1 Scope

This document stipulates the classification and categories, general requirements, technical requirements, test methods, inspection rules, marking, storage, transportation of sand for construction.

This document applies to cement concrete and its products, as well as sand used in ordinary mortar, in construction projects.

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 175 Common Portland cement

GB/T 601 Chemical reagent - Preparations of standard volumetric solutions

GB/T 2419 Test method for fluidity of cement mortar

GB/T 6003.1 Test sieves - Technical requirements and testing - Part 1: Test sieves of metal wire cloth

GB/T 6003.2 Test sieves - Technical requirements and testing - Part 2: Test sieves of perforated metal plate

GB 6566 Limits of radionuclides in building materials

GB 8076-2008 Concrete admixtures

GB/T 17671 Test method of cement mortar strength (ISO method)

SL/T 352-2020 Test code for hydraulic concrete

3 Terms and definitions

The following terms and definitions apply to this document.

4.1.1 According to the source, it is divided into natural sand, manufactured sand, mixed sand.

4.1.2 According to the fineness modulus, it is divided into coarse sand, medium sand, fine sand, extra fine sand. The fineness modulus are as follows:

- Coarse sand: 3.7 ~ 3.1;
- Medium sand: 3.0 ~ 2.3;
- Fine sand: 2.2 ~ 1.6;
- Extra fine sand: 1.5 ~ 0.7.

4.2 Category

Construction sand is divided into category I, category II, category III, based on particle gradation, clay content (fine content), methylene blue (MB) value, clay lumps and friable particles content, hazardous substances, soundness, crushing index, flake particle content technical requirements.

5 General requirements

5.1 In addition to complying with the provisions of 6.4, hazardous substances in manufactured sand, which are produced from mining waste rock and tailings, shall also comply with the requirements of the environmental protection and safety-related standards and specifications in China.

5.2 The technical requirements, test methods, inspection rules, marking, storage and transportation of mixed sand shall be implemented as for manufactured sand.

6 Technical requirements

6.1 Particle gradation

6.1.1 Except for extra-fine sand, the cumulative screening residue of category I sand shall comply with the requirements of Zone 2 in Table 1; the sub-calculated screening residue shall comply with the requirements of Table 2. The cumulative screening residue of category II and category III sand shall comply with the requirements of Table 1. The actual particle gradation of sand can be exceeded, except for 4.75 mm and 0.60 mm screen; however, the sum of the cumulative screen residue excess values at all levels shall not be greater than 5%.

in a moist state. Pile it into a round cake, which has a thickness of about 20 mm. Then divide the round cake into 4 equal parts, along two mutually perpendicular diameters. Take 2 diagonal sets. Mix them thoroughly. Then pile them into a round cake. Repeat the above process, until the sample is reduced to the required amount for the test.

7.1.3.3 The samples used in the bulk density and manufactured sand soundness tests can be tested directly, after being mixed evenly, without being reduced.

7.2 Test environment

The temperature of the laboratory shall be maintained at (20 ± 5) °C.

7.3 Particle gradation

7.3.1 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: The measuring range is not less than 1000 g; the graduation value is not more than 1 g;

c) Test sieve: The sieves which have specifications of 0.15 mm, 0.30 mm, 0.60 mm, 1.18 mm, 2.36 mm, 4.75 mm, 9.50 mm; have sieve bottom and sieve cover; comply with the provisions for square hole test sieves in GB/T 6003.1 and GB/T 6003.2;

d) Sieve shaker.

7.3.2 Test procedures

7.3.2.1 Take samples according to the provisions of 7.1. Screen out particles larger than 9.50 mm. Calculate the screening residue percentage. Reduce the specimen to about 1100 g. Dry it in an oven at (105 ± 5) °C, until it reaches constant weight. After cooling to room temperature, divide it into 2 equal portions, to prepare for use.

Note: Constant weight means that when the interval between two adjacent weighing is not less than 3 hours, the difference in mass between the two is not greater than the weighing accuracy required for the test (the same below).

