BRITISH STANDARD

BS 7258-2:
1994

Laboratory fume cupboards —

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

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. It supersedes BS 7258-2:1990, which is withdrawn.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.

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.*

IMPORTANT NOTE It is essential that this Part be read in conjunction with BS 7258-1.

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 ii, pages 1 to 14, 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.

Section 1. General

Introduction

The recommendations given in section **2** of this Part of BS 7258 apply to contracts for the supply and installation of laboratory fume cupboards, and these recommendations include items embodied in BS 7258-1. It is therefore essential that the recommendations given in section **2** of this Part be followed in order for the purchaser's requirements to be satisfied.

1.1 Scope

This Part of BS 7258 gives recommendations for the minimum information to be exchanged between the parties to contracts for the supply and/or installation of general purpose laboratory fume cupboards as specified in BS 7258-1. It also gives recommendations for installation, including siting and provision for extract systems and laboratory make-up systems.

1.2 References

1.2.1 Normative reference

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 page. 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.

1.2.2 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.

1.3 Definitions

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

Section 2. Exchange of information

2.1 General

It is strongly recommended that, for laboratory fume cupboards complying with BS 7258-1, the information given in **2.2**, **2.3** and **2.4** of this Part should be exchanged by the purchaser and the vendor/installer.

2.2 Information to be obtained from the purchaser by the vendor/installer

NOTE For the purposes of this British Standard, it is assumed in this clause that the vendor is the same party as the installer. If this is not the case both parties should obtain the information listed in items a) to g) but it is necessary only for the installer to obtain the information listed in items h) to n).

The following information should be obtained from the purchaser by the vendor/installer:

a) the material of construction for any part of the fume cupboard that will be affected by fumes emanating from the processes for which the fume cupboard will be used (see **5.2** of BS 7258-1:1994);

b) any specific requirements such as minimum flow rate which transpire from consideration by the purchaser of the guidance given in BS 7258-3:1994;

c) the minimum dimensions of the work surface;

d) the normal sash working height, the maintenance sash height, and the width of the opening in the plane of the sash;

e) the services to be fitted;

f) the maximum external dimensions of the fume cupboard, and its dismantled components if appropriate, and the dimensions available for access into the building and internal access to where the fume cupboard is to be installed;

g) whether the fume cupboard is to be used for manipulation of highly flammable liquids;

h) the following details of the siting of the fume cupboard:

1) general details of the building in which the fume cupboard is to be installed, the location of the laboratory and the intended siting of the fume cupboard(s) within the laboratory;

2) the locations of doors, windows, other fume cupboards, other laboratory furniture, ventilation grilles, diffusers, or other air moving equipment;

3) the absence of any features listed in item 2);

i) general details of the intended method of supplying laboratory make-up air and of the room ventilation existing or to be provided;

j) the environment requirements of the laboratory including:

1) requirements for the room in which the fume cupboard is to be installed (see **3.3.3**, **3.3.4** and **3.3.8**) including maximum sound-pressure levels in dB(A);

2) requirements, e.g. noise levels, for other rooms in the building;

3) requirements under the Environmental Protection Act, 1990 [1] for emission exterior to the building (see **3.2.4**);

k) the accommodation spaces, routes available and any specific design requirements of the fume extract system, including the range of working temperatures and the fittings to be provided, such as flow control devices, alarms and indicators, condensate collectors, and duct washing facilities;

l) the locations and details of any existing mechanical, electrical, plumbing and drainage services to be utilized in connection with the complete fume cupboard installation;

m) the following details of the fume cupboard:

1) the required air extract volume flow rates, corresponding face velocity(ies) and pressure drops across the fume cupboard(s);

2) whether a facility to vary the set extract volume flow rate is required and, if so, the range that is required;

3) whether the fume cupboard extract system is to be for continuous or intermittent use;

n) the commissioning tests to be undertaken by the installer. (See **7.2** of BS 7258-1:1994).

2.3 Further exchange of information before installation

NOTE For the purposes of this British Standard, it is assumed in this clause that the vendor is the same party as the installer. If this is the case, the information listed should be supplied to the purchaser by the vendor/installer. If this is not the case, the vendor should supply the information listed to the purchaser, and the installer should obtain the information listed from the purchaser (who will have received it from the vendor).

The following information should be exchanged before the fume cupboard is installed (see note):

a) dimensioned drawings of the fume cupboard (including maximum sash opening for access and normal maximum working sash opening corresponding to the sash positions at the maintenance sash height and the normal maximum sash height respectively);

b) an identification of all materials of construction;

c) fume cupboard type and serial number;

d) all the information reported on successful completion of the type test procedure as specified in BS 7258-1;

e) operating and maintenance instructions for all the equipment provided, including the pressure loss characteristics of the fume cupboard;

f) any specific limitations on use.

2.4 Information to be supplied to the purchaser upon installation

The following information should be supplied to the purchaser upon installation of the fume cupboard:

a) drawings showing the complete final installation provided;

b) an identification of the materials of construction of the extract system;

c) the results of the commissioning tests undertaken by the installer, and any proposed amendments to the purchaser's requirements (see **3.4.2**);

d) operating and maintenance instructions for the extract system and for any laboratory make-up air systems provided by the installer.

