BRITISH STANDARD

BS 5726:2005

Microbiological safety cabinets — Information to be supplied by the purchaser to the vendor and to the installer, and siting and use of cabinets — Recommendations and guidance

ICS 11.140

Confirmed December 2011

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CH/101, Healthcare and medical equipment, upon which the following bodies were represented:

Association of Anaesthetists of Great Britain and Ireland
Association of Clinical Pathologists
British Interior Textiles Association
Consumer Policy Committee of BSI
Furniture Industry Research Association
Guild of Healthcare Pharmacists
Health and Safety Executive
Hospital Infection Society
Institute of Biomedical Science
Institute of Healthcare Engineering and Estate Management
Institution of Mechanical Engineers
Institution of Occupational Safety and Health
Medical Sterile Products Association
Medicines and Healthcare products Regulatory Agency
Royal College of Pathologists
Royal Pharmaceutical Society of Great Britain
Society of Environmental Engineers

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Contents

Foreword

This British Standard has been prepared by Technical Committee CH/101. It supersedes BS 5726-2:1992 and BS 5726-4:1992, which are withdrawn. BS 5726-1:1992 and BS 5726-3:1992 were superseded by BS EN 12469:2000 and were withdrawn in July 2000.

This revision gives recommendations and guidance on the information to be supplied by the purchaser to the vendor and to the installer and recommendations on the siting and use of microbiological safety cabinets specified in BS EN 12469.

The Technical Committee identified the following differences, in what they considered to be important safety related areas, between BS EN 12469:2000 and BS 5726-1:1992 and BS 5726-3:1992.

— The mandatory part of the standard includes a type test for operator protection. However, this is only optional at installation and is not specifically required at routine maintenance.

— Some other important items that were mandatory in BS 5726-1 and BS 5726-2, such as airflows and dimensions are included in BS EN 12469 only as informative annexes.

— The option of potassium iodide or bacterial challenge testing for operator protection remain, but the methods for bacterial testing have been brought into line with those specified by the National Sanitation Foundation (USA) in NAF 49 for Class II microbiological safety cabinets, and the results are expressed in absolute values rather than as a ratio.

— Requirements for installation and commissioning remain open.

Attention is drawn to the Health and Safety Commission publication *The management, design and operation of microbiological containment laboratories* [1], which covers essential safety requirements for microbiological safety cabinets.

It has been assumed in the drafting of this standard that the execution of its provisions will be entrusted to suitably qualified and experienced people, for whose use it has been produced.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

In particular attention is drawn to the Control of Substances Hazardous to Health Regulations 2002 [2], the Building Regulations 2000 [3], the Building Standards (Scotland) Regulations 1990 [4] and the Building Regulations (Northern Ireland) 2000 [5].

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 9 and a back cover.

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1 Scope

This British Standard gives recommendations and guidance on information to be supplied by the purchaser to the vendor and to the installer, on siting, and on use, for microbiological safety cabinets as specified in BS EN 12469.

2 Normative references

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

BS EN 12469:2000, *Biotechnology — Performance criteria for microbiological safety cabinets.*

3 Terms and definitions

For the purposes of this British Standard the terms and definitions given in BS EN 12469:2000 apply.

4 Information to be supplied by the purchaser

4.1 General

It is strongly recommended that for safety cabinets conforming to BS EN 12469 the information given in **4.2** and **4.3** be supplied by the purchaser to the vendor and to the installer.

4.2 Information to be supplied by the purchaser to the vendor

The following information should be supplied by the purchaser to the vendor:

a) any specific requirements which are evident from consideration by the purchaser of the guidance given in Clause **5** and Clause **6**;

b) cabinet size and/or vendor's reference number;

c) services to be fitted;

d) dimensions available for access to the building.

