



**Fume Cupboards**

**Fume Extraction Systems**

**Laboratory Furniture**

**Turnkey Solutions**

**Microbiological Safety Cabinets**

**Laminar Flow Cabinets**

**Recirculatory Filtration Fume Cupboards**

**PCR Workstations**

**Annual Maintenance/Testing**

## COMPANY PROFILE



**Premier Laboratory Systems**  
Already a recognised leader in the design, manufacture and installation of fume cupboards and associated systems. The introduction of the new Enterprise Dynamic Flow fume cupboard now offers customers the most complete fume cupboard installation package available today.

### **Experience counts**

Our engineers have an unrivalled breadth of technical knowledge and experience, ensuring that all project management is successfully completed, regardless of size or complexity. We offer free consultancy service regarding relevant standards, safety and efficiency on all matters relating to the safe removal of corrosive/hazardous fumes. Design and drawings are produced using the latest CAD

technology. Manufacturing is in accordance with ISO 9001 Approved Quality Procedures.

### **Project Management**

Planning a new or upgrading an existing facility is invariably a team effort. A successful outcome is dependent on the manufacturer's ability to convert the Customer's requirements into an engineered, value-for-money solution. The larger the project, the higher the level of expertise needed.

Our Design Engineers are available to assist laboratory planners, architects, engineers and users at every stage of the project from initial conception to final acceptance. As our existing customers will testify, no-one has more experience in laboratory fume cupboard installations.

### **A Step-by-Step Approach**

Our comprehensive design-to-commission service includes not just a thorough analysis of the Customer's basic requirements, but also full consideration of a range of other aspects of the final design; noise attenuation, condensate drainage, fire compartmentation and pre-discharge fume treatment.

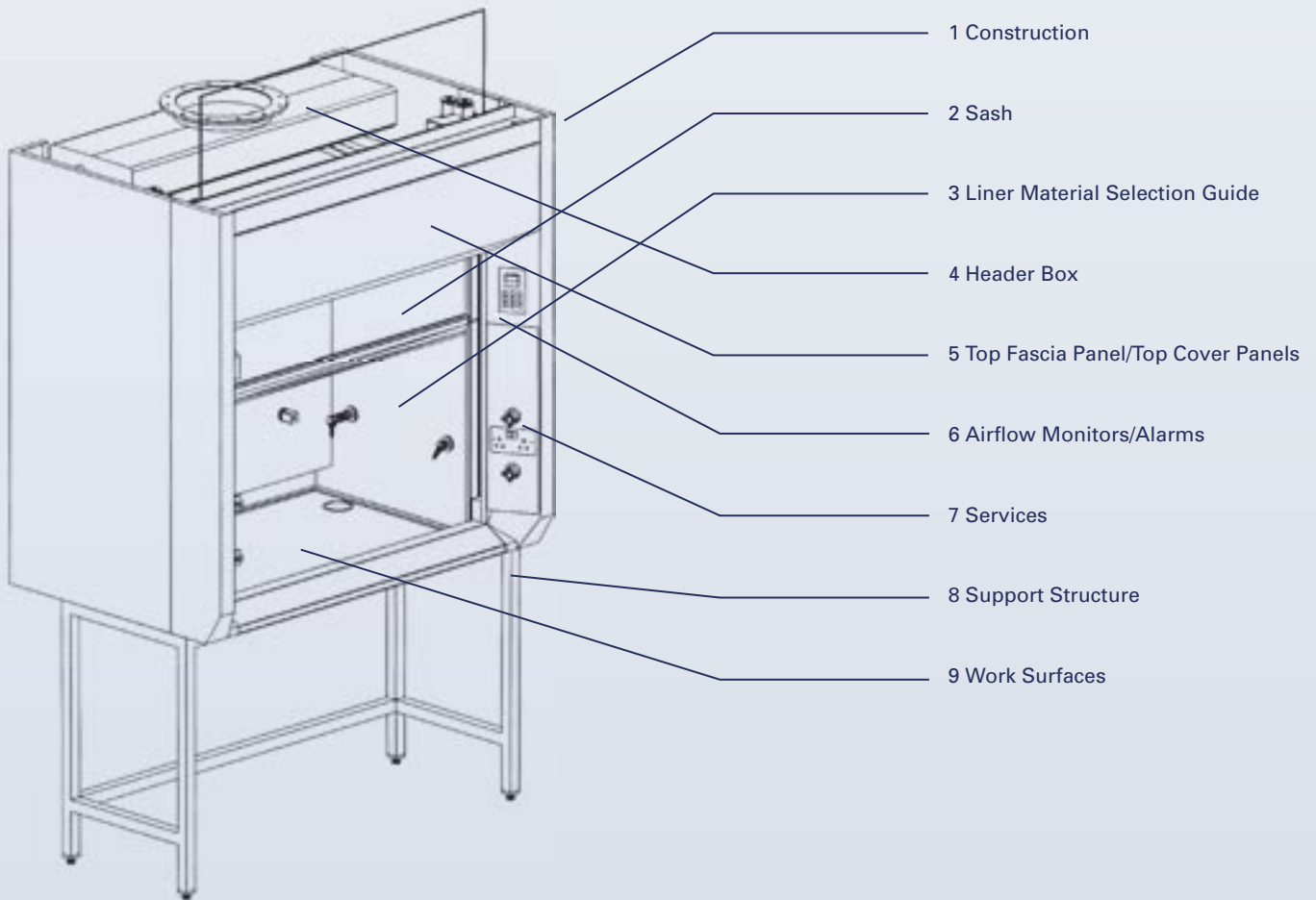
**Premier Laboratory Systems Ltd**  
10 Tollpark Place,  
Wardpark East,  
Cumbernauld,  
Glasgow G68 0LN,  
United Kingdom