2.5 Marking

After installation, the fume cupboard should bear a plate in a permanently exposed position on which the following is clearly and indelibly marked by the installer:

a) the installer's name or readily identifiable mark (if different from that of the vendor);

b) the vendor's name or readily identifiable mark;

c) the date and reference number of the certificate of compliance specified in clause **9** of BS 7258-1:1994;

d) the face velocity(ies) specified by the purchaser and used in the text, and the extract volume rate;

e) the date of the tests when the face velocity(ies) were measured;

f) limitations of use;

g) serial number.

Section 3. Installation

3.1 Siting

3.1.1 General

The siting of the fume cupboards should comply with the purchaser's requirements for containment, fume extraction and dispersal, laboratory make-up air, ventilation and general environmental safety and comfort. The recommendations for siting given in **3.1.2** and **3.1.3** are only intended to act as a guide to the avoidance of disturbances to the fume cupboard, its operator and other personnel and to the avoidance of interference with escape routes, etc. No specific dimension or planning arrangement can guarantee satisfactory performance.

NOTE The siting of fume cupboards in laboratories should ideally be considered at the initial stages in the planning of a new building, or before modification of an existing building. However, these recommendations are appropriate in cases when additional fume cupboards are required in an existing laboratory.

3.1.2 Avoiding disturbances to the fume cupboard and its operator

3.1.2.1 The distance from the sash to any circulation space should be at least 1 000 mm, so as to preserve a zone undisturbed by anyone other than the operator (see Figure 1 a).

3.1.2.2 The distance between the sash and a bench top opposite it and used by the same operator should be at least 1 500 mm (see Figure 1 b).

NOTE With more than one operator this distance may need to be greater.

3.1.2.3 There should be no opposing wall (or other obstruction likely to affect the air flow) within 2 000 mm of the sash (see Figure 1 c).

3.1.2.4 No fume cupboard should be installed in a position where it is likely to be affected by another item of equipment. In particular, the distance from the sash to the sash of an opposing fume cupboard, to the face of an open fronted safety cabinet, or to the edge of a hood, should be not less than 3 000 mm (see Figure 1 d).

3.1.2.5 Any room air supply diffuser should be not within 1 500 mm of the sash.

NOTE It is recognized that where the relative density of fume cupboards in a space is high, this recommendation is difficult to comply with; where it is unavoidable that diffusers have to be placed in close proximity to the fume cupboard, their discharge velocities and therefore air handling rates will necessarily need to be low.

3.1.2.6 No fume cupboard should be positioned with either side closer than 300 mm from a wall or similar obstruction (see Figure 1 e).

3.1.2.7 No large obstruction, e.g. an architectural column, projecting beyond the plane of the sash should be within 300 mm of the side of the fume cupboard (see Figure 1 f and Figure 1 g).

3.1.2.8 No doorway should be within 1 500 mm of the sash or within 1 000 mm of the side of a fume cupboard (see Figure 1 h and Figure 1 i) except where a door includes air transfer grilles.

3.1.3 Avoiding disturbances to other personnel, interference with escape routes, etc.

3.1.3.1 The position of a fume cupboard should satisfy the spatial requirements, e.g. vision, lighting and convenience of access, of the operator and personnel working nearby. (Typical problems and their solutions are illustrated in Figure 2 a to Figure 2 g and Figure 3 a to Figure 3 e.)

3.1.3.2 The possibility of a fire or explosion that may not be contained by a fume cupboard should always be considered. A fume cupboard should not be sited in a position where exit from a work space to the only escape route will necessitate passing directly in front of the fume cupboard (see Figure 3 b).

3.2 Fume extract systems

3.2.1 General

3.2.1.1 The primary function of the fume extract system is to safely contain and convey potentially dangerous or obnoxious fumes from the fume cupboard to an outside discharge point from which they can be adequately dispersed at an acceptably low concentration.

3.2.1.2 The extract system comprises a connection or connections to each fume cupboard, the ductwork, a fan or fans and a discharge flue or multi-flue stack. It may, as appropriate, also include equipment for regulating and indicating the extract rate, preventing reverse flow, preventing spread of fire and smoke, fume filtration, fume scrubbing, heat recovery, condensate collection, washdown and drainage. A satisfactory installation can be achieved only if all the requirements of these interrelated aspects are met.

3.2.1.3 The extract system (together with the arrangements for laboratory make-up air) should be so designed as to minimize the sensitivity of the fume cupboard to the effects of outdoor wind and other sources of air disturbance.

The discharge flue should be sited with due regard to the flow pattern of air around the building and should be sufficiently high to minimize the risk of fumes being drawn into buildings through open windows or air intake grilles (see **3.2.4.1**).

3.2.1.4 When in use, the extract system within the building should be at negative pressure. Fans should be mounted at roof level with their outlets connected to the discharge flues and their inlets connected to the ductwork. If a fan and its associated equipment cannot be accommodated on the roof, it should be installed at ground level, or on an easily accessible platform and the connections arranged such that, in use, a negative pressure is still maintained in all ductwork within the building. If ductwork is unavoidably under positive pressure it is essential that it is so arranged that if a leak does occur it cannot create a hazard.

3.2.1.5 The design of the ductwork (and its resulting resistance to the passage of air) and the fan should be such as to satisfy the maximum air flow requirement at operating temperatures for all fume cupboards served by the system. Fan capacities should exceed the operating requirements by at least 10 %.

NOTE Where highly toxic materials are handled, automatic changeover to a standby fan may be desirable.

