British Standard

BRITISH STANDARD

BS 812-100: 1990

Incorporating Amendment No. 1

Testing aggregates —

Part 100: General requirements for apparatus and calibration

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee (CAB/-) to Technical Committee CAB/2, upon which the following bodies were represented:

Aggregate Concrete Block Association
Association of Consulting Engineers
Association of Consulting Scientists
Association of Lightweight Aggregate Manufacturers
Brick Development Association
British Aggregrate Construction Materials Industries
British Cement Association
British Ceramic Research Ltd.
British Civil Engineering Test Equipment Manufacturers' Association
British Geological Sciences
British Precast Concrete Federation Ltd.
British Ready Mixed Concrete Association
British Steel Industry
Building Employers Confederation
Calcium Silicate Brick Association Limited
Chartered Institute of Building
Concrete Society
County Surveyors' Society
Department of the Environment (Building Research Establishment)
Department of the Environment (Property Services Agency)
Department of Transport
Department of Transport (Transport and Road Research Laboratory)
Electricity Supply Industry in England and Wales
Federation of Civil Engineering Contractors
Institute of Concrete Technology
Institution of Civil Engineers
Institution of Highways and Transportation
Institution of Structural Engineers
Institution of Water and Environmental Management
Mortar Producers Association Limited
Sand and Gravel Association Limited
Society of Chemical Industry

This British Standard, having been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on
29 June 1990

The following BSI references relate to the work on this standard:
Committee reference CAB/2
Draft for comment 89/10009 DC

ISBN 0 580 18852 3

Amendments issued since publication

Amd. No.	Date	Comments
8771	August 1995	Indicated by a sideline in the margin

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Foreword

This Part of BS 812 has been prepared under the direction of the Cement, Gypsum, Aggregates and Quarry Products Standards Policy Committee.

In the revision of BS 812:1975, each test, or collection of related tests, is being revised separately and is being issued as a separate Part or Section of this standard.

This Part includes definitions and symbols and specifies equipment common to the other Parts of BS 812.

Methods of calibration to be used for verifying and calibrating various apparatus when tests are to be used for compliance purposes are specified.

Apparatus that is restricted to a specific test is described in the Part concerned. In that case, reference to this Part is necessary only for general and calibration requirements.

It is intended that other British Standards should call up BS 812 test methods as the basis of compliance. Nevertheless it is *not* intended that aggregates should be subjected regularly to all the listed tests. Specifications in other standards should call up only relevant test methods.

It has been assumed in the drafting of this British Standard that the execution of its provision is entrusted to appropriately qualified and experienced people.

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, and inside front cover, pages i and ii, pages 1 to 8, 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.

0 Introduction

BS 812 is being revised into the following separate Parts.

a) *Part 100: General requirements for apparatus and calibration*. This contains general information relating to the tests, definitions and symbols of BS 812. It also describes apparatus common to other Parts and includes methods for calibrating common and specific apparatus when the tests are used for compliance purposes.

b) *Part 101: Guide to sampling and testing aggregates*. This gives general guidance on the sampling and testing of aggregates. It also gives guidance on the applicability of BS 812 to testing aggregates and describes procedures for assessing and use of precision data described in other Parts of BS 812.

c) *Part 102: Methods for sampling*. This describes methods for obtaining samples of aggregates of the quantity required for carrying out testing in accordance with other Parts of BS 812. The method to be used for recording the nominal description of materials sampled is also given.

d) *Part 103: Methods for determination of particle size distribution*. This describes two methods for the determination of the particle size distribution of samples of aggregates. It also includes a gravimetric method for the determination of the proportion of material finer than 20 μm in particle size in aggregates.

e) *Part 104: Procedure for qualitative and quantitative petrographic examination of aggregates*[1)]. This describes a general procedure for the examination of coarse or fine aggregate to determine petrographic composition and to assist in the assessment of those aggregates for potential suitability for the intended use.

f) *Part 105: Methods for determination of particle shape*. This describes the methods for determining the flakiness index and elongation index of coarse aggregates.

g) *Part 106: Method for determination of shell content in coarse aggregate*. This describes the method for the determination of the shell content of coarse aggregate.

