BRITISH STANDARD

BS 7959-1:
2004
Incorporating
Corrigendum No.1

Materials used for the control of liquid spillages —

Part 1: Determination of sorbency

ICS 13.020.40; 71.100.99; 75.180.99

Confirmed
December 2009

BSI
British Standards

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CII/63, Chemical spill control, upon which the following bodies were represented:

British Safety Industry Federation

CIA — Chemical Industries Association

Environment Agency

Personal Safety Manufacturers' Association

Co-opted members

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 19 October 2004

First published March 2000
Second edition October 2004

Amendments issued since publication

Amd. No.	Date	Comments
15978	18 November 2005	Correction to the derived units for S_{30} in **8.4.2** (litres per metre)

The following BSI references relate to the work on this British Standard:
Committee reference CII/63
Draft for comment 04/30092197 DC

ISBN 0 580 44546 1

Contents

Foreword

This British Standard has been prepared by Technical Committee CII/63. It supersedes BS 7959-1:2000, which is withdrawn.

BS 7959-1 gives test methods used for the control of spilled liquids. These materials, which are generically known as "sorbents", include those which act by adsorption, absorption and gelling. The test methods generally apply to sorbents of all types, which allows user to make reliable comparisons between materials of different types for specific applications.

This new edition of the standard differs from the 2000 edition in that four named challenge liquids are now included. Previously the standard allowed any liquid to be used for the test. The change was made to introduce clarity into the marketplace for sorbent materials thus enabling sorbent users to more easily compare information from suppliers and make informed decisions on the use of sorbent products.

Sorbent materials are generally available in two basic types. There are hydrophobic grades (so-called oil sorbents) that pick up oils and other organic liquids but repel water and most aqueous solutions. Hydrophilic grades, on the other hand, pick up both oils and organic liquids and most aqueous solutions of chemicals.

Named challenge liquids are specified in the standard as this will simplify the information likely to be given to users of sorbent materials. In principle, only two types are needed: one for hydrophobic materials and one for hydrophilic materials. However, it is widely found that that amount of liquid picked up varies according to the viscosity of the challenge liquid, and viscosity variations are much more widely found in oils than in aqueous solutions. Four hydrophobic challenge liquids have been included, three representing low, medium and high viscosity oils, and one representing volatile organic compounds (VOCs). For hydrophilic materials, water has been chosen rather than a chemical solution on the grounds of safety.

BS 7959-2 gives a method for the determination of water repellency (buoyancy) for hydrophobic materials.

This British Standard calls for the use of substances and/or procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its 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 and ii, pages 1 to 15 and a back cover.

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Introduction

Good working practices should ensure that liquid spills are prevented. However, when these do occur, there are many ways in which a liquid spill may be controlled. These include prevention by the use of safe working practices, physical containment either at source or later after the liquid has spread, and removal of the liquid.

Removal may be accomplished using several different techniques, such as purely mechanical (pumps, skimmers, separators), washdown (where permitted) with solvents or detergents, and the use of materials that immobilize the liquid into a form rendered suitable for physical lift-up. It is these latter materials that form the subject of this standard.

Traditionally, these materials have come to be known by the term "sorbents" and this term has been adopted for the purposes of the standard.

Sorbent materials carry out the process of fixing spilt liquids in different ways, of which the following have been clearly identified.

a) Adsorption is a surface process whereby capillary attraction holds the liquid on the external surface of the adsorbent material, and in the void spaces formed by the intrinsic structure of the material.

b) Absorption is a process whereby a material picks up and retains a liquid throughout its molecular structure, causing the material to swell.

c) Gelling is a process whereby usually a soluble material dissolves in a liquid forming a very viscous, continuous solution which takes on a solid form allowing physical removal. The same effect is sometimes achieved using insoluble materials such as clays.

Although the materials and processes described above are essentially very different, the principal aim of their use is to immobilize and facilitate physical lift-up of the spilled liquid. This part of BS 7959 covers methods of test to determine how much liquid may be picked up by a sorbent material. The word sorbency is used to describe this property.

