BRITISH STANDARD

BS 7258-1: 1994

Laboratory fume cupboards —

Part 1: Specification for safety and performance

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Committees responsible for this British Standard

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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
Department for Education
Department of Health
Department of the Environment (The Buying Agency)
Furniture Industry Research Association
GAMBICA (BEAMA Ltd.)
Health and Safety Executive
Manufacturing Science Finance
Medical Research Council
National Association of Teachers in Further and Higher Education
Royal Institute of British Architects
Royal Society of Chemistry
Universities Safety Association
Coopted members

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Contents

Foreword

This Part of BS 7258 has been prepared under the direction of the Laboratory Apparatus Standards Policy Committee and supersedes BS 7258-1:1990 which is withdrawn.

This edition introduces technical changes but it does not reflect a full review or revision of the standard, which will be undertaken in due course.

The changes made by this new edition include the following:

a) changes to the measurement grid for both the type test and the commissioning test, making the grid for the latter a subset of the grid for the former, thereby facilitating direct comparison (see **7.1.4**);

b) the addition of annex D, describing a method for the determination of average face velocity with reduced accuracy for routine maintenance.

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.*

The minimum level of performance of a fume cupboard is established by a performance type test, the procedure of which assesses the pattern and quality of air flow on the basis of measurements of air velocities in the plane of the sash opening.

It is recognized that a fume cupboard producing the required minimum level of performance when tested by the type test procedure may not perform adequately unless installed in a proper manner. Requirements for air flow of the installed fume cupboard are specified to establish that the minimum performance in the type test has not deteriorated after installation.

The performance type test will not allow discrimination between different levels of performance. The minimum level of performance may not be appropriate for some users and, in particular, higher levels of performance may be desired. It is not possible for more than one “minimum” level of performance to be accommodated within this specification and therefore a classification into different grades on the basis of performance has not been proposed.

Part 4 of BS 7258 describes a method recommended for containment testing. Acquisition of data using this and related methods (see the foreword of Part 4) should enable the Technical Committee to establish whether a further specification of performance, based on the results of such testing, is feasible. However, the further development of fume cupboard standards in EC/EFTA countries is likely to be undertaken by the European Committee for Standardization (CEN), rather than by national standards bodies.

Where it is known for particular fume cupboards that the rates of release of hazardous gases and vapours are low, or where the fume cupboards are used intermittently and then only for short periods, the performance type test procedure may be too stringent. In such situations, the requirements of this Part of BS 7258 are not applicable and reference should be made to other appropriate standards such as Design Note 29 *Fume cupboards in schools* [1] issued by the Department for Education. The recommendations found in Part 2 and Part 3 of BS 7258 may, however, be relevant.

Whenever a fume cupboard is used, it will be necessary for the purchaser/user to assess the hazards associated with the materials to be manipulated to ensure that the fume cupboard is satisfactory for its intended purpose and that current exposure limits for toxic substances are not exceeded.

Product certification. Users of this British Standard are advised to consider the desirability of third party certification of product conformity with this British Standard based on testing and continuing product surveillance which may be coupled with assessment of a supplier's quality systems against the appropriate Part of BS 5750.

Enquiries as to the availability of third party certification schemes are forwarded by BSI to the Association of Certification Bodies. If a third party certification scheme does not already exist, users should consider approaching an appropriate body from the list of Association members.

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 16, 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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Introduction

The performance of a fume cupboard may be expressed conveniently in qualitative terms as the ability to entrain a pollutant or pollutants (released from a definitive source within the operational zone) within the inward flow of air and to remove the pollutant(s) with no hazardous risk to the user and with the minimum susceptibility to perturbing influences. Perturbing influences include cross draughts, the effect of laboratory make-up air supply jets, operator movement, etc. The combined effects of entrainment and removal result in the containment of fume by a fume cupboard, which is the primary function of this type of protective device.

The patterns of flow within a fume cupboard are very complex and impossible to predict under all circumstances. In general, it is considered desirable for flow to attach to a boundary surface and to pass smoothly over it in preference to flow separation which may produce zones of local flow reversal and eddies. The effectiveness of scavenging of the main working zone of a fume cupboard is critically dependent on the positioning and the relative sizes of components such as back baffles or extract slots.

The inward flow of air into a fume cupboard is the mechanism by which the operator is usually protected. It is the nature, quality and stability of flow through a fume cupboard which characterizes the performance of a fume cupboard.

1 Scope

1.1 This Part of BS 7258 specifies minimum safety requirements for general purpose laboratory fume cupboards and describes the methods of test to be used to determine their performance.

1.2 This Part of BS 7258 is not intended to cover fume cupboards for such special applications as carrying out work on radioactive materials, perchloric acid, etc. or for work where large quantities of heat are released.

NOTE 1 Large quantities of heat create convection currents that adversely affect performance.

This Part of BS 7258 is applicable to fume cupboards for some special applications but such fume cupboards will also have to comply with additional requirements, appropriate to specific hazards of the particular application, which are not covered in this specification.

NOTE 2 Attention is drawn to the provisions of the following regulations.

a) The Control of Substances Hazardous to Health Regulations 1988 (Statutory Instrument No. 1657)[2] and associated Approved Codes of Practice. Fume cupboards should be regarded as local exhaust ventilation equipment for the purposes of these Regulations.

b) The Ionizing Radiations Regulations 1985 (Statutory Instrument No. 1333) [3] made under the Health and Safety at Work etc. Act 1974 and any other subsequent regulations made under that Act.

c) Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (Statutory Instrument No. 917) [4] (which were made under the Factories Act 1961) and in particular Regulation 10(2). Even when the regulations do not apply to particular premises, the standards they describe should be used as a guide.

d) The Electricity at Work Regulations 1989 [5]. These regulations may not apply to all premises but the standards described will be a useful guide.

