British Standard

BRITISH STANDARD

BS 4248:1974

Incorporating Amendment Nos. 1 and 2

Specification for

Supersulphated cement

UDC 666.943.4

Co-operating organizations

The Cement, Lime and Gypsum Products Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

Association of Consulting Engineers*
British Precast Concrete Federation*
British Railways Board
British Ready Mixed Concrete Association*
British Steel Industry*
Cement and Concrete Association*
Cement Makers' Federation*
Chemical Industries Association*
Concrete Society Limited*
Department of the Environment (Building Research Establishment)*
Federation of Civil Engineering Contractors*
Greater London Council*
Gypsum Products Development Association
Institution of Civil Engineers*
Institution of Municipal Engineers*
Institution of Structural Engineers*
Institution of Water Engineers
National Federation of Building Trades Employers*
The Royal Institution of Chartered Surveyors*
Sand & Gravel Association of Great Britain
Society of Chemical Industry*
Welwyn Hall Research Association

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Transport Docks Board
Department of the Environment — Transport and Road Research Laboratory
Overseas Geological Surveys
Royal Institute of British Architects
Royal Institute of Chemistry

This British Standard, having been approved by the Cement, Lime and Gypsum Products Industry Standards Committee, was published under the authority of the Executive Board on 14 February 1974

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First revision (metric) February 1974

The following BSI references relate to the work on this standard:
Committee reference CEB/1
Draft for approval 72/12742

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Amendments issued since publication

Amd. No.	Date	Comments
4420	March 1984	Indicated by a sideline in the margin

Contents

Foreword

This standard has been prepared, in accordance with the change to the metric system in the construction industry, giving values in terms of SI units. For further information on SI units, reference should be made to BS 3763, "The International system of units (SI)".

The values represent the metric equivalents of the values in imperial units in BS 4248:1968, rounded to convenient numbers. Although the values are not exact equivalents of the imperial ones, this is not a technical revision of the standard.

Propylene glycol may be added to the cement clinker before grinding to reduce the energy required. It is driven off by the heat generated during grinding and only traces remain. A method for determining the amount of any propylene glycol in the ground cement has been includes in BS 4550-2.

Pending a future technical revision, it was considered desirable that the contents of the Foreword of the 1968 edition, which was published in imperial units, should be retained in this edition to draw attention to the historical background. The substance of the 1968 Foreword is therefore repeated as follows:

This British Standard has been prepared under the authority of the Cement, Lime and Gypsum Products Industry Standards Committee.

Supersulphated cement is a product with a chemical resistance to most of the aggressive conditions commonly encountered by the construction industries. In particular, concretes and mortars made with this cement have considerable resistance to sulphates.

It has also been found in practice that dense concretes of a water/cement ratio of 0.45 or less made with this cement have given an acceptable life in contact with weak solutions of mineral acids of pH of the order of 3.5 upwards.

The chemical and physical properties of supersulphated cement are different from those of other cements dealt with in British Standard specifications. These differences have made it necessary to modify this standard with respect to other cement standards, the more important differences being as follows.

The water/cement ratio, by weight, for the concrete cube test for compressive strength has been fixed at 0.55 rather than 0.60. The lower value is considered to be more appropriate to a finely ground slag-based cement and also gives better test reproducibility.

The soundness test included is a cold water modification of the Le Chatelier test of BS 12, "Portland cement (ordinary and rapid-hardening)". The boiling procedure in the form of the test in BS 12 is specifically designed to detect expansion due to an excessive free lime content. As there will be no measurable quantity of free lime present in supersulphated cement complying with this standard, the test has been modified to act as a general safeguard against potential unsoundness.

No "loss-on-ignition" limit is included in the standard as this test is not appropriate to cements containing high percentages of blastfurnace slag. The fulfilment of the compressive strength, setting time and soundness test requirements, together with the chemical limits specified, are considered to be adequate safeguards.

No limit for a tricalcium aluminate component is specified as cement complying with this standard will not contain a measurable quantity of this phase.

