

Australian/New Zealand Standard™

Safety in laboratories

Part 8: Fume cupboards



AS/NZS 2243.8:2014

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Australian/New Zealand Standard™

Safety in laboratories

Part 8: Fume cupboards

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PREFACE

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee CH-026, Safety in Laboratories, to supersede AS/NZS 2243.8:2006.

The objective of this Standard is to provide requirements for fume cupboards relating to their safety and performance, along with recommendations and procedures for their selection, installation, testing and use.

This edition includes requirements for risk assessment and permits the consideration of manifolded duct systems.

This Standard is Part 8 in a series aimed at promoting safety in laboratories. Parts 2–10 are intended to be read in the context set by Part 1.

The series is as follows:

- Part 1: Planning and operational aspects
- Part 2: Chemical aspects
- Part 3: Microbiological safety and containment
- Part 4: Ionizing radiations
- Part 5: Non-ionizing radiations—Electromagnetic, sound and ultrasound
- Part 6: Plant and equipment aspects
- Part 7: Electrical aspects (obsolescent)
- Part 8: Fume cupboards (this Standard)
- Part 9: Recirculating fume cabinets
- Part 10: Storage of chemicals

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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FOREWORD

The primary reason for using a fume cupboard is to provide safe working conditions for the operator and other laboratory personnel. The fume cupboard provides a mechanical means of capturing, diluting and exhausting all fume, especially that which is hazardous or noxious.

The efficiency and safety of a fume cupboard depends upon the smooth entry of air, effective containment and scavenging of fume from the chamber, its siting with respect to air movement and laboratory ventilation, the materials used in its construction, the complete fume exhaust system, its controls and, if fitted, its cleaning system (e.g. scrubbers and filters) and the safe and remote dispersal of fumes to the atmosphere.

Existing fume cupboard installations will, in many instances, not comply with this Standard and consequently should not be used for applications that could create a hazard. In the interests of laboratory safety, a high priority should be allocated to the preparation of a program for upgrading substandard fume cupboard installations to meet the requirements of this Standard. Fully ducted fume cupboards that do not comply with this Standard should be replaced or upgraded to the required levels as soon as practicable.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Safety in laboratories

Part 8: Fume cupboards

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies safety requirements for the design, manufacture, use and maintenance of fume cupboards. The Standard also sets out methods of test for determining the performance of fume cupboards. It includes the method for conducting a smoke test and the method for determining face velocity.

This Standard covers fume cupboards that are intended primarily for use in general chemical operations but may be used for the special applications set out in Appendix D, provided that the additional requirements specified therein are complied with.

Recirculating fume cabinets (which recirculate air and do not extract to the outside atmosphere) are not covered by this Standard (see AS/NZS 2243.9).

1.2 NORMATIVE REFERENCES

The following are the normative documents referenced in this Standard:

NOTE: Documents for informative purposes are listed in the Bibliography.

AS	
1668	The use of ventilation and airconditioning in buildings
1668.2	Part 2: Mechanical ventilation in buildings
1807	Cleanrooms, workstations, safety cabinets and pharmaceutical isolators—Methods of test
1807.15	Part 15: Determination of illuminance
1807.20	Part 20: Determination of sound level at installed workstations, safety cabinets and pharmaceutical isolators
2444	Portable fire extinguishers and fire blankets—Selection and location
AS/NZS	
1826	Electrical equipment for explosive gas atmospheres—Special protection—Type of protection 's'
2208	Safety glazing materials in buildings
2243	Safety in laboratories
2243.3	Part 3: Microbiological safety and containment
2243.6	Part 6: Plant and equipment aspects
2430	Classification of hazardous areas
2430.3.6	Part 3.6: Examples of area classification—Laboratories, including fume cupboards and flammable medical agents
2982	Laboratory design and construction
2982.1	Part 1: General requirements

AS/NZS

- 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
- 3100 Approval and test specification—General requirements for electrical equipment
- 3760 In-service safety inspection and testing of electrical equipment

1.3 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 2982.1 and those below apply.

