
British Standard

Quicklime, hydrated lime and natural calcium carbonate

Part 4. Methods of test for physical properties
of hydrated lime and lime putty

Chaux vive, chaux hydratée et carbonate de calcium naturel

Partie 4. Méthodes d'essai des propriétés physiques de la chaux hydratée et du mastic de chaux

Branntkalk, Löschkalk und natürliches Kalziumkarbonat

Teil 4. Verfahren zur Prüfung der physikalischen Eigenschaften von Kalkhydrat und Kalkteig

Foreword

This Part of BS 6463 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Committee in order to bring together standard methods of test for quicklime, hydrated lime and natural calcium carbonate.

This standard incorporates and revises the test methods contained in BS 890 which is also to be revised. Although the standard deals primarily with methods of test for lime products used in the construction industry, methods used in other fields, e.g. water treatment, food, agriculture and the steel and chemical industries, have also been included.

BS 6463 is published in four Parts as follows:

- Part 1. Methods of sampling
- Part 2. Methods of chemical analysis
- Part 3. Methods of test for physical properties of quicklime
- Part 4. Methods of test for physical properties of hydrated lime and lime putty

Part 4 describes methods for testing hydrated lime and lime putty as produced and delivered to the customer. These tests include size grading, bulk density, soundness and the presence of coarse particles. The remainder of the tests are to determine the properties of lime putty produced from hydrated lime or quicklime or purchased in that form.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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Methods

1 Scope

This Part of BS 6463 describes methods for the physical testing of hydrated lime and lime putty.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Determination of particle size of hydrated lime

2.1 Principle

The particle size distribution is determined by sieve analysis using an air-jet sieving apparatus. This method of sieve analysis determines the particle size of the agglomerates of the very fine particles of hydrated lime in the dry material produced by the manufacturing process.

2.2 Apparatus

2.2.1 Air-jet sieving apparatus, of the form shown in figure 1, capable of giving a pressure difference of 1 kPa across the sieves, with 200 mm diameter, 40 μm , 63 μm and 75 μm mesh sieves in accordance with BS 410*.

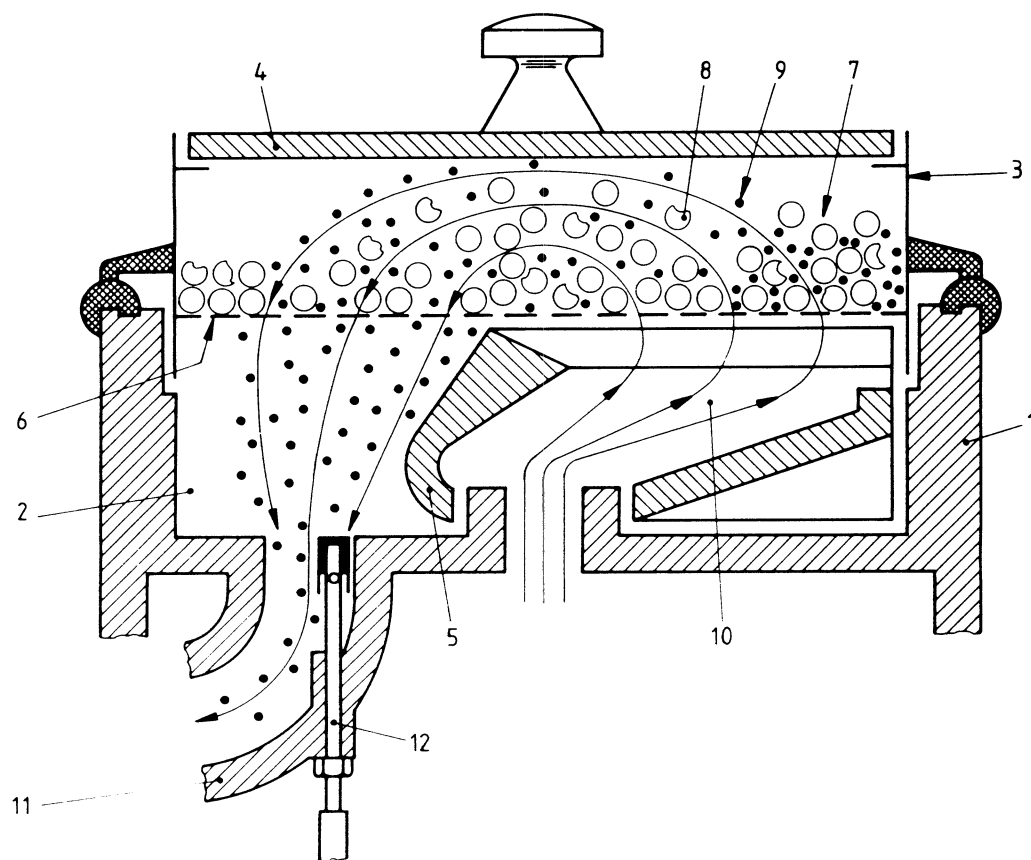
2.2.2 Balance, with an accuracy of 0.001 g.