h) *Part 107: Methods for determination of particle density and water absorption*[1)]. This describes the methods for the determination of the particle density and water absorption of aggregates.

i) *Part 108: Methods for determination of bulk density, optimum moisture content, voids and bulking*[1)]. This describes methods for the determination of the mass of a sample of the aggregate which fills a specified container. It also describes a method for the determination of the bulk density of fillers.

j) *Part 109: Methods for determination of moisture content*. This describes various methods of determining the moisture content of aggregate. These include oven-drying and various rapid methods which may give adequate results for quality control purposes.

k) *Part 110: Method for determination of aggregate crushing value (ACV)*. This describes a method for the determination of the aggregate crushing value (ACV) which gives a relative measure of the resistance of an aggregate to crushing under a gradually applied compressive load. Methods are also described for different size fractions.

l) *Part 111: Methods for determination of ten per cent fines value (TFV)*. This describes methods for the determination of the ten per cent fines value (TFV) of aggregates. The methods give a relative measure of the resistance of an aggregate to crushing under a gradually applied compressive load. Procedures are described for testing aggregates in a dry condition or in a saturated surface dry condition.

m) *Part 112: Method for determination of aggregate impact value (AIV)*. This describes two methods for the determination of the aggregate impact value (AIV) which give a relative measure of the resistance of an aggregate to sudden shock or impact. Procedures are described for testing aggregates in a dry condition or in a saturated surface dry condition.

n) *Part 113: Method for determination of aggregate abrasion value (AAV)*. This describes a method for the determination of the aggregate abrasion value (AAV) which gives a measure of the resistance of aggregates to surface wear by abrasion.

o) *Part 114: Method for determination of polished-stone value*. This describes a method for the determination of the polished stone value (PSV) which gives a measure of the resistance of aggregate to the polishing action of vehicle tyres.

p) *Part 115:* This has not yet been allocated.

q) *Part 116:* This has not yet been allocated.

[1)] In preparation.

r) *Part 117: Method for determination of water-soluble chloride salts*. This describes the method for the determination of the chloride content in terms of the chloride ion content.

s) *Part 118: Methods for determination of sulphate content*. This describes methods for determining both the water-soluble sulphate content of aggregates and the total sulphate content of aggregates.

t) *Part 119: Method for determination of acid-soluble material in fine aggregate*. This describes a method of determining the amount of acid-soluble material present in fine aggregate.

u) *Part 120: Method for testing and classifying drying shrinkage of aggregates in concrete*. This describes a method of determining the drying shrinkage of aggregates in concrete using concrete prisms made with the coarse and/or fine aggregate to be tested.

v) *Part 121: Method for determination of soundness*. This describes a method of determining the soundness of aggregates by subjecting the aggregate to cycles of immersion in a saturated solution of magnesium sulphate followed by oven-drying.

w) *Part 122: Method for determination of content of deleterious materials in fine aggregate*[2)]. This describes a method of determining the effect of deleterious materials in fine aggregate on the setting and hardening of Portland cement mortar. A preliminary procedure for indicating the presence of deleterious (organic) material is also described.

x) *Part 123: Determination of alkali-silica reactivity — concrete prism method*[2)]. This describes a method to determine the expansion in concrete caused by alkali-silica reaction involving specific combinations of aggregate.

y) *Part 124: Method for determination of frost-heave*. This describes a method of determining the frost-heave of an aggregate compacted into cylindrical specimens at a pre-determined moisture content and density.

1 Scope

This Part of BS 812 gives definitions and symbols and specifies common equipment and calibration procedures for the BS 812 series.

It also specifies general requirements for apparatus and methods of calibration to be used when testing aggregates for compliance purposes.

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

2 Definitions

For the purposes of this British Standard the following definitions apply.

2.1
particle size distribution

the percentages by mass of various grain sizes present in a material as determined by sieving and/or sedimentation

2.2
sampling

the selection of a representative portion of material

2.3
representative sample

a sample taken to represent a body of material in order to study its average properties

2.4
batch

a definite quantity of some commodity manufactured or produced under conditions which are presumed uniform

NOTE With a continuous process the quantity produced in a stated period should be treated as a batch.

