



# HAMILTON

A U S T R A L I A

## Specification for H Series Single Sided Fume Cupboard

Contents	Page	Contents	Page
Subsection 001		Subsection 006	
01 Scope	1	01 Services Generally	8
02 Standards	1	02 Valves	9
03 Definitions	2	03 Pipe Work & Fittings	9
04 Materials	2	Subsection 007	
05 Guards	2	01 Controls & Alarms Generally	10
Subsection 002		Subsection 008	
01 Guarantees	2	01 Painting	11
02 Performance Requirements	3	02 Indication & Labels	11
03 Noise & Vibration	4	Subsection 009	
04 Safety Requirements	5	01 Exhaust Fans Generally	11
Subsection 003		02 Components	11
01 Testing Generally	5	03 Fan Drains	12
02 Acceptance Tests	6	04 System Pressure Losses	12
Subsection 004		05 System Pressure	12
01 Manuals	6	06 Fan Noise	12
02 Maintenance & Service	6	Subsection 010	
Subsection 005		01 Attenuators Generally	12
01 Construction	6	Subsection 011	
02 Support Cupboard	8	01 Air Balancing	13
03 Siting of Cupboard	8	02 Measurement	13
		Subsection 012	
		01 Electrical Installation	13

**SUBSECTION 001: SINGLE SIDED SCHOOL LABORATORY FUME CUPBOARDS**

**01 SCOPE - LABORATORY FUME CUPBOARDS**

**OUTLINE DESCRIPTION:** This standard specification sets out the requirements for the Design, Quality of Materials and Standards of Construction, which shall be adopted in the supply and installation of a single sided Laboratory Fume Cupboard.

This type of installation and items of equipment to be supplied under the contract shall be as set out in the work specification and/or drawings defining the extent of work, and as follows:

**GENERAL DESCRIPTION OF WORK:** The fume cupboard shall be a floor mounted type complete with a PVC clad steel framed support bench and shall be installed where shown on the drawing.

The fume cupboard supplied under this contract shall have an exhaust system only. The fan shall be attenuated, if required, so that the sound level in the laboratory working at the cupboard shall not exceed NR 45.

The fume cupboard shall be manufactured from 4.5 mm rigid PVC and have a working surface which is suitable for the application. In the case of a ceramic tiled base the tiles should extend up the internal sides and back 150 mm the ceramic tile work surface shall be grouted with chemical resistant epoxy grout. The design of the fume cupboard shall incorporate a PVC aerodynamic sill and spill containment lip. If required, a 10 or 15 Amp Double outlet GPO shall be mounted on the recessed front Fascia under the fume cupboard, or on the electrical plenum. The GPO shall be RCD protected.

If required a 300 mm x 300 mm x 200 mm deep white injection moulded polypropylene sink, circular or oval drip cup can be provided to fit in the fume cupboard work surface. The sink shall be grouted into the base to ensure a water tight seal between the sink and work surface.

For example, one (1) Australian Standards approved, epoxy coated cold water outlet and One (1) remote control valves.

One (1) Australian Standards approved, epoxy coated gas outlet complete with gas solenoid valve and One (1) remote control valves.

The overall width of the fume cupboard size shall be as designated by the client, but generally chosen from the standard range provided by the manufacturer. The depth of the cabinet shall be 750 mm and the unit shall have an approximate over-all height of 1800 mm, which includes the 150 mm PVC clad, recessed Fascia for mounting the remote control valves. The over-all dimensions of the fume cupboard support bench shall be to suit the fume cupboard width x 690 mm deep x 720 mm high.

Full electrical fail-safe provisions with air flow isolation switch, gas solenoid valve, one minute pre-purge, twenty minute post-purge and emergency isolation, all in accordance with AS2243.8-2001 shall be provided. The "fail-safe" electrical system shall be installed in a fabricated PVC electrical plenum mounted above the sash opening on one side of the fume cupboard. The emergency isolator shall be labelled in accordance with Clause 2.12 of AS2243.8-2001.

**02 STANDARDS - LABORATORY FUME CUPBOARDS**

**REFERENCED DOCUMENTS:** The following standards are referred to in this section.

AS 2243.8	Safety in Laboratories Part 8 - Fume Cupboards
AS 2430.3	Classification of Hazardous Areas Part 3 - Specific Occupancies and Appendix A

**03 DEFINITIONS - LABORATORY FUME CUPBOARDS**

**LABORATORIES FUME CUPBOARD:** A Laboratory Fume Cupboard shall be defined as a partially enclosed work station, which minimises the spread of fumes to operators or other personnel in a laboratory, by utilising an



## 1200 mm x 750 mm Single Sided School Laboratory Fume Cupboard Specification.

induced flow of air through an adjustable working aperture, which dilutes the fume and by means of an extraction system, discharges it to a remote and safe location.