2.2.3 Soft brush (a camel hair brush is suitable).

2.2.4 Weighing bottle.

2.3 Procedure

Place the 40 μm sieve on the air-jet sieving apparatus (2.2.1) after ensuring that the corresponding nozzle is in position and properly located. Do not turn the nozzle by hand.



- | | |
|----------------|---|
| 1. Housing | 7. Test sample |
| 2. Dish | 8. Oversize material |
| 3. Sieve drum | 9. Undersize material |
| 4. Lid | 10. Air jet |
| 5. Slit-nozzle | 11. Air discharge |
| 6. Sieve | 12. Pressure gauge socket, with dust hood |

Figure 1. Air-jet sieving apparatus

*The Alpine A200 LS is a suitable apparatus.

Weigh approximately 5 g of hydrated lime to an accuracy of 0.001 g using the weighing bottle (2.2.4). Switch on the apparatus and pour the sample onto the sieve. Brush out the weighing bottle with the soft brush (2.2.3) and switch off the apparatus. When the vacuum has ceased, place on the lid, switch on the apparatus and adjust to give a pressure difference of 1 kPa. If there is any tendency for material to adhere to the lid, gently tap the knob as necessary with a mallet. Do not tap any other part of the lid.

After 15 min switch off the apparatus, carefully remove the sieve and brush the contents on to a clean sheet of paper taking care not to damage the mesh. Pour the material into a tared weighing bottle and reweigh.

Repeat the above procedure on further 5 g portions of the sample using the 63 μm and 75 μm sieves (2.2.1).

2.4 Expression of results

The percentage by mass passing the sieve, P , is given by the equation:

$$P = \frac{100 (m - w)}{m}$$

where

m is the mass of sample (in g);

w is the mass retained on the sieve (in g).

2.5 Test report

The percentage by mass passing each sieve shall be reported to the nearest whole number.

3 Determination of coarse material

3.1 Principle

The amount of coarse material present is determined by wet sieving.

NOTE. The coarse particles present in hydrated lime may sometimes cause unsoundness.

3.2 Apparatus

3.2.1 Balance, with an accuracy of 0.01 g.

3.2.2 500 mL wide-mouthed bottle, or other suitable vessel which can be sealed with a stopper.

3.2.3 200 mm diameter 180 μm and 90 μm mesh BS 410 test sieves.

3.2.4 5 mm bore rubber or plastics tubing.

3.2.5 Drying oven, controlled at $105 \pm 5^\circ\text{C}$.

3.2.6 Two sintered glass filter crucibles, of porosity equivalent to grade P 100 of BS 1752 with filter flask and adaptor funnel for crucibles.

3.2.7 Desiccator.

3.2.8 Wash bottle.

3.3 Procedure

Superimpose the 180 μm mesh BS 410 test sieve on the 90 μm mesh BS 410 test sieve (3.2.3) and wet the sieves with distilled or potable water. Place 50 ± 0.5 g of hydrated lime or 100 ± 1 g of lime putty in a 500 mL wide-mouthed bottle (3.2.2) and add about 250 mL of water. Replace the stopper and shake the bottle for about 30 s. Remove the stopper immediately and pour the contents of the bottle onto the sieves. Wash any residue remaining in the bottle or on the stopper with a jet of water from the 5 mm bore tubing (3.2.4) and at a pressure equal to a head of 1.2 m (approximately 10 kN/m^2) on to the sieves. Then use the jet to wash the residue on the 180 μm mesh BS 410 test sieve, for not less than 2 min or more than 5 min. Do not rub the residue through the sieve and take care not to flood the lower sieve during the operation. At the end of this period, wash the residue to one side of the sieve. Detach the 180 μm mesh BS 410 test sieve and, using a wash bottle (3.2.8), transfer the residue from the sieve through a glass funnel into one of the tared, sintered glass filter crucibles (3.2.6) connected to the suction system. When all the residue has been washed into the filter, and the water extracted, remove the filter containing the residue and dry it at $105 \pm 5^\circ\text{C}$ for 1 h. Cool the dried filter in a desiccator (3.2.7) and reweigh.

Wash the residue on the 90 μm mesh BS 410 test sieve for a minimum period of 4 min or a longer period, not exceeding 10 min in all, as may be necessary until the washings are clear.

Transfer the residue to a tared filter crucible, dry, cool and reweigh as described above.

3.4 Expression of results

The percentage by mass retained on each sieve, x , is given by the equation:

$$x = \frac{100w}{m}$$

where

m is the mass of the sample (in g);

w is the mass retained on the sieve (in g).

3.5 Test report

The residue on a 180 μm mesh BS 410 test sieve shall be reported to the nearest 0.05 %. The residue on a 90 μm mesh BS 410 test sieve which passes a 180 μm mesh BS 410 test sieve shall be reported to the nearest 0.05 % and the cumulative residue on a 90 μm mesh BS 410 test sieve shall be reported to the nearest 0.05 %.