Tel: +44 (0)1236 457545  
Fax: +44 (0)1236 457345

email: [info@premierlabs.co.uk](mailto:info@premierlabs.co.uk)  
web: [www.premierlabs.co.uk](http://www.premierlabs.co.uk)

# FUME CUPBOARDS

## INTRODUCTION



The “Enterprise” model fume cupboard is one of the safest available today achieving excellent containment performance when **type tested to BS 7258**, with maximum leakage rate of 0.008 ppm recorded during containment testing.

The angled entry together with the aerofoil cill and profiled sash-handle ensures that the fume cupboard offers uniform airflow characteristics.

The fume cupboard can be specified for either constant volume or variable volume use and can be supplied with various energy saving control systems.

### 1 Construction

The “Enterprise” fume cupboard is of double skin construction

with external panels of epoxy coated steel, coloured to match the underbench units. The double skin arrangement gives the fume cupboard excellent chemical and fire resistance capability.

### 2 Sash

The sash is of 6.0 mm toughened glass and is fitted with a profiled finger-pull to improve airflow characteristics at lower edge of sash. The sash is suspended on stainless steel cables running over ball-raced nylon pulleys with counterbalance weight, all arranged on a fail-safe principle in the event of cable failure. The sash is guided via low friction automatic spring tensioned guides. A simple, self-resetting mechanical sash stop is fitted to the side of the fume cupboard to prevent the sash being raised

above 500 mm working height unless the stop is released.

### 3 Liner Material Selection Guide

One of the most important decisions that has to be made when specifying a fume cupboard is the material specification of the internal lining to give the optimal performance against chemical usage within the fume cupboard. There is no single practical construction material for fume cupboard liners which is suitable for all applications. However, Premier Laboratory Systems offer a comprehensive range of construction materials suitable for most applications.

As a general rule, the fume cupboard worktop is subjected to more chemical attack than

the liners due to spillages, heat radiation etc. The worktop also has to bear the weight of any equipment placed within the fume cupboard and therefore is normally manufactured from a high density material.

To aid selection, please refer to chemical resistance chart and the following information.

### Solid Grade Laminate

Probably the most commonly used material to line fume cupboards, having a good overall resistance to most acids and solvents. Both the lining and the rear baffle are manufactured from 6 mm thick material. The material will seal to most worktops with silicone.

Available in a range of colours, although white and grey are

# INTRODUCTION

most common. The material however, is not particularly suitable for fume cupboard worktops as it does not offer good resistance against certain acids and is easily stained.

## Thermoplastic

Polypropylene or PVC lining and rear baffle are fabricated from 6 mm thick material. The plastic liners are excellent for fume cupboards used predominantly for heavy acid applications and are most suitable where wash down facility is incorporated. Some solvents will cause the plastic to soften, especially at elevated temperatures. However, once the solvent has evaporated, the plastic will usually appear unaffected. The main disadvantage of these liners is their relatively low heat resistance. PVC softens at 60°C and polypropylene at 90°C however this can be alleviated by means of ensuring the extract system is linked to any heat generation equipment within fume cupboard. Heat deflector panels can be fitted to minimise the effect of radiant heat on the plastic liners.

When plastic is used for a fume cupboard worktop, again the main disadvantage is damage to the worktop by heat, therefore insulation pads should be used.

With Polypropylene, it is not possible to seal the worktop to the liners except by fusion welding and then only if the liners and worktop are both Polypropylene.

## Stainless Steel

Stainless steel liners are manufactured from acid resistant Grade 316 stainless steel. They are available as either fabricated **sectional** liners with joints sealed with silicone or **one piece** liners with integral worktop incorporating large radii corners for ease of cleaning. Care should be taken when selecting this material, as stainless steel is affected by certain acids.

When used for boiling off acids,

the fume cupboard should be fitted with a water wash system to remove any condensed acids. Stainless steel sectionalised liners are suitable for use in low level radio-isotope applications. For higher level use, **one piece** liners should be specified.

## Epoxy Resin

There are two types of liners available – cast epoxy resin which is high density and suitable for the most concentrated acid applications. The material also offers good heat resistance up to 165°C and therefore is generally unaffected by heat generating equipment such as hot plates etc.