Supersulphated cement has an intrinsically low heat of hydration and a suitable test for verifying this property is included. The test however, involves a protracted and laborious series of observations which can only be satisfactorily performed by operatives possessing a high degree of experimental proficiency. For these reasons the test is listed as "optional" and is only applicable when the cement is to be used for low heat purposes.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, 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.

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1 Scope

This British Standard specifies requirements for the composition, manufacture, sampling and testing of supersulphated cement. It should be noted that Clause **10** is only applicable when the cement is to be used for low heat purposes.

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

2 Composition and manufacture of supersulphated cement

Supersulphated cement, hereinafter called "the cement", shall consist of a finely ground mixture of granulated blastfurnace slag and calcium sulphate together with Portland cement, Portland cement clinker or other source of lime. The granulated blastfurnace slag component shall be not less than 75 % by weight of the total quantity.

When determined by the method described in Clause **18** of BS 4550-2:1970, the proportion by mass of propylene glycol shall not exceed 0.10 %.

3 Tests

The sample or samples taken as described in Clause **11** shall be tested in the manner specified for each of the following:

1) fineness,

2) chemical composition,

3) compressive strength,

4) setting time,

5) soundness,

and, for cement to be used for low heat purposes,

6) heat of hydration.

4 Fineness

The cement shall be tested for fineness by the method described in Section 3.3 of BS 4550-3:1978, and shall have a specific surface of not less than 400 square metres per kilogram (m^2/kg).

5 Chemical composition

The chemical composition of the cement shall comply with the following requirements:

1) *Insoluble residue.* The weight of insoluble residue, as determined by the method described in **3.1** of BS 4550-2:1970, shall not exceed 3.0 %.

2) *Magnesia.* The weight of magnesia contained in the cement shall not exceed 9.0 %.

3) *Sulphuric anhydride.* The weight of sulphuric anhydride shall be not less than 4.5 %.

4) *Sulphur.* The weight of sulphur, other than present in sulphuric anhydride, shall not exceed 1.5 %.

6 Compressive strength

The cement shall be tested for compressive strength by one of the following two methods as agreed by the vendor[1)] and the purchaser at the time of placing the order.

In the event of a dispute, a retest shall be made in the presence of representatives of the parties concerned.

6.1 Method 1. The average compressive strength of three mortar cubes, prepared, stored and tested in the manner described in clause **2** of Section 3.4 of BS 4550-3:1978, shall be:

1) 3 days (72 ± 1 hours), not less than 14 meganewtons per square metre (MN/m^2).

2) 7 days (168 ± 2 hours), shall show an increase on the compressive strength at 3 days and be not less than 23 MN/m^2.

3) 28 days, shall show an increase on the compressive strength at 7 days and be not less than 34 MN/m^2.

6.2 Method 2. The average compressive strength of three concrete cubes, with a water-cement ratio of 0.55 by weight, prepared, stored and tested in the manner described in clause **1** of Section 3.4 of BS 4550-3:1978, shall be:

1) 3 days (72 ± 1 hours), not less than 7 MN/m^2.

2) 7 days (168 ± 2 hours), shall show an increase on the compressive strength at 3 days and be not less than 17 MN/m^2.

3) 28 days, shall show an increase on the compressive strength at 7 days and be not less than 26 MN/m^2.

7 Consistence of standard cement paste

The quantity of water needed to produce a paste of standard consistence shall be ascertained by the method described in Section 3.5 of BS 4550-3:1978.

8 Setting time

The setting time of the cement, when tested by the method described in Section 3.6 of BS 4550-3:1978, shall be as follows:

1) *Initial setting time.* Not less than 45 minutes.

2) *Final setting time.* Not more than 10 hours.

[1)] The term "vendor" in this standard shall mean the seller of the cement, whether or not he is the manufacturer of the cement.

9 Soundness

The cement, when tested for soundness by the cold water method described in Section 3.7 of BS 4550-3:1978, shall not have an expansion of more than 5 mm.