4.3 Information to be supplied by the purchaser to the installer

The following information should be supplied by the purchaser to the installer:

NOTE 1 The installer may be the same party as the vendor.

a) the following details of the siting of the safety cabinet(s):

1) details of the building in which the safety cabinet is to be installed which might adversely affect the performance of the cabinet, the location of the laboratory and the intended siting of the safety cabinet(s) within the laboratory;

2) the locations of doors, windows, fume cupboards, other safety cabinets, other laboratory furniture, laboratory equipment that might generate draughts (e.g. large centrifuges), ventilation grills, and diffusers or other air moving equipment;

3) any features listed in item 2) which are planned but have not yet been installed;

NOTE 2 A site survey might be appropriate.

b) details of the intended method of supplying ventilation make-up air and of the existing room ventilation;

c) the environmental requirements of the laboratory including the following:

1) maximum overall noise levels in the laboratory, particularly if more than one cabinet is required either in the same room or other rooms in the same building;

2) effects of any other cabinets and/or extraction units, air conditioning and ventilation systems, and equipment (e.g. large centrifuges), that might generate draughts or contribute to adverse air movements;

3) room air volume flow rate and any pressure differences with respect to the outside atmosphere;

d) the accommodation spaces, routes available and any specific design requirements for the safety cabinet extraction system;

e) the locations and details of any existing mechanical, electrical or other services to be utilized in connection with the complete safety cabinet installation;

f) the following details of the safety cabinet(s) required:

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

2) whether the safety cabinet extraction system is to be for continuous or intermittent use.

5 Recommendations for siting of cabinets

5.1 As a preliminary to the installation of safety cabinets in a laboratory, the site should be surveyed by the safety cabinet installer to assess environmental conditions and possible exhaust ductwork route(s). The survey should include a review of the possible positions for the safety cabinet(s) in relation to laboratory doors and windows, the main routes of foot traffic past the front and the effects of ventilation systems installed in the laboratory, particularly identifying any draughts or air circulations that are liable to interfere with cabinet performance, and confirming that there is an adequate air supply to the room (see Clause **6**). It is important to ensure that exhaust air is not released to the outside near windows, doors or air intakes. For containment level 3 laboratories, where there are difficulties in exhausting cabinet air to the outside, specialist advice should be obtained.

Depending on the outcome of the survey, modifications may be necessary to improve the environment before the contractor can install a safety cabinet so that it conforms to the performance requirements specified in BS EN 12469.

5.2 Operator protection offered by a safety cabinet can be adversely affected by poor siting of the unit. Strong air currents can disrupt the airflow in open fronted (class I and class II) cabinets, which can significantly reduce operator protection. It is important, therefore, to avoid siting a microbiological safety cabinet in a thoroughfare or in line with a doorway or openable window.

5.3 Preliminary airflow visualization tests, for example with small smoke tubes, can help in the selection of the optimum position within a room. In difficult conditions, it can be helpful to install the cabinet on a temporary basis in the proposed position and carry out aperture retention tests before making a final decision on the siting of the cabinet.

5.4 The siting of safety cabinets in laboratories should be considered at the initial stages of the planning of a new building or before modification of an existing building. If additional safety cabinets are required in an existing laboratory, the recommendations given in this clause also apply. The recommendations for siting of microbiological safety cabinets given here are intended to optimise the performance of the cabinets and improve safety through avoidance of disturbances to the cabinet, to its operator and to other personnel, and through avoidance of interference with escape routes, etc. It should be noted that it is not possible to recommend particular dimensions or siting arrangements that will prospectively guarantee satisfactory performance of a cabinet in all situations.

5.5 If cabinets are joined together it is strongly recommended that the junctions should be airtight and that care should be taken to ensure that they do not put undue stress on the cabinets or on any junction or adaptor pieces. Sealing gaskets or mating surfaces should be positioned such that they do not leave internal cavities or crevices.

NOTE Attention should be paid to vibration as, if it is excessive, damage to seals and gaskets can occur.

5.6 To avoid disturbances to the safety cabinet and its operator, consideration should be given to the following.

a) The distance from the plane of the aperture 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 1a).

b) The distance between the front aperture and a bench opposite it should ideally be at least 1 500 mm (see Figure 1b). However, containment performance is not likely to be affected if this distance is reduced, for instance to enable an operator to use the bench behind, whilst working at the cabinet. In this case operator movement over a smaller distance might cause less air disturbance.

c) There should be no opposing wall (or other obstruction likely to affect the airflow) within 2 000 mm of the front aperture (see Figure 1c).

d) Safety cabinets should not be installed in positions where they are likely to be affected by other items of equipment. In particular the distance to the aperture of an opposing safety cabinet, fume cupboard or the edge of a local exhaust ventilation outlet should be not less than 3 000 mm (see Figure 1d).

