BRITISH STANDARD

BS 7258-4: 1994

Laboratory fume cupboards —

Part 4: Method for determination of the containment value of a laboratory fume cupboard

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Laboratory Apparatus Standards Policy Committee (LBC/-) to Technical Committee LBC/18, upon which the following bodies were represented:

Association for Science Education
Association of the British Pharmaceutical Industry
British Furniture Manufacturers' Federation
British Occupational Hygiene Society
Chartered Institution of Building Services Engineers
Chartered Society of Designers
Chemical Industries' Association
CLEAPSS School Science Service
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Health and Safety Executive
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This British Standard, having been prepared under the direction of the Laboratory Apparatus Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on
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The following BSI references relate to the work on this standard:
Committee reference LBC/18
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Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

This Part of BS 7258 has been prepared under the direction of the Laboratory Apparatus Standards Policy Committee. It supersedes DD 191:1990 which is withdrawn.

Following the issue of DD 191, further research was carried out to evaluate fume cupboard containment and face velocity test methodologies, in particular those of DD 191 and DIN 12924. A further type of test gas injector was developed, consisting essentially of a scaled down version of the DIN injector. This technology was not considered sufficiently well established, however, for it to be adopted in the upgrading of DD 191 to Part 4 of BS 7258.

The test procedure given in this Part of BS 7258 yields standardized containment test values. This method is dissociated from any direct relationship with occupational exposure or short term exposure limits safety limits and other factors relevant to health hazard assessment which belong to the practice of industrial health and hygiene. The performance requirement in BS 7258-1 relates to the fume cupboard but not to the exposure of persons.

The measurement of containment using a designated test gas is described but the procedure may be considered using other gases in specific situations.

Recommended values for containment using the test procedure are not specified in this standard, which is set out as a test method only.

Test methods for the evaluation of fume cupboard performance have been under consideration in several European countries. Discussions between UK, French and German experts are in progress and work in this field will be undertaken in the European Committee for Standardization (CEN). Results of experience in the use of DD 191:1990 and of this Part of BS 7258 will be useful in the eventual preparation of a European Standard.

BS 7258 is published in four Parts as follows:

— *Part 1: Specification for safety and performance;*

— *Part 2: Recommendations for the exchange of information and recommendations for installation;*

— *Part 3: Recommendations for selection, use and maintenance;*

— *Part 4: Method for determination of the containment value of a laboratory fume cupboard.*

Amendment and reissue of Parts 1 to 3 has taken place at the same time as the issue of this Part of BS 7258.

This Part of BS 7258 describes a method of test only and should not be used or quoted as a specification defining limits of performance. Reference to this Part of BS 7258 should indicate that the method of test used is in accordance with BS 7258-4:1994.

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 and ii, pages 1 to 4, 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.

1 Scope

This Part of BS 7258 describes a method for the assessment of the containment efficiency of general purpose laboratory fume cupboards. The method is applicable to fume cupboards covered by BS 7258.

It is not intended for application to special purpose fume cupboards as detailed in BS 7258-1:1994. It does not apply to the testing of microbiological safety cabinets for which reference should be made to BS 5726.

The test procedure is intended for use in type testing in a standardized test room but may also be applied to the determination of the containment of an installed fume cupboard under on site conditions.

2 References

2.1 Normative references

This Part of BS 7258 incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on the inside back cover. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 7258 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 7258 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 7258, the definitions given in BS 7258-1:1994 apply.

4 Principle

A test gas is released at a specified rate inside the fume cupboard and the gas escaping from the fume cupboard is collected from specified positions in the plane of the sash; the average concentration in the collected sample is measured using a gas analyser.

5 Apparatus and materials

5.1 *Test room*

5.1.1 *Dimensions and construction.* The test room shall consist of an enclosure of square or rectangular shape, constructed of suitable materials within an existing laboratory or building. The internal width and length shall be not less than 4.0 m and the ceiling height not less than 2.7 m. The ceiling shall be level and all internal surfaces shall be devoid of internal supports or partitions.

NOTE The test room specified in annex B of BS 7258-1:1994 is suitable.

5.1.2 *Air input and outlets.* Make-up air at a temperature of 20 °C ± 3 °C shall be supplied to the test area to maintain a balanced system between input and exhaust.

NOTE It should be introduced into the test area in as uniform a manner as possible and in such a way as to minimize any influence on the operation of the fume cupboard. To this end, it is recommended that the air velocity in the vicinity of the fume cupboard should not exceed 0.1 m/s and the air inlet should be as far away as possible from the wall against which the fume cupboard is installed.

One suitable method for introduction of the air is through panels perforated in a regular pattern with a gross open area of not less than 6 m^2. The open area of the panels should be between 50 % and 70 % of the gross open area.

Extract fans and any associated measuring equipment shall be positioned outside the test room. The air extracted from the test room shall be discharged to atmosphere.

Air shall be supplied via a second fan and flow measuring device to the building in which the test room is housed to replace the air extracted from the fume cupboard in the test room.