1.3.1 Air

1.3.1.1 *Fume cupboard auxiliary air*

Air delivered directly adjacent to a laboratory fume cupboard to reduce consumption of conditioned room air.

1.3.1.2 *Make-up air*

Air needed to replace that exhausted from the room by laboratory fume cupboards and other air-exhaust devices.

1.3.2 Air pressure

1.3.2.1 *Negative air pressure*

Air pressure lower than atmospheric pressure.

1.3.2.2 *Positive air pressure*

Air pressure higher than atmospheric pressure.

1.3.3 Baffle

One or more readily removable plates incorporated at the rear or top of the working chamber to form a plenum between the working chamber and the exhaust duct connection to promote uniform scavenging of fume from the working chamber.

1.3.4 Base

The bottom slab or platform of a fume cupboard which may include the work surface or a sump.

1.3.5 Calibrated

Checked against measurement standards traceable to international or national measurement standards and either adjusted to provide measurement results directly or issued with a calibration correction factor to apply to readings.

1.3.6 Competent person

A person who has acquired through training, qualifications or experience, or a combination of these, the knowledge and skills enabling that person to perform a specified task.

1.3.7 Exhaust system

All exhaust air ductwork, fan and associated equipment installed between the point of connection to the fume cupboard and the point of discharge.

1.3.8 Face velocity

The velocity of the air passing through the working aperture measured in the plane of the sash (see Appendix B).

1.3.9 Fume (as used in the term ‘fume cupboard’)

Airborne contaminants in the form of gases, vapours, aerosols or particulate matter.

1.3.10 Fume cupboard

A substantially enclosed workplace that—

- (a) is designed to prevent the spread of fume to operators and other personnel;
- (b) is ventilated by an induced flow of air through a sash opening or working aperture that may be adjusted;
- (c) by means of an exhaust system, provides for dilution of the fume and its safe and remote discharge outside the building; and
- (d) reduces the risk associated with the use of appliances, flammable gases and chemicals in what may be dangerous processes.

NOTE: A fume hood is a device mounted over a workplace to receive or capture fumes. It may provide little or no enclosure for the workplace and is therefore unable to contain fumes as well as a fume cupboard.

In American usage, the term 'laboratory hood' means a laboratory fume cupboard.

1.3.11 Laminar airflow

A non-turbulent airstream of constant velocity, substantially uniform over its cross-section of flow, with a variation of not more than 20%.

1.3.12 May

Indicates the existence of an option.

1.3.13 Post-purge

A timed period of operation of the exhaust fan, after the fume cupboard system is shut down, to purge residual vapours.

1.3.14 Pre-purge

A timed period to allow establishment of adequate airflow before electrical and flammable gas services become available.

1.3.15 Radiotoxicity

The toxicity attributable to ionizing radiation emitted by a radionuclide (and its decay products) incorporated in the human body.

1.3.16 Removable work surface

A flat work surface supported above a sump incorporated in the base of the fume cupboard.

1.3.17 Sash

A transparent safety screen in the working aperture of a fume cupboard, which can be positioned between the working chamber and the operator for protection, and which can be adjusted either vertically or horizontally to vary the size of the working aperture.

1.3.18 Sash opening

The dimension of opening in the direction of the sash movement. This is sometimes referred to as the working aperture.

1.3.19 Services

Supplies of lighting, electricity, water, vacuum, compressed air, gas or other special requirements to the fume cupboard.

1.3.20 Shall

Indicates that a statement is mandatory.

1.3.21 Should

Indicates a recommendation.

1.3.22 Sump

A recess in the base of the fume cupboard capable of containing liquids spilled within the fume cupboard. The sump may be connected to a drain or a closed receptacle.