7.3.2.2 Weigh 500 g of specimen, accurate to 1 g. Pour the specimen onto a set of sieves (with sieve bottom), which are assembled from top to bottom according to the hole size. Then sieve it.

7.3.2.3 Place the sieve set on the sieve shaker. Shake the sieve for 10 minutes. Remove the sieve set. Sieve it by hand one by one, according to the size of the sieve holes, until the throughput per minute is less than 0.1% of the total specimen volume. The passed

w - Moisture content;

m_{w0} - Mass of methylene blue before drying, in grams (g):

m_{w1} - Mass of methylene blue after drying, in grams (g).

b) Preparation of methylene blue solution: Weigh [100 × (1 + w)/10] g ± 0.01 g of the undried methylene blue, that is, (10.00 ± 0.01) g of dry methylene blue, accurate to 0.01 g. Pour into a beaker, which contains about 600 mL of distilled water at a temperature of 35 °C ~ 40 °C. Use glass rod to stir continuously, until the methylene blue is completely dissolved. Cool it to 20 °C. Pour the solution into a 1 L volumetric flask. Use distilled water to rinse the beaker, to move all the methylene blue solution into the volumetric flask. The temperature of the volumetric flask and the solution shall be maintained at (20 ± 1) °C. Add distilled water to the 1 L mark of the volumetric flask. Shake the volumetric flask, to ensure that the methylene blue is completely dissolved. Move the solution from the volumetric flask into a dark storage bottle. Mark the preparation date and expiration date. Store it in a dark place. The shelf life of methylene blue solution shall not exceed 28 days.

7.5.1.3 Filter paper: Rapid quantitative filter paper shall be used.

7.5.2 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: The measuring range is not less than 1000 g and the graduation value is not greater than 0.1 g; the measuring range is not less than 100 g and the graduation value is not greater than 0.01 g;

c) Test sieves which have hole diameter of 75 μm, 1.18 mm, 2.36 mm;

d) Container: The depth is greater than 250 mm. When washing the specimen, keep the specimen from splashing.

e) Pipette: 5 mL, 2 mL;

f) Fine content meter or impeller stirrer: Adjustable speed, up to (600 ± 60) r/min, diameter (75 ± 10) mm;

g) Timing device: graduation value 1 s;

h) Glass volumetric flask: 1 L.

7.5.3 Test procedures

7.5.3.1 Determination of the content of manufactured sand and gravel powder

The fine content of manufactured sand powder shall be determined in accordance with the provisions of 7.4.2.

7.5.3.2 Determination of methylene blue value of manufactured sand

7.5.3.2.1 Take samples according to the provisions of 7.1. Reduce the specimen to about 400 g. Place it in an oven and dry it at (105 ± 5) °C, to a constant weight. After cooling to room temperature, screen out the particles larger than 2.36 mm, to prepare for use.

7.5.3.2.2 Weigh 200 g of the specimen, accurate to 0.1 g; record it as m_0. Pour the specimen into a beaker containing (500 ± 5) mL distilled water. Use an impeller mixer, to stir it at (600 ± 60) r/min for 5 minutes, to form a suspension. Then continue to stir at (400 ± 40) r/min, until the end of the test.

7.5.3.2.3 Add 5 mL of methylene blue solution to the suspension. Stir for at least 1 minute at (400 ± 40) r/min. Then use a glass rod to dip a drop of the suspension. The suspension droplets shall be such that the diameter of the sediment is within 8 mm ~ 12 mm. Drop it on the filter paper. At the same time, the filter paper shall be placed on an empty beaker or other support, so that the surface of the filter paper does not come into contact with any solid or liquid. If there is no color halo around the sediment, add another 5 mL of methylene blue solution. Continue stirring for 1 min. Then use a glass rod to dip a drop of the suspension into the filter paper. If there is still no color halo around the sediment, repeat the above steps, until a stable light blue halo of about 1 mm appears around the sediment. At this time, stirring shall be continued, without adding methylene blue solution. A contamination test shall be performed once every 1 minute. If the color halo disappears within 4 minutes, add another 5 mL of methylene blue solution; if the color halo disappears within 5 minutes, add another 2 mL of methylene blue solution. In both cases, stirring and staining tests shall be continued, until the halo persists for 5 minutes.

