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Specification for recirculatory filtration fume cupboards

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee LBI/18, Laboratory furniture and fittings, upon which the following bodies were represented:

- Association for Science Education
- BLWA Ltd. — The Association of the Laboratory Supply Industry
- British Educational Suppliers' Association
- British Furniture Manufacturers' Federation
- British Occupational Hygiene Society
- Chartered Society of Designers
- Chemical Industries Association
- CLEAPSS — School Science Service
- Department for Education and Employment
- Furniture Industry Research Association
- Health and Safety Executive
- Institution of Mechanical Engineers
- Manufacturing Science Finance
- Medical Research Council
- Research and Development Facilities Consortium
- Royal Institute of British Architects
- Royal Society of Chemistry
- United Kingdom Fume Cupboard Association
- Universities Safety Association

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Foreword

This British Standard has been prepared under the direction of the Sector Committee for Materials and Chemicals (I/-) by Technical Committee LBI/18, Laboratory furniture and fittings. It has been prepared in response to calls from industry for a standard for fume cupboards of the filtration type, which are not covered by BS 7258. It was intended originally that this work should be undertaken as part of the European (CEN) programme of work on fume cupboard standards, but this proved unfeasible in the short term.

The structure of BS 7258 has been used to some extent in this British Standard and, where possible, identical requirements have been specified. However, this British Standard should be considered as essentially separate and distinct from BS 7258. Attention is also drawn to Building Bulletin 88 [1], issued by the Department for Education and Employment in 1998.

Whenever a fume cupboard is used, it is necessary for the purchaser and/or 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.

Annex A and Annex B are informative. Annex C and Annex D are normative.

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

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

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Introduction

The purpose of a recirculatory filtration fume cupboard is to contain a pollutant or pollutants released from a source or sources within the fume cupboard and, by a filtering device, to reduce substantially the concentration of specified pollutants prior to recirculating the air back to the room.

These devices should only be used with pollutants of documented hazard, which permits the selection of appropriate filter(s).

NOTE Several of the tests described in this British Standard require the use of hazardous substances. Appropriate risk assessment should be made and suitable precautions taken at all times.

1 Scope

This British Standard specifies requirements for fume cupboards designed to recirculate air back to the room after filtering out specified pollutants. This British Standard does not specify requirements for fume cupboards of the type dealt with in BS 7258.

This British Standard is not applicable to recirculatory filtration fume cupboards of the following types:

- recirculatory filtration fume cupboards for work on radioactive materials;
- recirculatory filtration fume cupboards for work on microbiological agents;
- high thermal load recirculatory filtration fume cupboards;
- recirculatory filtration fume cupboards employing wet scrubbing systems.

This British Standard is not intended to apply to small enclosures intended only for applications such as weighing, in which the filter retention capacity is likely to be small.

2 Normative references

This British Standard incorporates, by dated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. Subsequent amendments to, or revision of, any of these publications apply to this part only when incorporated in it by amendment or revision.

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

BS 7258-2:1994, *Laboratory fume cupboards — Part 2: Recommendations for the exchange of information and recommendations for installation.*

BS 7258-3:1994, *Laboratory fume cupboards — Part 3: Recommendations for selection, use and maintenance.*

BS 7258-4:1994, *Laboratory fume cupboards — Part 4: Method for determination of the containment value of a laboratory fume cupboard.*

BS 7501:1989, *General criteria for the operation of testing laboratories.*

BS EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

BS EN 292-2: 1991, *Safety of machinery — Basic concepts, general principles of design — Part 2: Technical principles and specifications.*

BS EN 1822-1:1998, *High efficiency air filters (HEPA and ULPA) — Part 1: Classification, performance testing, marking.*

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

BS EN 60529:1992, *Specification for degrees of protection provided by enclosures (IP code).*

BS EN 60651:1994, *Specification for sound level meters.*

BS EN 60804:1994, *Specification for integrating-averaging sound level meters.*

BS EN 61010-1:2001, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements.*

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

NOTE Some of the definitions are identical with definitions given in BS 7258-1:1994.

3.1

air pollutant

gases, vapours, aerosols, fumes 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) 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.

3.2

area of opening

product of the average width of the opening (3.20) and the height of the opening (3.8)

3.3

baffle

plate installed to minimize the variation of face velocity (3.4) over the sash opening plane (3.17) and encourage scavenging throughout the fume cupboard

3.4

face velocity

velocity of air passing through the sash opening plane (3.17)

3.5

filter breakthrough alarm

substance-specific alarm designed to indicate when an unacceptable concentration of a specific pollutant is emerging from the filter

3.6

filter efficiency

gaseous phase filtration efficiency of a recirculatory filtration fume cupboard, defined as:

$$\frac{100(C_o - C_e)}{C_o}$$

where C_o is the concentration of a given pollutant in the fume cupboard and C_e is the concentration of that pollutant in the recirculated air (3.13)

3.7

gaseous phase filter

filter capable of adsorbing pollutant gases and vapours

NOTE The filter commonly contains activated carbon. Chemicals may be impregnated into the filter media to improve efficiency and filter life.