2.5
sampling increment

a quantity of material taken at one time from a larger body of material

NOTE When sampling aggregate the material taken by a single operation of the scoop should be treated as a sampling increment.

2.6
bulk sample

an aggregation of the sampling increments

2.7
laboratory sample

a sample intended for laboratory inspection or testing

2.8
test portion

the material used as a whole in testing or inspection

2.9
quartering

the reduction in quantity of a large sample of material by dividing a circular heap, into four parts of around equal size, by diameters at right angles, removing two diagonally opposite quarters and mixing the two remaining quarters intimately together so as to obtain a truly representative half of the original mass. The process is repeated until a representative sample of the required size is obtained

[2)] In preparation.

2.10
riffling

the reduction in quantity of a large sample of material by dividing the mass into two approximately equal halves by passing the sample through an appropriately sized riffle (or riffle box). The process is repeated until a sample of the required size is obtained

2.11
compaction

the process of packing aggregate particles more closely together by rolling or mechanical means, thus increasing the dry density of the material

2.12
bulk density

the mass of material (including solid particles and any contained water) per unit volume, including the voids between the particles

2.13
dry density

the mass of material after drying to constant mass at 105 °C contained in unit volume of undried material

2.14
particle density on an oven-dried basis

the ratio of the oven-dried mass of a sample of aggregate to the volume it occupies in water including both internal sealed voids and water-accessible voids

2.15
apparent particle density

the ratio of the oven-dried mass of a sample of aggregate to the volume it occupies in water including any internal sealed voids but excluding water-accessible voids

NOTE This corresponds to the value of particle density as determined by the method given in BS 1377-2.

2.16
particle density on a saturated and surface-dried basis

the ratio of the combined mass of a sample of aggregate and the mass of water in the water-accessible voids to the volume it occupies in water including both internal sealed voids and water accessible voids when present

2.17
moisture content

the mass of water which can be removed from an aggregate, usually by heating at 105 °C, expressed as a percentage of the dry mass

NOTE Although the term moisture content has been used throughout this standard the term water content is also widely used and either may be employed.

2.18
optimum moisture content

the moisture content at which a specified amount of compaction will produce a maximum density calculated as a dry density

2.19
maximum dry density

the calculated dry density obtained using a specified amount of compaction at the optimum moisture content

2.20
relative compaction

the percentage ratio of the dry density of the material to the maximum dry density of that material as determined by a specified laboratory compaction test

2.21
dry density/moisture content relationship

the relation between the dry density and moisture content of a material when a given compaction effort is employed

2.22
saturated and surface-dried aggregate

aggregate in which all the accessible pores of the aggregate are fully saturated with water, but where the outer surface of the aggregate is dry and has no adhering water

2.23
oven-dry aggregate

aggregate dried to a constant mass at 105 °C

2.24
water absorption

the increase in mass of a sample of aggregate due to the penetration of water into the water-accessible voids of the oven-dried aggregate

2.25
percentage air voids

the volume of air voids in the material expressed as a percentage of the total volume

2.26
air voids line

a line showing the relation between the dry density and moisture content for an aggregate containing a constant percentage of air voids

2.27
saturation line (zero air voids line)

a line showing the dry density/moisture content relation for a material containing no air voids

3 Symbols and units

For the purposes of BS 812, the symbols given in Table 1 together with those given in BS 5775 are used.

Table 1 — Symbols and units for BS 812

Term	Symbol	Unit
Moisture content	w	%
Bulk density	ρ	Mg/m^3
Dry density	ρ_d	Mg/m^3
Particle density	ρ_m	Mg/m^3
Percentage air voids	V_m	%
Saturated and surface dried	SSD	—
Aggregate abrasion value	AAV	—
Aggregate crushing value	ACV	%
Aggregate impact value	AIV	%
Polished stone value	PSV	—
Ten per cent fines value	TFV	kN

4 Common equipment and calibration

4.1 General

4.1.1 *Apparatus for test methods*

The apparatus required for each test method shall be as listed in the appropriate clause of the relevant Part of this standard.