FUMES: Any hazardous gas, vapours, aerosols or particulate materials in air with one (1) or more of the following characteristics:

- (a) Toxicity
- (b) Flammability (includes risk of explosion)
- (c) Chemical activity (includes corrosion)
- (d) Discomfort
- (e) (Note: This fume cupboard standard is not intended to cover the requirements for radioactive, perchloric acid or micro biological materials).

### 04 MATERIALS - LABORATORY FUME CUPBOARDS

**CORROSION PROTECTION:** The entire fume cupboard inside and out shall be constructed from corrosion resistant materials.

Unless otherwise specified, protect all ferrous metals against corrosion by hot dip galvanising to AS 1650.

Epoxy coating shall be as specified under 'Services - Laboratory Fume Cupboards'.

REFER FURTHER: Construction - Laboratory fume cupboards.

### 05 GUARDS - LABORATORY FUME CUPBOARDS

All exposed moving parts shall be protected in accordance with the requirements of the Division of Occupational Safety.

Refer Further: Fans - Laboratory Fume Cupboards.

## SUBSECTION 002 PERFORMANCE

### 01 GUARANTEES - LABORATORY FUME CUPBOARDS

The Contractor shall be required to give the following Guarantees:

That regardless of design details shown on the drawings, the Contractor shall guarantee the performance of the whole fume cupboard installation, in accordance with this specification, AS 2243.8-2001 and AS 2430.3.

That all components will have adequate size and capacity to achieve the specified performance requirements.

Note: All capacities, sizes and all arrangements of equipment, controls, etc. set out in the specification and/or shown in the drawings are MINIMUM PROVISIONS ONLY and all such further provisions shall be made as are necessary to meet the guarantees required above.

Refer further: 'Performance Guarantee'

- Special Conditions of Contract, Mechanical
- Mechanical Preliminaries

### 02 PERFORMANCE REQUIREMENTS - LABORATORY FUME CUPBOARDS

The design exhaust air quantity for each cupboard will vary depending on the cupboard dimensions and shall be based on an even, average face velocity of 0.6 m/s through the door opening, +20% -0%.



1200 mm x 750 mm Single Sided School Laboratory Fume Cupboard Specification.

Irrespective of the above, the Contractor shall satisfy the following requirements with respect to velocity through the opening.

- (a) Average face velocity shall be not less than 0.5 m/s.
- (b) Velocity at any point shall be not less than 0.5 m/s.
- (c) Velocity at any point shall be no greater than 1.0 m/s.
- (d) Air flow across the leading edges into the fume cupboard shall not be turbulent, as measured by a smoke testing device.
- (e) The face velocity at the 500 mm high sash open position is equal to or greater than 0.5 m/s.
- (f) The uniformity at any point does not vary more than 20% from the average, when tested at any point on the fully open sash.
- (g) Smoke tests in accordance with AS 2243.8-2001 to prove that there is full containment of fume within the fume cupboard (i.e.: no leakage from inside the fume cupboard at any point).

**03 NOISE AND VIBRATION - LABORATORY FUME CUPBOARDS**

**NOISE:** The sound pressure level within the laboratory, measured at a point 1.5 metres from the fume cupboard opening, with one (1) cupboard operating only, shall not exceeds NR45. A fabricated PVC attenuator may need to be provided to achieve this rating.

(Note: The above noise levels shall include the noise generated by air make-up fans, where applicable).

**VIBRATION:** All equipment shall be selected, mounted and installed so as to produce no vibration that can reasonably be objected to and so as to meet the required noise guarantees set out elsewhere in the specification. The following provisions, however, shall at least be made.

All rotating equipment shall be mounted on supports incorporating:

- Rubber-in-shear anti-vibration mounts or springs with a deflection designed according to an approved procedure to give at least 95% isolation of vibrating forces, taking into account the type, size and span of the supporting floor. The rubber-in-shear mounts or springs shall be designed with a sufficiently large diameter to give lateral stability, but not less than 0.75 of the compressed height of the mount or spring at design load. Springs shall have a minimum additional travel to solid equal to 50% of the design deflection.
- If springs are used, pads of neoprene in series with the springs, designed for interrupting the passage through the springs of high frequency vibration in the audible range.
- Provision for levelling the supported equipment.
- Motion limiters where necessary for preventing excessive movement.

All electrical conduit and rigid conductors shall be isolated from motors by a section of flexible conduit and wiring.