1.4 RISK ASSESSMENT

Risk assessment of all operations in the laboratory involving plant, equipment and chemicals shall be carried out. For further information on risk identification, control and management, see AS/NZS 4801 and the AS/NZS 60079.10 series.

When controlling risks, the most effective control measures available should be chosen in order of effectiveness. The hierarchy of controls is as follows:

- (a) Elimination of hazards from the laboratory.
- (b) Substitution of a substance or process.
- (c) Isolation of the hazard.
- (d) Application of engineering controls, e.g. local exhaust ventilation.
- (e) Adoption of safe work practices, including documented work methods.
- (f) Where other effective means to control the hazard are not practical, use of suitable personal protective equipment.

As part of the risk assessment, the information contained in various regulations and accompanying codes of practice, instructional manuals and the other parts of this series needs to be considered in areas such as chemical safety. Tasks shall be assessed for performance during normal working hours and outside of normal working hours, as the risk is often increased out of hours when the availability of emergency personnel is reduced. Security requirements for the laboratory's activities should also be considered with respect to access to the laboratory area. This risk assessment shall also address access to, and operations in, the laboratory pertaining to students, maintenance staff, contractors, visitors (including children), cleaners, security staff and animals (experimental and companion).

Within particular industries there may be existing methodology together with control levels that apply to the operation of these assessments. In addition, national, state and territory authorities provide guidance notes on the application of risk assessment procedures that need to be adopted when implementing and complying with the regulations.

SECTION 2 TYPES, SERVICES AND COMPONENTS

2.1 FUME CUPBOARD TYPES

2.1.1 Walk-in fume cupboards

Walk-in fume cupboards are designed for large-scale work that cannot successfully be executed in a bench-type fume cupboard. These larger types usually have the sash in two or more pieces or doors. Any portion of the working area may be reached simply by sliding the sashes or opening the doors. When the work involves larger apparatus, one of the sashes may be removed temporarily. Sections of the sash can also be used as a safety shield.

2.1.2 Bench-type fume cupboards

2.1.2.1 *General*

Benchtop operations form the majority of chemical work undertaken within fume cupboards and thus the majority of fume cupboards are of this type. The enclosure is usually constructed so that work can be enclosed by pulling down a vertically sliding sash on the front of the cupboard.

Where there is a need for a fume cupboard to enclose a tall apparatus (e.g. a chromatography column), the enclosing cupboard may be adapted to suit the use, having a sliding sash covering the front portion of the cupboard.

2.1.2.2 *Downdraught fume cupboard*

A downdraught fume cupboard allows air to be exhausted across or through the base of the fume cupboard. This type of fume cupboard is used in applications where heavier than air fumes are generated.

2.1.2.3 *Variable exhaust air volume fume cupboard*

A variable exhaust air volume fume cupboard maintains an approximately constant face velocity irrespective of sash position. A reduced volume of room air is exhausted through the fume cupboard as the sash is moved to reduce the opening size. The modulation of exhaust air volume out of the laboratory minimizes the waste of conditioned air. See also Clause 3.1.2 for minimum airflow requirements.

2.1.2.4 *By-pass fume cupboard*

A fume cupboard that allows a variable portion of the room air to flow into the working chamber, other than through the working aperture (sash opening), with the objective of preventing excessively high face velocities at low sash openings and allowing a constant total exhaust airflow irrespective of sash position.

NOTE: At small sash openings, in the absence of a by-pass, the air velocity may be so high (e.g. much greater than 1.5 m/s) that it has an adverse effect on the work being performed.

2.1.2.5 *Double-sided fume cupboard*

A fume cupboard having two movable sashes on opposite sides. (See Paragraph D10 of Appendix D.)

2.2 SERVICES

2.2.1 Electrical services

The electrical services to operate the fume cupboard exhaust system, electrical socket-outlets, controls and lighting shall be in accordance with AS/NZS 3000 and the requirements of this Standard.

Electrical service outlets (including socket-outlets) shall not be positioned within the fume cupboard chamber as they create an ignition hazard, are susceptible to corrosion from acid fumes and preclude the use of any fume cupboard wash-down facility.