3.2.1.6 Extract systems should incorporate an air flow control device for each fume cupboard served. If the control device is mounted in an easily accessible position it may be necessary to incorporate a locking arrangement to prevent unauthorized interference.

3.2.1.7 It is often the case that not all the fume cupboards in a building are in use at any one time, and economies in running costs can be achieved by providing independent extract systems for groups of fume cupboards. Flues beyond the extract fans may be grouped and encased in multi-flue discharge stacks but usually at the expense of longer and more complicated flue runs and higher discharge stacks.

In order to prevent mixing of fumes that could give rise to unacceptable hazards such as risk of fire or explosion, fume cupboards should be grouped according to the processes to be undertaken. However, the connection of more than one fume cupboard to an extract fan involves the provision of larger and usually more complicated ductwork with an increased maintenance liability. The need for a standby fan and additional controls and indicators should be considered.

A collection/dilution system may be used for the dispersal of fumes from a number of individual extract systems or from common extract systems. The collection/dilution duct, discharge fan and common discharge flue should have a capacity (after allowing for the frequency of fume cupboard use) in excess of the total capacity of the extract fans connected to the duct, this excess depending on the quantity of air needed to be drawn in at the open end of the duct in order to restore the concentration of fumes in the common sections of the system to an acceptable working level. With this arrangement also, the need for a standby fan and additional safety controls and indicator should be considered (see also **3.2.4.3**).

3.2.2 Ductwork

3.2.2.1 Ductwork should have a smooth, obstruction-free interior and should be circular in cross-section.

NOTE For recommendations regarding services accommodation ducts see BS 5588-9 and BS 8313.

3.2.2.2 The cross section of the ductwork and the routeing of the ducts within the building should be such that the noise level is within the environmental requirements of the laboratory (see item j) of **2.2**). Air velocities within the ducts should not exceed 7.5 m/s and where the noise level requirement is low, the air velocity should not exceed:

a) 5.0 m/s for single unit systems and branches to fume cupboards on multiple unit systems;

b) 5.5 m/s for main ducts within buildings;

c) 6.0 m/s for external ducts.

Air velocities exceeding 6.0 m/s may be necessary for fume cupboards intended for handling large quantities of aerosol or dust, in order to minimize the accumulation of deposits at bends and joints. In these cases, specialist advice should be obtained.

3.2.2.3 Ductwork should follow the most direct route from fume cupboard to fan. Bends should be kept to a minimum number and have the largest radii practicable. There should be a minimum of horizontal runs and where such runs are unavoidable, they should have an in-built slope towards a drainage point. Drainage points should be provided at all low points of the extract system.

3.2.2.4 The materials of construction for the ductwork should be chosen to give the best resistance to the chemical and physical conditions to which they will be subjected, and which cost and practicability will allow.

NOTE 1 No material is completely resistant to all forms of chemical attack.

Materials should be selected from the following.

a) *Rigid polyvinylchloride (PVC).* This is the most widely used material where service temperatures up to 60 °C are envisaged. It should have been tested in accordance with BS 2782-1: Method 140E and should comply with flame spread classification class 1 of BS 476-7. The material may be reinforced externally by the application of glass fibre/resin laminate [glass-reinforced plastics materials (GRP)] to impart additional structural strength and to increase useful temperature range.

NOTE 2 The material is available as extruded circular tube with a range of preformed fittings for sizes up to 800 mm diameter, as flat sheet (which may have longitudinal seams fusion welded by machine process) for fabricated ductwork, and as rod and stock.

b) *Polypropylene.* Polypropylene may be useful where service temperatures up to 90 °C are envisaged or where organic solvents in condensate form may be present. Fabrication techniques are similar to those for rigid PVC. The material burns readily when ignited by flame and drips as it burns, but is available with a glass fabric backing that allows external application of glass fibre/resin laminate (GRP), which, in certain formulations, provides similar or superior fire retardation to rigid PVC.

NOTE 3 The material is available in extruded circular tube in small sizes and as flat sheet for fabricated ductwork.

c) *Moulded glass fibre / resin laminate (GRP).* GRP may be used for fume extract systems where a duct of high structural strength is required. Variation of the resin/glass ratio and the type of resin used leads to a very wide choice of properties. Generally, resin-rich formulations produce the best chemical resistance and a high glass fibre content produces greater strength.

NOTE 4 The high cost of moulds required for different shapes or sizes and the mainly hand processes involved in producing the ductwork makes the system very expensive.

NOTE 5 Joints may be difficult to seal under site conditions. Consistent quality of fabrication is difficult to achieve and faults may not show for some time after installation. Fire test and chemical resistance tests carried out on laboratory samples may not be consistent with tests on samples of installed ductwork.

d) *Stainless steel and coated mild steel.* Stainless steel and coated mild steel are used when very high air temperatures are envisaged; these materials give some degree of fire protection.

NOTE 6 Certain commonly used acids will attack stainless steel quite readily. Coatings can be easily damaged during installation or subsequent cleaning and this will quickly lead to chemical attack of the exposed metal. Seams may be welded and sealed joints made via flanges with gaskets. However, it is at the joints that leakage frequently occurs.

3.2.2.5 The ductwork should accommodate thermal expansion and contraction. It should be leak-proof and gaskets, where fitted, should be resistant to fume and condensate. Ductwork of circular cross-section up to 500 mm diameter, or rectangular ducts up to 400 mm on the longer side, may be jointed by socket and spigot. Large round and rectangular ducts should either be joined by flanged joints or be sufficiently rigid to be satisfactorily joined by socket and spigot joints. To ensure satisfactory stiffness of socket and spigot joints, reinforcement of the ducts adjacent to joints is necessary.