Refer further:

- (a) 'Noise Emission and Vibration'
  - Special Conditions of Contract - Mechanical
  - Mechanical Preliminaries
- (b) 'Fans' - Laboratory Fume Cupboards



04 **SAFETY REQUIREMENTS - LABORATORY FUME CUPBOARDS**

The fume cupboards shall be constructed to comply with of AS 2243.8-2001, and shall thus be classified as non hazardous.

Refer further: 'Controls and Alarms' - Laboratory Fume Cupboards.

LABELS: Various labels relating to the safety in the use of the fume cupboard are required to be located adjacent to the control and alarm panel.

Refer further: 'Indication and Labels' - Laboratory Fume Cupboards.

**SUBSECTION 003 TESTING**

01 **TESTING GENERALLY - LABORATORY FUME CUPBOARDS**

NOTICE: Give reasonable written notice so that the Superintendent may attend and inspect all tests.

REQUIREMENT: The Contractor shall carry out air flow tests where necessary, on the manufacturer's proprietary line or prototype fume cupboard, to verify the performance of the aerodynamic edging and scrubber noise levels. Such tests shall be carried out on premises provided by the Contractor and shall be made prior to site installation.

AIR FLOW: Tests shall be performed by a NATA accredited Laboratory endorsed to perform mechanical testing of fume cupboards in accordance with the current AS 2243.8 and the following:-

- (a) Containment test of all edges  
I.e. Sash,  
Mullions,  
Base,  
By means of hand held smoke generator and/or internal smoke bomb.
- (b) Evenness of flow across the sash opening utilising a hot wire anemometer

The above tests are to be carried out with and without laboratory equipment set up inside fume cupboard. Typical of such equipment would be an evaporator or digester of approximately the following dimensions:

500 long x 300 deep x 225 high.

The Contractor shall provide all necessary testing equipment such as fans, flexible intake and discharge ducting, air flow measuring station, measuring instruments, smoke generator, and all labour required to set up and dismantle such equipment.

- (b) Evenness of flow across the sash opening utilising a hot wire anemometer.

All tests shall be repeated and the Contractor shall have any alterations made to the cupboard as is necessary, until acceptance performance is achieved.

On completion of satisfactory testing, approval will be given within 14 days for commencing production of the approved cupboard.

02 **ACCEPTANCE TESTS - LABORATORY FUME CUPBOARDS**

SPECIFICATION REFERENCE: System acceptance tests - Mechanical Services Generally.

PERFORMANCE TESTS: Provide for Performance Testing by a NATA accredited Laboratory endorsed to perform the mechanical testing of fume cupboards in accordance with the current AS 2243.8 and any necessary final adjustments arising there from, to be carried out on site at a time to be nominated by the Superintendent during the Defects Liability Period or, in the event of failure of the installation to meet the minimum requirements of the Specification, such extended period as the Superintendent may permit.



1200 mm x 750 mm Single Sided School Laboratory Fume Cupboard Specification.

Such tests shall include:

- (a) Noise Level Tests
- (b) Air Flow and Volume Tests
- (c) Control and Safety Equipment Tests
- (d) Any other Test deemed necessary by the Superintendent to satisfy Performance Guarantee Requirements.

**COMMISSIONING AND PERFORMANCE DATA:** Provide copies of all NATA certificates and data recorded during commissioning of the installations together with all necessary inspection certificates from local authorities.

Practical Completion will not be granted until a favourable NATA endorsed test report and all data, certificates etc. referred to above have been received and approved.

All data relative to the Performance Tests shall be provided within seven (7) days of completion of the tests.

**SUBSECTION 004 MAINTENANCE**

**01 MANUALS - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** Before the date for practical completion, provide the three (3) copies of an operator's manual. The manual shall be complete with fully detailed electrical drawings and operating instructions. A copy of the electrical drawings shall also be provided in the electrical plenum for easy reference.

**02 MAINTENANCE AND SERVICE - LABORATORY FUME CUPBOARDS**

**SCOPE:** Provide full maintenance and servicing for the entire installation from Practical Completion to the end of the Defects Liability Period.

Maintenance during the defects liability period of 12 months shall include the labour and replacements of faulty parts.

Routine maintenance shall be deemed to be the regular maintenance of equipment and shall generally conform to the requirements of AS 2243.8, as well as the following:

**SUBSECTION 005 FUME CUPBOARD**

**01 CONSTRUCTION - LABORATORY FUME CUPBOARDS**

**GENERAL:** The fume cupboard shall be based on a proven standard design, (Hamilton "H" series fume cupboard as manufactured by Hamilton Australia Pty Ltd Phone: (07) 3268 5188 Fax: (07) 3268 1121 or approved equal) modified if necessary to incorporate aerodynamic containment edges, and to conform generally to the drawings. Contractors shall demonstrate a working model before approval shall be given. Complete and detailed General Arrangement drawings shall be provided for approval prior to manufacture.