e) Any room air supply diffuser should not be within 1 500 mm of the front aperture. If there are large numbers of safety cabinets in a laboratory this recommendation may be difficult to implement, but where diffusers have to be placed in close proximity to a safety cabinet their air handling rates need to be low to ensure low discharge velocities.

f) A safety cabinet should not be positioned with either side closer than 300 mm to a wall or similar obstruction (see Figure 1e).

g) Large obstructions (e.g. an architectural column) projecting beyond the plane of the aperture should not be within 300 mm of the side of the safety cabinet (see Figure 1f and Figure 1g).

h) Doorways should not be within 1 500 mm of the aperture or within 1 000 mm of the side of the safety cabinet (see Figure 1h) except where a door includes air transfer grills, in which case protection factor testing should be carried out to ascertain a suitable distance.

5.7 The position of a safety cabinet should be such that the spatial requirements (e.g. vision, lighting and convenience of access) of the operator and personnel working nearby are met. When a cabinet is installed on a bench top, the leading edge should be flush with or slightly overhanging the edge of the bench top.

NOTE 1 Typical problems and their solutions are illustrated in Figure 2.

NOTE 2 There should not be an open space between the leading edge of the cabinet and the front of the bench as this could create turbulence in front of the aperture. It also provides an obstacle which could adversely affect airflow across the cabinet face.

6 Make-up air systems

6.1 Safety cabinets should be installed only after there has been consideration of the details of the make-up air system necessary to replace all of the air entering the safety cabinets in the laboratory. The safety cabinets and other air extraction points together with the make-up air supply in the laboratory should be regarded as an integral system. The air supply system should be such that it does not compromise the performance of the safety cabinets.

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

6.3 Arrangements for the supply of make-up air should be consistent with the requirements for protection from fire and smoke and with the achievement of the environmental conditions specified for the laboratory as given in the design specifications for the laboratory agreed between the purchaser and the vendor and installer. Make-up air should be heated or cooled, as necessary, to maintain a laboratory air temperature within ±2 °C of that required by the design specifications. The introduction of make-up air should be arranged so as to avoid draughts in the area of the safety cabinets.

6.4 For air make-up by passive air inflow, openings, louvres or transfer grilles should be provided in walls and doors for make-up air to be introduced into the room from its surroundings, preferably from adjacent heated corridors (see Figure 3a). The locations and sizes of these openings, louvres or transfer grilles should be chosen to ensure the avoidance of discomfort to staff due to draughts and to ensure that the opening and closing of doors does not affect the performance of the safety cabinets. The use of damped door closure devices can help to reduce sudden air movement. The drawing-in of potentially 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 specified for the laboratory as given in the design specifications.

NOTE It is essential that installers and users take care not to breach the integrity of the fire protection system particularly when fitting grilles into doors designed to provide half hour fire resistance. Use of intumescent material is often necessary.

6.5 The objective of the 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 safety cabinet airflow pattern, and the make-up air supply system should be such that it does not

reduce the degree of protection afforded to the operator by the safety cabinet. In general, air diffusers, grilles or terminal units (whether ceiling, wall or floor mounted) should not discharge directly towards or across the safety cabinet aperture. It is unlikely that the room airflow pattern employed in the performance testing procedure given in BS EN 12469:2000, Annex C can be realised in the majority of actual installations. However, every effort should be made to prevent relatively high velocity air movement (velocity greater than 0.3 m/s) anywhere in the room housing the safety cabinet (see Clark et al, 1990 [6]).

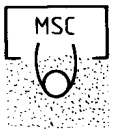
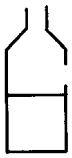
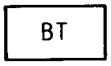
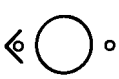
6.6 A fan-assisted source of make-up air should be filtered, heated and otherwise treated as necessary, to maintain the environmental conditions specified for the laboratory in the design specifications. It is common practice to prevent pressurization of the laboratory (which would cause a spread of potentially contaminated air into other areas) by supplying a lower rate of fan-assisted make-up air than the total extraction rate. When there is a significant reduction in or a complete loss of the air extraction from the room by the safety cabinet installation, the fan-assisted inflow of make-up air should be correspondingly reduced, or disconnected, either automatically or manually following an automatic alarm (see Figure 3b). In laboratories at containment level 3 or above, the controls for the supply and extraction airflows should be interlocked to prevent positive pressurization of the room.