Electrical socket-outlets used to operate electrical equipment within a fume cupboard shall be protected by residual current devices and fitted with illuminated indicators to show power status. Where laboratories have a room emergency switch for all electrical socket-outlets in the laboratory (see AS/NZS 3100 and AS/NZS 3760; and see AS/NZS 2982.1 for secondary school and tertiary laboratories), the fume cupboard electrical socket-outlets may be supplied from the common circuit. If multiple electrical supplies are connected to a fume cupboard, they shall each be clearly labelled in accordance with AS/NZS 3000.

It shall not be possible to use electrical appliances within a fume cupboard without compliance with Clause 2.2.4.

2.2.2 Other (piped) services

The outlets for piped services (e.g. gas, water) should be located on the inner surface of the fume cupboard.

Each service outlet shall be individually controlled and the controls shall be located on the outer surface of the fume cupboard or the supporting structure. Control knobs or handles should not protrude beyond the line of the face of the fume cupboard.

Control knobs or handles shall not affect fume containment.

Controls shall be unambiguously associated with their outlets by means of colour coding and labelling to indicate the specific service. Colour-coding should be in accordance with EN 13792.

It shall not be possible to use flammable gas within the fume cupboard without compliance with Clause 2.2.4.

2.2.3 Links to building management systems

Fume cupboard(s) may be linked to a building management system or central management control system for monitoring. It shall not be possible for such a system to remotely start or shut down a fume cupboard. Any building management system shall not interfere with the requirements for services set out in this Clause (Clause 2.2).

2.2.4 Fume cupboard control and isolation systems

2.2.4.1 Manual controls

Fume cupboard manual controls shall be readily accessible to the fume cupboard operator and provide means for the following:

- (a) Starting the fume cupboard exhaust system and pre-purge. A delay of one minute from establishment of adequate airflow shall be implemented before electrical and flammable gas services to the fume cupboard become available. There shall be a visual indication when electrical and flammable gas services are available. [See also Clauses 2.2.4.2, 2.2.4.3 and 3.2.5.5(b).]
- (b) Shutting down the fume cupboard services and exhaust system by means such as an off control [see Clause 3.2.5.5(d)].

- (c) Quickly shutting down any electrical and flammable gas services provided to the fume cupboard by means of an emergency isolator.

Upon operation of the manual off or emergency isolator controls, power to fume cupboard electrical socket-outlets and flammable gas services shall be isolated immediately. The visual indication of electrical and flammable gas service status shall change to show they are not available.

When the manual emergency isolator is operated, it shall require manual resetting before the fume cupboard services can be reactivated. The manual off and emergency isolator controls may be combined provided manual resetting is maintained when the control is used for emergency isolation.

NOTE: An audible alarm is not required to sound on operation of the manual emergency isolator.

2.2.4.2 Automatic emergency isolator

An automatic emergency isolator shall be fitted to operate when any of the following, or other events that can compromise safety, occur:

- (a) Low face velocity of the air being drawn into the fume cupboard is detected (see Clauses 3.1.2 and 3.2.3). The isolator shall operate before the average face velocity falls below 0.3 m/s.

NOTE: The isolator should commence operation within 15 s.

- (b) Mains power failure occurs.
- (c) The thermal detector located in the exhaust throat of the fume cupboard (if fitted) senses an excessive temperature (see Clause 2.14.2).
- (d) Low solution level or inadequate operation of any scrubber or other air cleaning device associated with the fume cupboard is detected.
- (e) Any room emergency switch that interrupts power to room electrical socket-outlets or any isolating valve that stops flammable piped gases (see AS/NZS 2982.1) operates.