It shall be the Contractor's responsibility to ensure that the performance requirements of this specification are met. In addition, the fume cupboard, scrubber (where fitted), fan, ductwork, associated hardware and services and services shall be manufactured, supplied, installed, tested, commissioned and maintained in accordance with AS2243.8-2001, AS2430.3 and AS3000.

**MATERIALS:** The acceptable material for all fume cupboards is to be 4.5 mm thick, white unplasticised PVC.



## 1200 mm x 750 mm Single Sided School Laboratory Fume Cupboard Specification.

**INNER CHAMBER:** The inner chamber of the fume cupboard shall be to the Manufacturer's Standard Guaranteed Construction. The chamber shall be constructed so that the assembly shall have a smooth interior finish and generous radiused corners in the work surface for ease of cleaning.

**FASCIA AND SASH:** The fascia of the fume cupboard shall be constructed of unplasticised PVC and have fully radiused corners for aerodynamic air flow. The fascia, together with the door assemblies, shall be PVC welded to the inner chamber. Allowance shall be made for removal of the sash from the front (i.e.: it shall not be necessary to remove the fume cupboard from the bench to replace the sash). Remote control valves for the services shall be fitted to the recessed 150 mm high bottom Fascia panel. This Fascia shall be recessed a minimum of 50 mm from the front face of the fume cupboard to prevent accidental operation of the remote control valves for the services.

The sash of the fume cupboard shall be constructed from 6 mm thick toughened glass to AS 2208 (stamped by the Manufacturer) together with the SAA Approval stamp for toughened glass. The sash shall slide vertically in either extruded or moulded unplasticised PVC guides. The sash shall be carefully balanced by counterweights to ensure even and easy operation, using stainless steel cables and large diameter (min. 40 mm) low friction nylon pulleys with stainless steel sheaves. Closure cushions shall be installed at the bottom of the sash guides to allow a minimum 50 mm opening and at the fully closed position. The lower closure cushions shall be sufficiently strong to take the full force of a falling sash, due to the failure of one or both counterweights.

A sash height limiting device shall be installed to limit the operating opening to 500 mm. This limiting device shall also be cushioned. This device shall be capable of being overridden by the operator so that tall apparatus may be installed or removed in the fume cupboard whilst it is not in use.

An airfoil shaped edge section manufactured from white fire retardant fibreglass shall be fixed to the sash to ensure smooth airflow into the chamber. This airfoil section shall have a smooth radiused curve leading into the chamber and shall double as a handle for raising and lowering the sash. Handles that penetrate the glass sash shall not be permitted.

**AERODYNAMIC EDGES:** The Fascia edge at the chamber floor level (the lower sill) and the lower edge of the sash and the Fascia mullion edges into the containment area are to be to an approved tested aerodynamic design and shall be of PVC construction. The aerodynamic entry at the chamber floor level (the sill) shall be also manufactured from PVC and shall be incorporated into the fume cupboard base.

**BYPASS AIR:** The fume cupboard can be used in a constant flow mode. This shall consist of an epoxy coated aluminium egg-crate grille with a removable core panel, mounted above head height on the fume cupboard to draw air from the room. The air by-pass grille shall be approximately the same size of the fully open sash so as to achieve an even, average airflow at any sash position.

The bypass air shall be introduced into the containment chamber via an opening above the closed door positions, so that the opening will be progressively closed off by the sash as it is raised. With the sash fully raised to the working position, the bypass shall be fully sealed off to make all the airflow pass through the sash opening. At all times, air velocities shall be maintained within the range specified in the current AS 2243.8 and the performance range. An auxiliary make-up system shall not be fitted, as these types of systems have been the cause of many fume containment problems in the past.

**VARIABLE AIR SYSTEM:** The sash shall be interlocked to give variable speed to the exhaust fan. At any given sash height, the average face velocity through the opening of the fume cupboard shall not fall below 0.5m/sce. At minimum sash opening, the fume cupboard shall retain at least five (5) "cupboard volume" air changes per minute.

**WORKING SURFACE AND SINK:** The fume cupboard shall have a heat and acid resistant unglazed ceramic tile work surface or similar to suit application. The tiled work surface shall be complete with radius cove tiles that upturn 150 mm to the sides and rear of the fume cupboard. The work surface shall be grouted with chemical resistant epoxy grout. The tiles shall be fixed to a fully sealed PVC base laminated to an 18 mm thick Foamex PVC base. support. The PVC base under the tiles shall incorporate the aerodynamic entry at the chamber floor level (the sill) and the anti-spill lip required by the current AS 2243.8.