The user of these materials may want to compare and verify supplier's claims for sorbency, therefore a common test methodology is given for sorbents of all types. This allows the user to make reliable comparisons between materials of different types.

The test method for the determination of swell ratio allows the difference between an adsorbent and the other types of sorbent material to be readily distinguished.

1 Scope

This part of BS 7959 describes methods of sampling and determining the sorbency of materials used for the control of liquid spillages.

A variety of materials of different composition and format are used in this application and, for the purposes of this standard, the following categories are used.

— Type I web type sheet, pad or roll.
— Type II: loose material discrete particles of variable size.
— Type III: filled products socks, booms, pillows, cushions.
— Type IV: agglomerates masses of strands for pick-up of viscous liquids.
— The methods are applicable to sorbent materials of any type.

The standard also includes a test (swell ratio test, Clause **10**) that will distinguish between absorbents and adsorbents.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the reference cited applies. For undated references, the latest edition of the referenced document (including any amendments).

BS 604, *Specification for graduated glass measuring cylinders.*

BS 4231, *Industrial liquid lubricants — ISO viscosity classification.*
(ISO 3448)

BS EN 590, *Automotive fuels — Diesel — Requirements and test methods.*

3 Terms and definitions

For the purposes of this part of BS 7959, the following terms and definitions apply.

3.1
absorption
process where the liquid is distributed into the solid body of the material

NOTE This process is usually accompanied by swelling, enabling the volume of liquid absorbed to exceed the free volume of the absorbent.

3.2
adsorption
process where the liquid is held on the surface of the material

NOTE This process generally limits the volume of liquid which can be adsorbed to the free volume of the adsorbent, except in the case of high viscosity liquids where the volume of liquid adsorbed is increased by liquid clinging to the external surface.

3.3
free volume
volume of interstitial space between particles or fibres which is available for liquid uptake

NOTE As applied to adsorbents, the free volume is the overall volume of the material in the form supplied less the volume of solid adsorbent present. Calculation of the free volume of filled materials allows an assessment to be made of the maximum volume of liquid that can be adsorbed.

3.4
gelation
process where a gellant or thickener is added to a liquid to increase its viscosity until it becomes a solid or semi-solid

3.5
material
solid product used to pick up spilled liquids by a process of adsorption or absorption or gelation

3.6
sorbency
volume of liquid which can be picked up by the material

NOTE The test methods allow for calculation of sorbency after a period of draining. The sorbency is normally expressed as the volume of liquid picked up by a given amount of the material.

4 Sampling and preparation of test samples

4.1 Sampling

4.1.1 *Type I, web-type*

Wherever possible, take sample pads from the top, middle and bottom of at least one pack in order to cover variability. When sampling, take note of the height of packs to ensure that sampling covers a range of bulk.

For rolls, take three sample pieces at least 50 cm long from the start, middle and end of at least one roll, bearing in mind the remarks concerning variations in roll bulk. Discard the first 50 cm to 1 m on the roll, which might be damaged by handling.

Weigh the full packs of pads or rolls before sampling.

Handle the materials carefully to avoid compression.

4.1.2 *Type II, loose material*

Where possible, take three samples of at least one litre of sorbent from the top, middle and bottom of at least one bag of material. Where the material is packed by volume, weigh the pack before sampling.

4.1.3 *Type III, filled products*

Where the size of the individual piece permits it to be tested whole, take three whole pieces from at least one pack.

For larger booms and other filled products, where the size prohibits easy handling in the laboratory, it is permissible to section it down into more manageable lengths (e.g. 1 m or less) as described in **8.3.1**. Where possible, make three test pieces.

4.1.4 *Type IV, agglomerates*

Usually a single agglomerate is of a suitable size for testing. In this case, take three pieces from at least one pack. Where the agglomerate is too large, it may be reduced providing the strands are fixed together as in the original material. Where the agglomerate is supplied in continuous bulk form, take samples of size to fit the test apparatus. Weigh the full pack before sampling.