The automatic emergency isolator shall immediately isolate any electrical and flammable gas services used within the fume cupboard. The visual indication of electrical and flammable gas service status shall change to show they are not available. In circumstances other than when mains power failure occurs, the power supply to the exhaust system shall not be interrupted. When the automatic emergency isolator operates, it shall require manual resetting before the fume cupboard services can be reactivated. The following requirements apply:

- (i) When a mains power failure occurs, the audible signal shall sound for 20 min or until manually acknowledged. Upon resumption of electrical power, the electrical and flammable gas services to the fume cupboard shall not be automatically re-established.
- (ii) When the automatic emergency isolator operates for other reasons, the audible signal shall sound until manually acknowledged.

Alarm provision shall allow compliance with the above arrangements [2.2.4.2(i) and (ii)] in accordance with the reason for the isolator's activation.

The manual emergency isolator [see Clause 2.2.4.1(c)] and automatic emergency isolator systems may be combined, provided that the manual emergency isolator requires operation of only one control, e.g. a single master switch.

2.2.4.3 Room emergency switch

A room emergency switch shall not interrupt the power supply to the exhaust system.

2.2.5 Lighting

Illuminance at the work surface shall be not less than 400 lx.

Lighting shall be either—

- (a) located outside the fume cupboard working chamber, behind a non-opening transparent or translucent panel, sealed from the interior of the chamber; or
- (b) flameproof and corrosion-proof when installed inside the fume cupboard (see AS/NZS 1826).

Access shall be provided for maintenance and cleaning of the light and, where fitted, translucent panel.

2.2.6 Fault indicators

Where a fume cupboard does not have services that require the isolators in Clause 2.2.4 to be fitted, the fume cupboard shall be fitted with audible and visual indicators which operate in an equivalent manner when low airflow or power failure conditions occur.

2.2.7 Control systems

Control systems adopted for fume cupboard functions should be of fail-safe type.

2.3 BASE

The fume cupboard base shall be sealed, and shall incorporate a means (e.g. a raised lip or a sump) of minimizing the hazardous effects of spillage toward the fume cupboard operator. The base, or sump, if fitted, shall be of 10 mm minimum depth and have a minimum capacity of 5 L.

NOTE: A raised lip at the front of the fume cupboard which incorporates a vertical inner surface will promote turbulence in the air entering the fume cupboard from the laboratory and may result in the fume cupboard failing the smoke test specified in Clause 3.1.1.

2.4 SINK

Any sink fitted to a fume cupboard needs to comply with relevant local water authority requirements.

NOTE: AS/NZS 2982.1 specifies requirements for laboratory water services, including disposal systems.

2.5 SUMP

Any sump fitted to a fume cupboard shall be impervious to materials used in the fume cupboard. When a fume cupboard is fitted with a removable work surface, the sump shall be free draining and designed so that the void under the removable panel is sufficiently ventilated to prevent accumulation of flammable vapours.

2.6 CHAMBER

The working chamber of the fume cupboard shall be made of suitable materials for the intended work (see Appendix C). The fume cupboard shall be constructed with a smooth interior so that the entire work surface can be cleaned and residues cannot become trapped.

2.7 SASH

2.7.1 General

Transparent, easily movable, horizontally sliding or vertically rising panels of adequate strength that will substantially close off the cupboard face shall be provided. A vertically rising sash shall be counterbalanced. Each sash shall move easily and quietly, yet remain in place wherever it is stopped. Components of sash guides, internal sash surfaces and the counterbalance mechanism, where fitted, that are exposed to corrosive fumes shall be made of a corrosion-resistant material or have a corrosion-resistant finish.

2.7.2 Maximum working sash opening

The maximum working sash opening shall be limited by a physical stop that prevents the sash being opened further.

It shall not be possible to open the sash beyond the maximum working sash opening except by means of a key or tool, and any physical stop shall be reset automatically when the sash is moved to reduce the opening size.

2.7.3 Minimum sash opening

An operating fume cupboard shall have a minimum sash opening—

- (a) designed to limit the development of excessively high face velocities in fume cupboards that do not incorporate a by-pass or air extraction rate controlled by the sash opening; and
- (b) ensuring adequate airflow through the sash opening to dissipate heat and dilute fume generated within the fume cupboard.