1.3 This Part of BS 7258 is not applicable to microbiological safety cabinets (see BS 5726).

1.4 This Part of BS 7258 is not applicable to specially designed fume cupboards of the following kinds:

a) “walk in” fume cupboards;

b) recirculating fume cupboards;

c) mobile fume cupboards not installed or operated in a manner complying with **3.2** and **3.4** of BS 7258-2:1994;

d) fume cupboards for demonstrating experiments;

e) fume cupboards for the storage of chemicals;

f) industrial and continuous production process enclosures;

g) fume cupboards with openings on more than one side;

h) fume cupboards with a direct make-up air supply.

NOTE Design criteria for laboratory fume cupboards are given in annex A.

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 page 20. 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 following definitions apply.

3.1
area of the opening

product of the width of the opening (**3.19**) and the height of the opening (**3.11**) in the plane of the sash

NOTE No correction is made for the thickness of any airfoil or equivalent device.

3.2
back baffle

rear baffle situated between the working space and the point of connection to the extract system with the purpose of minimizing the variation of face velocity over the working aperture and encouraging scavenging action throughout the fume cupboard chamber (See **4.4**.)

3.3
bypass

arrangement that allows air to flow into a fume cupboard by a route other than through the working aperture, with the objective of preventing excessively high face velocities at low sash openings and allowing a nearly constant total extract rate irrespective of sash position

3.4
chamber

volume inside a fume cupboard above the work surface bounded by the plane of the sash at the front, by the back baffle or rear wall, by the side walls and by the internal ceiling of the fume cupboard

3.5
direct make-up air

air fed directly to the fume cupboard

3.6
extract system

all ductwork and associated equipment installed between the point of connection to the fume cupboard and the point of discharge

3.7
extract volume flow rate

quantity of air extracted per unit time from the fume cupboard

NOTE For the purposes of testing, the minimum required extract volume flow rate is established with the sash set at the normal sash working height.

3.8
face velocity

velocity of air passing through the working aperture measured in the plane of the sash

3.9
fume

gases, vapours, aerosols or particulate materials in air, constituting one or more of the following hazards:

a) toxicity (all injuries to health including asphyxiation, allergy, narcosis);

b) flammability (including risks of explosion);

c) chemical activity (including corrosion);

d) radioactivity;

e) discomfort, e.g. lachrymosis, objectionable odours.

NOTE In the field of environmental pollution, fume is defined as an aerosol of solid particles, usually from metallurgical processes, generated by condensation from the gaseous state generally after volatilization from melted substances and often accompanied by chemical reactions such as oxidation.

3.10
fume cupboard

partially enclosed work space that limits the spread of fume to operators and other personnel. It is ventilated by an induced flow of air through an adjustable working aperture that dilutes the fume and, by means of an extract system, provides for the release of fume remotely and safely

3.11
height of the opening

distance between the lower surface of a solid sash handle and the upper surface of the work surface (or raised anti-spill lip) in the plane of the sash at the normal sash working height. For a fume cupboard fitted with an airfoil on the sash handle, the upper limit is taken as the lower surface of the solid part of the sash handle in the plane of the sash. For a fume cupboard fitted with a lower lip foil, the lower limit is taken as the upper surface of the work surface or anti-spill lip in the plane of the sash

NOTE No allowance is made for the thickness of any airfoil or equivalent device.

3.12
laboratory make-up air

air that replaces the air entering the fume cupboard from the laboratory

3.13
maintenance sash height

maximum height of the sash which is reachable by overriding the stop device (see **3.14**)

NOTE It is used only for cleaning and maintenance purposes, and for setting up apparatus.

3.14
normal sash working height

maximum height to which the sash should be raised during use of the fume cupboard, and at which point a stop or other device is fitted to prevent the height being exceeded under normal use

3.15
plane of sash

vertical plane through the centre of the sash itself (not the handle or airfoil)

NOTE If the sash is formed by more than one vertical transparent panel (e.g. as for fume cupboards for use in laboratories with a low ceiling) then the centre of the lowermost panel (at the normal sash working height setting) is used.

3.16
sash

transparent screen between the operator and work place that can be adjusted vertically

NOTE The sash provides some protection to the operator against splashing and minor explosions.

3.17
sash height

vertical distance between the lower surface of the sash handle or airfoil in the plane of the sash and the horizontal plane of the upper surface of the work surface

if no sash handle or airfoil is fitted, the sash height is the vertical distance between the lowest point of the plain glass edge (or frame) in the plane of the sash and the horizontal plane of the upper surface of the work surface

NOTE 1 In order to measure sash height, it may prove necessary to project the horizontal plane of the upper surface of the work surface, whether or not there is a sash handle or airfoil fitted.

if the work surface is not essentially flat, the horizontal plane is taken as that horizontal plane passing through the point of the upper surface of the work surface lying half way between the vertical plane of the sash and the rear wall of the fume cupboard and lying half way between the two side walls of the chamber (i.e. in the middle)

NOTE 2 For the purposes of defining sash height, any lip airfoils, etc. are neglected.

3.18
services

supplies of illumination, electricity, water, vacuum, compressed air, gas or other special fluids

3.19
width of the opening

distance measured between the two sides of the clear opening into the fume cupboard at half the normal sash working height in the plane of the sash. The depth of any recessed track is not included in the width of the opening

3.20
work surface

slab or platform above the spillage tray which acts as the base of the fume cupboard interior. If no spillage tray is fitted, the work surface is defined as the upper surface of the base of the fume cupboard interior

4 General safety

4.1 Control of air entry

In order that the fume cupboard complies with clause **7**, it shall be provided with a device to control the air entry profile.

NOTE A suitable device is an airfoil situated at the front of the work surface, but other devices producing the same effects can also be used.