4.2 Preparation and conditioning of the material

Remove all materials for test from their original packaging and allow them to attain a temperature of 20 °C ± 5 °C.

5 Test liquid

The test liquid shall be one of the following liquids:

a) *diesel fuel* (conforming to BS EN 590), representing low viscosity oils;

b) *hydraulic oil* (viscosity grade ISO VG 32; see BS 4231), representing medium viscosity oils;

c) *motor oil* (SAE 10W-40), representing high viscosity oils;

d) *xylene* (minimum 99 % purity, general purpose reagent), representing VOCs;

e) *deionized water*, representing aqueous solutions.

6 Determination of sorbency of Type I materials (web-type)

6.1 Principle

A preweighed test piece of fixed size is allowed to saturate completely in the test liquid. It is then removed and hung vertically to allow it to drain.

After a standard draining time, it is reweighed allowing calculation of the sorbency after draining.

The temperature of the test liquid is 20 °C ± 2 °C.

6.2 Apparatus

6.2.1 *Ordinary laboratory apparatus.*

6.2.2 *"S" hook*, made from metal paper clip or fine point tweezers.

6.2.3 *Balance*, capable of weighing to the nearest 0.01 g.

6.2.4 *Stopwatch or stopclock.*

6.2.5 *Water bath or other apparatus*, capable of maintaining the test liquid at 20 °C ± 2 °C.

6.3 Procedure

6.3.1 *Test piece*

Using a 100 mm × 100 mm square blank or other method, mark and then cut out from the middle of the pad or roll a (100 ± 2) mm × (100 ± 2) mm test square. Take care to handle the material in a way that avoids compression. Weigh the test piece and record the mass, W_P.

6.3.2 *Preparation of test liquid*

Fill a container, of area at least double that of the test piece, with the liquid to a depth of at least 30 mm or twice the depth of the sorbent web, whichever is greater. Adjust the temperature of the test liquid to 20 °C ± 2 °C and ensure that it remains within this range during the test, preferably by use of the water bath.

6.3.3 *Determination*

If using an "S" hook, attach it through a corner of the test piece. Take a receptacle, A, of sufficient size to hold the saturated test piece (e.g. a plastic tub or glass beaker) and weigh this with the "S" hook, if used, recording the mass as W_{A1}.

Place the test piece on the surface of the liquid. Using a stopwatch or stopclock, measure the time taken for the liquid to reach visual saturation.

Immerse the test piece in the liquid for a further 2 min after saturation.

NOTE With very dense liquids, the test piece might need to be held down.

Using tweezers or the "S" hook, remove and immediately hang or hold the test piece vertically from a corner and allow it to drain. After 30 s, transfer the test piece, with the "S" hook if used, to receptacle A. Weigh receptacle A with the test piece and "S" hook, recording the mass as W_{A2}.

6.4 Calculation of sorbency

Calculate the sorbency after 30 s draining, S_{30}, in litres per kilogram, using the equation:

$$S_{30} = \frac{V_{30}}{W_{\mathrm{p}}}$$

where

W_{P} is the mass of the test piece, in kilograms;

V_{30} is the volume of liquid, in litres, held by the test piece after 30 s draining, calculated as follows:

$$V_{30} = \frac{W_{30}}{\rho}$$

where

W_{30} is the mass of liquid held by the test material after 30 s draining, in kilograms, i.e. $W_{30} = W_{\mathrm{A2}} - W_{\mathrm{A1}} - W_{\mathrm{P}}$;

W_{A1} is the mass of the receptacle plus "S" hook (if used), in kilograms;

W_{A2} is the mass of the receptacle plus "S" hook (if used) plus test piece plus liquid retained after 30 s, in kilograms

ρ is the density of the test liquid, in kilograms per litre.

NOTE The sorbency of a larger unit of material (e.g. single pad or sheet; pack of pads; whole roll) might also be calculated by extrapolation from the mass of the pack.