The fume cupboard work-surface can incorporate a 300 x 300 x 200 mm white injection moulded polypropylene sink or circular or oval drip cup, and a polypropylene 50 mm BSP plug and waste. Openings can be provided in the tiled floor to take the cold water outlet. A 10 mm thick PVC sink tile complete with 50 mm downturn can be grouted into the ceramic tile base to enable water proof fixing of the sink from under the work surface.



**BACK BAFFLE:** The fume cupboard containment chamber shall contain a removable back baffle constructed from 3 mm thick white heat and chemical resistant high pressure laminate (ABET "Lab grade" or similar approved). This baffle shall have slot openings top centre and bottom for the efficient scavenging of the containment chamber at high, medium and low levels. The baffle shall be shaped and positioned to completely cover the air outlet opening at the top, so that any condensation is directed down the rear of the baffle to the sink, and does not impinge onto equipment in use in the cabinet. Slot openings shall be fixed sizes and position (i.e. non adjustable). The design of the baffle shall be designed to assist in the achievement of an even, average airflow through the open sash must be to the manufacturer's time proven arrangement and shall comply with the performance guarantee requirements of the specification.

**LIGHT:** One (1) light fitting shall be installed in the compartment above the working chamber. It shall be an industrial type fluorescent fitting, mounted in a vacuum formed enclosure designed so that it can be readily removed for maintenance. The light fitting shall illuminate the containment chamber below through a suitably sized toughened glass panel, set flush with the interior of the chamber. A clear PVC Panel shall not be accepted. The light shall be accessible via removable PVC panels set behind the removable air by-pass grilles. The lights shall be sized to comply with the requirements of AS2243.8.

**PANELS:** The fume cupboard shall be complete with fully welded white PVC side panels, having surfaces resistant to chemicals and which are easy to clean. The base of the cupboard, under the work surface shall be constructed from minimum 18 mm thick Foamex PVC. Clear 4.5 mm thick PVC viewing panels may be requested within the side panels to allow students to observe experiments within the fume cupboard.

## **02 SUPPORT CUPBOARD - LABORATORY FUME CUPBOARD**

**SUPPORT FRAME:** The support cupboard shall be constructed from epoxy coated 32 mm x 32 mm RHS welded steel sections fully clad with 4.5 mm white PVC on both the sides and back. Gussets plates and 32 mm x 32 mm RHS bracing shall be provided for rigidity where necessary. The support cupboard shall be complete with two (2) 4.5 mm white PVC sliding doors and one (1) white PVC covered shelf welded to the side walls. The bottom of the support cupboard shall be constructed from 18 mm thick Foamex PVC with 3 mm thick white PVC to the top and front edge. The bottom of the support cupboard shall be fitted 150 mm off floor level.

The fume cupboard is not required to be fixed to the support frame; however, the top of the frame shall present a neat and level surface, so that there are no gaps between the frame and the cupboard. The cupboard shall sit rigidly on the frame and packing between the frame and the base of the fume cupboard shall not be acceptable.

**LEVELLING FEET:** The cupboard and/or mounting frame shall have adjustable feet for levelling the cupboard on uneven surfaces. The feet shall be constructed from suitable materials.

## **03 SITING OF CUPBOARD - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** The fume cupboard shall be located as shown on the drawings, but in any case should be generally to the requirements of AS 2243.8, Section 4.

## **SUBSECTION 006 SERVICES**

### **01 SERVICES GENERALLY - LABORATORY FUME CUPBOARDS**

**GENERAL:** The appropriate services for each fume cupboard as required shall be factory installed and piped.

All Piped Services should be pre-plumbed from the remote control valve to the outlet. A connection pipe from the inlet side of the valve shall be of adequate length to allow on site connection to the main services pipe work. On-site connection of water and waste services shall be provided by others.



## 02 VALVES - LABORATORY FUME CUPBOARDS

**REQUIREMENT:** All valves shall be of the panel mount type and shall be specifically designed for laboratory use, valves shall be suitable for mounting on the 150 mm recessed PVC covered Fascia panel and shall incorporate a lock nut or back washer, to firmly locate the valve in position. Where screws are required to locate the valve, they shall penetrate the Fascia panel and connect to a metal back washer or locating plate.

All water valves and outlets shall be Australian Standards "Watermark" approved. (Broen or equal approved)

All gas valves and outlets shall be Australian Gas Authority (AGA) approved. (Broen or equal approved)

Where possible, valves should be of the non-rising stem type and of equivalent manufacture but in any case, all valve hand-wheels shall be of circular appearance with identical size and shape.

Hand-wheels shall be of coloured polypropylene construction, colour coded to international standard DIN.12920 recommendations.