Specifications for items of general apparatus that appear in more than one Part of this standard shall be as specified in **4.2**.

Apparatus used only for one purpose shall be as described in the appropriate Part of this standard.

Each item of apparatus shall be checked before use to ensure that it complies with this clause.

A piece of apparatus referred to as a calibrated item shall have been calibrated in accordance with **4.4**.

4.1.2 *Relevant standards*

Where appropriate, test apparatus and equipment shall comply with the relevant British Standards.

4.1.3 *Tolerances*

4.1.3.1 *Manufacturing tolerances*

4.1.3.1.1 *Linear dimensions*

Drawings indicating the specified requirements for apparatus used in the tests described in this standard shall include essential dimensions, marked*, for which manufacturing tolerances or limits are given.

NOTE All other dimensions are given for guidance.

4.1.3.1.2 *Mass*

Where mass is specified, the manufacturing tolerance on the mass shall be within ± 1 % unless otherwise stated.

4.1.3.2 *Working tolerances*

Working tolerances apply to apparatus after being subjected to wear in use, and shall not exceed twice the manufacturing tolerance unless other requirements are specified.

4.2 Test apparatus (see 4.1.1)

4.2.1 *Measuring instruments*

4.2.1.1 *Balances and weights.* Balances and weights shall be calibrated.

NOTE 1 Examples of suitable balances are given in Table 2.
NOTE 2 Balances may incorporate an analogue or a digital display.

The balance and weights, if required, selected for a weighing shall enable the mass to be determined to the accuracy required for the purpose of the test.

Calibration of balances shall comply with **4.4.4.1**. Balances shall be labelled showing limitations of use with regard to the lower end of their range as determined by calibration.

Table 2 — Examples of categories of balances

Capacity	Scale interval or digit	Maximum error of weighing
g	g	g
200	0.001	0.005
1 200	0.01	0.05
kg		
2	0.1	0.3
5	0.5	1
10	1	3
25	5	10
50	10	20

4.2.1.2 *Thermometers.* Thermometers having the graduations listed in Table 3 shall be selected as appropriate to the test.

Table 3 — Accuracy and graduations of thermometers

Required accuracy of reading	Graduation intervals or digit
°C	°C
0.2	not greater than 0.1
0.5	not greater than 0.2
1.0	not greater than 0.5

For mercury-in-glass thermometers the form of graduations shall comply with clause **8** of BS 593:1989. The calibration of thermometers shall comply with **4.4.4.2**.

4.2.1.3 *Linear measurement instruments*

4.2.1.3.1 *Steel rule.* When required an engineer's steel rule with scale divisions every 0.5 mm shall be used.

4.2.1.3.2 *Vernier calipers.* Vernier calipers for internal and external measurements shall be readable to 0.1 mm or better and shall be calibrated in accordance with **4.4.4.3**.

4.2.1.3.3 *Micrometers.* Micrometer measuring devices shall be readable to 0.01 mm or 0.002 mm or better, depending upon the resolution specified in the test method. Calibration shall be in accordance with **4.4.4.3**.

4.2.1.3.4 *Dial gauges.* Dial gauges shall be readable to 0.01 mm or 0.002 mm or better depending upon the range of travel required by the test method. Dial gauges shall be calibrated in accordance with **4.4.4.3**.

4.2.1.4 *Timers.* Timers shall be calibrated in accordance with **4.4.4.4**.

NOTE Stopwatches or stopclocks readable to 1 s are suitable. A suitably placed wallclock with seconds hand, and large enough to read from the workstation is an acceptable alternative.

4.2.1.5 *Volumetric glassware.* Glassware shall be calibrated in accordance with **4.4.4.5**.

NOTE For the purpose of this standard volumetric glassware complying with class B of BS 5898:1980 is adequate provided that random samples are checked in accordance with **4.4.4.5** at periodic intervals for compliance with this Part of this British Standard.

4.2.2 ***General apparatus***

4.2.2.1 *Ovens.* Ovens used for drying aggregates shall incorporate a thermostatic temperature control which can be set to maintain the specified working temperature to within ± 5 °C.