6.5 Test report

The test report shall include the following information:

a) name and description of material;

b) supplier/manufacturer and product code;

c) method of sampling used;

d) date of test;

e) reference to this British Standard;

f) liquid reference and name as specified in Clause **5**;

g) time taken to visual saturation;

h) sorbency after 30 s draining, in litres per kilogram;

i) any unusual features observed during the test.

Items g) and h) shall include individual and mean test results.

7 Determination of sorbency of Type II materials (loose material)

7.1 Principle

A preweighed, fixed volume of loose sorbent held in a mesh basket is allowed to saturate completely in the test liquid at 20 °C ± 2 °C. It is then removed and allowed to drain. After a standard draining time, it is reweighed, and the sorbency is calculated after draining.

7.2 Apparatus

7.2.1 *Ordinary laboratory apparatus.*

7.2.2 *Wire mesh basket*, comprising an open-top basket of area 100 mm × 100 mm and depth at least 50 mm.

The basket shall be constructed of mesh with apertures suitable to contain the smallest particles of material during the test. If necessary, should the material be very fine, an inner bag of filter cloth may be constructed and used with the wire mesh basket.

The basket and any filter bag shall be constructed of materials resistant to the liquid used in the test.

7.2.3 *Balance*, capable of weighing to the nearest 0.1 g.

7.2.4 *Stopwatch or stopclock.*

7.2.5 *Water bath or other apparatus*, capable of maintaining the test liquid at 20 °C ± 2 °C.

7.3 Procedure

7.3.1 *Test portion*

For adsorbent materials, loosely fill a container of 200 ml volume with material and level off to give an exact 200 ml.

For absorbent or other materials which might block when used in a thick layer, reduce the volume as necessary to give a thinner layer in the basket.

Report any such reduction in thickness and volume used as part of the test report.

Weigh the material, recording the mass as W_P. If the material supplied is packed by volume, weigh a whole pack before sampling.

7.3.2 *Preparation of test liquid*

Fill the liquid to a depth of at least 40 mm in a container of area at least double that of the wire mesh basket. Adjust the temperature of the test liquid to 20 °C ± 2 °C and ensure that it remains within this range during the test. Use of a water bath is preferred.

7.3.3 *Determination of tare mass of wire mesh basket in test liquid*

Take a receptacle, A, of sufficient size to hold the wire mesh basket and weigh, recording the mass as W_A. Immerse the wire mesh basket with inner bag (if needed) in the liquid to a depth of 30 mm.

Remove and allow it to drain, using a stopwatch or stopclock to time the drainage. After 30 s draining, transfer the wire mesh basket to receptacle A. Weigh the receptacle, recording the mass as W_{A1}.

7.3.4 *Determination of sorbency*

Weigh receptacle A, recording the mass as W_{A2}. Tip the 200 ml test portion into the wire mesh basket and spread evenly. Lower the wire mesh basket sufficiently into the test liquid so that the material is fully immersed when saturated. Observe the material for signs of saturation.

NOTE When fully saturated, the test liquid will have penetrated through to the top of the layer of material and all particles will be covered with liquid.

Using a stopwatch or stopclock, record the time taken to reach saturation. Leave immersed for a further 2 min after saturation, then remove the basket from the liquid, allowing it to drain. Drain for 30 s then transfer to receptacle A. Weigh receptacle A, recording the mass as W_{A3}. Repeat the determination using a longer period of soaking. If there is no increase in the mass of the material after 30 s draining time, there is no need to continue. If, however, the mass has increased, repeat with an increased soaking time until constant mass is reached. Record the time needed for this point to be reached. If a time of more than one hour is needed, proceed as follows. With viscous or dense liquids, if the material is not saturated within one hour, manually agitate the material in the liquid with a spatula or glass rod until the material is clearly seen to be saturated by visual inspection. Continue to test as described. The test report shall state that manual agitation was necessary.