3.2.2.6 No ductwork should violate the fire compartmentation of the building in passing between the fume cupboard and its final discharge point. Fire dampers should be avoided and adequate fire protection provided by means of suitable treatment of the ductwork, or by enclosure of the duct within a compartmented accommodation duct, or by running the ductwork outside the building. Where fire dampers cannot be avoided they should be of suitable corrosion and fume-resistant design and they should have the damper blade clear of the air flow. They should be accessible for maintenance and replacement.

NOTE Installers should take note of the requirements of the Building Regulations: 1991 Part B Approved Document [2] (and any subsequent legislation) regarding the effect of the installation on the compartmentation of the building and on the provision of firestops. They should also take note of Regulation 10(7) of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (Statutory Instrument No. 917) [3] on ductwork intended to be a fire-resisting structure. The corresponding parts of the Building Standards (Scotland) Regulations, 1990 [Statutory Instrument No. 2179 (S.187)] [4], and the corresponding part of the Building Regulations (Northern Ireland), 1990 [5] (Statutory Instrument No. 59) are also relevant.

3.2.2.7 Leak-proof inspection covers should be provided as necessary to permit inspection and cleaning of the entire internal surface of the system; the ductwork should be suitably labelled at these points to indicate the nature of the hazard.

3.2.3 Fans

3.2.3.1 Fans should be selected so that their performance is near to the point of maximum efficiency on the fan characteristic curve (see clause **15** of BS 848-1:1980). For quiet operation, the outlet velocities should be between 5.5 m/s and 7.5 m/s with impeller tip speeds within the range 10.0 m/s to 15.0 m/s. Appropriately selected fans of the backward curved centrifugal type should be considered as a first choice as they are generally more efficient and generate less noise than others. They are also able to operate over a wide range of air flow without instability. Where particular performance requirements and other extract system design constraints, e.g cost and space, preclude the use of such fans as a first choice, other types should be carefully considered.

3.2.3.2 Fans may be either directly coupled or belt driven.

NOTE Belt driven fans give greater flexibility of fan performance.

3.2.3.3 All parts of the fan likely to come into contact with the fume or condensate should be resistant to them and should be able to withstand the maximum expected temperature.

3.2.3.4 The fan motor should be situated outside the air stream and should be suitably protected to ensure that sparks cannot be transmitted to the fume. If the motor is in a potentially explosive area it should comply with the requirements for that area (see BS 5345).

NOTE Attention is drawn to Regulation 10(8) of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (Statutory Instrument No. 917) [3].

3.2.3.5 A permanently plumbed-in drain should be connected to the lowest point of the fan casing to permit the disposal of condensate and liquids used for cleaning the extract system.

3.2.3.6 The construction and installation of the fan should permit access for cleaning all parts of the fan, especially those in contact with fumes.

3.2.4 Fume discharge to atmosphere

3.2.4.1 Because the vertical height of the aerodynamic wake of a building extends, typically, to about 125 % of the building height above ground, the point of discharge to atmosphere, even for small discharges, should normally be above this height. However, effluent dispersion patterns can be affected considerably by the building shape and by the presence of other nearby large buildings and topographical features. Where this is likely to be the case, special advice should be sought. The required height of the point of discharge is therefore peculiar to each project, but for an isolated rectangular building of low plan ratio in flat open territory, a height above ground of 1.25 multiplied by the highest point of the building, or 3 m above the highest point, whichever is the greater, will normally be adequate for an isolated vertical flue with plain opening. In more complex circumstances, it may be obvious that a higher point of discharge is needed. In some cases, wind tunnel smoke tests carried out on a model of the building and its surroundings may be necessary in order to arrive at the lowest safe height (but see note 1 to **3.2.4.4**).

3.2.4.2 High discharge velocities will ensure that the discharge will not be trapped in the aerodynamic wake of the stack itself, thereby utilizing the full height of the stack. Discharge velocities should not normally be less than 7 m/s and a design figure of 10 m/s is preferable. Higher discharge velocities are sometimes employed, especially in windy locations, but they may cause a noise problem (see note 2 to **3.2.4.4**).

3.2.4.3 Dilution of the effluent in the discharge flue or stack has no effect on perceived concentrations of the effluent in the atmosphere at any distance from the source and is not normally an adequate solution to pollution problems. Open ended collection-dilution ducts for multiple fume extract systems may be resorted to, however, as a means of reducing the number of discharge points where this is necessary and for achieving safe conditions within common extract systems (see **3.2.1.7**).

3.2.4.4 Effluent treatment before discharge may be advantageous in some cases. However, the various effluent treatment methods commercially available, e.g. wet scrubbing, filtering or incineration, tend to be effective for quite specific ranges of materials and no universal treatment can be recommended. Specialist advice should be sought if a specific form of treatment is considered. It should also be remembered that all treatment systems leave some residual effluent, and safe discharge of this to the atmosphere is still required (see note 3).

NOTE 1 Attention is drawn to the Planning and Compensation Act 1991 [6], the Town and Country Planning General Development Order, 1988 [7] and the corresponding Acts and Orders for Scotland and Northern Ireland regarding the erection of tall chimneys.