NOTE: The requirements for minimum airflow are set out in Clause 3.1.2.

2.7.4 Vertically rising sashes

For vertically rising sashes, stops shall be fitted to provide a minimum opening of at least 50 mm below the sash. These stops provide operator protection in the event that one or more of the sash suspending cords, or equivalent devices, fail. Failure of an individual sash suspension system shall not allow the sash to fall freely. Power-operated sashes shall incorporate a manual override.

2.7.5 Sash handles

External sash handles shall be provided. It shall be demonstrated by smoke testing (see Appendix A) that the sash handles do not generate an eddy in the plane of the sash opening.

2.7.6 Design of sash opening

The sash opening should incorporate aerodynamic features to promote non-turbulent entry of room air into the working chamber.

2.8 BAFFLES

2.8.1 General

Removable baffles are usually fitted at the rear or at the top of the fume cupboard chamber for the purpose of minimizing variation in face velocity over the working aperture and to ensure scavenging of fume from the fume cupboard chamber.

2.8.2 Construction

Baffles shall be constructed from an impervious material capable of withstanding removal and cleaning operations. Fastenings shall be suitable for repeated removal and replacement of baffles and shall not be affected by fume.

2.8.3 Baffle setting

Baffles shall be set at fume cupboard commissioning to ensure that airflows comply with Clause 3.1. If baffles are adjustable, their setting shall not be affected by their removal and replacement for cleaning.

2.9 SUPPORT STRUCTURE

The support structure shall be constructed to carry the weight of the fume cupboard, working equipment and materials, and to withstand the temperatures and operational environment to which it is expected to be exposed to during the proposed use.

2.10 FUME SCRUBBERS AND WASH-DOWN FACILITIES

Fume cupboard scrubbers are air cleaning devices fitted to the exhaust duct to wash contaminants from the effluent fume, usually with water or an aqueous solution. The exhaust airflow contacts the wash liquor inside the scrubber to effect transfer of contaminants from the air to the liquid phase. Liquid droplets are disentrained from the airstream in a demister section after the scrubber. The washed effluent can still contain traces of the contaminant, but at reduced concentration. The purpose of the scrubber is to minimize accumulations of hazardous residues in the exhaust duct, and to decrease the exhaust effluent concentration sufficiently to ensure safe dispersal. For example, hot sulfuric acid fumes condense visibly in the exhaust airstream and, if not scrubbed, precipitate acid droplets around the discharge stack. Perchloric acid is an example of a cumulative residual hazard (risk of explosion). Compact scrubbers may be sufficient to treat fumes that condense and are readily soluble in water. However, removal of other contaminants, especially stable gases of low solubility, may require the addition of neutralizing reagents to the wash liquor, or larger, purpose-designed scrubbers to achieve adequate results. Scrubbers intended to achieve air quality standards are beyond the scope of this Standard, although they may be used with fume cupboards if they meet the requirements set out in the remainder of this Clause.

Some scrubber components for which performance is a function of air velocity may not be suitable for use with variable air volume fume cupboards. Scrubbers should be effective for the full range of airflows encountered in service.

Scrubbers shall be fitted to fume cupboards designed for work with perchloric acid and hydrofluoric acid (see Appendix D). During the use of these substances in such fume cupboards, the scrubber pump and the exhaust fan shall be electrically interlocked. The scrubber shall continue to operate during the post-purge period. The automatic emergency isolator (see Clause 2.2.4.2) shall activate in the event of inadequate scrubber water level or flow. Consideration should be given to the inclusion of other monitoring systems to ensure proper operation of the scrubbing fluid.

Scrubbers shall wash all fumes passing from the fume cupboard into the exhaust duct. The scrubber should be designed to fit directly onto the fume cupboard to minimize the length of duct requiring continuous cleaning. Any nozzles shall be of corrosion-resistant material, and be easily removed for inspection and cleaning. The spray pattern within the scrubber shall be observable while in operation.