Although cast epoxy offers excellent chemical resistance, it is expensive and where a lesser degree of performance is required, we would recommend the use of laminated epoxy sheet.

This material is of a lower density being modified epoxy resin and fibreglass filled sheet. It however still offers good heat resistance, mechanical strength and chemical resistance. Laminate sheet is available in 5 mm thick, colour white.

## Glass Reinforced Plastic

G.R.P. Liners are fabricated from 6 mm thick glass fibre with chemically resistant resin and isophthalic solid gel coating. The liner is formed from a mould in **one piece** (to form sides, back and top panel) incorporating large radii corners. GRP is a good compromise between cast epoxy resin and thermoplastic.

To give the liner a heavy duty base, this is normally manufactured from cast epoxy resin and sealed with resin grout to the liner. Again, the liner being of one piece construction, it can easily incorporate wash down facility.

## 4 Header Box

The fume cupboard header has been aerodynamically designed to extract evenly

across the top of the fume cupboard. The header design reduces pressure drop and also contributes to low noise level. They can be provided in either PVC, Polypropylene or fire retardant G.R.P. A flanged spigot is fitted to the top of the header for connection to the extract system.

## 5 Top Fascia Panel/Top Cover Panels

Top cover panels to fit between fume cupboard and ceiling are designed to be easily demountable, and are supplied in epoxy coated steel to match fume cupboard outer panels. Along with the front fascia panel both are hinged for easy access to top of fume cupboard where controls/electrical junction boxes are located. They give a flush, neat finish to false ceiling.

## 6 Airflow Monitors/Alarms Main Functions

To continuously measure and display the face velocity of the air flowing through the fume cupboard and also to monitor sash position. Both visual indication and audible alarms as detailed below are provided for user safety.

### Standard Facilities

- Analogue meter with red/green scale for continuous display of measured face velocity
- Visual green LED indication of safe air
- Visual red LED indication of air fail
- Audible low air alarm sounder with mute facility
- Analogue meter with red/green scale for continuous display of measured face velocity
- Visual green LED indication of sash safe
- Visual amber LED indication of sash high
- Audible sash high alarm sounder with mute facility

### Optional Facilities

- Fan stop/start push buttons
- Visual green LED indication of fan run
- Low air alarm volt free relay output

- Auxiliary relays, outputs and controls for remote signalling and monitoring
- Battery back up

## 7 Services

Up to 6 gas and water front control valves/outlets can be provided on each removable service panel mounted on vertical side wings of the fume cupboard. Standard electrical services provided include light switch and 2 No. twin electrical outlets. If more services are required, or there is a preference for services to be mounted under the worktop, then a horizontal service rail can be provided below the front cill.

## 8 Support Structure

Fully welded table frame, allowing removable storage cabinets to be placed underneath. Storage cabinets can be specified for corrosive or flammable use (details follow) and incorporate catchment trays. Units are normally supplied with a ventilation kit to hook up to extract system or incorporate integral fan unit.

## 9 Work Surfaces

As stated within the liner selection guide, the worktop is subjected to more chemical attack than the liners and can also be subjected to varying temperatures. Depending on the nature of work, the worktop can also be subjected to impact and abrasion when the fume cupboard is in operation. Again to aid selection please refer to the Chemical Resistance Chart and the following information.

- **Epoxy Resin**  
Dished epoxy resin worktops are manufactured from cast solid epoxy resin and are self supporting. The standard colour is grey although black and white are available on request. Sinks and drip cups are either epoxy to match or Polypropylene.
- **Solid Grade Laminate**  
Dished solid grade laminate worktop is manufactured

# FUME CUPBOARDS

## INTRODUCTION

from melamine resins, well established in the UK laboratory industry. Providing good scratch, wear and chemical resistance. A durable surface that will perform well. They are not recommended for exposure to highly concentrated acid.

### • Thermoplastic

Plastic tops are available in two types:

Polypropylene (PP)

Polyvinyl Chloride (PVC)

Sheet material fabricated around a core of marine plywood with all joints fusions welded. Used extensively in high acid applications, but are not suitable for high working temperatures.

### • Stainless Steel

Stainless steel worktops are manufactured from acid resistant Grade 316 stainless steel. The stainless steel is formed to provide dishing around the perimeter and the sides fully return and is supported with a marine ply core. These tops offer good chemical resistance, however care should be taken when selecting this material, as stainless steel is affected by certain acids. The worktops give good abrasion and heat resistance.

### • Stoneware/Ceramic

These tops are of solid acid-resistant, glazed stoneware. All tops have a thickness of 30 mm, with a raised front edge 7 mm high. Full range of colours are available. Sinks and drip cups are integral to form one-piece workbase.