7.4 Calculation of the sorbency

Calculate the sorbency after 30 s draining, S_{30}, in litres per kilogram, using the equation:

$$S_{30} = \frac{V_{30}}{W_p}$$

where

W_p is the mass of the test piece, in kilograms;

V_{30} is the volume of liquid held by the test portion after 30 s draining, in litres, calculated as follows:

$$V_{30} = \frac{W_{30}}{\rho}$$

where

W_{30} is the mass of liquid held by the test material after 30 s draining, in kilograms; i.e.

$W_{30} = (W_{A3} - W_{A2}) - (W_{A1} - W_A) - W_P$;

$(W_{A3} - W_{A2})$ is the mass of the wire mesh basket plus material after 30 s draining, in kilograms;

$(W_{A1} - W_A)$ is the tare mass of the mesh basket after 30 s draining, in kilograms;

ρ is the density of test liquid, in kilograms per litre;

NOTE The sorbency of a larger quantity of the material may be extrapolated from the weight of sorbent material in a bag or pack. This pack weight may be given or determined by weighing.

7.5 Test report

The test report shall include the following information:

a) name and description of material;

b) supplier/manufacturer and product code;

c) method of sampling used;

d) date of test;

e) reference to this British Standard;

f) liquid reference and name as specified in Clause **5**;

g) time taken for saturation or maximum mass. If greater than one hour, state that manual agitation was necessary;

h) sorbency after 30 s draining, in litres per kilogram;

i) any unusual features observed during the test;

j) any alteration in volume used in the test (see **7.3.1**).

Items g) and h) shall include individual and mean test results.

8 Determination of sorbency for Type III materials (filled products)

8.1 Principle

Preweighed whole pieces of contained materials (if possible) or sectioned-down lengths of larger booms, cushions, pillows or socks are completely immersed in the test liquid at 20 °C ± 2 °C until saturated. They are then removed, allowed to drain and reweighed after a standard draining time, allowing calculation of sorbency after draining.

8.2 Apparatus

8.2.1 *Ordinary laboratory apparatus*, including suitably sized pans or receptacles.

8.2.2 *Wire mesh basket*, comprising an open-top basket of size and strength suitable to carry the test pieces.

NOTE Long socks may be loosely coiled on the base of the basket for ease of fit. The mesh aperture size should be at least 1.5 cm.

8.2.3 *Balance*, capable of weighing to the nearest 0.01 kg (for dry test pieces).

8.2.4 *Balance*, capable of weighing to the nearest 0.1 kg (for saturated test pieces).

8.2.5 *Stopwatch or stopclock.*

8.3 Procedure

8.3.1 *Test piece*

Test cushions, pillows and small diameter socks or booms in their standard size. Section down larger booms, ensuring that when doing this the ratio of length to diameter is at least 3.0. Ensure that in the cut-down boom the packing density of the filler is the same as in the original. Terminate the ends with a tie or clip, there being no need to reproduce the exact termination method of the original material. For socks and booms, measure the length of the test piece and record as L_P. Take the measurement from the point at which the boom starts to narrow, rather than at the tie or clip itself. Weigh the test piece before the test recording the mass as W_P.

8.3.2 *Preparation of test liquid*

Hold the test liquid in a suitably sized container at a depth sufficient to immerse totally the test piece when fully saturated. Maintain the temperature at 20 °C ± 2 °C if possible. If this is not possible, measure and report the temperature.

8.3.3 *Determination of tare mass of wire mesh basket in test liquid*

Take a receptacle, A, of sufficient size to hold the basket and weigh, recording the mass as W_A.

Immerse the wire mesh basket with inner bag (if needed) in the liquid to a depth of 30 mm. Remove and allow to drain using a stopwatch or stopclock to time the drainage. After 30 s draining, transfer the wire mesh basket to receptacle A. Weigh the receptacle, recording the mass as W_{A1}.

8.3.4 *Determination of sorbency*

Weigh receptacle A, recording the mass as W_{A2}. Place the test piece in the wire mesh basket, lower it into the test liquid. Use a stopwatch or stopclock to measure the soaking time. After a soaking time of 10 min, remove and allow to drain. Drain for 30 s and transfer to receptacle A. Weigh the receptacle, recording the mass as W_{A3}. Repeat the determination using a longer period of soaking. If there is no increase in mass of the test piece after 30 s drain, there is no need to continue. If, however, the mass has increased, repeat with an increased period of soaking until a constant mass gain is reached. Record the soaking time needed for this to be reached. If the mass is still increasing after 24 h soaking, stop the test and record the 24 h result.