All valves shall incorporate an escutcheon plate under the hand wheel, clearly marked with the wording 'on' - 'off' and a directional apron or symbol indicating the direction of turn for closed and open positions. Labels screwed to the cupboard Fascia for this purpose, shall not be acceptable.

Valves shall be arranged in a neat and orderly fashion, to an approved order of services (to be shown clearly on shop drawings).

Generally, valve bodies shall be constructed from Australian Standards approved de-zincified (DR) brass or gunmetal, except where specified for special requirements.

Finish shall be baked epoxy coating to an approved colour.

## 03 PIPE WORK AND FITTINGS - LABORATORY FUME CUPBOARDS

**REQUIREMENT:** Unless specified otherwise for special requirements, all pipe-work shall be copper to AS 1432 or Australian Standards approved high pressure nylon and all fittings shall be brass. All connections to valves and outlets shall be double flared (copper pipe) or high pressure nylon (nylon pipe). Pipe-work and fittings shall be sized to match the valves and to suit the particular requirements of each service. Where used with combustible fuel gas, pipe-work and fittings shall be in accordance with Australian Gas Association Code AG601. All pipe-work within the fume cupboard shall be neatly arranged and saddle clipped at regular intervals, to present a neat and workmanlike appearance.

### SUBSECTION 007 CONTROLS AND ALARMS

#### 01 CONTROLS AND ALARMS GENERALLY - LABORATORY FUME CUPBOARDS

**REQUIREMENT:** The fume cupboard construction shall allow for a PVC electrical plenum for mounting of the fume cupboard electronic control module, located between the air bypass grille and cupboard opening. The electrical plenum shall be constructed from 4.5 mm thick white PVC and shall be easily removed for access to wiring and shall present a neat and workmanlike appearance with no gaps between the panel and cupboard Fascia. When the electrical plenum is removed, the fume cupboard shall be easily transported through "standard" doorways. The fume cupboard shall be fitted with an electronic "Fail-safe" control module. The electronic module shall be controlled by a proven proprietary brand of programmable Logic Controller (PLC) for ease of servicing and/or reprogramming should any requirements of the Australian Standard change. The control system shall be programmed to control the fume cupboard operations in compliance with AS2243.8-2001, AS2430.3 Appendix "A" and AS3000.

The control system shall be assembled using proven proprietary items and using proprietary technology. Terminals shall be provided for connection to power and fan. All wires and terminals are to be numbered, sized and color coded in accordance with AS3000. The control system shall be complete with pre-purge and post-purge timers (controlled by the PLC), all LED graphic indicators giving status of fan, pre-purge, post-purge, power/gas availability, alarm and alarm mute.



1200 mm x 750 mm Single Sided School Laboratory Fume Cupboard Specification.

The control system is to be complete with an adjustable airflow sensor which allows (in the event of an extraction rate failure) the control system to activate a 100 dB audible alarm, a flashing red LED "Airflow Fault" graphic on the control panel and will turn off (isolate) gas and GPO services to the fume cupboard via an AGA approved gas solenoid valve and contactor. (All in accordance with AS2243.8)

The electronic control panel shall have flush mounted touch switches for the following:

- (a) "Fan On/Off" to switch the fan on and off.
- (b) "Light On/Off" switch to switch the fluorescent light on and off.
- (c) "Gas/GPO" Set/Reset" switch to switch the gas and GPO's on after the pre-purge cycle or after an airflow fault has been rectified.
- (d) "Audible Alarm On/Off" switch for muting the audible alarm.
- (e) "Lamp Test" switch (to indicate faulty LED's and/or audible alarm).

In addition, the control panel shall have tricolor (red, orange and green) LED graphic indicators to indicate the status of the following:

- (a) "FAN ON" Indicator (Green)
- (b) "FAN 20 MINUTE RUN ON" Post-purge Indicator (Flashing Orange)
- (c) "AIRFLOW 1 MINUTE PRE-PURGE" Pre-purge Indicator (Flashing Orange)
- (d) "AIRFLOW FAULT" Indicator (Flashing Red with 100 dB Audible Alarm)
- (e) "GAS/GPO AVAILABLE" Indicator (Green)
- (f) "AUDIBLE ALARM MUTE" Indicator (Red)

In addition to all of the above, provide the following safety features:

- (a) Emergency Stop button to isolate gas and/or electrical supplies to the fume cupboard. (As described in the Emergency Isolator section below.)
- (b) Time delays so that the power and gas supply shall be delayed for one (1) minute after the restoration of power after a main power failure.

No GPO's will be fitted inside the fume cupboards. The GPO's (if fitted) shall be fitted outside the fume cupboard on the recessed lower Fascia.