NOTE: Disposal of contaminated wash liquor needs to comply with local regulations.

Wash-down facilities, if fitted, shall irrigate all concealed surfaces, especially behind rear baffles, if fitted, and all internal surfaces of the duct below the fume scrubber. It should be possible to inspect and clean all surfaces of the duct between the fume cupboard and the scrubber.

A scrubber shall not be used as an alternative to the use, where possible, of methods that minimize the release of fumes and of primary devices that capture and treat fumes close to the source.

2.11 HEAT SHIELDS

Heat shields, where fitted, shall be designed to provide adequate protection for the inner surfaces of the fume cupboard. Heat shields shall be easily removable for cleaning. Heat shields shall not be positioned so that they compromise the safe and efficient operation of the fume cupboard.

2.12 WARNING LABEL

A warning label shall be fixed to the cupboard that—

- (a) specifies the spillage containment volume of the fume cupboard;
- (b) requires the operator to ensure that volumes of hazardous, flammable, oxidizing and corrosive substances do not exceed the limits determined during the risk assessment process (see Clause 6.1);
- (c) directs that, in the event of a liquid spill or fire, the manual emergency isolator shall be activated; and
- (d) prohibits the placement of any ignition source within the sump of the fume cupboard.

NOTE: Clause 6.1.1 provides guidance on the assessment of the risks associated with the particular liquids to be used and processes to be carried out in the fume cupboard. The results of the risk assessment may indicate the need for other warning labels and special work procedures which restrict the volume of liquids used in the fume cupboard.

2.13 IDENTIFICATION LABELS

A permanent label or permanent labels shall be affixed, in a prominent position, on each fume cupboard, giving the following information:

- (a) Identification number of the fume cupboard.
- (b) Model number of the fume cupboard and name of manufacturer.
- (c) List of air cleaning devices associated with the fume cupboard.
- (d) Indication of whether the cupboard is single or manifold ducted.

Permanent labels shall also be affixed, in prominent positions, on all fume cupboard system units, such as fans, air-cleaning devices and ductwork, indicating the identification number of the fume cupboard with which they are associated and the laboratory location of that fume cupboard.

NOTE: It may be necessary to take special measures (material selection, protective covering or periodic replacement) to ensure that the labels and markings remain legible.

2.14 FIRE PROTECTION

2.14.1 Fixed fire protection

(See also Appendix C for requirements and information on fire-retardant materials for use in fume cupboards.)

In Australia, where the building has an automatic fixed water sprinkler system for fire protection, a sprinkler head should be located on the ceiling of the room approximately 1 m in front of the centre of the face of the fume cupboard. If significant flame or heat escapes from the fume cupboard, the sprinkler will help to minimize the spread of fire to adjacent laboratory areas.

In New Zealand, sprinkler placement should comply with NZS 4541:2007, Clause 511.10.3.

A separate water sprinkler head(s), not linked to the main sprinkler system, designed to create a misting effect when operated, should be fitted in the fume cupboard throat to protect the exhaust duct by cooling any hot gases being drawn into the exhaust. If fitted, the sprinkler head(s) shall be—

- (a) protected against corrosion or made from corrosion-resistant materials;
- (b) fitted with a manual cut-off;
- (c) operated by the thermal detector specified in Clause 2.14.2; and
- (d) maintained in an operable state and inspected at least annually.

In specialized cases, protection by a foam system, a dry powder system or a fixed, gas flooding system may be required. The installation of such flooding systems shall comply with the appropriate standards. Canisters of extinguishant shall be installed outside the fume cupboard chamber to avoid corrosion of the canisters. Care should be taken to ensure that discharge velocities of extinguishing systems are not so great as to create a further hazard by displacing materials within the fume cupboard.