4.2 Sash

4.2.1 *Handle*

The sash handle shall be such that the operator is provided with satisfactory purchase for operating the sash and, in particular, it shall be such that a flow is maintained over its lower surface to minimize the chances of reverse flow occurring and air escaping towards the breathing zone of the operator.

It is conventional for the sash handle to extend some distance into the fume cupboard. Its size and position shall not be such as to pose a hazard to the operator by obstructing vision or by restricting the space available for pouring or similar manipulative tasks when using large flasks and containers.

NOTE The sash handle may incorporate an airfoil and, if fitted, the flow through the resultant slot should be sufficient to reduce the risk of potentially dangerous reverse flows occurring.

4.2.2 *Suspension*

The sash and its counterbalance shall be such that the sash cannot fall when one of its suspending cords or equivalent devices fails.

4.2.3 *Stops*

The minimum sash opening in the closed position shall be 25 mm. Some form of stop shall be incorporated to prevent the sash being lowered below the minimum sash opening. Some form of stop shall also be incorporated to prevent the sash being raised above the normal sash working height. It shall not be possible to override the stops at either level without a deliberate act on the part of the operator.

NOTE Where possible, interim stops with or without associated indicators should be provided to encourage operators to keep the sash in the lowest practical position at all times.

4.2.4 *Guide track*

Raised tracks shall not be used.

NOTE 1 Raised tracks may cause increased eddy formation at the entrance to the operational zone.
NOTE 2 The edge of the glass sash should run in a recessed track of near square cross section. It is not desirable for the edges of the recessed track to be chamfered. Shallow and wide recessed tracks should not be used.

4.2.5 *Bypass system*

When the sash is set to the normal sash working height, a bypass system shall not be operational, i.e. all the air extracted from the fume cupboard shall pass through the opening in the plane of the sash below the lower edge of the sash.

NOTE 1 Some form of bypass or damper control may be provided to prevent excessive velocities occurring when the sash is partially or fully closed.
NOTE 2 The normal form of bypass whereby air enters the top of the chamber over the top of the sash should be satisfactory provided there is a back baffle which produces an acceptable degree of scavenging at low level. In particular, a large eddy is likely to be set up which, if not opposed, will tend to flow forwards over the work surface at low level.
This form of bypass, if properly designed and constructed, should not significantly alter the resistance of the extract system and thus the make-up air requirement will not depend much on sash position. In order to minimize the make-up air requirement, an alternative method of preventing excessive velocities at low level as the sash is lowered is to reduce the extract volume flow rate.

4.3 Width of chamber

The width of the chamber shall be such that a smooth flow of air is obtained within the fume cupboard after the air has passed the plane of the sash.

4.4 Primary extract devices

The fume cupboard shall be provided with extract devices, e.g. slots, at both high level and low level. The low level device shall be such that a scavenging effect across the work surface is provided.

NOTE 1 The installation of a back baffle is an effective method of providing the necessary extract air pattern. The purpose of the back baffle is to produce primary extract slots at high level and at the rear of the work surface. A secondary function is to ensure effective scavenging of a spillage tray (if fitted) usually by drawing air up from underneath the work surface via a substantial gap between the rear of the work surface and the rear wall. (See **A.3** for design criteria for back baffles.)
NOTE 2 Each primary extract device, and its position within the fume cupboard, should be such that good equalization of flow across the cupboard's complete width is ensured.

In order to ensure scavenging of the spillage tray, if fitted, the bottom edge of the lower primary extract device shall not be above the plane of the work surface. If no spillage tray is fitted, the lower edge of the extract device may be raised by not more than 15 mm to prevent spilt liquid flowing directly into the slot.

NOTE 3 It is recommended that adjustable features associated with baffles and slots are not incorporated into the primary extract devices. If adjustable features are fitted, the manufacturer's instructions should be strictly followed.

4.5 Secondary extract devices

Secondary extract devices shall not compromise the effectiveness of the two primary extract devices.

If a secondary extract device is fitted, there shall be flow equalization across its whole extent.

NOTE 1 The provision of a secondary extract device is often considered in situations where a fume cupboard is supplied and used for a specific task. They are sometimes fitted to the rear wall of or at the top of the chamber of a fume cupboard with the object of promoting good scavenging.
NOTE 2 If the vertical dimension or position of a secondary extract device can be changed or altered by the operator, it is essential that the manufacturer supply recommendations for the operator to follow. However, in practice, it is recommended that fume cupboards should not be fitted with adjustable features since correct and proper use may not occur.

4.6 Flow indicator

Some means of indicating unambiguously to the operator either that air is being extracted at a satisfactory rate, i.e. within 10 % of the value specified by the purchaser, or that there is an inadequate extract flow rate, i.e. less than 80 % of the value specified by the purchaser, shall be incorporated. The flow indicator shall be constructed in such a way as to provide a satisfactory indication only when the extract system is operational, i.e. the flow indicator shall be of the fail-safe type. Some form of audible and visual alarm shall be incorporated.

If alternative sensor locations are utilized, e.g. behind or in front of a back baffle, measures shall be taken to ensure the sensor responds to the total extract flow rather than to the extract flow rate in its immediate locality.

Provision shall be made for access to the flow sensor for cleaning and maintenance purposes.

NOTE 1 Ideally, a two state indicator should be fitted covering both normal and alarm conditions. The provision of some form of flow measuring device, in addition to the normal (or alarm) indicator is to be encouraged. However, it is not necessary to provide a separate indication of excessively high extract volume rates, although such high rates should be avoided. Any flow measuring or flow sensitive device should be sufficiently accurate.

For a fume cupboard fitted with a bypass system using sash position to control the extract volume flow rate, the flow indicator fitted by the manufacturer shall indicate the total extract flow rate.

NOTE 2 If operation of the fume cupboard is linked in any way to a mechanical direct or laboratory make-up air supply, clear indications of the correct performance of the interlinked and/or interlocked supply system should also be provided.