### • Tiles

Tiled worktops are manufactured on a core of marine ply, the tiled surface is bonded to the base, and jointed with chemically resistant cement. The standard colour is red. These tops are available as flat worktops or with a raised edge. Due to the recent price reduction in one piece ceramic bases, tiled tops have more or less been superseded

*Note: All fume cupboard bases incorporate a perimeter raised rim to contain spillage, and include either drip cups, rear trough or sinks as required.*

### Toughened Glass

Toughened glass is most commonly specified for general chemistry applications, offering excellent chemical resistance. Although probably the cheapest material available, it actually works out as expensive as cast epoxy resin due to the construction requirements necessary.

The glass incorporates an epoxy coated steel backing liner and Polypropylene bushing where the glass is penetrated for service outlets, scaffold supports, etc. The glass is supplied with an opaque green or white finish.

The most common worktop used in conjunction with glass is ceramic glazed stoneware. This is sealed to the glass with silicone and is available with a range of ceramic drip cups and sinks.

### Flammable Storage Cabinets

Flammable cabinets are built to comply with the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 and the Petroleum (Consolidation) Act 1928.

The cabinet is labelled to identify hazard in accordance with COSHH Regulations.

Manufactured from 16 gauge Zintec steel with epoxy paint finish minimum thickness 70 microns.

Door(s) (units greater than 600 wide fitted with 2 No. doors) are suitably reinforced to prevent distortion due to heat under fire conditions and incorporate sealing lipped edges. Doors incorporate Grade 316 stainless steel hinges, and handle lock.

Unit carcass is fully welded with integral Grade 316 stainless steel "ladder" shelf adjustment strips. Carcass fitted with

100 mm high plinth for floor mounting and incorporates 4 No. adjustable feet.

The rear panel is fitted with stainless steel flame arrestor and fire collar suitable for 42 mm extract spigot.

The cabinet is supplied with either adjustable 16 gauge epoxy coated steel or stainless steel banded (20 mm ) shelf and banded (75 mm ) sump tray.

The unit is dimensioned to slide within space between fume cupboard support frame allowing a 5 mm clearance on width and height to allow maximum storage space, units are 500 mm deep.

### Acid/Alkaline

**Carcass:** Manufactured from 19 mm melamine faced high density particle board, colour off white. All edges finished 0.5 mm thick melamine edging.

The rear panel is manufactured from PVC and incorporates spigot for connection to extract system. The cabinet is fitted with a 100 mm high fixed plinth manufactured from WBP marine ply with laminate finish suitable for wet areas. The height and level of the cabinet is adjustable via 4 No. feet.

**Shelves:** For module widths up to 600 mm shelves, are manufactured from 19 mm melamine coated high density particle board, front edge finished with 0.5 mm thick melamine edging. Shelves for the 900 and 1200 mm modules are made from a blockboard core faced both sides with 0.3 mm pressboard and melamine finished. Both front and back edges finished with 0.5 mm thick melamine edging. Shelf and bottom panel can be supplied with banded 30 mm deep PVC trays fully formed and welded to give leak proof containment.

**Doors:** Manufactured from 19 mm thick high density particle board, melamine faced both sides to colour off white. Sides edged

with 3.0 mm thick Polypropylene edging. Top edge fitted with PVC finger pull incorporating rubber buffer for quiet action.

**Hinges:** Wide angle epoxy coated (to give acid resistance) solid hinges and mounting plates, adjustable in two directions, opening through 270° incorporating built in tension for self closing from 30° angle.

Both types of storage cabinet can be supplied as mobile units with 4 No. castors (2 No. front lockable)

### Standard Fittings

The Enterprise fume cupboard is factory fitted with the following standard fittings:-

- Wiring loom which includes 2 No. twin 240 volt 13 amp switch socket outlets, light tube with a fused light switch positioned on the front fascia. All items are pre-wired to a junction box including clip-on terminals for final connection to customer supply.
- Electronic warning panel for airflow/sash monitoring, in compliance with BS 7258.
- Polypropylene 13 mm dia scaffold bosses mounted on rear baffles.

### Optional Extras

A range of additional equipment can be specified and fitted to the Enterprise fume cupboard. The most common options are listed below:

- Energy saving control system.
- Automatic sash closing.
- Water wash spray system for fume cupboards used for boiling off acids.
- Integral wet acid scrubber system.
- Zone 1 electrics and fittings for petro-chemical applications.
- Automatic fire extinguishing system.
- RCD protection for electrical supply.
- Vacuum pump system including controller valves and outlets.

# INTRODUCTION

## Siting of Fume Cupboards

It is not uncommon for our high containment Enterprise fume cupboard to be installed within a laboratory and have its performance impaired due to its location and environment. It is very important during the design phase that reference is made to BS 7258 which gives recommendations with respect to siting of fume cupboards i.e. preferred locations, minimum distance between face of fume cupboards door, walls etc. It is also important that the air make up system is designed to prevent excessive turbulence at the face of the fume cupboard which will reduce containment performance.