NOTE. To enable the residue in the lime putty to be referred to the dry mass of hydrated lime the water content of the lime putty should be determined by the method given in BS 6463 : Part 2.

4 Determination of particle density

4.1 Principle

The particle density of hydrated lime is determined by displacement of a non-reactive liquid in a density bottle. This density is then used in the determination of the specific surface (see clause 5).

4.2 Material

Displacement liquid, redistilled kerosine (paraffin oil), the density of which shall not change more than 0.0005 g/mL when evacuated for a period of 5 h at a pressure of 0.27 kPa to 2.7 kPa (2.7 mbar to 27 mbar).

NOTE. A suitable liquid can be prepared in the laboratory by redistilling kerosine and collecting the fraction condensing at 200 °C to 240 °C. Alternatively, petroleum fraction with boiling ranges within the range 190 °C to 225 °C and with sufficiently stable density characteristics is commercially available.

4.3 Apparatus

4.3.1 Density bottle, of nominal capacity 50 mL, in accordance with BS 733.

4.3.2 Small funnel, to fit inside the neck of the density bottle.

4.3.3 Balance, capable of weighing up to at least 100 g to an accuracy of ± 0.0005 g.

4.3.4 Thermostatically controlled water bath, capable of being maintained to within ± 0.2 °C at a selected operating temperature slightly above room temperature.

NOTE. A convenient operating temperature is 25 °C, but this is left to the discretion of the operator.

4.3.5 Vacuum desiccator and pump, capable of reducing the pressure to 0.27 kPa to 2.7 kPa (2.7 mbar to 27 mbar).

NOTE. A glass vacuum desiccator should be enclosed in a suitable protective mesh guard.

4.4 Procedure

4.4.1 Water bath. Maintain the water bath at the same selected operating temperature throughout the following tests.

4.4.2 Determination of density of displacement liquid.

Clean and dry the density bottle and stopper (4.3.1) and weigh to ± 0.0005 g.

Fill the bottle with de-aerated distilled or de-aerated de-ionized water at room temperature and, without undue force, insert the stopper with a slight twist, taking care to avoid trapping air bubbles.

Immerse the bottle nearly to the top of its neck in the water bath (4.3.4) and leave for at least 30 min.

After ensuring that air bubbles are absent and that the bottle is filled to the top of the capillary bore, remove with dry filter paper any water on the top of the neck of the bottle where stopper and neck meet, and dry the sides and the top of the stopper, taking care not to withdraw any water from the capillary.

Remove the bottle from the water bath and, after allowing it to cool for a few minutes, wipe it free of water with the minimum of handling, and weigh to ± 0.0005 g.

By topping up the bottle with more distilled or de-ionized water, re-immersing it in the water bath and proceeding as before, make two additional weighings of the bottle filled with water.

Calculate the mean of these three weighings, and from the difference between this mean weighing and the first weighing of the bottle and stopper alone, calculate the mass of water to fill the bottle at the selected operating temperature.

Clean and dry the density bottle and stopper used in the above test and reweigh to ± 0.0005 g. Repeat the above procedure but filling the bottle with the displacement liquid instead of water, and determine the average mass of displacement liquid to fill the bottle at the selected operating temperature.

4.4.3 Determination of particle density of hydrated lime.

Clean and dry the calibrated density bottle and stopper and weigh to 0.0005 g.

Place 4 g to 5 g of hydrated lime in the bottle by means of the small funnel (4.3.2), reweigh with stopper to ± 0.0005 g and, from the difference between the first and second weighings, calculate the mass of the sample of hydrated lime in the bottle.

Add sufficient displacement liquid to cover the hydrated lime sample and half fill the bottle, ensuring that the lime is thoroughly wetted by swirling the contents gently, taking care to keep lime particles clear of the neck of the bottle.

Place the bottle, together with a small beaker containing some displacement liquid, in the vacuum desiccator (4.3.5) and evacuate at a pressure of 0.27 kPa to 2.7 kPa (2.7 mbar to 27 mbar) for at least 30 min until bubbles of air cease to be evolved.

Remove the bottle from the desiccator and fill with displacement liquid from the beaker.

Using the same procedure as described in 4.4.2, determine the average mass of the bottle, stopper, hydrated lime sample and displacement liquid to fill the bottle at the selected operating temperature.

4.5 Expression of results

4.5.1 Density of displacement liquid. Calculate the density of the displacement liquid, ρ_L , (in g/mL) to the nearest 0.0005 g/mL from the equation:

$$\rho_L = \left(\frac{m_2}{m_1} \right) \rho_W$$

where

ρ_W is the density of pure water at the selected operating temperature (in g/mL) (see table 1);

m_1 is the mass of water to fill the bottle at the selected operating temperature (in g);

m_2 is the mass of displacement liquid to fill the bottle at the selected operating temperature (in g).