10 Heat of hydration

When specially desired for low heat purposes, the heat of hydration test shall be asked for at the time of placing the order. It shall be made by the method described in Section 3.8 of BS 4550-3:1978 and the heat of hydration of the cement shall be as follows:

1) 7 *days.* Not more than 250 kilojoules per kilogram (KJ/kg).

2) 28 *days.* Not more than 290 KJ/kg.

11 Sampling

If a sample is required for independent tests, it shall be taken, at the option of the purchaser or his representative, before or within one week after delivery of the cement by method specified in BS 4550-1:1978. The tests shall be commenced within four weeks of delivery. If the vendor so desires, he or his representative shall be present at the sampling.

12 Facilities for sampling and identifying

When a sample of cement for testing is to be taken on the premises of the vendor, he shall afford every facility and provide all labour and materials for taking and packing the sample and, as far as possible, for subsequently identifying the cement sampled.

NOTE It is recognized that there may sometimes be difficulty in satisfying the last requirement since it may not be possible to identify a particular lot of cement after it has been placed with other cement in a silo on the user's site.

13 Manufacturer's certificate

The manufacturer shall satisfy himself that the cement, at the time of its delivery, complies with the requirements of this British Standard and, if requested, shall forward a certificate to this effect to the purchaser or his representative.

14 Compliance and independent tests

Any consignment, or part of a consignment, which, when sampled in accordance with the requirements of Clause **11**, does not satisfy the whole of the test and analytical requirements specified above, shall be deemed not to comply with the requirements of this British Standard.

If the purchaser or his representative requires independent tests, the samples shall, at the option of the purchaser or his representative, be taken before or immediately after delivery and the tests shall be made in accordance with the requirements of this British Standard, on the written instructions of the purchaser or his representative. If the vendor so desires, he or his representative shall be present at the sampling. The manufacturer shall supply, free of charge, the cement required for testing.

The cost of such tests (unless otherwise specified) shall be borne:

1) By the manufacturer if the results show that the cement does not comply with this British Standard.

2) By the purchaser if the results show that the cement complies with this British Standard.

15 Cement in tropical climates

The temperatures specifically mentioned in Section 3.4, Section 3.5, Section 3.6, Section 3.7 and Section 3.8 of BS 4550-3:1978 are applicable to temperate climates. Cement intended for use in tropical climates may be tested at temperatures exceeding 20 °C but not exceeding 35 °C[2)]. When so tested, cement satisfying the requirements herein specified for temperate climates shall be deemed to comply with this British Standard.

16 Marking

Supersulphated cement manufactured in compliance with this British Standard, shall be marked on or in relation to the product (i.e. on the bag, the manufacturer's certificate, or on the delivery note or invoice etc.) with the following particulars:

1) The name, trade mark or other means of identification of the manufacturer.

2) The name of the material, i.e. supersulphated cement.

3) The number of this British Standard, i.e. BS 4248.

NOTE Attention is drawn to the certification facilities offered by BSI; see the inside back cover of this standard.

[2)] When cement is tested at temperatures above those specified in this standard the setting time, compressive strength and heat of hydration requirements may be altered by agreement between the purchaser and the vendor. It should be noted that an increase in the testing temperature reduces the setting time and increases both the compressive strength and the heat of hydration.