Fume cupboards should not be sited near doorways nor in other areas of heavy traffic flow. Statistics show that within the laboratory, fume cupboards – due to the nature of the work carried

out in them – are the likeliest source of an accident such as fire or explosion. Cupboards sited close to doorways will therefore compound the danger to personnel leaving a laboratory during an emergency. In addition, the increased air turbulence caused by rapid movement of people in the immediate vicinity of the fume cupboard may cause a loss of containment.

Ideally, fume cupboards should be sited at the opposite end of the laboratory from where the doorway is sited, so that operatives have to walk specifically to the cupboard and not continually go past it when performing unrelated duties.

BS 7258 gives recommendations with respect to siting of fume cupboards i.e. preferred locations, minimum distance between face of fume cupboards door, walls etc.

Premier Laboratory Systems will be pleased to offer guidance and provide CAD layout drawings for any proposed layout.

## Maintenance

Users of fume cupboards are reminded that proper maintenance is essential to ensure their personal safety. We recommend fume cupboards to be inspected biannually all in accordance with BS 7258: 1994: part 3: Section 6.

To meet the requirements of COSHH, the extract system is required to be inspected at 14 monthly intervals. This ensures that the specified face velocity/containment levels are in accordance with minimum requirements. As part of our aftersales service, our inspection engineer will be pleased to discuss your particular service requirements.

**Chemical Resistance Chart**

	Solid Grade Laminate	Ceramic	Epoxy Resin	Stainless Steel GR 316	Tiles	PP	Glass	PVC
<b>ACIDS</b>								
Sulphuric	●	○	●	●	●	○	○	○
Hydrochloric	●	○	○	●	●	○	○	○
Phosphoric	●	○	○	○	○	○	○	○
Perchloric	●	○	○	●	○	○	○	○
Nitric	●	○	●	●	●	○	○	○
Chromic	●	○	○	●	○	○	○	○
Hydrofluoric	●	●	●	●	●	○	●	○
<b>REAGENTS</b>								
Ammonia	○	○	○	○	○	○	○	○
Sodium Hydroxide (40%)	●	○	●	○	○	○	○	○
Silver Nitrate (30%)	●	○	○	○	○	○	○	○
Potassium Permanganate (30%)	●	○	○	●	○	○	○	○
Iodine (in 15% Potassium Iodide Soln.)	●	○	●	○	○	○	○	○
Bromine	●	○	●	●	●	●	○	●
<b>STAINS</b>								
Malachite Green	●	○	●	●	●	○	○	○
Crystal Violet	●	○	●	○	●	○	○	●
Carboxy Fuchsin	●	○	●	●	●	○	○	●
<b>SOLVENTS</b>								
Acetone	○	○	○	○	○	○	○	●
Toluene	○	○	○	○	○	○	○	●
Methyl Alcohol	○	○	○	○	○	○	○	●
Carbon Tetrachloride	●	○	●	○	○	○	○	●
Dimethyl Formamide	○	○	●	○	○	○	○	●
Tetra Hydrofuran	○	○	○	○	○	○	○	●

The table shows the chemical resistance at 100% concentration unless otherwise stated. Please note that this table should be used as a guide only and we would recommend that the liner materials should be tested prior to order. For samples, please contact our technical department.

- No Effect
- Slight staining after wiping surface clean
- Severe staining and potential erosion after prolonged used

# FUME CUPBOARDS

## ENTERPRISE

Bench-Mounted Fume Cupboard				
	Standard	✓	Options	✓
overall width	1200 mm		2100 mm	
	1500 mm		2400 mm	
	1800 mm		Other – please specify	
	2000 mm			
width of side walls	150 mm		120 mm	
overall depth	950 mm		900 mm	
overall height	2320 mm		top cover panels: specify height	
internal clear height	1150 mm		Other – please specify	
lining	solid grade laminate		epoxy resin - laminate	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
			Glass	
extract plenum with flange spigot connection	1200 – Ø250		underbench extraction	
	1500 – Ø315		vacuum pump extract	
	1800 – Ø315		other	
	2000 – Ø355			
extract control	constant volume		constant with diversity	
			variable	
			variable with diversity	
warning panel	airflow/sash		include fan on/off	
			others	
worktop	solid grade laminate		ceramic	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
drip cup	round/oval		L/H	R/H
	sink/trough		L/H	R/H
support	table frame		storage units	
storage cupboards	underbench unit on plinth		corrosives/acid	
			solvents/flammable	
	50% or 100%		movable on castors	
services specify requirements	cold water		argon	
	natural gas		H P water	
	comp. air		helium	
	vacuum		other	
	nitrogen		other	
electrical services	240 V twin (2 No.)		additional MCB/RCD incomer	
clients special requirements	auto sash		Firetrace	
	pass thro' ports		scaffold frame	
	horizontal sash		others	

The bench mounted Enterprise fume cupboard is manufactured according to BS7258 : 1994 and is available in a range of sizes, as detailed on attached table. The table lists the available options.