NOTE A circulation fan may be fitted as an aid to uniform temperature distribution.

Each oven shall have a temperature indicating device of the required range and accuracy.

Ovens shall be calibrated in accordance with **4.4.5.1**.

4.2.2.2 *Test sieves.* Test sieves shall comply with BS 410. Sieves with aperture sizes of 5 mm and above shall be perforated plate square hole test sieves. Below that size they shall be woven wire test sieves.

Each sieve shall be separately identified and the certificate issued with each sieve by the manufacturer shall be retained throughout its working life.

Calibration checks on sieves shall be carried out in accordance with **4.4.5.3**.

4.2.2.3 *Sieve shakers.* Mechanical sieve shakers shall hold securely a nest of sieves with their lid and receiver. Their design shall ensure that the test material on any given sieve progresses over the surface of the sieve while it is agitated.

4.2.2.4 *Sample dividers.* When sample dividers are used they shall be of a size appropriate to the largest size of particle contained in the sample to be divided.

4.2.2.5 *Desiccators.* Glass desiccators shall be provided with a lid which can form an airtight seal. Desiccator cabinets shall be fitted with an airtight seal around the doors. Shelves shall allow air to circulate.

The desiccant shall normally be of self-indicating silica gel crystals.

A vacuum desiccator shall be covered by a safety cage during pumping down, while under vacuum and during vacuum release.

4.2.2.6 *Bottle shakers and rollers.* If a motorized unit is used for shaking and rotating it shall be capable of rotating the containers continuously at the specified speed for periods up to 24 h.

A suitable protective guard shall be provided if appropriate.

Motorized bottle shakers and rollers shall be calibrated in accordance with **4.4.5.5**.

4.2.2.7 *Heaters.* An electric hotplate shall be fitted with an adjustable control to provide boiling or simmering temperatures.

NOTE A bunsen burner, with tripod and gauze, may be used as an alternative controlled source of heat.

4.2.3 *Special apparatus.* Apparatus required only for a particular laboratory or in-situ test shall be as described in the relevant test method. Calibration of these items shall comply with this Part of this standard.

4.3 Laboratory reference standards

4.3.1 *Reference standards for in-house calibration*

Where calibration of test measuring instruments is carried out in-house the laboratory shall hold reference standards or instruments that are used solely for calibration purposes as recommended by BS 5781.

Reference standards or instruments shall be retained securely in a suitable environment separate from working standards or instruments when not in use. They shall be used only by personnel who are trained in their use.

Reference standards and instruments shall be of an accuracy greater than that of the working device so that the desired accuracy of test measurement is achieved.

Reference standards and instruments shall be calibrated and certificated as specified in **4.3.2** and **4.3.3**.

Re-calibration of reference standards shall be at intervals not greater than those specified in **4.3.3** for each type of instrument. Notwithstanding these intervals, whenever a change in accuracy of a reference instrument is suspected, or when a reference instrument has been repaired, dismantled, adjusted or overhauled, it shall be re-calibrated before further use.

4.3.2 *Traceability of reference standards*

Reference standards and instruments shall have official certification provided by the relevant competent national body, e.g. the National Physical Laboratory (NPL), National Weights and Measures Laboratory (NWML), or a laboratory currently recognized for official certification within the national measurement system such as a National Measurement Accreditation Service (NAMAS) accredited calibration laboratory or by an acceptable international body. The certification shall show traceability to national standards.

NOTE For information on the availability of certification, apply to Enquiry Section, BSI, Linford Wood, Milton Keynes MK14 6LE.

4.3.3 *Specifications for reference standards and instruments*

4.3.3.1 *Reference weights*

Calibrated and certificated reference weights used for calibrating balances and working weights shall be kept separate and in a secure place. Reference weights shall be initially re-calibrated after 2 years and every 5 years thereafter.

4.3.3.2 *Reference thermometers*

Mercury-in-glass thermometers used as reference thermometers for calibrating laboratory working thermometers shall be calibrated before use and re-calibrated or replaced at 5 year intervals.

NOTE Thermometers complying with BS 593 are suitable for use as reference thermometers, if calibrated.