4.7 Work surface

4.7.1 *With spillage tray (if fitted)*

The work surface shall be flat with a raised edge at the front. Provision shall be made for spillages to pass down to, and be contained by, the tray underneath. Gaps at the side of the work surface shall be provided to allow spilt liquid to drain away rapidly.

NOTE 1 The gaps should not disturb the inward air flow over the work surface and side walls.

The spillage tray shall be fitted with a waste outlet suitable for connection to a drain or collecting trough. The anti-spill lip or hump at the front of the work surface shall not adversely affect the inward flow over the work surface.

NOTE 2 The waste outlet may be fitted to a sink incorporated into the work surface. Effective scavenging of the zone between the work surface and the spillage tray is necessary to prevent the build-up of pollutants. This scavenging is normally produced by inducing a small amount of incoming air to pass under the work surface via small gaps between the front edge of the work surface and the anti-spill lip. Air should be removed equally across the whole width of the fume cupboard. The lower primary extract devices (often formed by the lower edge of the back baffle, if fitted) should be instrumental in extracting the air not only from the upper surface of the work surface but also from the spillage tray underneath.

4.7.2 *Work surface with no spillage tray*

The work surface shall be flat with a raised edge around the periphery. It shall be fitted with a waste outlet suitable for connection to a drain or collecting trough. The anti-spill lip or hump at the front of the work surface shall not adversely affect the inward flow over the work surface.

NOTE The waste outlet may be fitted to a sink incorporated into the work surface. If sunken troughs or sinks are fitted, they should be positioned towards the rear of the work surface to reduce the risk of air (and pollutant) being drawn out of the fume cupboard by, for example, operator movement, due to the difficulty of ensuring effective scavenging. Given the additional problems of cleaning and ensuring effective scavenging of a spillage tray, a fume cupboard with only a work surface forming the base could be preferable in circumstances where spillage of relatively large quantities of liquid is either unlikely or not a significant hazard.

5 Materials of construction

5.1 Framework

If a fume cupboard structure provides a space underneath the work surface into which a storage cupboard is fitted, either:

a) the materials of construction of the framework shall be non-combustible as defined in and when tested in accordance with BS 476-4:1970;

or

b) the fume cupboard shall bear a warning notice, e.g.: "**IMPORTANT.** The space below this fume cupboard must not be used for storing flammable materials."

5.2 Materials that might come into contact with the fume

The materials of construction of those parts of the fume cupboard (excluding services) that might come into contact with the fume shall be selected from those listed in Table 1 (see note 1).

NOTE 1 The manufacturer should establish from the purchaser whether any special requirements exist that might influence the choice of materials.

NOTE 2 Where highly flammable materials are manipulated or used in the fume cupboard, not all the materials listed in Table 1 will satisfy the requirements of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (Statutory Instrument No. 917) [4] (see F 2434, the Certificate of Approval made in pursuance of these Regulations).

NOTE 3 For recommendations on the selection of materials, see BS 7258-3.

6 Services

6.1 General

With the exception of electrical supplies, the outlets to services shall be located on the inner surface of the fume cupboard.

NOTE 1 Service outlets may be positioned on the side walls of the fume cupboard and should not seriously affect the performance of the fume cupboard.

The controls for all the services shall be located on the outer surface of the fume cupboard such that each control can be unambiguously associated with its outlet and positioned in such a way as to minimize interference with air flow.

NOTE 2 The controls should be suitably colour coded (see BS 1710).

6.2 Electrical outlets

Electrical outlets shall be located on the outer surface of the fume cupboard. It shall not be possible for liquids or flammable vapours flowing over the cupboard's front outer edge (from spillages within) to come into contact with electrical outlets.

6.3 Lighting

Lights shall be capable of providing an illuminance at the work surface not less than 400 lx. Where the lights might be exposed to fumes within the fume cupboard chamber, the fittings shall be non-sparking and the surface temperature of the tube (or any enclosure for the tube) shall be below the ignition temperature of any flammable vapour that might be present in the chamber.

NOTE It is preferable that lighting, wherever possible, be located so as not to be exposed to fumes. In circumstances where this is not possible, only the tube should be exposed within the chamber. The starter, controls and switch should be externally mounted.

7 Performance

NOTE Attention is drawn to the procedure specified in BS 7258-4 and recommended for containment testing of fume cupboards.

7.1 Type test procedure

7.1.1 *General*

NOTE 1 The aim of the type testing procedure is to establish whether or not the pattern and quality of the flow of air through the particular design of fume cupboard under test complies with this British Standard with respect to safety. The procedure involves detailed velocity measurements in the plane of the sash.
NOTE 2 The type tests may be performed by the manufacturer or, alternatively, the manufacturer may arrange for a third party to perform the tests.

The type testing procedure shall be applied to one example of a production model of the fume cupboard to be tested.

The test shall be carried out on the fume cupboard installed in accordance with the manufacturer's instructions in a test room as described in **B.1**.

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

NOTE 3 In practice, with the sash set at the maximum working opening, it is unlikely that face velocities below 0.3 m/s will give satisfactory containment. In some cases, face velocities of 0.5 ms or above may be necessary.
NOTE 4 Where and when possible, measurements should be performed with no personnel present in the test room.

The door to the test room shall remain closed at all times during testing.

NOTE 5 Measures should be taken to prevent undue and excessive temperature differences between the temperature of the air in the test room and the temperature of the air in the building in the immediate vicinity of the test room.

The type test shall comprise the measurement of the air velocity using the anemometer described in **B.2.1** at a series of points in the plane of the sash as described in **B.3**.

NOTE 6 It is recommended that the entire type test procedure should be carried out at various face velocities and sash opening heights.