7.5.3.2.4 Record the total volume (V) of methylene blue solution, which is added when the color halo lasts for 5 minutes, accurate to 1 mL.

7.5.3.3 Rapid test of methylene blue

7.5.3.3.1 Prepare specimen according to 7.5.3.2.1.

7.5.3.3.2 Stir it according to 7.5.3.2.2.

7.5.3.3.3 Add 30 mL of methylene blue solution to the beaker at one time. Stir continuously for 8 minutes at (400 ± 40) r/min. Then use a glass rod to dip a drop of the suspension, to drop it on the filter paper. Observe the precipitate, to see whether there is any obvious color halo around.

7.5.4 Result calculation

and cool to room temperature; then measure its density, until the solution density reaches 2000 kg/m^3.

7.8.2 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: The measuring range is not less than 1000 g; the graduation value is not more than 0.1 g;

c) Measuring tools: A measuring cup which has a measuring range of 1000 mL and a graduation value not greater than 5 mL; a measuring cylinder which has a measuring range of 250 mL and a graduation value not greater than 5 mL; a beaker which has a measuring range of 150 mL and a graduation value not greater than 1 mL;

d) Hydrometer: Measuring range is 1800 kg/m^3 ~ 2200 kg/m^3;

e) Test sieve: The sieve which has hole diameter of 4.75 mm and 0.30 mm;

f) Mesh basket: The inner diameter and height are both about 70 mm; the mesh hole diameter is not larger than 0.30 mm.

7.8.3 Test procedures

7.8.3.1 Take specimens according to the provisions of 7.1. Reduce the specimen to about 800 g. Dry it in an oven at (105 ± 5) °C to a constant weight. After cooling to room temperature, screen out the particles larger than 4.75 mm and smaller than 0.30 mm. Divide into 2 parts equally, to prepare for use.

7.8.3.2 Weigh 200 g of the specimen, accurate to 0.1 g. Record it as m_{d0}. Pour the specimen into a measuring cup, which contains heavy liquid. Use a glass rod to stir thoroughly, to fully separate the lightweight materials and sand in the specimen. After standing for 5 minutes, pour the floating lightweight materials together with part of the heavy liquid into the mesh basket. The lightweight materials remain on the mesh basket, while the heavy liquid flows into another container through the mesh basket. Sand particles shall not be brought out when pouring the heavy liquid. Generally, pouring will stop when the distance between the surface of the heavy liquid and the surface of the sand is 20 mm ~ 30 mm; pour the flowing out heavy liquid back into the measuring cup, which contains the specimen. Repeat the above process, until no lightweight material floats.

7.8.3.3 Use clean water to wash the substance remaining in the mesh basket. Then move it into a beaker which reaches constant weight (mass m_{d1}). Place it in an oven and dry it to constant weight at (105 ± 5) °C. After cooling to room temperature, weigh the total

value is not greater than 5 mL, 1000 mL and the graduation value is not greater than 5 mL;

c) Test sieve: A sieve which has a hole diameter of 4.75 mm.

7.9.3 Test procedures

7.9.3.1 Take samples, according to the provisions of 7.1. Reduce the specimen to about 500 g. After air-drying, screen out particles larger than 4.75 mm, to prepare for use.

7.9.3.2 Put the air-dried specimen into the 250 mL volumetric cylinder, to the 130 mL mark. Then inject the sodium hydroxide solution to the 200 mL mark. Add the stopper. Shake vigorously. Let it stand for 24 hours.

7.9.3.3 Compare the color of the upper solution of the specimen and the standard solution. The measuring cylinder which contains the standard solution shall be consistent with that containing the specimen.