8.4 Calculation of sorbency

8.4.1 *Cushion/pillows (tested as whole pieces)*

Calculate the sorbency after 30 s draining, S_{30}, in litres per kilogram, using the equation:

$$S_{30} = \frac{W_{30}}{\rho}$$

where

W_{30} is the mass of liquid held by the test material after 30 s draining, in kilograms, i.e.
$W_{30} = (W_{A3} - W_{A2}) - (W_{A1} - W_A) - W_P$;

$(W_{A3} - W_{A2})$ is the mass of the wire mesh basket plus material after 30 s draining, in kilograms;

$(W_{A1} - W_A)$ is the tare mass of the wire mesh basket after 30 s draining, in kilograms;

W_P is the mass of the test portion, in kilograms;

ρ is the density of the test liquid, in kilograms per litre.

NOTE The results obtained will apply to individual units of material, such as small socks or pillows. These results may be scaled up by extrapolation to larger units of material such as packs by reference to the quantity in a pack.

8.4.2 *Socks/booms (tested whole or sectioned down)*

Calculate the sorbency per unit length after 30 s draining, S_{30} in litres per ⟩A1⟨ metre ⟨A1⟩ using the equations:

$$S_{30} = \frac{W_{30}}{\rho L_p}$$

where

W_{30} is calculated as in **8.4.1**;

L_P is the length of the test piece, in metres.

NOTE The results apply to unit length of filled socks or booms. They may be scaled up for whole packs by reference to the total length of socks or booms in a pack.

8.5 Test report

The test report shall include the following information:

a) name and description of material including diameter of boom/sock;

b) supplier/manufacturer and product code;

c) method of sampling;

d) date of test;

e) reference to this British Standard;

f) liquid reference and name as specified in Clause **5**;

g) temperature of liquid if outside specified range;

h) for both 10 min soak time and, if applicable, for the time taken to reach maximum mass (or 24 h if not fully saturated) the following:

— time of soak;

— sorbency after 30 s draining;

i) any unusual features observed during the test.

Item h) shall include individual and mean test results.

9 Determination of sorbency for Type IV materials (agglomerates)

9.1 Principle

Preweighed whole pieces of sorbent materials (if possible) or sectioned-down lengths of larger pieces are completely immersed in the test liquid at 20 °C ± 2 °C until saturated. They are then removed, allowed to drain and reweighed after a standard draining time, allowing calculation of sorbency after draining. The material and liquid are agitated during the test because these materials are designed for use with heavy or viscous liquids, and the test is usually performed with such liquids.

9.2 Apparatus

9.2.1 *Ordinary laboratory apparatus*, including suitably sized pans or receptacles.

9.2.2 *Wire mesh basket*, comprising an open-top basket of size and strength suitable to carry the test pieces without any folding or "bunching" of the pieces.

NOTE This is to ensure that the volume available for oil pick-up is not reduced. The mesh aperture size should be at least 1.5 cm.

9.2.3 *Balance*, capable of weighing to the nearest 0.01 kg for dry test pieces.

9.2.4 *Balance*, capable of weighing to the nearest 0.1 kg for saturated test pieces.

9.2.5 *Stopwatch or stopclock*.

9.3 Procedure

9.3.1 *Test piece*

Test the agglomerate in its standard size.

NOTE If it is too large, it may be sectioned down. In this case, weigh the larger agglomerate before sectioning down.

Weigh the test piece before the test, recording the mass as W_P.

9.3.2 *Preparation of test liquid*

Fill a suitably-sized container with the test liquid to a depth sufficient to immerse totally the test piece when fully saturated. Maintain the temperature at 20 °C ± 2 °C if possible. If this is not possible, measure and report the temperature.