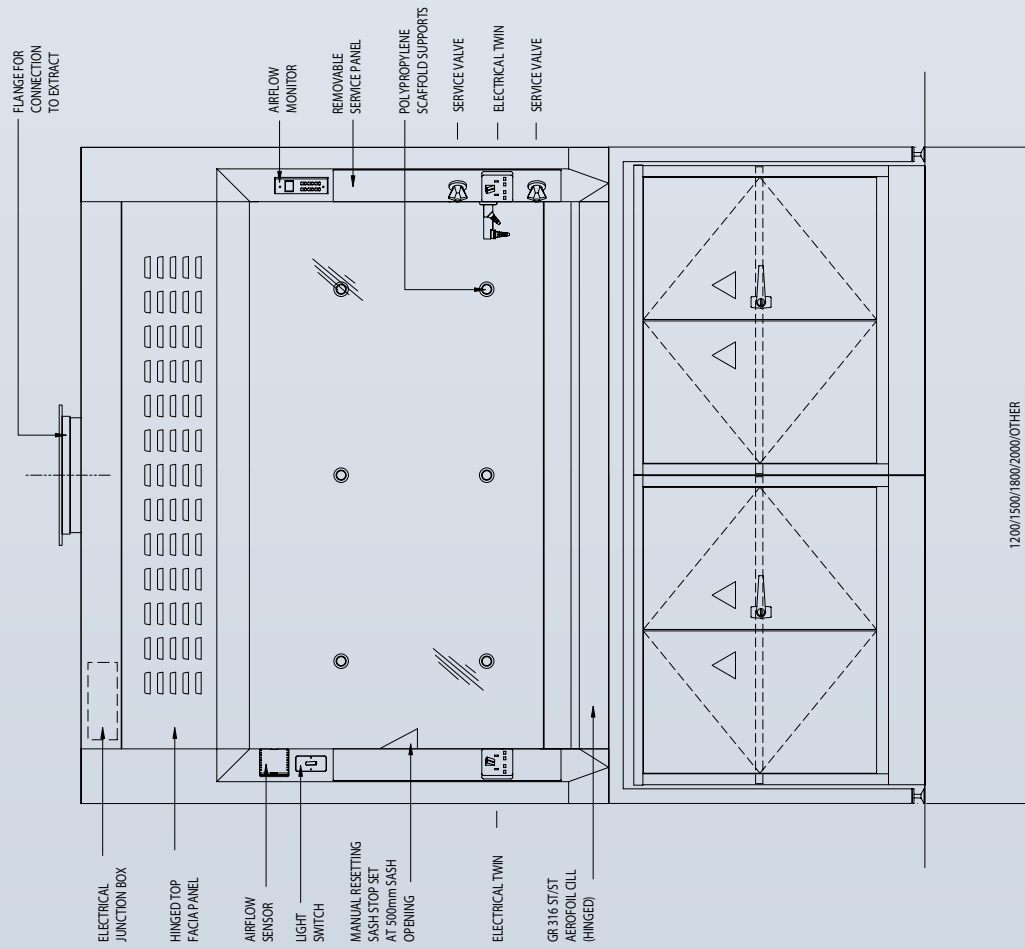
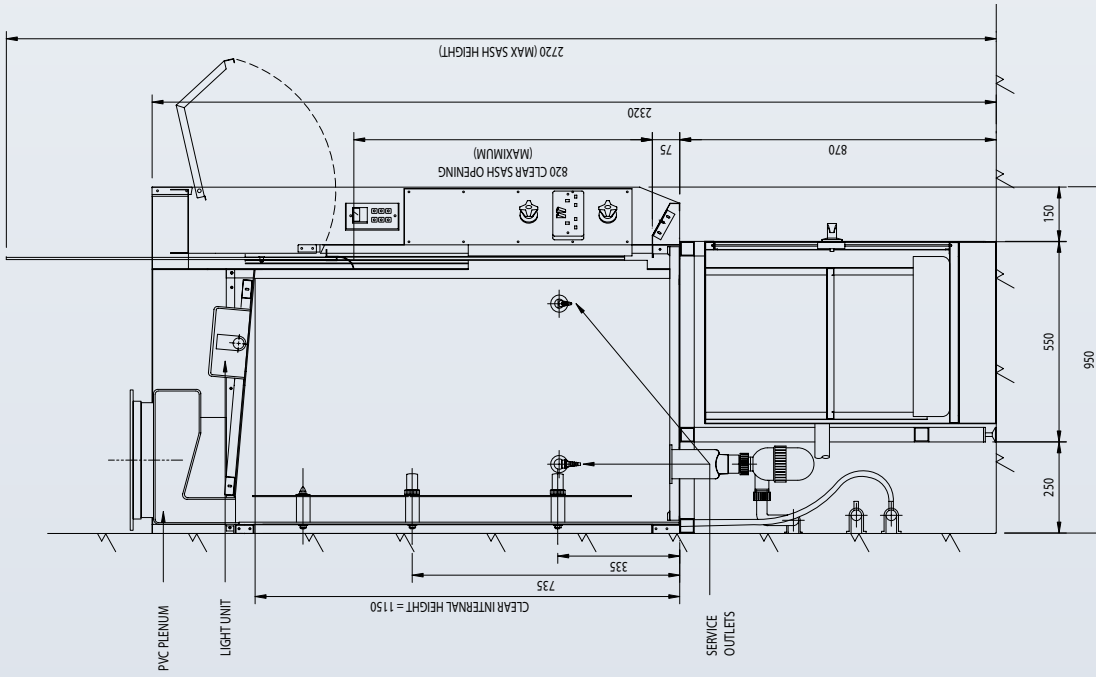
The standard dimensions are available from stock metalwork. Other special internal depths, widths and heights can be made to order.