Emergency Isolator.

Fitted to the control module shall be a latching mushroom head "FUME CUPBOARD EMERGENCY ISOLATOR" which, when activated, will isolate GPO power and Gas supplies to their outlets but will allow the exhaust fan to continue running as required by the Australian Standard AS2243.8. The Isolator shall be labeled in accordance with Clause 2.12 of AS2243.8.

Gas Solenoid Valve:

A gas solenoid valve suitable for use with Liquid Petroleum Gas shall be fitted on the gas supply line under the fume cupboard before the gas valves. The solenoid shall be interconnected with the fume cupboard "fail-safe" electrical system to isolate gas supply during pre-purge and post purge cycles and during fault and alarm conditions as required by AS2243.8. The solenoid valve shall be of the fully sealed type suitable for use in a Class 1 Zone 2 area. It shall incorporate a removable solenoid coil for ease of servicing.



**SUBSECTION 008 PAINTING, INDICATION AND LABELS**

**01 PAINTING - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** All painting shall be in accordance with Project Services Standard Specification for Painting. Finish colours of all items requiring painting shall be to the approval of the Superintendent.

**02 INDICATION AND LABELS - LABORATORY FUME CUPBOARDS**

**SERVICES:** All services shall be identified by labels, fixed to the fume cupboard recessed control valve Fascia, below the service valve. All labels shall be white/black/white Traffolyte engraved with minimum 6 mm high lettering.

**CONTROL PANEL:** The electronic control panel touch pad will be constructed from a single sheet of minimum 1.2 mm thick aluminium covered by a screen printed lexan. Lettering and graphics shall be screen printed to the reverse of lexan to indicate the control switches and indicator lights. The lettering shall be clear so that the lights illuminate them when activated. The lettering for the Emergency Isolator shall be minimum 6 mm high in red.

**SUBSECTION 009 FUME CUPBOARD EXHAUST FAN**

**01 EXHAUST FANS GENERALLY - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** Exhaust fan shall be a single phase, variable speed, direct driven, centrifugal type, specially constructed for use with fume cupboard installations and selected to meet Performance Guarantee Requirements. The duty shall be sufficient to provide an even, average airflow through the fully open sash of 0.5 m/s + 20% reserve (i.e.: 0.6 m/s even, average airflow through the fully open sash) as required by AS 2243.8.

**02 COMPONENTS - LABORATORY FUME CUPBOARDS**

**HOUSING:** Fan housings shall be moulded in two pieces entirely from rigid white PVC,

**IMPELLER:** The impeller shall be of injection moulded polypropylene construction with a cast iron or steel centre on a steel shaft. In addition to the key, three locking grub screws shall be provided. All metal parts, including the shaft, which may be exposed to corrosive fumes, shall be completely coated with liquid vinyl or similar corrosive resistant material.

The impeller shall be statically and dynamically balanced.

**SHAFT SEAL:** The polypropylene impeller centre hub shall extend through the fan side plate to the outside and a high quality plastic seal which is resistant to chemical corrosion and wear and tear shall be fitted to seal between the impeller centre hub and the fan side plate.

**DRIVE MOUNTING PLATE:** The fan motor shall be mounted on epoxy coated aluminium or galvanised steel mounting plate assembly.

Generally, bolts and nuts shall be of stainless steel grade 316.

**ELECTRIC MOTOR:** The motor shall be a variable speed, single phase totally enclosed fan cooled (TEFC) type in quantity production and freely available.

Three phase motors used in conjunction with VSD and filter may be used as an alternative to the single phase motor. The motor shall be suitable for use with an approved variable speed pot type of controller mounted inside the electrical plenum of the fume cupboard which will be used to set the required air flow at time of commissioning.

**BEARINGS:** The bearings in the motor shall be "sealed for life" type bearings designed and selected for 100,000 hours of service life.



**03 FAN DRAINS - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** Provide a 25 mm diameter PVC drain outlet on the fan scroll. This drain outlet shall be connected to a suitable drainage system by others.

**04 SYSTEM PRESSURE LOSSES - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** The Contractor shall allow for all ductwork losses, air bypass losses, fan losses and any other pressure losses applicable, to enable him to make the correct fan selection, to meet Performance Guarantee Requirements.

**05 SYSTEM PRESSURE - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** To prevent hazards arising from leaks in the duct work, the fume cupboard exhaust fan shall be located external to the building or in an exhaust air plant room, as required by Clause 3.2.2 of AS2243.8. Under no circumstance shall the fume cupboard exhaust fan be located inside the building or in a supply air plant room. If the fume cupboard fan is to be located on the roof external to the building it is the contractors responsibility to ensure that the fan is suitable for extended external use. The contractor shall also provide a weather proof motor cover that shall not in any way interfere with the cooling of the motor and a Hot Dip Galvanised fan support frame for mounting the exhaust fan and PVC exhaust stack on the roof.