NOTE 2 Attention is drawn to the Environmental Protection Act, 1974-3 regarding the noise emitted at the nozzle, and the Control of Noise (Measurements and Registers) Regulations, 1976 (S.I. No. 37) [8]. See also BS 4142.

NOTE 3 Attention is drawn to the Environmental Protection Act, 1990, [1] the Clean Air Act, 1993 [9] and Section 3 of the Health and Safety at Work, etc. Act, 1974 [10] regarding discharges of polluted air into the outside air, and the Radiating Substances Act, 1993 [11].

3.3 Laboratory make-up air systems

3.3.1 A fume cupboard should not be installed without first considering the provision of the laboratory make-up air system necessary to replace all of the air entering the fume cupboards in the laboratory. The fume cupboards and other extract points together with the laboratory make-up air supply in the laboratory should be regarded as an integral system. It is therefore of paramount importance that the air supply system does not compromise the performance of the fume cupboards and, consequently, operator protection.

3.3.2 The high air change rate in a laboratory resulting from a multiple fume cupboard installation, or from a single installation in a small laboratory, necessitates careful selection of the method of supplying laboratory make-up air. Insufficient space may preclude the use of conventional equipment, and special diffusers, grilles, or a perforated ceiling, may be required to achieve low room-air velocities.

3.3.3 Arrangements for the supply of laboratory make-up air should be consistent with the purchaser's requirements for protection from fire and smoke and the achievement of the environmental conditions required for the laboratory (see **3.3.4**).

3.3.4 The opening of the windows should not be relied upon for the supply of laboratory make-up air because staff may omit to open them, particularly in cold weather, and draughts from windows in the vicinity of a fume cupboard may prevent the attainment of the level of performance required by the purchaser. The ingress of untreated air from outside the building may also result in unwelcome contamination, particularly in urban situations.

3.3.5 Sufficient openings, louvres or transfer grilles should be provided in walls and doors for laboratory make-up air to be infiltrated into the room from its surroundings, preferably from adjacent heated corridors. The locations and sizes of these openings, louvres or transfer grilles should be chosen to ensure the avoidance of discomfort due to draughts and to ensure that the opening and closing of doors does not affect the performance of the fume cupboards. The use of "damped" door closure devices can help to reduce sudden air movement. The drawing in of contaminated air, e.g. from adjacent laboratories, should be avoided and the general quality of the air should be consistent with the achievement of the environmental conditions required for the laboratory by the purchaser (see Figure 4 a).

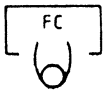
3.3.6 The objective of the laboratory make-up air distribution system (and any other mechanical ventilation system) should be to introduce the required volume of air into the room with the minimum possible disruption to the fume cupboard air flow pattern. In other words, the laboratory make-up air supply system should not reduce the degree of protection afforded to the operator of the fume cupboard. In general, air diffusers, grilles or terminal units (whether ceiling, wall or floor mounted) should not discharge directly towards or across the fume cupboard face. It is unlikely that the room air movement pattern employed in the performance type testing procedure (i.e. air approaching a fume cupboard normal to the plane of the sash with relatively uniform and low velocities) could be released in the majority of actual installations. However, every effort should be made to prevent the occurrence of supply jets of relatively high velocities (above 0.3 m/s) anywhere in the occupied zone of the room housing the fume cupboard (see **3.1.2.5**).

3.3.7 A fan-assisted source of laboratory make-up air should be filtered, heated, and otherwise treated as necessary, to maintain the environmental conditions required for the laboratory by the purchaser. It is common practice to prevent pressurization of the laboratory (which would cause the spread of contaminated air into other areas) by supplying less fan-assisted make-up air than the total extract rate. When, in such an installation, there is for any reason a significant reduction in the rate of (or a complete loss of) air extraction from the room by the fume cupboard installation, the fan-assisted laboratory make-up air rate should be correspondingly reduced, or discontinued, either automatically or manually following an automatic alarm (see Figure 4 b).

3.3.8 If the air change rate induced by the fume cupboard would be adequate to ventilate the laboratory and if the laboratory is to be occupied when the fume cupboard is not in use, separate arrangements made to meet the level of room ventilation required by the purchaser (see Figure 4 c and 4 d).

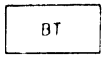
3.3.9 Air extracted from a room in which a fume cupboard is situated should not be recirculated.

Key to Figure 1 to Figure 4



fume cupboard undisturbed zone (area in which air should be undisturbed by anyone other than the operator)

column



bench top

traffic route or escape route

hazard affecting an escape route

wall or obstruction above work top height

fume cupboard in section

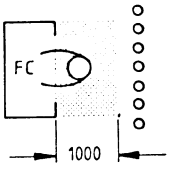
fume cupboard extract system operating

fume cupboard extract system not operating

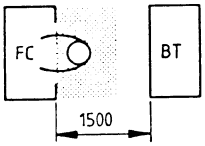
separate room ventilation system

NOTE to Figure 1 to Figure 4 Desirable dimensions between fume cupboards and other equipment, obstructions, traffic or escape routes and desirable ventilation are illustrated. Siting arrangements which should be avoided are overlaid with a cross.