7.9.4 Results evaluation

7.9.4.1 When the color of the solution in the upper part of the specimen is lighter than the color of the standard solution, the organic matter content of the specimen is deemed to be qualified.

7.9.4.2 When the colors of the two solutions are close, the specimen shall be poured into the beaker together with the upper solution. Place it in a water bath device that can maintain the water temperature at 60 °C ~ 70 °C. Heat it for 2 h ~ 3 h. Then compare it with the standard solution. When it is lighter than the standard solution, the organic matter content is considered qualified.

7.9.4.3 When the upper solution of the specimen is deeper than the standard solution, cement mortar shall be prepared for further test. The preparation method is as follows: Take a portion of the specimen; use sodium hydroxide solution to wash away the organic matter; then use clean water to rinse it. Use the same raw materials as another unwashed portion of specimen to prepare cement mortar, according to the provisions of GB/T 17671. Measure the compressive strength at 28 days. When the strength of the cement mortar, which is made from the unwashed specimen, is not less than 95% of the strength of the cement mortar, which is made from the specimen after removing the organic matter, the organic matter content is considered qualified.

7.10 Sulfide and sulfate content (based on SO_3 mass)

7.10.1 Reagents and materials

Reagents and materials shall comply with the following requirements:

a) Barium chloride solution: Dissolve 5 g of barium chloride in 50 mL distilled water;

b) Dilute hydrochloric acid: Mix concentrated hydrochloric acid with the same volume of distilled water;

c) Silver nitrate solution: Dissolve 1 g of silver nitrate in 100 mL of distilled water; then add 5 mL ~ 10 mL of nitric acid; store in a brown bottle;

d) Filter paper: Medium speed quantitative filter paper, slow speed quantitative filter paper.

7.10.2 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: Measuring range is not less than 100 g and graduation value is not more than 0.0001 g

c) High temperature furnace: The temperature is controlled at (800 ± 25) °C;

d) Test sieve: A sieve which has a hole diameter of 75 μm;

e) Beaker: 300 mL;

f) Graduated cylinder: 20 mL and 100 mL, which has a graduation value of not greater than 1 mL;

g) Dryers, porcelain crucibles, shallow plate, brushes, etc.

7.10.3 Test procedures

7.10.3.1 Take samples according to the provisions of 7.1. Reduce the specimen to about 150 g. Place it in an oven and dry it to a constant weight at (105 ± 5) °C. After cooling to room temperature, grind it all and pass it through a 75 μm sieve, to obtain a powdery specimen. Then reduce it into 30 g ~ 40 g, according to the quartering method. Dry it in an oven at (105 ± 5) °C to a constant weight. Wait until it is cooled to room temperature, to prepare for use.

7.10.3.2 Weigh about 1 g (m_{e0}) of the powdery specimen, accurate to 0.001 g. Pour the powdery specimen into a 300 mL beaker. Add 20 mL ~ 30 mL of distilled water and 10 mL of dilute hydrochloric acid. Then place it on an electric stove and heat to a slight boiling. Keep it at a slight boiling for 5 minutes, until the specimen is fully decomposed. Remove it. Use medium-speed filter paper to filter it. Use warm water to rinse it 10 ~ 12 times.

7.10.3.3 Add distilled water to adjust the volume of the filtrate to 200 mL. After boiling, add 10 mL of barium chloride solution dropwise with stirring. Boil the solution for 5 minutes. Remove and let stand for at least 4 hours. At this time, the volume of the

7.11.2 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: The measuring range is not less than 1000 g; the graduation value is not more than 0.1 g;

c) Erlenmeyer flask: 300 mL;

d) Pipette: 50 mL;

e) Burette: 10 mL or 25 mL, graduation value 0.1 mL;

f) Volumetric flask: 500 mL;

g) 1000 mL beaker, shallow plate, brush, etc.

7.11.3 Test procedures

7.11.3.1 Take specimens according to the provisions of 7.1. Reduce the specimen to about 1100 g. Dry it in an oven at (105 ± 5) °C to a constant weight. After cooling to room temperature, divide it into 2 parts equally for later use.

