

Methods of testing cement —

Part 3: Physical tests —

Section 3.8 Test for heat of hydration

IMPORTANT NOTE. It is recommended that this Section be read in conjunction with the information in the “General Introduction” to BS 4550 and with the information in BS 4550-3.1, which are both issued separately.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date of issue	Comments

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1 Test principle

The heat of hydration of cement is determined calorimetrically based on the difference in the heat of solution between the unhydrated and the hydrated cement. It is expressed in kilojoules per kilogram anhydrous mass. The method when applied to cements other than Portland cements requires the determination of water content. For Portland cements the procedure may be simplified by replacing this determination by that for loss-on-ignition in accordance with clause 13 of BS 4550-2:1970.

2 References

The titles of the publications referred to are listed on the inside back cover.

3 Materials

3.1 For the determination of heat of solution, make up in bulk $2.00 + 0.05M$ nitric acid from analytical reagent quality materials and a 40 % *m/m* solution of analytical reagent quality hydrofluoric acid.

NOTE Bulk preparation of the mixture of these acids in the required proportions is permissible and the bulk mixture should be stored in a non-reactive container.

3.2 For the determination of heat capacity, use analytical reagent quality zinc oxide.

3.3 For the determination of water content, use dried magnesium perchlorate containing not more than 14 % of moisture.

WARNING NOTE. Hydrofluoric acid can produce painful skin burns that heal only with difficulty and precautions in handling this very corrosive substance should be observed.

Attention is also drawn to the handling of magnesium perchlorate which is a powerful oxidizing agent and should not be brought into contact with substances that could cause possible ignition or explosion.

4 Apparatus

The following apparatus is required.

4.1 Calorimeter. The calorimeter shall consist of a 150 mm × 75 mm diameter open mouthed vacuum flask with a cork or rubber stopper 40 mm thick; an insulated container for the flask; a thermometer (range 6 °C with an accuracy of ± 0.001 °C) with reading lens, or any other temperature measuring device which gives the same degree of accuracy; a constant speed stirrer; and a funnel for the introduction of the sample. A typical calorimeter is shown in Figure 1.

The flask shall be of such a kind that:

- a) when filled with 398 ml of water, the water surface is 20 ± 5 mm below the lower surface of the stopper;
- b) when the flask is filled with 400 ml of warm water, the temperature loss, determined after standing without stirring for approximately 30 min, does not exceed 0.002 °C/min per °C above room temperature.

The whole inner surface of the vacuum flask, the underside of the stopper and the parts of the thermometer and the stirrer, if made of glass, which protrude beneath the stopper, shall be evenly and thinly covered with a suitable acid-proof coating.

NOTE A suitably adherent coating may be prepared by melting together equal parts by mass of paraffin wax and petroleum jelly. Alternatively, strip-off lacquer has been found suitable.

To resist damage through wear and tear the mouth of the vacuum flask is given an additional coating of pure paraffin wax.

Should the coating at any time become damaged, as revealed by visual examination, or by anomalous increases in temperature, remove the whole coating and renew it.

The container shall have an insulating layer of cork, cotton wool or similar material at least 25 mm thick, completely enclosing the flask, and also providing support for the flask and the stirrer motor. It is important that the insulation be kept dry and intact since the heat capacity of the apparatus is seriously affected by changes of this sort. The container is divided in a vertical plane into two halves, which are hinged together at one side and provided with a fastening device at the other.

The thermometer shall be adjusted so that the upper end of the range approximates to 25 °C and its zero is recorded by reference to another thermometer to ± 0.1 °C. It shall be rigidly held by the stopper so as to avoid accidental contact with the stirrer blades. In order to facilitate removal of the thermometer, the stopper may be divided into two halves, one of which supports the thermometer and the other the funnel.