5.1.3 *Flow measuring device.* Means shall be provided for the measurement of the supply volume air flow rate which shall be measured after the supply fan and damper.

5.2 *Inlet device*, capable of providing an injection of the test gas at a flow rate of 2 l/min per metre width of aperture, constant to within ± 5 %. The device shall consist of a cylindrical filter funnel fitted with a sintered glass disc near its base 30 mm in diameter and having a pore rating of P 40 in accordance with BS 1752:1983.

NOTE The distance between the disc and the end of the tube of the cylinder may affect the inlet flow pattern. It is recommended that it should not exceed 100 mm.

5.3 *Gas flow rate measuring device*, capable of measuring gas flow rates in the range 1 l/min to 5 l/min and equipped with means for adjusting the flow rate.

5.4 *Sampling probe(s)*, each consisting of a stainless steel tube having an internal diameter of 5 mm ± 0.5 mm.

NOTE The suction velocity at the probe inlet should be of the order of 0.1 m/s in order to approach isokinetic sampling conditions. Means of channelling the inlet flow may be necessary to achieve this at the required aspiration rate (see **5.7**).

5.5 *Means of mounting the probes*, at the positions stated in **6.3**.

NOTE The frame or other means used should be such as to minimize obstruction to the flow of air into the fume cupboard aperture.

5.6 *Means of mounting the inlet device*, inside the fume cupboard at the positions stated in **6.2** and **6.6**.

5.7 *Aspirator*, a sampling pump capable of operating at a flow rate of approximately 2 l/min and constant to within ± 5 %.

5.8 *Collector*, consisting of a chamber into which the outputs from the individual probes are fed and combined and from which the output to the analyser is taken.

5.9 *Connecting tubing*, for connection of the sampling probes to the collector and for connecting the cylinder of test gas to the flow regulator and the injection device. The tubes connecting the probes to the collector shall be of the same length to within ± 20 mm.

NOTE The internal diameter of the tubes should be approximately 5 mm and, for connecting the probes, should be compatible with the external diameter of the probe tube. It is recommended that the length of the tubes from the probes should be not more than 1 m.

5.10 *Gas analyser*, capable of measuring concentrations of sulfur hexafluoride down to 10^{-9} ± 10 % (*V*/*V*). Its calibration shall be traceable to national standards.

NOTE Infra-red or electron capture combined with gas chromatograph types may be suitable but their performance should be checked before use.

5.11 *Test gas*, sulfur hexafluoride (SF_6), 10 % (*V*/*V*) in nitrogen.

6 Procedure

6.1 Install the fume cupboard in accordance with the manufacturers' instructions. The type test shall be carried out at the extract volume flow rate specified by the purchaser with the sash set to the normal sash working height, except where variations of these parameters are required by the purchaser as part of the type test procedure.

NOTE The face velocity specified by the purchaser is given by the net volume flow rate of air passing through the opening in the plane of the sash divided by the area of the opening.

6.2 Mount the inlet device(**5.2**) with its axis parallel to the plane of the sash with the open end facing upwards and the top of the funnel 150 mm above the work surface at a point 150 mm from one of the side walls and 150 mm behind the plane of the sash.

6.3 Set the sash to the rated normal working height and place the support system for the probes so that the probe inlets are in the same plane as each other and in the plane of the sash. Adjust the probe positions to the grid points as follows.

a) Determine the dimensions of a rectangular grid such that the corners are 50 mm from the sides of the aperture (see Figure 1, A_1, A_4, C_1, C_4).

b) Divide the height of the rectangle by two and the width by a whole number *n*, such that the width of each of the 2*n* cells so formed does not exceed 350 mm.

c) Place the probes at the 3(*n* + 1) grid points so established, i.e. at the corners of the grids.

6.4 Connect the cylinder of test gas to its flow regulator and to the inlet device (**5.2**). Turn on the main flow and adjust the flow rate to 2 l/min per metre width of aperture.

6.5 Connect the sample probes to the collector (**5.8**) and aspirator (**5.7**). Switch on the aspirator and pass test gas through the inlet device (**5.2**) for 180 s ± 20 s and allow the collected gas to run to waste through the gas analyser (**5.10**). Continue to collect a test sample and measure the concentration of SF_6 in the sample using the analyser over a period of 600 s ± 20 s. Turn off the aspirator and injection systems.

6.6 Move the inlet device (**5.2**) successively to five further positions, each 150 mm behind the sash plane as shown in Figure 2. Repeat the procedure in **6.5** at each position.

7 Expression of results

Select the highest value from the six values of concentration of SF_6 found for the inlet device positions. Take, as the containment value, the concentration of SF_6 in p.p.m. (*V/V*) at that position.