7.1.2 *Individual velocities at face velocity as specified by the purchaser*

7.1.2.1 *Velocity at all grid points*

When measured at the points of the grid established in accordance with **B.3**, the average velocity at any grid point shall be not less than 0.85 × the face velocity as specified by the purchaser.

7.1.2.2 *Symmetry of velocity about centreline*

When measured as described in **B.4**, the ratio of the larger of the velocities at any pair of corresponding points either side of the centreline to the smaller velocity shall be between 1.0:1 and 1.3:1.

7.1.3 *Under condition of 0.8 × face velocity used in 7.1.2*

The measurement of velocities shall be carried out as described in **B.4** at 0.8 × the extract volume flow rate specified in **7.1.1**. The grand mean of the corrected local average velocities shall be calculated and divided by 0.8. The value obtained shall differ by no more than 10 % from the grand mean of the corresponding velocities determined in **7.1** at the face velocity specified by the purchaser.

7.1.4 *Conformity with commissioning requirements*

The measurement grid specified for the commissioning test (see **C.1.2**) is a sub-set of the measurement grid for the type test (see **B.3**). In order to facilitate direct comparison with installed examples of the same type of fume cupboard, the performance criteria specified in **7.1.2** shall be applied to the sub-set of the measured data corresponding to the grid specified in **C.1.2** and the results reported.

7.2 Commissioning tests

Where the manufacturer is the same party as the installer, he shall, after the fume cupboard has been installed, either:

a) carry out commissioning tests as described in annex C; or

b) arrange for a third party to carry out the commissioning tests as described in annex C.

NOTE 1 Where the manufacturer is not the same party as the installer, these tests will be carried out by the installer or a third party (commissioned by the installer), e.g. a certification house.
NOTE 2 The purpose of the commissioning tests is to ensure that the performance of the installed fume cupboard has not fallen from the performance established by the type test procedure.
NOTE 3 In certain circumstances, the user may wish to use a less rigorous procedure to monitor routinely the performance of an installed fume cupboard. Such a procedure is given in annex D. If effective use of this procedure is to be made, it should be carried out at the commissioning stage in addition to the specified requirements. In the event of a change of performance being apparent from the routine testing using the procedure in annex D, the normal procedure in annex C should be applied together with appropriate remedial action.

Table 1 — Materials of construction

Materials	Variety	BS specification
Metals	Stainless steel	BS 1449-2:1983
	PVC[a] — coated mild steel	—
	PE[b] — coated mild steel	—
	Aluminium	BS 1470:1987
	Monel	—
	Chemical lead, type A	BS 334:1982
Glass	Toughened glass	—
Plastics	Rigid PVC	BS 3757:1978
	Polycarbonate	—
	Glass-reinforced plastics	BS 3532:1990 or BS 5734-3:1990 and BS 5734-5:1990 or BS 3953:1990
	Polypropylene	—
	Amino resins	BS 1322:1992
	Epoxide resins	BS 3815:1964 or BS 3816:1989
Finishes	Epoxide surface coatings	—
	Chlorinated rubber paints	—
Fibre reinforced cement[c]	Sheet materials	—
Ceramics, etc.	Slate	—
	Quarry tiles	—
	Glazed stoneware	—
	Vitreous tiles	—
Mastics and adhesives	Silicone rubber	—
	Epoxy resin	—
	Furfuryl resin	—

[a] Polyvinylchloride.
[b] Polyethylene.
[c] Asbestos cement was previously used extensively but it is not now recommended. Substitutes for asbestos cement with equivalent chemical and fire-resistant properties are now commonly available.

8 Type test report

If the fume cupboard has been found to comply with the type test (see **7.1**), the manufacturer shall provide the purchaser with a test report.

If the type test has been performed by a third party (see note 2 to **7.1.1**), the manufacturer shall obtain the test report from that third party for supplying to the purchaser.

The test report shall include the following:

a) the make or model of the fume cupboard, and its serial number;

b) the name or trade mark of the manufacturer;

c) the name and address of the organization carrying out the test;

d) the date of the test;

e) a reference to this British Standard, i.e. BS 7258-1:1994;

f) the normal sash working height;

g) the results of the velocity surveys;

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

i) any other test results;

j) information on limitations of use and, if relevant, on materials of construction.

9 Certificate of compliance with type test

When a fume cupboard has been tested, the manufacturer shall issue a certificate to certify that the fume cupboard has been type tested in accordance with **7.1** of BS 7258-1:1994 and that it complied with the requirements therein.

The certificate shall be dated and carry a reference number and shall identify clearly the type and make of the fume cupboard concerned.

NOTE In cases where the manufacturer is not supplying the fume cupboard directly to the purchaser, a copy of this certificate should be supplied to the purchaser by the supplier or vendor.

Annex A (informative) Design criteria

A.1 General

The individual design features representing entry profiles, shape factors, positioning and effectiveness of primary extract slots, flow rates, etc., will determine the maximum level of performance which a particular fume cupboard can achieve. There are, however, other considerations such as laboratory make-up air supply and siting arrangements which have to be adequately addressed if the performance in practice of the fume cupboard is not to be impaired when installed in its intended environment. (See **3.1** and **3.3** of BS 7258-2:1994.)

NOTE The objective of this annex is to set out some of the design features considered necessary to promote the preferred patterns of flow. It is not intended to cover every aspect of the design and construction of a fume cupboard.

A.2 Extract volume flow rate and face velocity

The face velocity of a fume cupboard is often regarded as the most important parameter for assessing its performance and has been traditionally used both for selecting new equipment and for assessing suitability from a health and safety aspect in particular installations.

Determination of face velocity over some form of grid in the plane of the sash gives a good indication of the air flow into a fume cupboard. Factors that have an influence on face velocity include the internal aerodynamic design of the fume cupboard and its internal loading, room air movement and operator movement. All these factors could affect the protection provided to the operator.