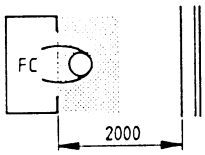
a) Separation of undisturbed zone from traffic routes



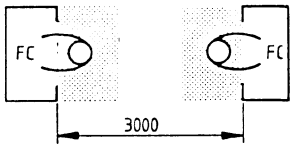
b) Spacing where same operator uses fume cupboard and bench top, or where occasional traffic only is anticipated



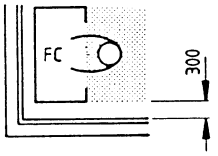
c) Spacing determined by air flow requirements



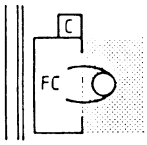
d) Spacing determined by air flow requirements



e) Spacing determined by air flow requirements

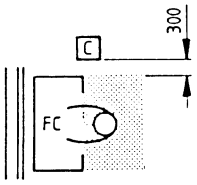


f) Spacings that avoid undue disturbance of air flow



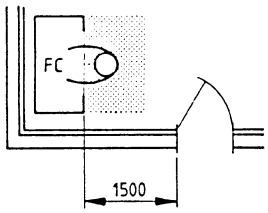
Face of column not in front of plane of sash

g) Spacings that avoid undue disturbance of air flow

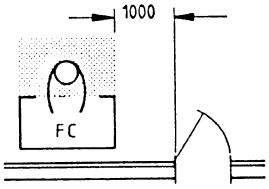


Face of column in front of plane of sash

h) Spacings that avoid undue disturbance of air flow (but see **3.1.2.8**)

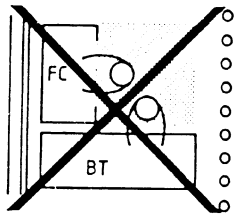


i) Spacings that avoid undue disturbance of air flow (but see **3.1.2.8**)

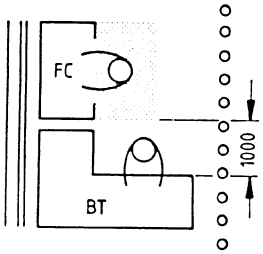


All dimensions are in millimetres, and are minimum values.

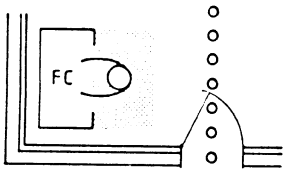
Figure 1 — Minimum distances for avoiding disturbance to the fume cupboard and its operator



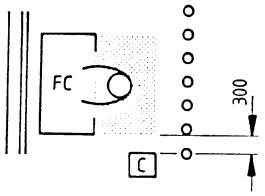
a) A bench at right angles to cupboard face may keep traffic away from undisturbed zone but work at bench will cause disturbance to air flow



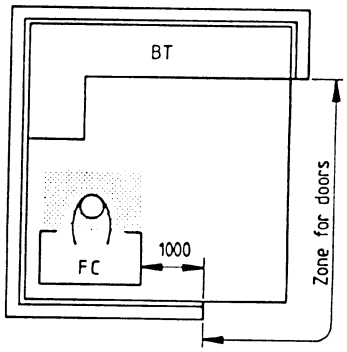
b) Projecting bench will help to keep traffic clear of undisturbed zone and work at bench will have little effect on air flow if sufficient distance between cupboard and projecting bench is allowed



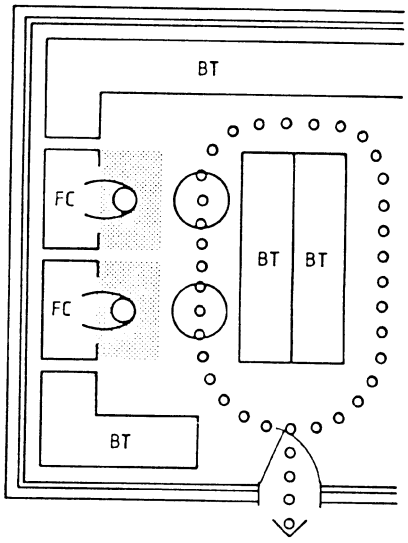
c) Projecting walls and the positioning of doors can be effective in defining traffic routes



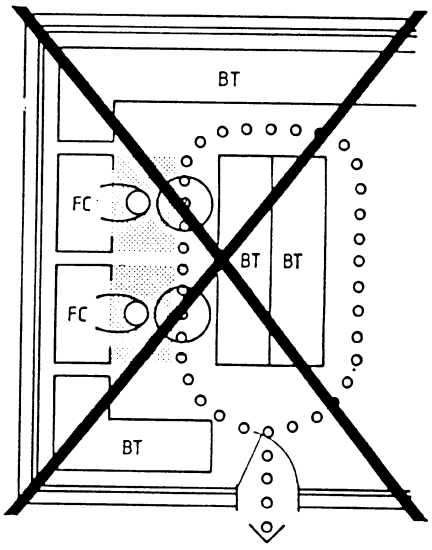
d) Columns can assist the definitions of traffic routes



e) In a small laboratory, the fume cupboard should be clear of personnel entering through doors (but see **3.1.2.8**)



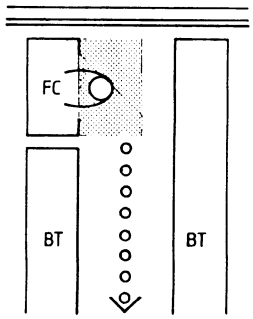
f) Too much movement in front of fume cupboards should be avoided by providing more than the minimum distance between faces of fume cupboards and bench tops



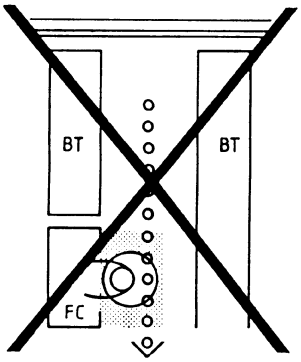
g) Too much movement in front of fume cupboards should be avoided by providing more than the minimum distance between faces of fume cupboards and bench tops

All dimensions are in millimetres, and are minimum values.