9.3.3 *Determination of tare mass of wire mesh basket in test liquid*

Take a receptacle, A, of sufficient size to hold the wire mesh basket and weigh, recording the mass as W_A. Immerse the mesh basket in the liquid to a depth of 30 mm. Remove it and allow it to drain, using a stopwatch or stopclock to time the drainage. After 30 s draining, transfer the wire mesh basket to receptacle A. Weigh the receptacle, recording the mass as W_{A1}.

9.3.4 *Determination of sorbency*

Weigh receptacle A, recording the mass as W_{A2}. Place the test piece into the wire mesh basket and lower it into the test liquid. Leave immersed for 5 min, during which time agitate the sample continuously by manual stirring to ensure that the test liquid has penetrated completely into the mass of the agglomerate. Check liquid penetration by visual inspection. Remove the wire mesh basket from the liquid and allow it to drain. Drain for 30 s then transfer to receptacle A. Weigh the receptacle, recording the mass as W_{A3}.

9.4 Calculation of sorbency

Calculate the sorbency after 30 s draining, S_{30}, in litres per kilogram, using the equation:

$$S_{30} = \frac{V_{30}}{W_{\mathrm{p}}}$$

where

W_{P} is the mass of the test piece, in kilograms;

V_{30} is the volume of liquid held after 30 s draining, in litres, calculated as follows;

$$V_{30} = \frac{W_{30}}{\rho}$$

where

W_{30} is the mass of liquid held by the test material after 30 s draining, in kg, i.e.

$W_{30} = (W_{\mathrm{A3}} - W_{\mathrm{A2}}) - (W_{\mathrm{A1}} - W_{\mathrm{A}}) - W_{\mathrm{P}}$;

$(W_{\mathrm{A3}} - W_{\mathrm{A2}})$ is the mass of the wire mesh basket plus material after 30 s draining, in kilograms;

$(W_{\mathrm{A1}} - W_{\mathrm{A}})$ is the tare mass of the wire mesh basket after 30 s draining, in kilograms;

ρ is the density of test liquid, in kilograms per litre.

NOTE The results obtained will apply either to individual units of material or to sectioned-down test pieces. These results may be scaled up by extrapolation to larger units of material by reference to the overall mass of the original units.

9.5 Test report

The test report shall include the following information:

a) name and description of material;

b) supplier/manufacturer and product code;

c) method of sampling;

d) date of test;

e) reference to this British Standard;

f) liquid reference and name as specified in Clause **5**;

g) temperature of liquid if outside specified range;

h) sorbency with 30 s draining, in litres per kilogram;

i) any unusual features observed during the test.

Item h) shall include individual and mean test results.

10 Determination of sorbency and swell ratio for materials of Type II (loose material)

10.1 Principle

A small, weighed volume of absorbent is placed in an excess of liquid, the swell volume is measured and the sorbency and swell ratio are calculated.

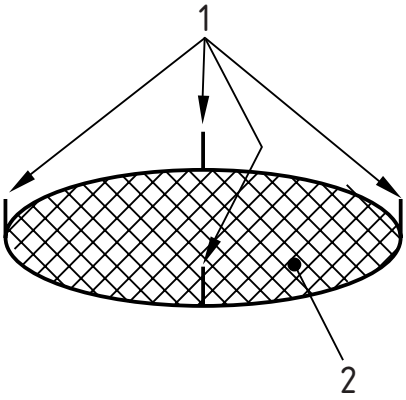
NOTE This method utilizes the fact that absorbent materials generally swell to several times their original volume when they pick up a liquid.

10.2 Apparatus

10.2.1 *Ordinary laboratory apparatus*.

10.2.2 *Graduated cylinders*, 10 ml and 100 ml, conforming to the requirements of BS 604.

10.2.3 *Circular screen*, made of 200 mesh wire as shown in Figure 1, having a diameter slightly smaller than the 100 ml cylinder to ensure it just fits.