7.11.3.2 Weigh 500 g of the specimen, accurate to 0.1 g, recorded as m_f. Pour the specimen into the beaker. Use a volumetric flask to measure 500 mL of distilled water. Pour it into the beaker. Use a glass rod, to stir the sand-water mixture. Cover the beaker with a watch glass. Place it in a water bath, to heat it from room temperature to 80 °C for 1 hour. Then stop heating. Stir once every 5 minutes for a total of 3 times to fully dissolve the chloride salt. Remove the beaker from the water bath. Let the solution cool to room temperature. Filter the clarified solution in the upper part of the beaker. Then use a pipette to absorb 50 mL of the filtrate. Pour it into an Erlenmeyer flask. Then add 1 mL of potassium chromate indicator. Use 0.01 mol/L silver nitrate standard solution to make titration, until it becomes brick red, which is the end point. Record the number of milliliters of silver nitrate standard solution consumed (V_{f1}), accurate to 0.1 mL.

7.11.3.3 Blank test: Use a pipette to transfer 50 mL of distilled water into an Erlenmeyer flask. Add 1 mL of chromic acid indicator. Use 0.01 mol/L silver nitrate standard solution to make titration, until the solution turns brick red. Record the number of milliliters of silver nitrate standard solution, which is consumed at this point (V_{f2}), accurate to 0.1 mL.

7.11.4 Result calculation

7.11.4.1 The chloride content shall be calculated according to formula (10) and shall be accurate to 0.001%:

Reagents and materials shall comply with the following requirements:

a) Barium chloride solution: Dissolve 5 g of barium chloride in 50 mL distilled water;

b) Sodium sulfate solution: Add 350 g of anhydrous sodium sulfate (Na_2SO_4) to 1 L of water, at a temperature of about 30 °C. Use a glass rod to stir, while adding, to dissolve and saturate it. Then cool to 20 °C ~ 25 °C. Let it stand at this temperature for 48 h.

7.13.2 Instruments and equipment

Instruments and equipment shall meet the following requirements:

a) Oven: Temperature controlled at (105 ± 5) °C;

b) Balance: The measuring range is not less than 1000 g; the graduation value is not more than 0.1 g;

c) Tripod mesh basket: It is made of high-strength, high-temperature-resistant, corrosion-resistant materials. The diameter and height of the mesh basket are both 70 mm. The hole diameter of the mesh shall not be greater than half of the smallest particle size in the specimen contained;

d) Container: Non-ferrous, with a volume of not less than 10 L;

e) Glass rods, shallow plate, brushes, etc.

7.13.3 Test procedures

7.13.3.1 Take samples according to the provisions of 7.1. Reduce the specimen to about 2000 g. Pour the specimen into a container. Soak it in water. Rinse it clean. Dry it in an oven at (105 ± 5) °C to a constant weight. After cooling to room temperature, screen out the particles larger than 4.75 mm and smaller than 0.30 mm. The particles are then sieved into four particle size levels of 0.30 mm ~ 0.60 mm, 0.60 mm ~ 1.18 mm, 1.18 mm ~ 2.36 mm, 2.36 mm ~ 4.75 mm according to the provisions of 7.3. Weigh it in sequence ($m_{h,i}$), accurate to 0.1 g.

7.13.3.2 Weigh 100 g ($m_{h0,i}$) of specimen of each particle size, accurate to 0.1 g. Put specimens of different particle sizes into mesh baskets. Immerse them in a container, which contains newly prepared sodium sulfate solution. The volume of the solution shall not be less than 5 times the total volume of the specimen. When the mesh basket is immersed in the solution, it shall be raised and lowered 25 times, to eliminate air bubbles in the specimen. Then place it in the container. The bottom surface of the mesh basket shall be about 30 mm from the bottom of the container. The distance between the mesh baskets shall not be less than 30 mm. The surface shall be at least 30 mm higher than the surface of the specimen. The solution temperature shall be maintained at 20 °C ~ 25 °C.

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