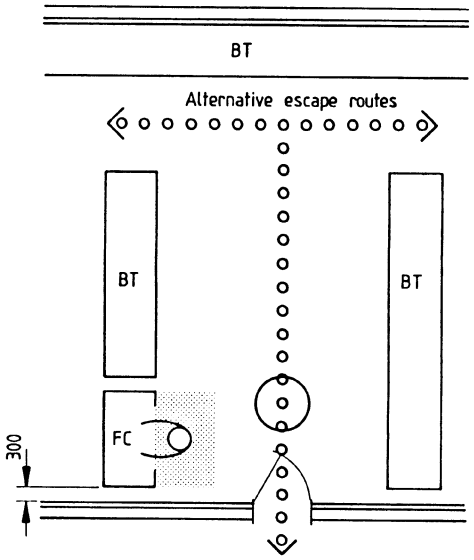
Figure 2 — Planning arrangements for avoiding disturbance to the fume cupboard and its operator from other personnel



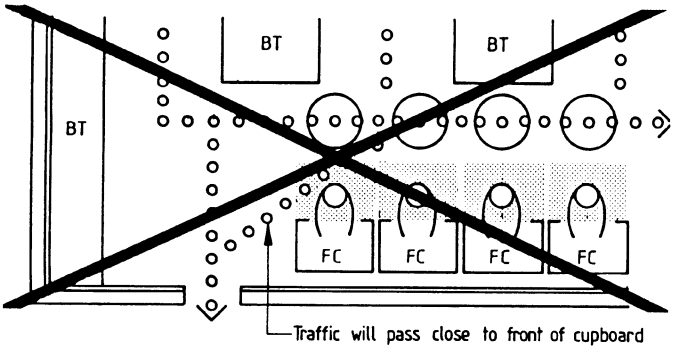
a) Escape routes should not cross a hazard area where there is no alternative escape route



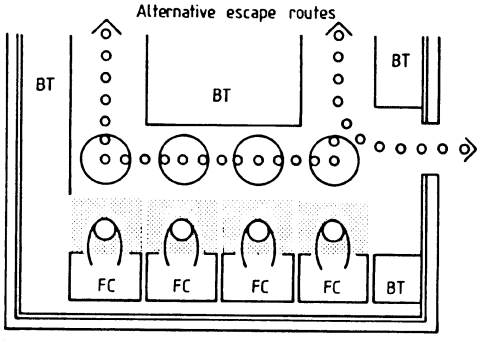
b) Escape routes should not cross a hazard area where there is no alternative escape route



d) An escape route which crosses a hazard area should be supplemented by alternative escape routes



c) Principal escape routes should not cross hazard areas

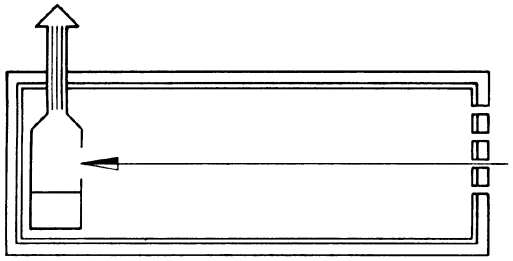


e) Alternative escape routes should be provided from all hazard areas in laboratories with more than one fume cupboard

All dimensions are in millimetres, and are minimum values.

Figure 3 — Escape routes

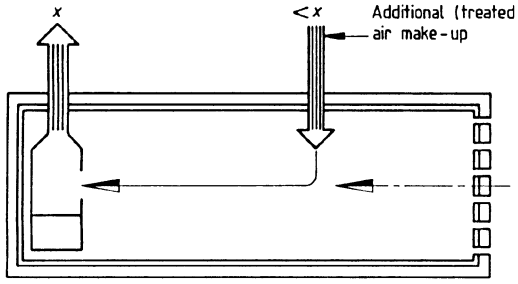
a) Laboratory air make-up by infiltration only. Room naturally ventilated when fume cupboard extract is off



Section

Infiltration via grilles, diffusers, doors, windows, etc.

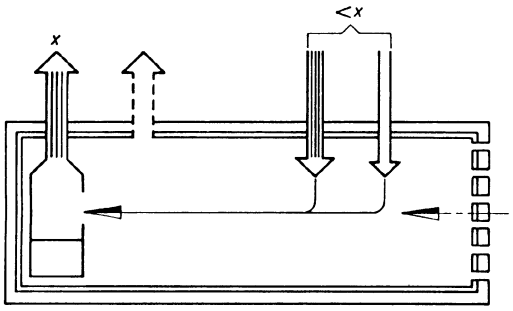
b) Laboratory air make-up by infiltration and fan-assisted air make-up. Room naturally ventilated when fume cupboard extract and fan-assisted air make-up are off



Section

Consideration should be given to the extract/air make-up ratio, its effect on room pressure, and to the possibility of reverse flow through fume cupboard when extract is low or off and other fume cupboard extracts are on