Key
1 4 × centering wires
2 200 mesh screen

Figure 1 — Circular screen

10.2.4 *Balance*, capable of weighing to the nearest 0.01g

10.2.5 *Stopwatch or stopclock*.

10.2.6 *Water bath*, oven or cabinet, capable of maintaining the test liquid at 20 °C ± 2 °C.

10.3 Procedure

10.3.1 *Test sample*

Pour the required volume, initially 2 ml, of absorbent, gently tapped down, into a preweighed 10 ml cylinder and determine its mass by difference. Record the mass of absorbent as W_A, and the volume as V_A. If the absorbent is supplied in packs by volume, determine the mass of absorbent in a pack.

10.3.2 *Preparation of test liquid*

Maintain the test liquid at 20 °C ± 2 °C using a water bath or oven/cabinet.

NOTE To maintain this temperature during the test it will be necessary to keep the test cylinder plus contents in the water bath or oven.

10.3.3 *Procedure*

Take the weighed test sample of volume 2 ml. Pour approximately 50 ml of the test liquid into a 100 ml graduated cylinder, and record the exact volume as V_L. Carefully pour the absorbent into the cylinder of liquid so that it does not stick to any liquid on the sides of the cylinder. (If any solid does stick to the sides, use a spatula or rod to push it down into the liquid.) Cover the cylinder to prevent evaporation. Leave for 2 h, agitating every half hour for a short period with a glass rod. If there is still free liquid present either above or below the swollen absorbent place the mesh insert in the fluid on top of the absorbent, or if the liquid is of high density and is below the absorbent, place a weight on the mesh sufficient to push the absorbent down. Record the level of the screen as V_S and the upper level of the liquid as V_U.

NOTE 1 This will normally be slightly higher than V_L.

If the swell, V_S, is less than 20 ml, repeat the test with a 10 ml test portion and a higher volume of test liquid. If there is no free liquid showing, repeat the test with a greater volume of liquid up to a maximum of 90 ml.

NOTE 2 It is unlikely that this will be insufficient but, if it is, the test should be repeated with a weighed 1 ml sample of absorbent.

Leave the cylinder sealed for a total of 24 h to check that no further swelling has occurred. If further swelling has occurred, repeat determination of swell volume and volume of free liquid.

10.4 Calculation of results

10.4.1 *Sorbency by volume*

Calculate the sorbency by volume, S_V, in litres per litre, i.e. as the volume of liquid absorbed per unit volume of absorbent, using the following equation:

$$S_V = \frac{V_L - (V_U - V_S)}{V_A}$$

where

V_L is the volume of test liquid used, in litres;

V_U is the upper level of the liquid, in litres;

V_S is the level of the screen, in litres;

V_A is the volume of the absorbent, in litres.

10.4.2 *Sorbency by mass*

Calculate the sorbency by mass, S_w, in litres per kilogram, i.e. as the volume of liquid absorbed per unit mass of absorbent, using the following equation:

$$S_W = \frac{V_L - (V_U - V_S)}{W_A}$$

where

W_A is the mass of the absorbent, in kilograms.

10.4.3 *Swell ratio*

Calculate the swell ratio, S_R, i.e. the volume increase of the absorbent, using the following equation:

$$S_R = \frac{V_s}{V_A}$$

10.4.4 *Extrapolation of results*

The sorbency may be scaled up from the test results by extrapolation, using the given or measured pack weights.

10.5 Test report

The test report shall include the following information:

a) name and description of material;

b) supplier/manufacturer and product code;

c) method of sampling;

d) date of test;

e) reference to this British Standard;

f) liquid reference and name as specified in Clause **5**;

g) time period for absorption (2 h or 24 h, depending whether full saturation is reached in 2 h);

h) sorbency of a standard unit of material (S_V and S_W);

i) swell ratio, S_R for the absorbent;

j) any unusual features noted during the test.

Items f) and g) shall include individual and mean test results.

blank

Bibliography

BS 7959-2:2000, *Materials used for the control of liquid spillages — Part 2: Determination of water repellency or buoyancy for hydrophobic (oil sorbent) materials.*

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