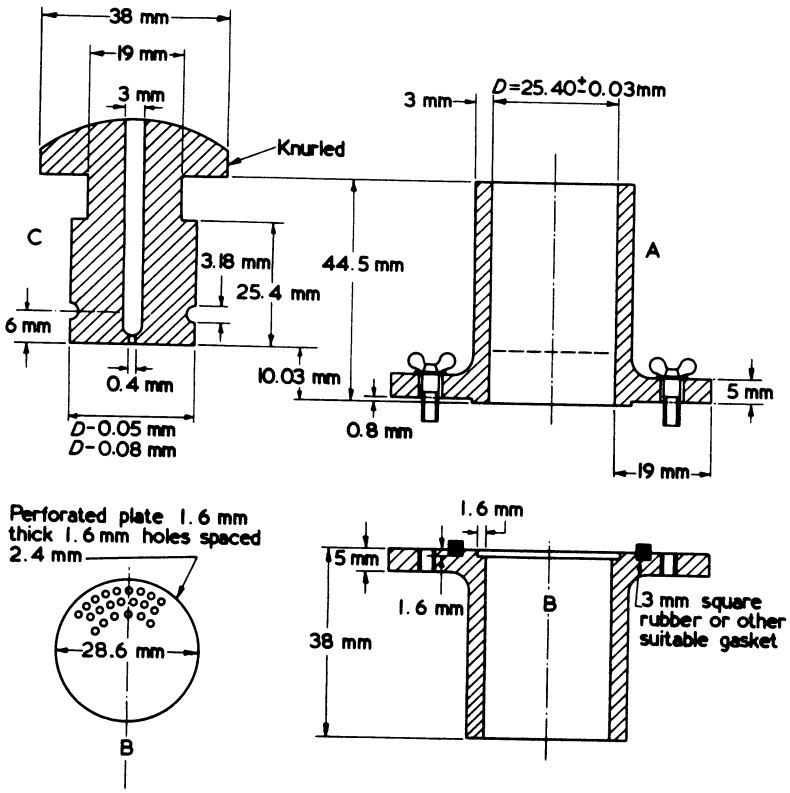


Figure 1 — Details of permeability cell

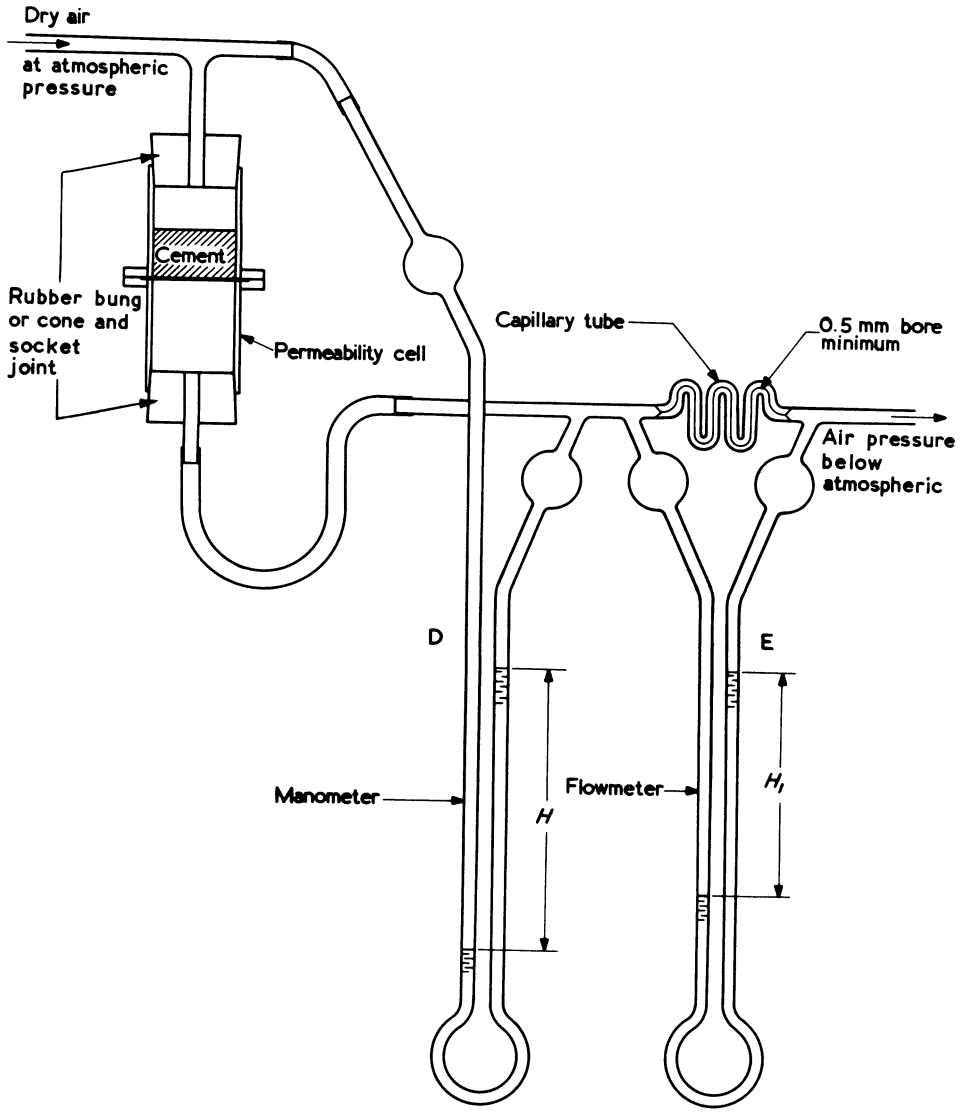