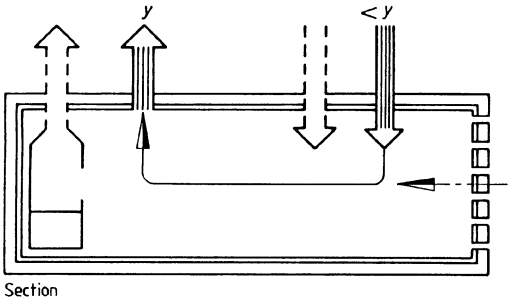
c) Laboratory air make-up by infiltration and fan-assisted air make-up with fan-assisted room ventilation systems off when fume cupboard in use



Section

The room ventilation system may need to be run if the fume cupboard extract is insufficient for room ventilation requirements

d) Fan-assisted room ventilation system on. Fume cupboard not in use



Section

Figure 4 — Laboratory air make-up and room ventilation systems

3.4 Commissioning tests

3.4.1 General

On completion of the installation of a fume cupboard and the associated fume extract and laboratory make-up air supply, the system should be tested overall for compliance with the purchaser's requirements (see items h) to n) of **2.2**).

NOTE It is essential that the commissioning tests are performed by following the appropriate procedures described in annex C of BS 7258-1:1994.

3.4.2 Variations

If the site conditions are such that any of the recommendations given in **3.1** to **3.3** cannot be complied with then, with the exception of items a), c), e), f), h) and n) of **2.2**, any of the purchaser's requirements included in that clause may be amended, and the revised information should be supplied to the purchaser.

3.4.3 Performance

In addition to the tests of face velocity described in **C.1** of BS 7258-1:1994, it is recommended that some form of containment test be carried out in accordance with BS 7258-4:1994, and that suitable tests to establish the pattern of airflow inside the fume cupboard, through the working aperture across the laboratory environment and at that point of discharge to the atmosphere should also be carried out: these can be used to check the integrity of the extract systems, i.e. to reveal the presence of leaks.

NOTE 1 Smoke generating equipment and pyrotechnic smoke generators are useful means of providing a visual demonstration of the pattern of airflow.
Smoke tubes are also available and are particularly useful for investigating airflow patterns.

In all smoke tests, particular notice should be taken of any flow reversals or eddies and whether these may be attributed to any particular causes. Special note should be taken of momentary escapes.

NOTE 2 Smoke tests are not definitive and reliance should not be placed on them for fume cupboards in which highly toxic substances are to be handled.

3.4.4 Sound-pressure levels

When required by the purchaser (see item j) of **2.2**) the sound-pressure levels from the fume cupboard and the extract and laboratory make-up air systems should be measured and, if relevant, the noise generated external to the building should be measured. Measurements should be made in accordance with **C.2** of BS 7258-1:1994.

3.4.5 Reporting

The results of the commissioning tests should be recorded (see **C.4** of BS 7258-1:1994) and copies held by the person responsible for the completed installation.

List of references (see 1.2)

Normative references

BSI standards publications

BRITISH STANDARDS INSTITUTION, London

BS 7258, *Laboratory fume cupboards*.
BS 7258-1:1994, *Specification for safety and performance*.

Informative references

BSI publications

BRITISH STANDARDS INSTITUTION, London

BS 476, *Fire tests on building materials and structures*.
BS 476-7:1987, *Method for classification of the surface spread of flame of products*.
BS 848, *Fans for general purposes*.
BS 848-1:1980, *Methods of testing performance*.
BS 2782, *Methods of testing plastics*.
BS 2782-1, *Thermal properties*.
BS 2782: Method 140E:1982, *Flammability of a small, inclined test piece exposed to an alcohol flame (laboratory method)*.
BS 4142:1990, *Method for rating industrial noise affecting mixed residential and industrial areas*.
BS 5345, *Code of practice for selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosive processing and manufacture)*.
BS 5588, *Fire precautions in the design, construction and use of buildings*.
BS 5588-9:1989, *Code of practice for ventilation and air conditioning ductwork*.
BS 7258, *Laboratory fume cupboards*.
BS 7258-1:1994, *Specification for safety and performance*.
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*.
BS 8313:1989, *Code of practice for accommodation of building services in ducts*.

Other references

[1] Great Britain. Environmental Protection Act, 1990. London: HMSO
[2] Great Britain. Building Regulations: 1991 Part B Approved Document. London: HMSO
[3] Great Britain. Highly Flammable Liquids and Liquefied Petroleum Gases Regulations (S.I. No. 917, (1972) as amended by S.I. No. 1244 (1984). London: HMSO
[4] Great Britain. Building Standards (Scotland) Regulations 1990 [S.I. No. 2179 (S.187)]. London: HMSO
[5] Great Britain. Building Regulations (Northern Ireland) 1990 (S.R. No. 59). London: HMSO
[6] Great Britain. Planning and Compensation Act, 1991. London: HMSO
[7] Town and Country Planning General Development Order, 1988.
[8] Great Britain. Control of Noise (Measurements and Registers) Regulations (S.I. No. 37) 1976. London: HMSO
[9] Great Britain. Clean Air Act, 1993. London: HMSO
[10] Great Britain. Health and Safety at Work, etc. Act, 1974. London: HMSO
[11] Great Britain. Radiating Substances Act, 1993. London: HMSO

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