A.3 Back baffle

There are certain features that should be incorporated in the design of a back baffle. The vertical dimensions of the two primary extract slots formed by the back baffle, while not required to be equal, should not be significantly different. It is recommended that the cross-sectional area for flow behind the back baffle be as uniform as possible across the width of the back baffle. The back baffle should be constructed in such a way as to readily facilitate periodic cleaning. The back baffle and associated mounting system should be of robust construction in order that, in normal use, the performance of the fume cupboard is not compromised by damaged or poorly fitting components. A fume cupboard should not be used with a partially displaced or damaged back baffle.

Annex B (normative) Performance type testing

B.1 Test room

B.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 building or laboratory.

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, partitions, etc.

B.1.2 *Air input and outlets*

Air shall be supplied to the wall directly opposite that against which the fume cupboard for test is to be installed.

NOTE The air should be supplied in as uniform a manner as possible. One suitable method for introduction of 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 perforated panels should be between 50 % and 70 % of the gross open area.

Extract fans and any associated flow 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.

B.1.3 *Location of flow measuring devices*

The supply volume flow rate shall be measured after the supply fan and damper.

B.1.4 *Measurement of volume flow rate*

Measure the extract volume flow rate using a venturi nozzle, orifice plate or pitot-static tube as detailed in clauses **20, 22** and **23**, respectively, of BS 848-1:1980.

B.2 Apparatus for measuring local average air velocities

B.2.1 *Anemometer*

The anemometer shall be of an omni-directional type capable of measuring air velocities between 0.1 m/s and 2.0 m/s. The response time of the sensor shall be not more than 2.0 s. The accuracy of an individual reading shall be better than 15 % at air velocities between 0.2 m/s and 1.5 m/s.

NOTE The anemometer is intended for measurement of low air velocities in situations in which the flow direction is not necessarily known. Appropriate anemometers will be those suitable for measurements associated with indoor climate and comfort conditions. Typically such anemometers employ a spherical sensor of diameter between 2 mm and 5 mm.

For type testing of fume cupboards, calibrate the anemometer before and after use in a wind tunnel or equivalent device, preferably with a calibration traceable to a national standard.

B.2.2 *Equipment for transporting the anemometer*

No specific equipment is specified but any mounting system used should be such as to minimize disruption of the inward air flow. It should be capable of transporting the anemometer to each point of the measurement grid (see **B.3**), and of adjusting the anemometer's orientation.

B.3 Measurement grid

NOTE The measurement grid is based on a rectangular area in the plane of the sash with the sash set to normal maximum sash height.

B.3.1 *Horizontal boundaries*

Take as the upper horizontal boundary a line 50 mm below the upper edge of the opening. For solid sash handles the upper edge is the lower surface of the handle. If an airfoil type of sash handle is used, the upper edge is the lower surface of the airfoil.

Take as the lower horizontal boundary the line 50 mm above the lower edge of the opening. If a lipfoil is fitted, take as the lower edge the upper surface of the lipfoil.

B.3.2 *Vertical boundaries*

Take as the vertical boundaries lines 50 mm from the sides of the opening or the innermost edge of any guidelines or raised guide rails if wider than 15 min.

B.3.3 *Grid points*

Over the whole of the rectangular area defined by the horizontal (see **B.3.1**) and vertical (see **B.3.2**) boundaries establish the following:

a) a series of equally spaced points in the horizontal direction with the two outermost points on the vertical boundaries. The points shall be a distance of 150 mm apart or less;

b) a series of five equally spaced points in the vertical direction with the lowest on the lower horizontal boundary and the highest on the upper horizontal boundary.

See Figure B.1 a).

B.4 Measurements

Using the equipment detailed in **B.2** take 12 measurements of the air velocity at 2 s intervals at each grid point (see **B.3.3**).

Calculate the average velocity at each grid point from the data obtained. Correct the mean value so obtained for calibration of the anemometer.

NOTE It is anticipated that the orientation of the anemometer and any mounting system (see **B.2.2**) may have to be changed to enable all points to be surveyed.

B.5 Flow indicator performance

Carry out tests as necessary to ensure that the flow indicator meets the requirements of **4.6**.