Figure 2 — Permeability apparatus with manometer and flowmeter

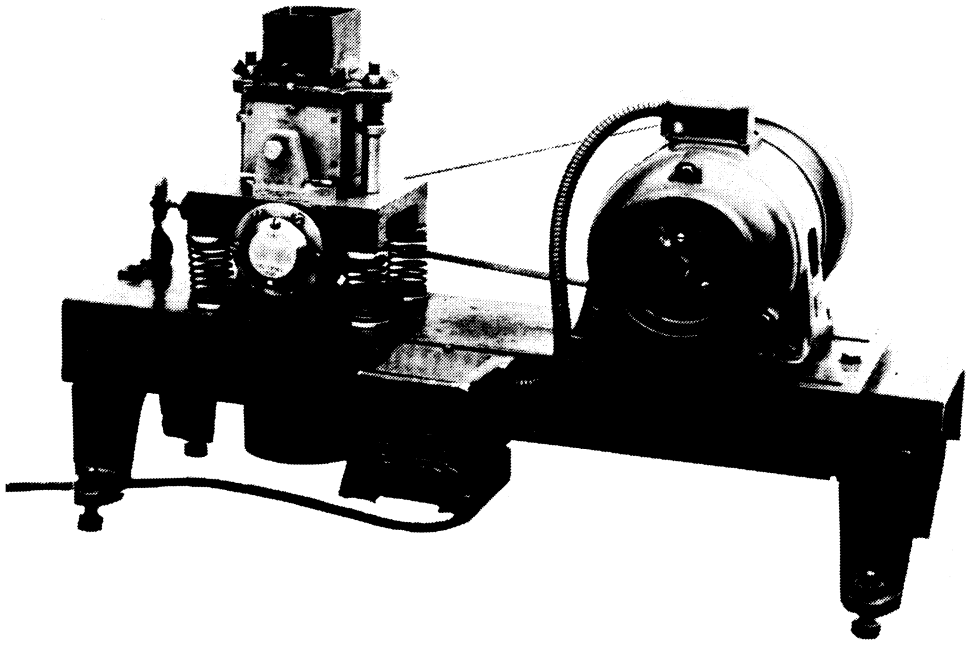
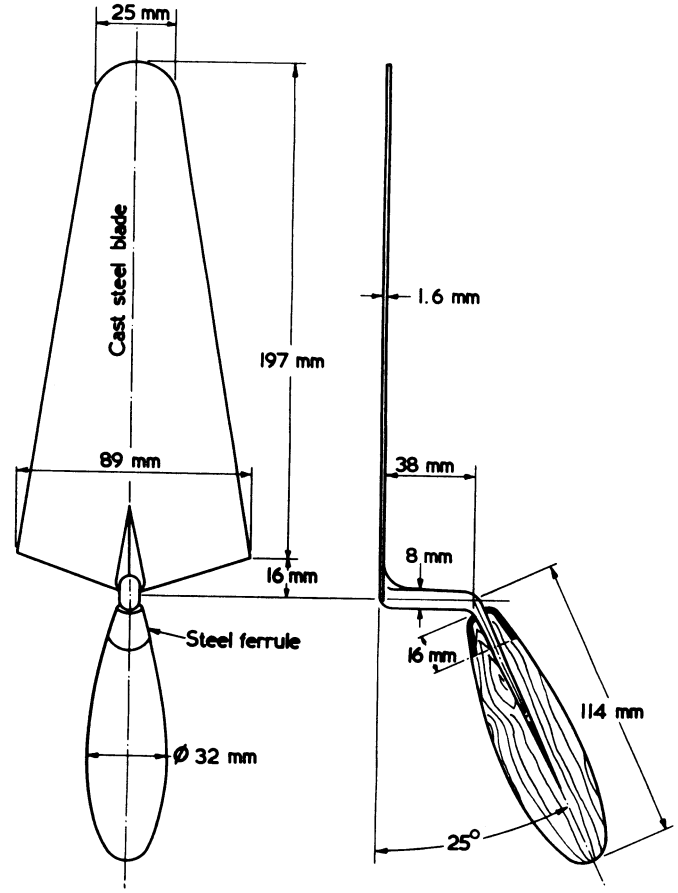