8 Test report

The test report shall include at least the following information:

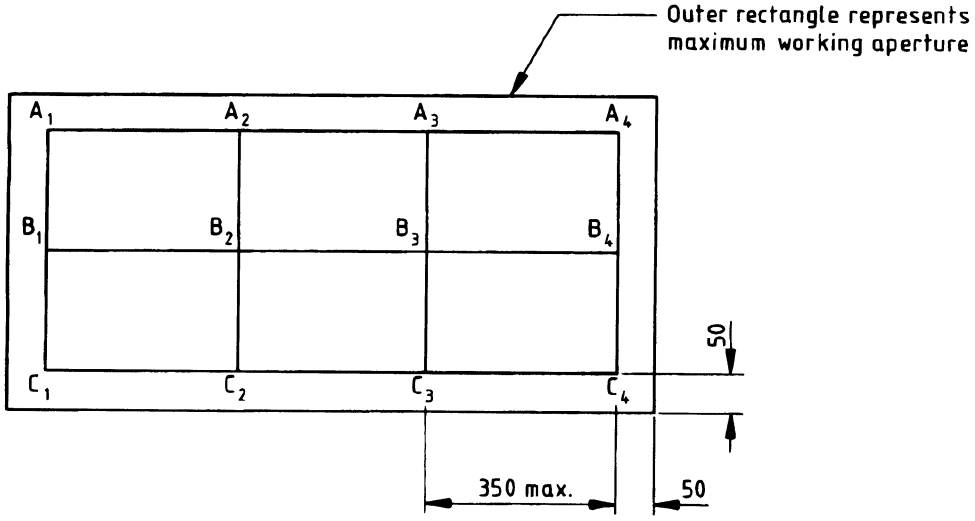
a) an identification of the fume cupboard tested including aperture width and rated normal sash working height;

b) the containment value of SF_6 obtained in p.p.m.(*V/V*);

c) a reference to this Part of BS 7258, i.e. BS 7258-4:1994;

d) the face velocity specified by the purchaser and used in the test and the extract volume flow rate;

e) any deviations from the test procedure by agreement or otherwise.



All dimensions are in millimetres.

Figure 1 — Grid positions for sampling probes for containment test, example for $n = 3$ (see **6.3**)

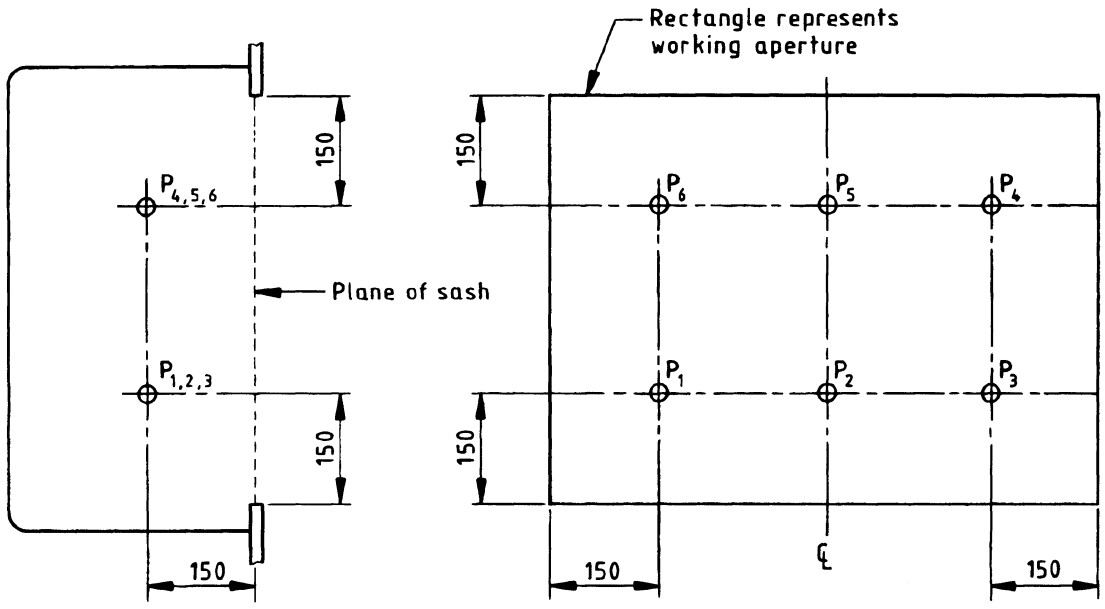


Figure 2 — Injection positions for test gas (see **6.2** and **6.6**)

List of references (see clause 2)

Normative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 1752:1983, *Specification for laboratory sintered or fritted filters including porosity grading.*
BS 7258, *Laboratory fume cupboards.*
BS 7258-1:1994, *Specification for safety and performance.*

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 5726, *Microbiological safety cabinets.*
BS 7258, *Laboratory fume cupboards.*
BS 7258-2:1994, *Recommendations for the exchange of information and recommendations for installation.*
BS 7258-3:1994, *Recommendations for selection, use and maintenance.*

Other references

DIN 12924, *Laboratory furniture; fume cupboards*[1)].

[1)] Referred to in the foreword only.

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