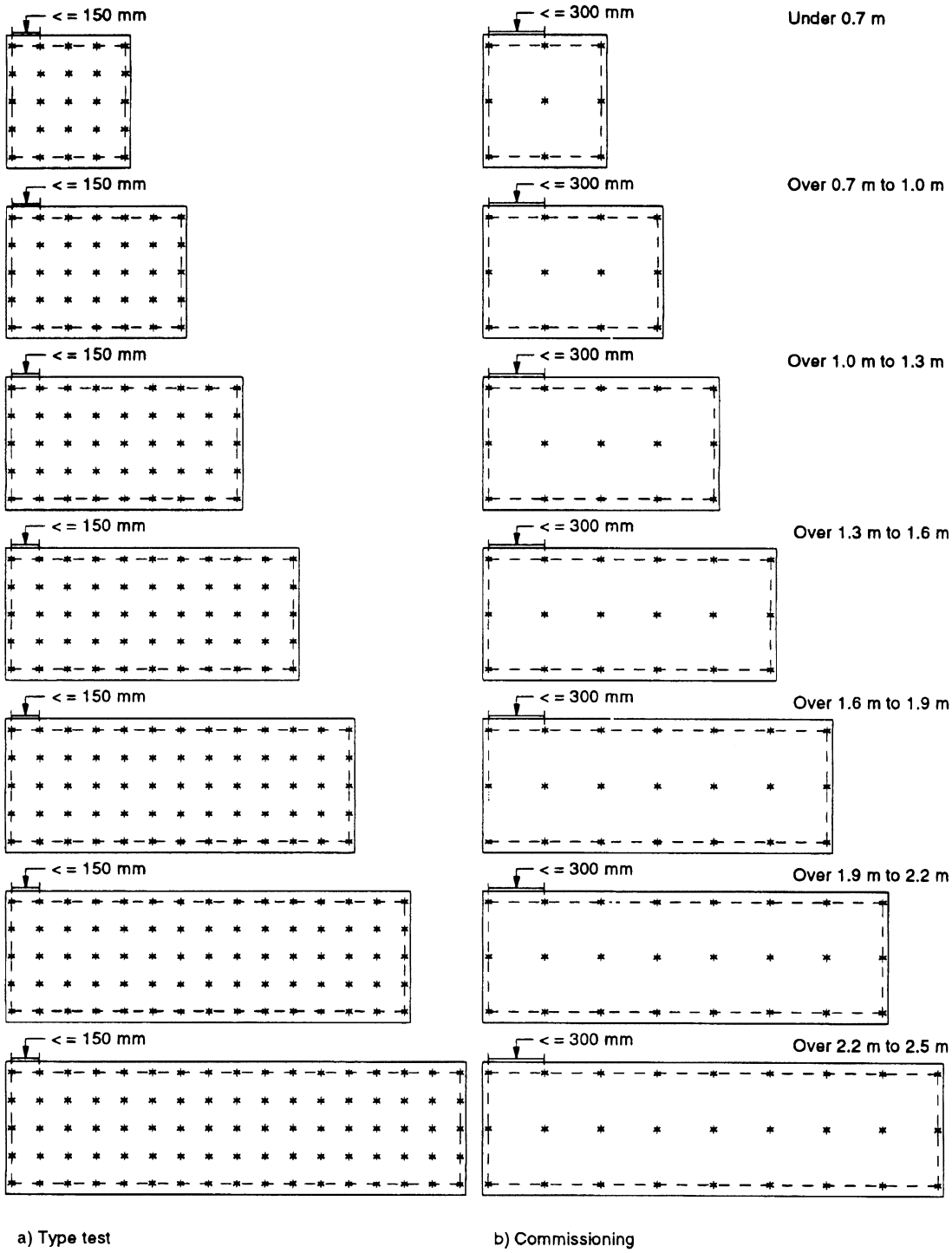


Figure B.1 — Permitted grid point separations

Annex C (normative) Commissioning tests

NOTE It is essential that whichever party is responsible for installing the fume cupboard perform the commissioning tests (where appropriate) by following the procedures described in this annex.

C.1 Measurement of local average face velocities

C.1.1 *Apparatus*

The apparatus shall be as given in **B.2**.

C.1.2 *Measurement grid*

NOTE The measurement grid is based on a rectangular area in the plane of the sash with the sash set to normal maximum sash height.

Over the whole of the rectangular area defined by the horizontal (see **B.3.1**) and vertical (see **B.3.2**) boundaries establish the following:

a) a series of equally spaced points in the horizontal direction with the two outermost points on the vertical boundaries. The points shall be a distance of 300 mm apart or less;

b) a series of three equally spaced points in the vertical direction with the lowest on the lower horizontal boundary and the highest on the upper horizontal boundary.

See Figure B.1 b).

C.1.3 *Measurements*

Using the equipment detailed in **B.2**, take 12 measurements of the air velocity at 2 s intervals at each grid point (see **C.1.2**).

Calculate the average velocity at each grid point from the data obtained. Correct the mean value so obtained for calibration of the anemometer.

NOTE It is anticipated that the orientation of the anemometer and any mounting system (see **B.2.2**) may have to be changed to enable all points to be surveyed.

The average measured velocity at any grid point shall be greater than 0.8 × the face velocity as specified by the purchaser.

C.2 Sound-pressure levels

Where sound-pressure levels have been specified by the purchaser, they shall be measured using a sound level meter complying with BS 5969:1981 or BS 6698:1986 at the following points.

a) For the measurement of the noise emitted by the fume cupboard the microphone shall be positioned at a distance of 300 mm from the face of the fume cupboard and at a height of 1 500 mm from the floor. With the extract and direct and laboratory make-up air systems in operation the sash opening and air flow rate shall be varied to establish the combination given the maximum sound-pressure reading.

b) The noise emitted by the extract and direct and laboratory make-up air systems in any room through which the ductwork passes or terminates shall be measured at the centre of each room with the microphone positioned at a height of 1 800 mm above the floor.

The sound-pressure levels determined in accordance with a) and b) shall be corrected for background noise by measurement of the sound-pressure levels at the positions given in a) and b) with the extract and direct and laboratory make-up air systems switched off in accordance with BS 4773-2:1989 and BS 4856-5:1979.

C.3 Other commissioning tests

Tests shall be carried out to ensure that the flow indicator meets the requirements of **4.6**.

Other tests shall be carried out, as appropriate, to determine compliance with any other requirements specified by the purchaser, e.g. a containment test.

NOTE 1 Recommendations concerning commissioning are given in BS 7258-2.

NOTE 2 A procedure recommended for carrying out a containment test is described in BS 7258-4.

C.4 Commissioning test report

On completion of the commissioning test(s), the organization carrying out the test(s) (see **7.2**) shall provide a test report which shall include the following:

a) a statement that the measured velocities in the plane of the sash comply with **C.1.3** of BS 7258-1:1994;

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

c) the results of any other tests commissioned by the purchaser, e.g. sound-pressure levels, containment;

d) the date of the test;

e) the name and address of the organization carrying out the test(s).

Annex D (informative) Method for determining average face velocity with reduced accuracy for routine maintenance purposes

D.1 Principle

The face velocity is measured over specified areas of the maximum working aperture and a mean velocity calculated for each area. The mean of these area values is reported as the average face velocity.

D.2 Apparatus

D.2.1 *Anemometer* with vane diameter not less than 60 mm and not exceeding 100 mm, together with a table or graph of calibration, preferably one certified by an accredited test laboratory.

NOTE The anemometer should be calibrated at regular intervals.