NOTE Consideration should be given to the possibility of reverse flow through a safety cabinet when the extraction system is low or off and other safety cabinets or containment facilities are on. Consideration should also be given to situations where several cabinets might be operating independently in one room.

6.7 If the airflow rate induced by the safety cabinet is inadequate to ventilate the laboratory or if the laboratory is to be occupied when the safety cabinet is not in use, separate arrangements should be made for room ventilation (see Figure 3c and Figure 3d).

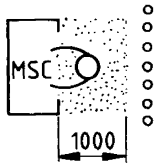
6.8 Air extracted by a separate ventilation system from a room in which a safety cabinet is installed should not be re-circulated.

Key to figures 1 to 3

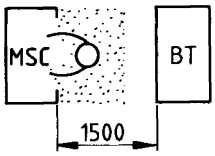
	Microbiological safety cabinet zone (area in which air should be undisturbed by anyone other than the operator)		Microbiological safety cabinet in section
	Column		Microbiological safety cabinet extraction system operating
	Bench top		Microbiological safety cabinet extraction system not operating
	Traffic route or escape route		Separate room ventilation system
	Hazard affecting a traffic or escape route	x	Safety cabinet discharge volume
	Wall or obstruction above work top height	y	Room ventilation extraction volume

NOTE In Figures 1 to 3, siting arrangements which should be avoided are overlaid with a cross.

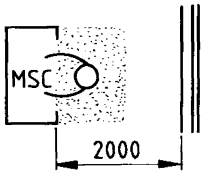
a) Separation of an undisturbed zone around a safety cabinet from traffic routes



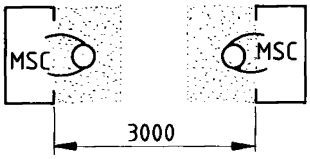
b) Spacing when the same operator uses a safety cabinet and a bench top opposite, or where occasional traffic only is anticipated



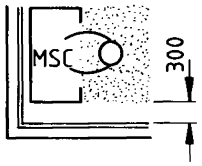
c) Spacing determined by airflow requirements with an opposing wall



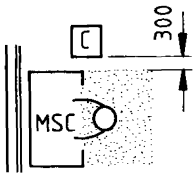
d) Spacing determined by airflow requirements when safety cabinets are opposite each other



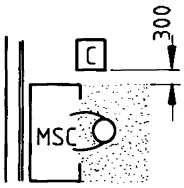
e) Spacing determined by airflow requirements with adjacent walls



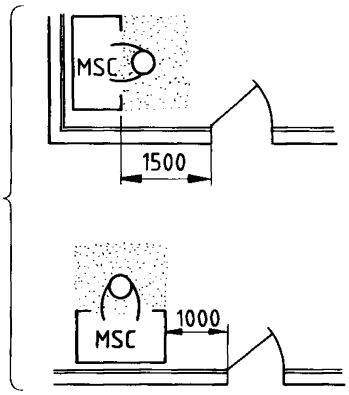
f) Spacings that avoid undue disturbance to airflow. Face of column not in front of plane of cabinet aperture



g) Spacing to avoid undue disturbance to airflow when face of column is in front of plane of cabinet aperture

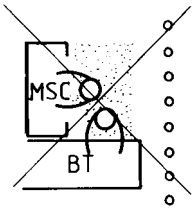


h) Spacings that avoid undue disturbances to airflow in relation to door openings

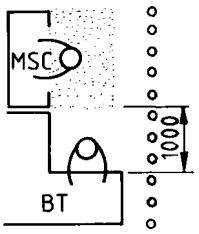


Dimensions in millimetres

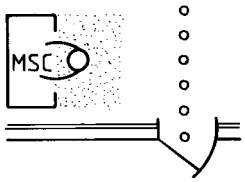
Figure 1 — Recommendations for minimum distances for avoiding disturbance to the safety cabinet and its operator



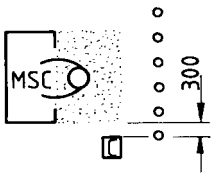
a) A bench at right angles to a safety cabinet may keep traffic away from the undisturbed zone but work at the bench will cause disturbances in the air flow