**06 FAN NOISE - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** The selected fan shall have inherently low noise level characteristics, to enable the Contractor to meet specified noise levels. Maximum fan speed shall be 24 rev. per second. The fan shall be located external to the building or in the exhaust Plant Room, to prevent fan 'break out' noise intruding into the Laboratory space, and to comply with the requirements of AS 2243.8 with regards System Pressure.

Irrespective of the foregoing requirements, should the installed fan system not meet the specified noise levels, the Contractor shall, at his own cost, provide all attenuators, insulation and sound proofing as necessary, to lower measured noise levels to specification requirements.

**SUBSECTION 010 ATTENUATORS**

**01 ATTENUATORS GENERALLY - LABORATORY FUME CUPBOARDS**

**REQUIREMENT:** Where possible, attenuators should be installed in vertical duct runs, so as to be self draining but in any case, provide a 25 mm diameter drain and float trap to each attenuator at its lowest point, connected to the fume cupboard drainage system. Drains and traps shall be similar to those specified for fan scrolls and may be common for convenience.

**CONSTRUCTION:** Attenuators shall be constructed from a cylindrical housing of PVC with flanged PVC ends, to permit removal and cleaning. Attenuators shall be lined with an acoustic, sound absorbent material, faced with perforated PVC sheeting and shall incorporate sufficient baffling and/or a centre pod where necessary, to achieve the desired noise level reduction. The acoustic insulation shall be of a material impervious to most Laboratory chemicals and shall be fixed in such a manner, so as to be easily removable for cleaning or replacement, when contaminated.

**PROPRIETARY LINE:** Where possible, attenuators should be selected from the proprietary line range of a company experienced in the manufacture of PVC attenuators, but in any case, the Contractor shall be able to produce certified test data of insertion losses for selected attenuators, if requested by the Superintendent.



**SUBSECTION 011 BALANCING AND MEASUREMENT**

**01 AIR BALANCING - LABORATORY FUME CUPBOARDS**

REQUIREMENT: Air balancing for exhaust fan shall be carried out by the following:

- (a) Adjustment of the variable speed exhaust fan speed by the control pot located inside the electrical plenum.

**02 MEASUREMENT - LABORATORY FUME CUPBOARDS**

REQUIREMENT: All NATA calibrated measuring and test equipment required, to satisfy the performance and test requirements of this specification shall be provided by the Contractor.

The Contractor shall be able, upon request, to supply proof of the accuracy and calibration of his measuring equipment and to allow recalibrating or providing a replacement for any such equipment found to have an inaccuracy greater than that recommended by the manufacturer.

**SUBSECTION 012 ELECTRICAL**

**01 ELECTRICAL INSTALLATION - LABORATORY FUME CUPBOARDS**

REQUIREMENT: All electrical work shall be carried out in accordance with Australian Standard 3000 - Part 1, SAA Wiring Rules, Australian Standard 2430 - Part 3, Appendix A and the requirements of the Local Supply Authority.

UNIFORMITY: All accessories throughout the installation shall be as uniform as possible in shape, appearance, colours, position, etc.

CONDUCTORS: In general, conductors shall consist of PVC insulated stranded copper cable. No joints will be allowed in any cables, except at approved terminals at switchboards or equipment.

For cables to motors, no conductors of less cross sectional area than 1.5 sq. mm stranded shall be used. All wiring to instruments, controls etc. shall be run in multi-strand cables.

TAPE: The use of self adhesive plastic tape will not be allowed. Where cables need to be bundled or supported, nylon ties or another approved method shall be used. PVC sleeving, heat shrink tubing and the like shall be used where insulation is to be made good.

EQUIPMENT AND CIRCUIT IDENTIFICATION: All terminal blocks and wires shall be numbered.

All items of equipment shall be labelled.

FUSES: Fuses shall be of the H.R.C. type and shall comply with AS 2005, Parts 1 and 2 unless specified otherwise.

RELAYS: Relays used shall be plug in type enclosed in dust proof cover.

Contacts shall be de-rated by a minimum factor of 2 - i.e. contact rating shall be at least twice connected load.

LABELLING: All labels, unless otherwise specified or directed, shall be engraved multi-layer plastic sheet, giving black block letters on white background. Fix labels securely in such a way that the label cannot buckle under all extremes.

Label each item of equipment and each control suitably to describe its function and the operation of its controls.

LUMINARIES: The luminare shall be power factor corrected and fitted with a code type ballast and white tube.