D.2.2 *Stop watch*

D.2.3 *Lengths of rod or wire,* not exceeding 12 mm in diameter, for holding or fixing the anemometer at the positions described in **D.3.1**.

D.2.4 *Framework,* consisting of lengths of wood and cotton thread, which may be found useful for determining the test positions at which the anemometer is held or fixed.

D.3 Procedure

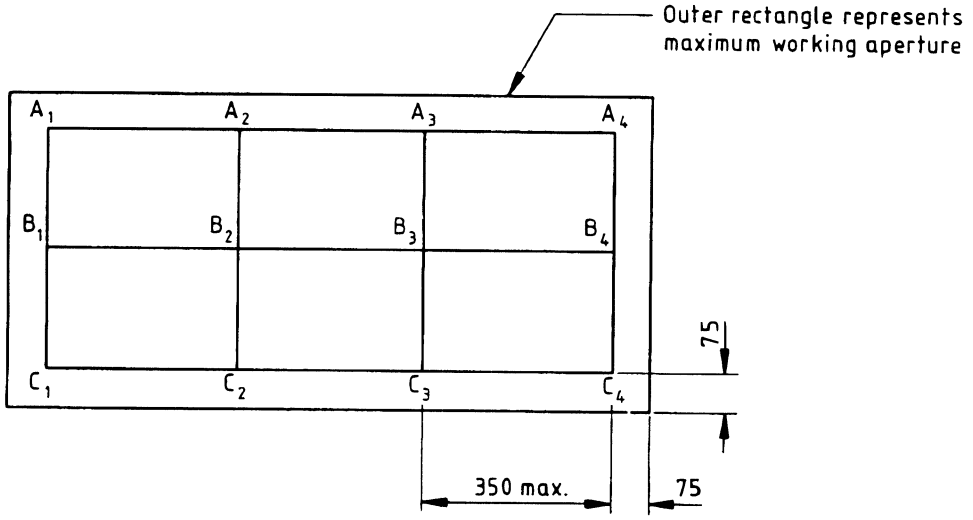
D.3.1 Set the sash at its normal sash working height (see **3.14**). Determine the dimensions of a peripheral rectangle $A_1A_n + {}_1C_n + {}_1C_1$ (see Figure D.1) so constructed that the sides lie in the plane of the sash and 75 mm distant from the sides of the aperture. Divide the height of the peripheral rectangle by two, and the width of the peripheral rectangle by a whole number n, such that the width of each of the $2n$ cells so formed does not exceed 350 mm. The corners of the cells define $3(n + 1)$ grid positions at which the anemometer (**D.2.1**) is held or fixed.

D.3.2 Ensure that the fume cupboard is empty. Remove from the immediate vicinity all equipment not involved in the test.

D.3.3 Using no more than one person, fix or hold the anemometer at position A_1, in such a way that the disturbance to the air flow in the aperture is minimized. If the anemometer is held by a support of rods or wires (**D.2.3**), which is in turn held by the operator, he should stand well away from the plane of the sash. Ensure that the air flow through the anemometer is in the direction for which it was calibrated.

Using the stop watch (**D.2.2**), take three readings over a period of 30 s such that they are taken at approximately 15 s intervals and enter those in the first column of a table of a suitable format (see Figure D.2). Move the anemometer to position A_2 and take three further readings. Repeat at all positions up to and including A_{n+1}, then rows B and C. Determine the arithmetic means at the $3(n + 1)$ test positions, and correct them if necessary using the calibration of the anemometer.

Determine the arithmetic mean of the $3(n + 1)$ corrected position means and report this (grand) mean as the average face velocity.



All dimensions are in millimetres.

Figure D.1 — Grid positions over the maximum working aperture for air velocity measurements taken at corners of each cell: example if n = 3 (see **D.3.1**)

Reading number[1]	**Air velocity, m/s**												
	Row A				**Row B**				**Row C**				
	Column				**Column**				**Column**				
	1	2	3	4	1	2	3	4	1	2	3	4	
1													
2													
3													
Position mean													
Corrected position mean $\bar{x}^2$													Grand mean $\bar{x}$

[1] Three readings over 30 s periods at approximately 15 s intervals.

[2] This method of recording corrected position means is useful for diagnostic purposes.

Figure D.2 — Method of recording and averaging anemometer readings

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List of references

Normative references

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BS 476, *Fire tests on building materials and structures.*
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BS 848, *Fans for general purposes.*
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BS 4773, *Methods for testing and rating air terminal devices for air distribution systems.*
BS 4773-2:1989, *Acoustic testing.*
BS 4856, *Methods for testing and rating fan coil units, unit heaters and unit coolers.*
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BS 6698:1986, *Specification for integrating-averaging sound level meters.*

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BS 1710:1984, *Specification for identification of pipelines and services.*
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.*
BS 7258-4:1994, *Method for determination of the containment value of a laboratory fume cupboard.*

Other references

[1] Design Note 29 Fume cupboards in schools 1982[1)].

[2] Great Britain Control of Substances Hazardous to Health Regulations (COSHH) 1988 (Statutory Instrument No. 1657) as amended by Statutory Instrument No. 2026 (1990), Statutory Instrument No. 2431 (1991) and Statutory Instrument No. 2382 (1992). London: HMSO.

[3] Great Britain Ionizing Radiations Regulations 1985 (Statutory Instrument No. 1333). London: HMSO.

[4] Great Britain Highly Flammable Liquids and Liquified petroleum Gases Regulations 1972 (Statutory Instrument No. 917) as amended by Statutory Instrument No. 1244 (1984). London: HMSO.

[5] Great Britain Electricity at Work Regulations 1989 (Statutory Instrument No. 635). London: HMSO.

[1)] Referred to in the foreword only and available from Department of Education and Science, Elizabeth House, York Road, London SE1 7PH.

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