3.8

height of the opening

distance, measured in the plane of the sash (3.16), between the upper edge of the work surface (3.21) (or raised anti-spill lip where fitted) and the lower edge of the sash, sash airfoil or sash finger pull sections where fitted

3.9**high efficiency particulate air filter
HEPA filter**

filter used to remove particles to submicron levels

NOTE Examples are classes H 13 and H 14, as specified in BS EN 1822-1:1998.

3.10**normal sash opening**

maximum height (in the case of vertically adjustable sashes) or width (in the case of horizontally adjustable sashes) to which the sash should be opened during use of the fume cupboard and at which point a stop or other device is fitted to prevent the opening being exceeded under normal use

3.11**occupational exposure limit
OEL**

time weighted average concentration limit (TWL) of a hazardous substance in air, which may be either an occupational exposure standard (OES) or a maximum exposure limit (MEL)

NOTE 1 Two time periods are used: long term (8 hours) and short term (15 minutes).

NOTE 2 An OES is a TWL set at a level at which (based upon current scientific knowledge) there is no indication of risk to the health of workers exposed to it by inhalation day after day.

NOTE 3 An MEL is the maximum concentration of an airborne substance, averaged over a reference period, to which employees may be exposed by inhalation under any circumstances.

3.12**pre-filter**

filter used to remove particulates and protect HEPA (3.9) and/or gaseous phase filter(s) (3.6)

3.13**recirculated air**

air that is passed back into a room after passing through the fume cupboard filter system

3.14**recirculatory filtration fume cupboard**

fume cupboard that is fitted with an integral filtration system capable of reducing specified air pollutants (3.1) before the air is recirculated back into the room

3.15**retention capacity**

mass of specified pollutant adsorbed by the gaseous phase filter (3.7) of a recirculatory filtration fume cupboard (3.14), under defined conditions, before the concentration in the filtered air reaches the OEL (3.11) of the pollutant

3.16**sash**

transparent screen between the operator and the working space that can be adjusted by either vertically or horizontally moving panels or hinged panels

3.17**sash opening plane**

plane of the sash (3.16) or, when the plane of the sash does not meet the work surface (3.21), non-vertical plane bounded at the top by the lowest point of the upper edge of the opening in the plane of the sash, at the bottom by the uppermost point of the lower edge of the opening and at the sides by the side edges of the opening

NOTE If the sash is formed by more than one transparent panel, then the plane used is that through the centre of the outermost section.

3.18

services

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

3.19

volume flow rate

volume of air per unit time passed through the fume cupboard and filters

3.20

width of the opening

average distance measured between the two sides of the clear opening of the fume cupboard in the case of vertically adjustable sashes (including hinged panels), or the average distance between the vertical edges of the opening (between two sliding sash panels for centrally positioned openings or between one sliding panel and the inner edge of the outer vertical side of the opening) in the case of horizontally adjustable sashes

NOTE The gap between the end sash panels and the sash frame or edges of the side wall is not included in this dimension.

3.21

work surface

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

4 Safety

4.1 General

Recirculatory filtration fume cupboards shall be designed to protect users and the working environment. This shall be achieved by:

- a) minimizing the escape of hazardous concentrations or quantities of fumes from the fume-cupboard, either through the frontal sash opening or through the filters into the room;
- b) efficiently purging the enclosure to reduce the potential for an explosive or hazardous atmosphere to develop within the enclosure;
- c) providing some protection to the user against splashing of hazardous substances and minor explosions.

NOTE Attention is drawn to HSE Guidance Note EH40 [2] and Statutory Instrument 1999 No. 437 (The Control of Substances Hazardous to Health Regulations) [3].

4.2 Electrical

4.2.1 Electrical aspects of the construction of the fume cupboard shall be in accordance with BS EN 61010-1:2001.

4.2.2 Electric motors incorporated in the construction of the fume cupboard shall be non-sparking and of minimum enclosure ingress protection factor IP-44, as defined in BS EN 60529:1992. Other electrical components shall be isolated from the airstream.

4.3 Mechanical

Aspects of the construction of the fume cupboard relating to mechanical safety shall be in accordance with BS EN 292-1:1991 and -2:1991.

NOTE Attention is drawn to relevant regulations, such as the Safety of Machinery Directive 98/37/EC, as amended by 98/79/EC [4].

4.4 Specific

4.4.1 *Control of air entry*

The air entry profile of the front opening shall be designed such that the fume cupboard complies with clause 8.

NOTE Good entry of air into the cupboard reduces the size of eddies at the boundaries and improves containment. This can be achieved by using aerodynamic styling of the opening, including top edge, sidewalls and sill and, where fitted, the sash handle.