Calibrated thermocouples and platinum resistance thermometers used as reference instruments shall be re-calibrated at least once a year.

4.3.3.3 *Dimensional standards*

Gauge blocks shall comply with Grade I of BS 4311-1 and shall be re-calibrated at 5 year intervals.

4.4 Calibration and checking of test equipment

4.4.1 *Traceability*

All measurements necessary for the performance of tests covered by this standard shall be traceable, where this concept is applicable, to UK national standards of measurement through an unbroken chain of calibrations. The number of links in the chain shall be no greater than necessary to achieve the required accuracy.

4.4.2 *External and in-house calibration*

4.4.2.1 *General requirements*

Calibrations shall be carried out either by an external organization, or in-house by the laboratory's own staff. In either case traceability to UK national standards shall be achieved. Systems used shall follow the principles set out in BS 5781-1 and BS 5781-2, as well as the requirements given in **4.4.4** and under the relevant test method, where appropriate.

All calibrated equipment shall be used only over the range for which it has been calibrated.

4.4.2.2 *External calibration*

When calibration is carried out under contract by an external organization, traceability shall be established by the issue of a certificate of calibration for the relevant item. The certificate shall include the following information, and shall be retained on file:

a) the name of the calibrating organization;

b) for whom calibration was done and at what location;

c) the description of the item calibrated, including identification number;

d) the method of calibration;

e) the equipment used, including reference devices;

f) the calibration certificate number of the reference device against which the instrument was calibrated, and the traceability route, if the calibration is not performed by a laboratory of the National Measurement System;

g) the calibration temperature;

h) the calibration data and results;

i) the date of calibration;

j) the signature of person responsible for the calibration.

4.4.2.3 *In-house calibration*

Calibration shall be carried out in-house only by suitably qualified and experienced staff, in accordance with written procedures for each item. Reference instruments or standards against which working instruments are calibrated shall comply with, and shall be kept, used and maintained in accordance with **4.3**.

Calibration records shall be retained on file and shall include the following information:

a) a description of the item calibrated, including identification number;

b) the method of calibration;

c) the equipment used, including reference device(s);

d) the calibration certificate number of the reference device(s);

e) the calibration temperature;

f) the calibration data and results;

g) the date of calibration;

h) the date when the next calibration is due, if appropriate;

i) the signature of person responsible for the calibration.

4.4.3 ***Frequency of calibration***

Routine re-calibration of measuring instruments shall be carried out at intervals that are based on usage and on the analysis of documented calibration data to ensure the required accuracy is not lost between calibrations.

NOTE The periods between re-calibrations specified in **4.4.4** are the maximum periods for each type of instrument.

Whenever a change in accuracy of an instrument is suspected, or when an instrument has been repaired, dismantled, adjusted or overhauled, it shall be re-calibrated before further use.

4.4.4 ***Calibration of measuring instruments***

4.4.4.1 *Balances*

Balances shall be checked, adjusted and calibrated over their working range, using certified reference weights, at least once a year, or at shorter intervals if necessary to prevent the maximum error of readings exceeding the values specified in **4.2.1.1**.

4.4.4.2 *Thermometers*

Mercury-in-glass thermometers complying with BS 593 shall be calibrated or replaced at intervals not exceeding 5 years. Other mercury-in-glass thermometers shall be calibrated against a reference standard before first use and shall be re-calibrated or replaced at intervals not exceeding 5 years.

If thermocouples are used, e.g. for verifying oven temperatures, they shall be calibrated against a reference thermocouple, reference platinum resistance thermometer or reference mercury-in-glass thermometer at least once every 6 months.

4.4.4.3 *Dimensional measuring instruments*

The following applies to dimensional measuring instruments.

a) Steel rules shall be checked before use and examined for readability and for wear at their ends at least once a year.

b) Vernier calipers shall be calibrated at least once a year against reference gauge blocks.

c) Micrometers shall be calibrated at least once a year against reference gauge blocks.

d) Dial gauges shall be calibrated at least once a year against a calibrated micrometer device, or in a comparator frame using gauge blocks or length bars.

