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**Test methods for water requirement of standard consistency,
setting time and soundness of the Portland cement**
(English Translation)

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1 Scope

This document specifies the principles, instruments and equipment, test water, test conditions and determination methods for the water requirement of standard consistency, setting time and the inspection method for volume soundness mainly caused by free calcium oxide.

This document is applicable to the water requirement of standard consistency, setting time and soundness inspection of general-purpose Portland cement.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 6682 Water for Analytical Laboratory Use - Specification and Test Methods

GSB 14-1510 Cement Standard Samples for Strength Test

JC/T 727 Apparatus for Determining Normal Consistency and Setting Time of Cement Paste

JC/T 729 Mixer for Cement Paste

JC/T 954 Le Chatelier for Determining Soundness of Cement Paste

JC/T 955 Boiling Box for Determining Soundness of Cement

JC/T 962 Tester for Determining Expansion of Le Chatelier Needles

3 Terms and Definitions

3.1

water requirement of standard consistency

When neat cement paste reaches the standard consistency state, the percentage of water used for mixing the neat paste as a percentage of cement mass.

3.2

setting time

When the cement paste reaches the standard consistency condition, the time required from the addition of cement to the sinking of the test needle into the paste to a certain depth.

NOTE: it includes initial setting time and final setting time.

3.3

soundness

The capability of neat cement paste to maintain a stable volume after hardening.

NOTE: it is characterized by the Le Chatelier method or the test cake method.

4.1 Standard Consistency of Cement

The neat cement paste with the standard consistency has a certain resistance to the sinking of the standard test rod (or test cone). When a metal test rod (test rod method) or test cone (test cone method) is used to sink into neat cement pastes with different water contents, and the test rod or test cone can stay in the specified equilibrium position, the water content is the water requirement of standard consistency, and the neat paste is the standard consistency cement paste.

4.2.1 Le Chatelier method

The relative displacement of the test needle after boiling the neat cement paste with standard consistency in the Le Chatelier is determined to characterize the degree of volume expansion.

4.2.2 Test cake method

The change state of the test cakes of neat cement paste with standard consistency after boiling is observed to characterize the volume soundness.

5.1 Cement Paste Mixer

Meet the requirements of JC/T 729.

5.2.1 Cement standard consistency and setting time tester

The cement standard consistency and setting time tester is also called "Vicat apparatus", which shall meet the requirements of JC/T 727. The total mass of the sliding part is $300\text{ g} \pm 1\text{ g}$. The surface of the sliding rod connected to the test rod and the test needle shall be smooth and can fall freely by gravity. There shall be no tightness or looseness, as shown in Figure 1a) and Figure

8 Determination Method for Water Requirement of Standard

Consistency - Test Rod Method (reference method)

8.1 Preparation before the Test

8.1.1

The sliding rod of the Vicat apparatus can freely slide. Wipe the test mold and the glass bottom plate with a wet cloth and place the test mold on the glass bottom plate.

8.1.2

Make adjustments, so that the pointer points at the reference point when the test rod contacts the glass plate.

8.1.3

The mixer normally operates.

8.2 Mixing of Neat Cement Paste

Use neat cement paste mixer for mixing. First, use a wet cloth to wipe the mixing pot and mixing blades. Measure-take or weigh-take a certain amount of mixing water, accurate to 0.5 mL or 0.5 g, and pour it into the mixing pot. Then, within 5 s ~ 10 s, carefully add the weighed

$500\text{g} \pm 1\text{ g}$ of cement into the water, and prevent water and cement from splashing out. When mixing, first place the pot on the pot base of the mixer, raise it to the mixing position, start the mixer, stir at a low speed for 120 s, stop for 15 s; when stopping mixing, scrape the cement paste on the blades and pot wall into the middle of the pot, and then, stir at a high speed for 120 s and stop.

8.3 Determination Steps of Water Requirement of Standard Consistency

After mixing is completed, immediately take an appropriate amount of neat cement paste and put it into the test mold placed on the glass bottom plate at one time. Use a straight-edge knife with a width of about 25 mm to cut a circle between the neat paste and the inner wall of the test mold, then, lift the glass plate and gently vibrate it on the rubber pad for no more than 5 times.

Avoid water seepage during vibration. Then, at about 2/3 of the upper surface of the test mold, slightly tilt it to the test mold surface; respectively and gently saw off the excess neat paste outwards, and then, from the edge of the test mold perpendicular to the saw direction, gently wipe the top of the test mold once. During the operation of sawing off the excess neat paste and screeding, the neat paste shall not be compacted. After screeding, quickly move the test mold and the glass bottom plate to the base of the Vicat apparatus, so that the test rod is located in the center of the test mold surface. Lower the test rod, until it contacts the surface of the neat cement paste, tighten the screws for 1 s ~ 2 s, and then, suddenly release it to allow the test rod to vertically and freely sink into the neat cement paste.

When the test rod stops sinking or when the test cone is released for 30 s, record the distance between the test rod and the bottom plate. After raising the test rod, immediately wipe it clean.

The entire operation shall be completed within 1 minute after mixing. The neat paste with the standard consistency is when the test rod sinks into the neat paste and is $6\text{ mm} \pm 1\text{ mm}$ away from the glass bottom plate. The percentage of mixing water to cement mass is the water requirement of standard consistency (P) of the cement.

9 Determination Method for Water Requirement of Standard

Consistency - Test Cone Method (substitute method)

9.1 Preparation before the Test

9.1.1

The metal rod of the Vicat apparatus can freely slide.

9.1.2

Make adjustments, so that the pointer points at the zero point when the test cone contacts the top surface of the cone mold.

9.1.3

The mixer normally operates.