Figure 3 — Typical vibration machine for compacting mortar cubes for the compressive strength test



Mass approximately 210 g

Figure 4 — Typical trowel

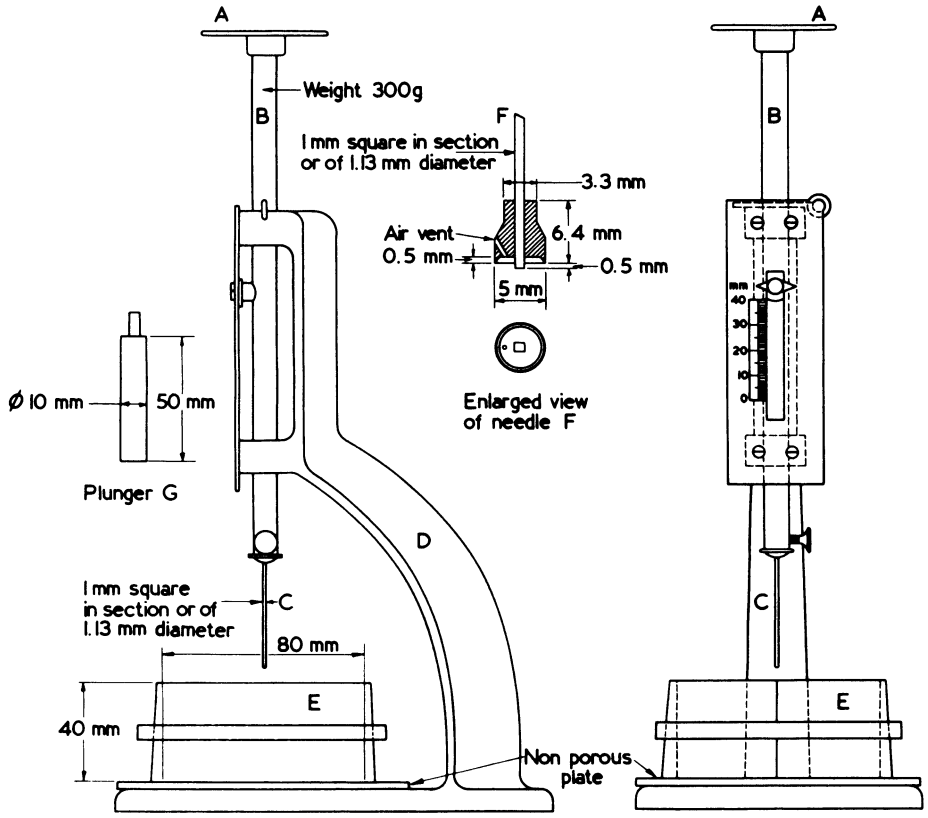


Figure 5 — Vicat apparatus for determining the standard consistence and setting time of cement