Standard colour finish is white (RAL 9010). Other RAL colours are available to order.



**Note:** Please tick boxes with your requirements.

# ENTERPRISE



# FUME CUPBOARDS

## ENTERPRISE WALK-IN

Walk-In Fume Cupboard				
	Standard	✓	Options	✓
overall width	1200 mm		2100 mm	
	1500 mm		2400 mm	
	1800 mm		Other – please specify	
	2000 mm			
width of side walls	150 mm		120 mm	
overall depth	950 mm		Other – please specify	
overall height	2320 mm		top cover panels: specify height	
internal clear height	2020 mm		Other – please specify	
lining	solid grade laminate		epoxy resin - laminate	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
			Glass	
	Other			
extract plenum with flange spigot connection	1200 – Ø250			
	1500 – Ø315			
	1800 – Ø315			
	2000 – Ø355			
extract control	constant volume		constant with diversity	
			variable	
			variable with diversity	
warning panel	airflow/sash		include fan on/off	
			others	
removable worktop	solid grade laminate on table frame		trolley mounted	
			ceramic	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
drip cup	integral		L/H	R/H
	sink/trough		L/H	R/H
services specify requirements	cold water		argon	
	natural gas		H P water	
	comp. air		helium	
	vacuum		other	
	nitrogen		other	
electrical services	2 No. 240 V twin outlets		additional outlets	
			MCB/RCD incomer	
clients special requirements	auto sash		Firetrace	
	pass thro' ports		scaffold frame	
	horizontal sash		others	