4.4.4.4 *Timers*

Timing devices such as stopclocks and stopwatches shall be calibrated at least once a year to within 1 s in 5 min.

4.4.4.5 *Volumetric glassware*

In-house calibration of volumetric glassware shall be carried out by weighing the amount of distilled water that the vessel contains or delivers at a measured temperature. A calibrated balance, and the tables in BS 1797 shall be used.

4.4.4.6 *Load measuring devices (compressive forces)*

Each load measuring device shall be calibrated at least once a year against a calibrated proving device having a range and sensitivity appropriate to that of the measuring device. Where a device is fitted with a dial gauge or displacement transducer this shall be considered to be an integral part of the device, identified as such and shall not be replaced without re-calibration of the device.

4.4.5 ***Calibration and checking of general apparatus***

4.4.5.1 *Ovens*

The temperature at the midpoint of the usable oven space of an empty oven shall be verified at least once a year by means of a calibrated temperature measuring device.

4.4.5.2 *Constant temperature bath*

Constant temperature water baths shall be checked by using a calibrated immersion thermometer at several points within the working area of the bath and observing the temperature when it becomes steady.

NOTE For a given steady room temperature the water temperature control setting may be calibrated against various water temperatures by repeating the procedure over a range of settings.

4.4.5.3 *Test sieves*

All test sieves shall be checked by the following methods.

a) *Visual checks.* Sieves shall be checked visually by the operator before each use. A detailed visual check shall be made of the condition of every sieve at regular intervals depending on use.

b) *Measurement checks.* The apertures of perforated plate test sieves shall be measured in accordance with appendix F of BS 410:1986, at least once a year.

c) *Performance checks.* The apertures of woven wire cloth test sieves shall be checked at regular intervals depending on use, by either of the following methods.

1) *Reference sample.* Reference samples, consisting preferably of rounded or sub-rounded particles, of known particle size distribution, and having approximately 50 % retained on the sieve being checked, shall be used to check each working test sieve.

2) *Master sieves.* Working test sieves shall be checked against a master set of sieves retained exclusively for that purpose. The check procedure shall be to dry-sieve a test portion, which gives approximately 50 % retained on the test sieve being checked on both sets of sieves consecutively for a controlled period and to compare the masses retained on each sieve of each set. It will be necessary to use a different test portion with each sieve size.

A sieve shall be considered as failing the performance check when the corresponding masses on individual sieves of the same mesh size differ by more than 5 %.

Test sieves which fail measurement or performance checks shall be clearly marked and either discarded or used as protection sieves where appropriate.

NOTE Wear and tear on sieves is very dependent on their manner of use and the abrasiveness of the material being used so up until such time that the laboratory has sufficient records to indicate rates of wear and thus fix rational check periods, performance checks should be at intervals of not less than three months.

4.4.5.4 *Moulds, etc.*

Items of equipment such as moulds shall be checked by determining their internal measurements and mass. These determinations shall be carried out on new items and shall be repeated at intervals, depending on frequency of use, to allow for wear. When the change due to wear exceeds the permitted working tolerance the item shall be discarded.

4.4.5.5 *Bottle shakers and rollers*

The speed of rotation of machines used for shaking or rolling bottles and gas jars shall be calibrated at least once a year with the shaker or roller fully laden.

4.4.5.6 *Compression testing machines*

The machines shall be calibrated in accordance with BS 1610-1 and BS 1610-2.

5 Reagents

5.1 *Distilled water.* Where distilled water is specified it shall be produced either by distillation or by the use of de-ionizing apparatus. The latter shall incorporate a device for measuring the electric conductance of the water which includes a means of indicating when an acceptable upper limit is reached. Distilled or de-ionized water shall comply with the following requirements:

a) *non-volatile residue*: not more than 5 mg/L of residue when tested in accordance with appendix A of BS 3978:1987;

b) *pH value:* not lower than 5.0 and not higher than 7.5.

5.2 *Chemical reagents.* Chemical reagents used in performing the tests given in BS 812 shall be of analytical quality, e.g. AR reagents.

Publications referred to

BS 410, *Specification for test sieves.*
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[3)] In preparation.

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