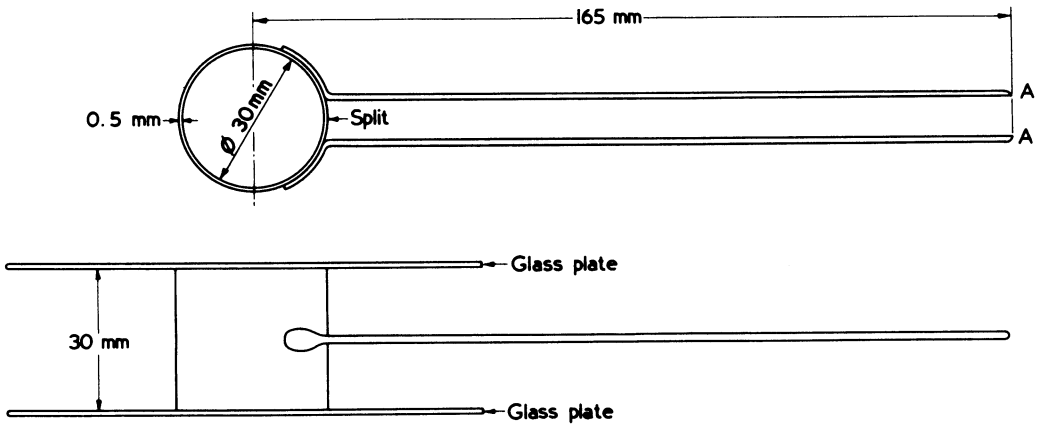


Figure 6 — Apparatus for conducting the "Le Chatelier" test

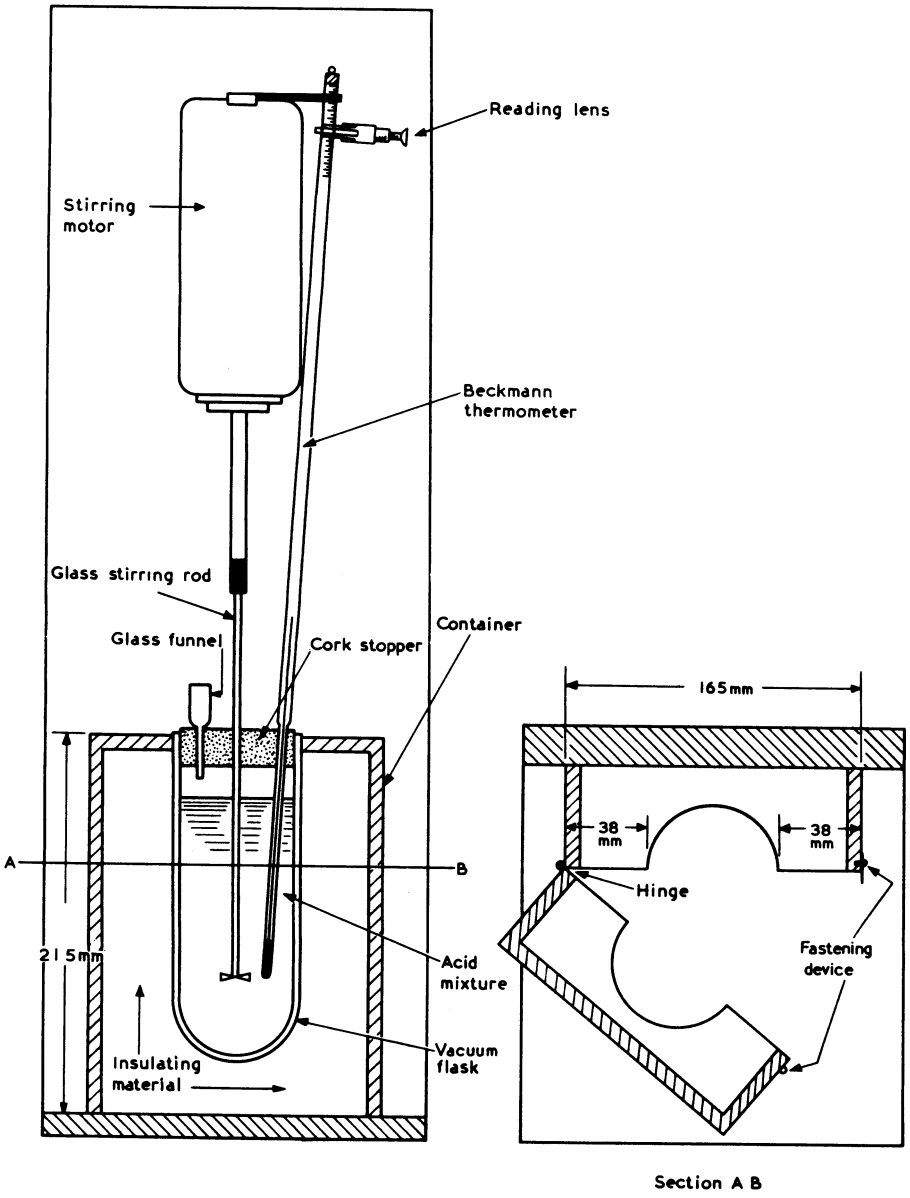


Figure 7 — Calorimeter

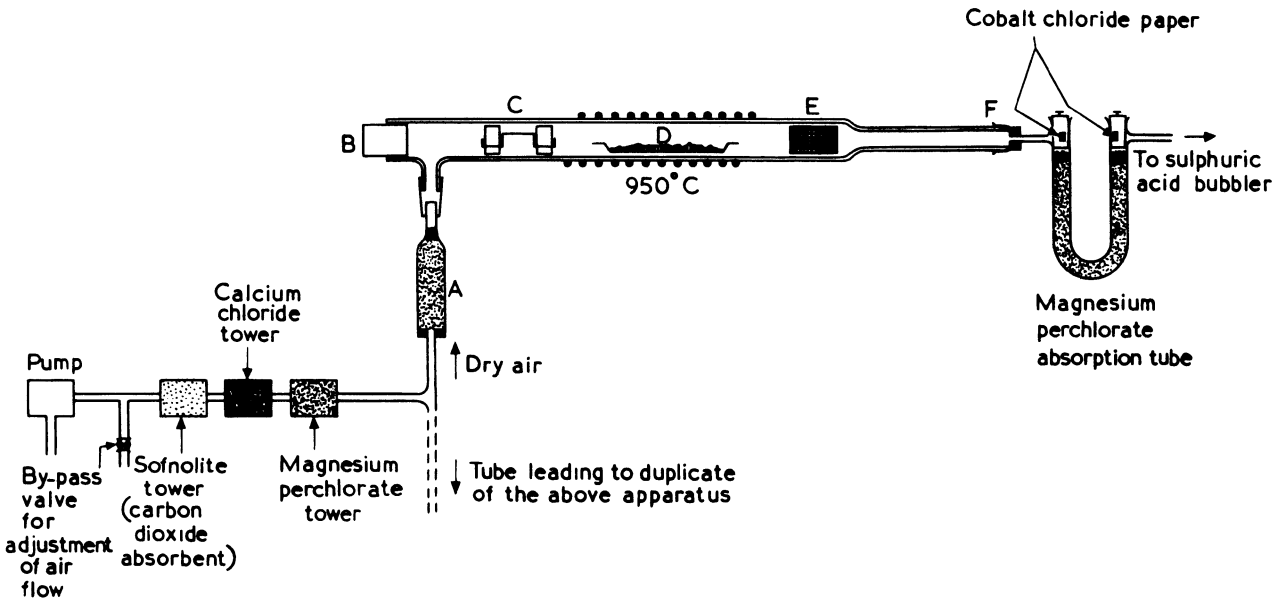


Figure 8 — Water content determination apparatus

Publications referred to

This standard makes reference to the following British Standards:
BS 12, *Portland cement (ordinary and rapid-hardening).*
BS 4550, *Methods of testing cement.*
BS 4550-1, *Sampling.*
BS 4550-2, *Chemical tests.*
BS 4550-3, *Physical tests.*

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