It is preferable to connect the fume cupboard's fire detection system directly to the building's fire detection system. However, the main types of building fire detection system are incompatible with one another, so the fume cupboard manufacturer is often not able to provide a fume cupboard controller capable of linking directly to all available types of building fire detection system. The fume cupboard controller may need to be modified for direct connection, or the building system may require an additional fire detector. Where direct connection will be required, this should be specified prior to purchase of the fume cupboard.

2.14.2 Thermal detectors

Detectors located in the exhaust throats of fume cupboards and exhaust ducts shall be corrosion resistant. They should activate at a temperature not more than 60°C, in order to detect any fire in its early stages. (For example, an exhaust flow of 400 L/s will increase in temperature by approximately 2°C for each kilowatt of heat released within the fume cupboard.)

Activation of the thermal detector shall operate the automatic emergency isolator.

2.14.3 Fire extinguishers

In addition to fire extinguishers provided in accordance with AS 2444, an extinguisher of minimum 5B rating (for light hazard) shall be available approximately 4 m from the fume cupboard. The fire extinguisher shall not be installed on the outside of the fume cupboard as heat or smoke may prevent its use.

SECTION 3 AIRFLOW, FUME EXHAUST AND DISPERSAL

3.1 REQUIREMENTS FOR AIRFLOW INTO THE CUPBOARD

3.1.1 Containment

A fume cupboard shall draw any fumes released from operations in the cupboard away from the operator and the working chamber to the exhaust of the cupboard. Ideally, airflow through the cupboard should be free from turbulence in order to achieve total containment of the fume. Leading edges of the cupboard, the sash window, and the apparatus in the cupboard all contribute to the formation of turbulent eddies within the cupboard. These eddies can transport some of the fumes close to the face of the cupboard, where other eddies or draughts within the room may draw some of the fumes into the operator's working area in front of the cupboard. The turbulence within the cupboard may be reduced by aerodynamic entries to fume cupboard fasciae, an aerofoil entry sill and correct design and positioning of baffles. The baffles also assist in scavenging heavy vapours.

Containment of the fume cupboard shall be assessed by, and comply with, the smoke test specified in Appendix A.

3.1.2 Face velocity

Face velocity shall be as uniform and stable as possible throughout the sash opening with the sash fully opened. The average face velocity shall be not less than 0.5 m/s when measured in accordance with Appendix B. Individual measurements shall be equal to or greater than 0.3 m/s.

A minimum airflow of five fume cupboard volumes per minute shall be maintained at all times when the fume cupboard is operating.

NOTES:

- 1 At the minimum sash opening, the face velocity may need to exceed 0.5 m/s to retain an exhaust rate of five fume cupboard volumes per minute.
- 2 Face velocities in excess of 1 m/s through the fully open sash can lead to local turbulence in front of an operator and generate overall instability of the airflow. High flow rates through the aperture lead to energy wastage by exhausting an unnecessary amount of conditioned air from the laboratory.
- 3 An area where the individual measurement varies from the average by more than 20% should be investigated as this may indicate an area where containment problems could occur.

3.1.3 Make-up air

3.1.3.1 Provision of make-up air

Make-up air is required to replace air exhausted through fume cupboards. Contaminated air, e.g. from adjacent laboratories, shall not be used for make-up air. The quality of make-up air should be consistent with the environmental conditions specified for the laboratory. Make-up air should be filtered and heated, cooled, or otherwise treated to meet the laboratory specification.

For laboratories that are not mechanically ventilated, sufficient openings, louvres or transfer grilles shall be provided in walls and doors for part or all make-up air to infiltrate into the laboratory from its surroundings. Openings should conform with the requirements of AS/NZS 2982.1 and may need to be closable for fire isolation purposes. Any openings that are subject to unpredictable turbulent draughts that can overwhelm fume cupboard containment, e.g. open windows, shall not be used to supply make-up air.

Fan-assisted make-up air systems shall comply with Clause 3.1.3.2.