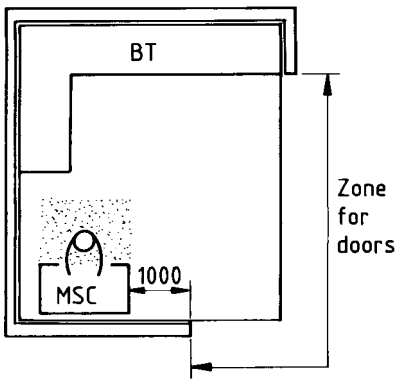
b) A projecting bench will help to keep traffic clear of the undisturbed zone and the work at the bench will have little effect on air flow if sufficient distance is allowed between the cabinet and the projecting bench



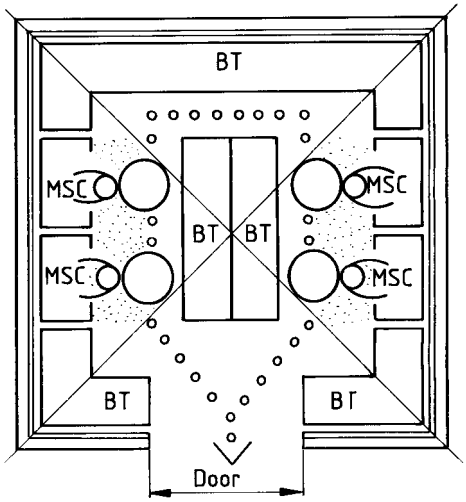
c) Projecting walls and the positioning of doors can be effective in defining traffic routes



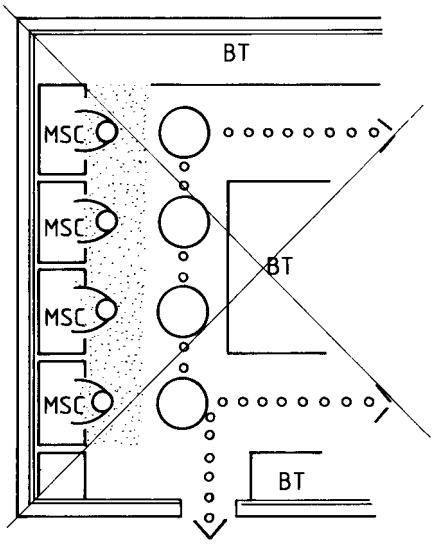
d) Columns can assist in the definition of traffic routes



e) In a small laboratory, the safety cabinet should be clear of personnel entering through the doors



f) Danger of too much air movement in front of safety cabinets should be alleviated by allowing more space between the apertures of the safety cabinets and the bench tops

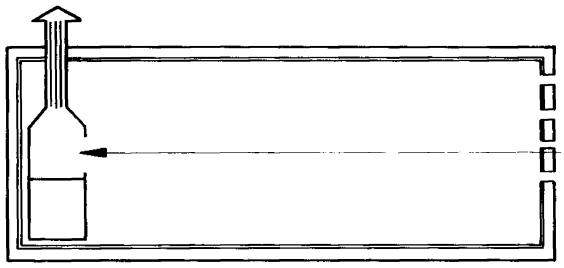


g) Danger of too much movement in front of safety cabinets should be avoided by allowing more space between the apertures of the safety cabinets and the bench tops

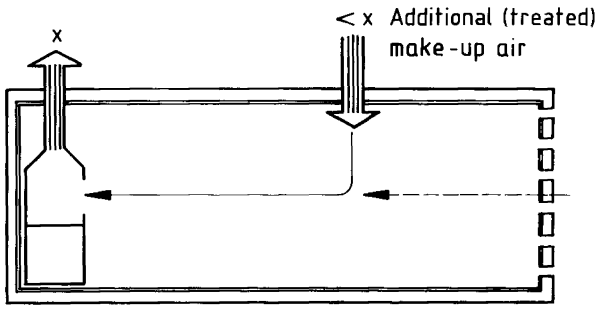
Dimensions in millimetres

Figure 2 — Recommendations for minimum distances for avoiding disturbance to other personnel

a) Air make-up by passive air inflow only. Room naturally ventilated when safety cabinet is off. Inflow is via grilles, doors, diffusers, windows etc.

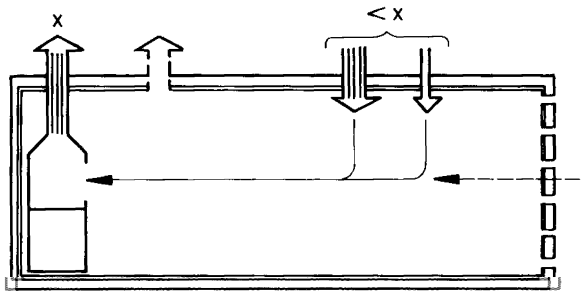


b) Air make-up by passive air inflow and fan assistance. Room naturally ventilated when safety cabinet and fan assisted air make-up are off.



c) Air make-up by passive air inflow and fan assistance with active room ventilation systems off and safety cabinet in use.

NOTE The room ventilation system may need to be run if the safety cabinet extraction system is insufficient for room ventilation requirements.



d) Fan assisted room ventilation system on. Safety cabinet not in use.

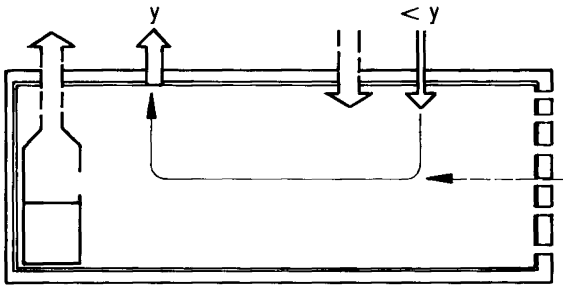


Figure 3 — Air make-up and room ventilation systems

7 Selection of cabinets

Activities such as shaking, mixing or ultrasonic disruption of any material likely to contain hazardous organisms should be conducted in a class I or class II cabinet. In containment level 2 or level 3 laboratories class I cabinets are suitable, although if protection of the work from airborne contamination is essential then a class II cabinet should be used.

NOTE Attention is drawn to the Control of Substances Hazardous to Health Regulations 2002 [2], to the Health and Safety Executive (HSE) publication *The Control of Substances Hazardous to Health Regulations 2002. Approved codes of practice and guidance* [7], and to the HSE Health Services Advisory Committee publication *Safe working and prevention of infection in clinical laboratories and similar facilities* 2003 [8].

Laboratories for disciplines other than microbiology, in which material known to contain human pathogens is handled might require dedicated class I or class II cabinets (according to local assessments) or access to such cabinets in a microbiology department. Class I or class II cabinets should not be used for hazard group 4 pathogens.

Class II cabinets are generally preferable for uninoculated cell culture work or similar operations in which protection of the work is paramount.

Class III cabinets are not required in most clinical laboratories, as they are primarily recommended for hazard group 4 pathogens, however they may be used for handling high titre cultures of some hazard group 3 pathogens. Use of class III cabinets demands high standards of maintenance and training of operators. The turbulent air flow within the cabinet means that there is a greater likelihood of the contents becoming contaminated from a spill within the cabinet.

8 Training of users

All users of cabinets should be fully instructed on the following:

a) classification of cabinets;

b) appropriate and inappropriate use of cabinets;

c) mode of operation and function of all controls and indicators;

d) limitations of performance;

e) how to work at cabinets safely;

f) how to decontaminate cabinets after use;

g) principles of airflow and operator protection tests.

9 Use of cabinets

Sudden and extensive changes in air pressure in the laboratory can seriously compromise cabinet performance. These effects are particularly important in containment level 3 negative pressure facilities. A procedure should be put in place to preclude actions that could cause such changes in air pressure while a cabinet is in use. These actions include opening the laboratory door, turning on another cabinet or opening the door of an autoclave.

Apparatus and materials in use in the cabinet should be kept to a minimum and placed so as to minimize any effect on airflows. In class I cabinets this means towards the rear, and in class II cabinets all materials should remain on work surfaces and be placed so as not to obstruct vents. Centrifuges should never be used in class I or class II cabinets. All work should be carried out well inside the cabinet and in such a position that it is visible through the front window which should not be opened when work is in progress.

Use of a gas burner within the cabinet is not recommended. However, if it is essential, a low profile type with a lever control which can be used to give a full flame only as required should be used as this produces the least disturbance to air flow.

Before use of a cabinet the operator should check that the fan is switched on and the airflow indicator demonstrates that air is being extracted through the cabinet. After completion of work the cabinet should be run for at least 5 min.

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