**Note:** Please tick boxes with your requirements.

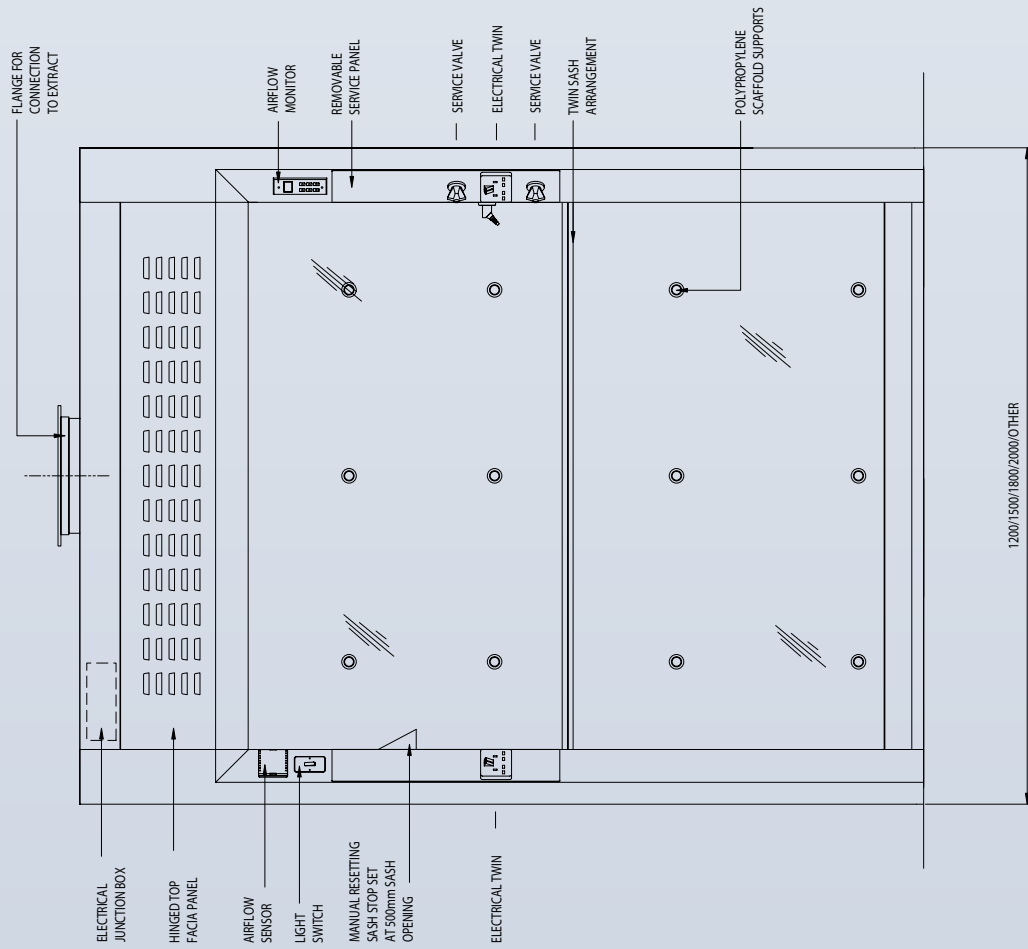
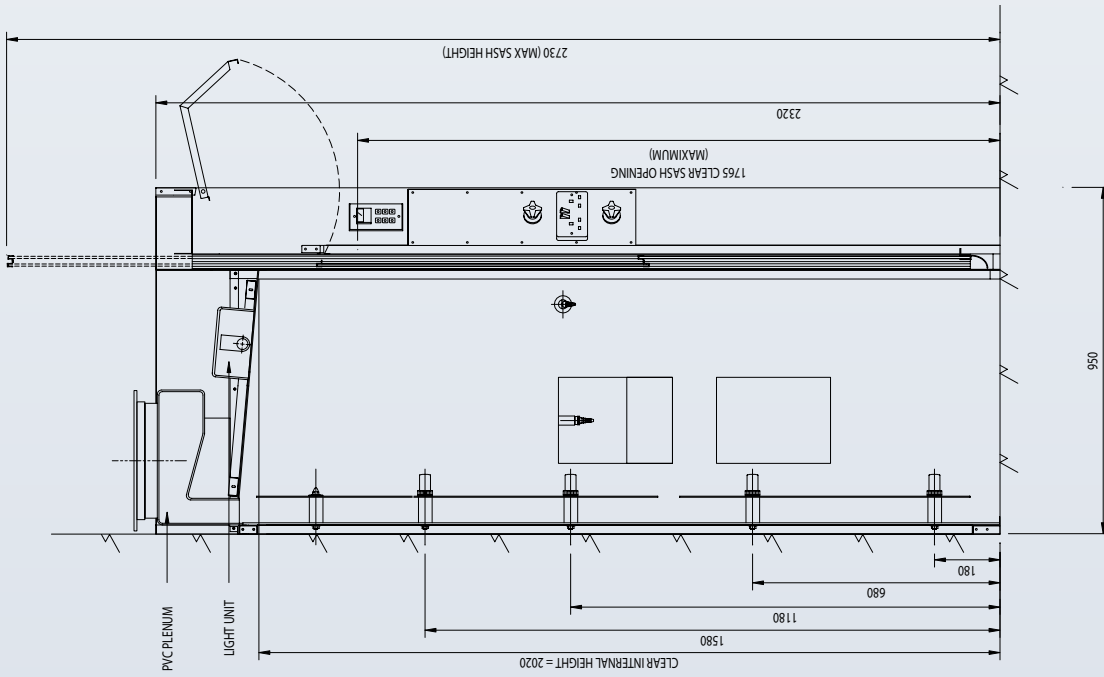
The walk-in Enterprise fume cupboard is manufactured according to BS7258 : 1994 and is available in a range of sizes, as detailed on attached table. The table lists the available options.

The standard dimensions are available from stock metalwork. Other special internal depths, widths and heights can be made to order.

Standard colour finish is white (RAL 9010). Other RAL colours are available to order.



# ENTERPRISE WALK-IN



# FUME CUPBOARDS

## ENTERPRISE LOW LEVEL

Low Level Fume Cupboard				
	Standard	✓	Options	✓
overall width	1200 mm		2100 mm	
	1500 mm		2400 mm	
	1800 mm		Other – please specify	
	2000 mm			
width of side walls	150 mm		120 mm	
overall depth	950 mm		900 mm	
overall height	2320 mm		top cover panels: specify height	
internal clear height	1600 mm		Other – please specify	
lining	solid grade laminate		epoxy resin - laminate	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
			Glass	
extract plenum with flange spigot connection	1200 – Ø250		underbench extraction	
	1500 – Ø315		vacuum pump extract	
	1800 – Ø315		other	
	2000 – Ø355			
extract control	constant volume		constant with diversity	
			variable	
			variable with diversity	
warning panel	airflow/sash		include fan on/off	
			others	
worktop	solid grade laminate		ceramic	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
drip cup	round/oval		L/H	R/H
	sink/trough		L/H	R/H
support	table frame		storage units	
storage cupboards	underbench unit on plinth		corrosives/acid	
			solvents/flammable	
	50% or 100%		movable on castors	
services specify requirements	cold water		argon	
	natural gas		H P water	
	comp. air		helium	
	vacuum		other	
	nitrogen		other	
electrical services	2 No. 240 V twin outlets		additional outlets	
			MCB/RCD incomer	
clients special requirements	auto sash		Firetrace	
	pass thro' ports		scaffold frame	
	horizontal sash		others	

**Note:** Please tick boxes with your requirements.

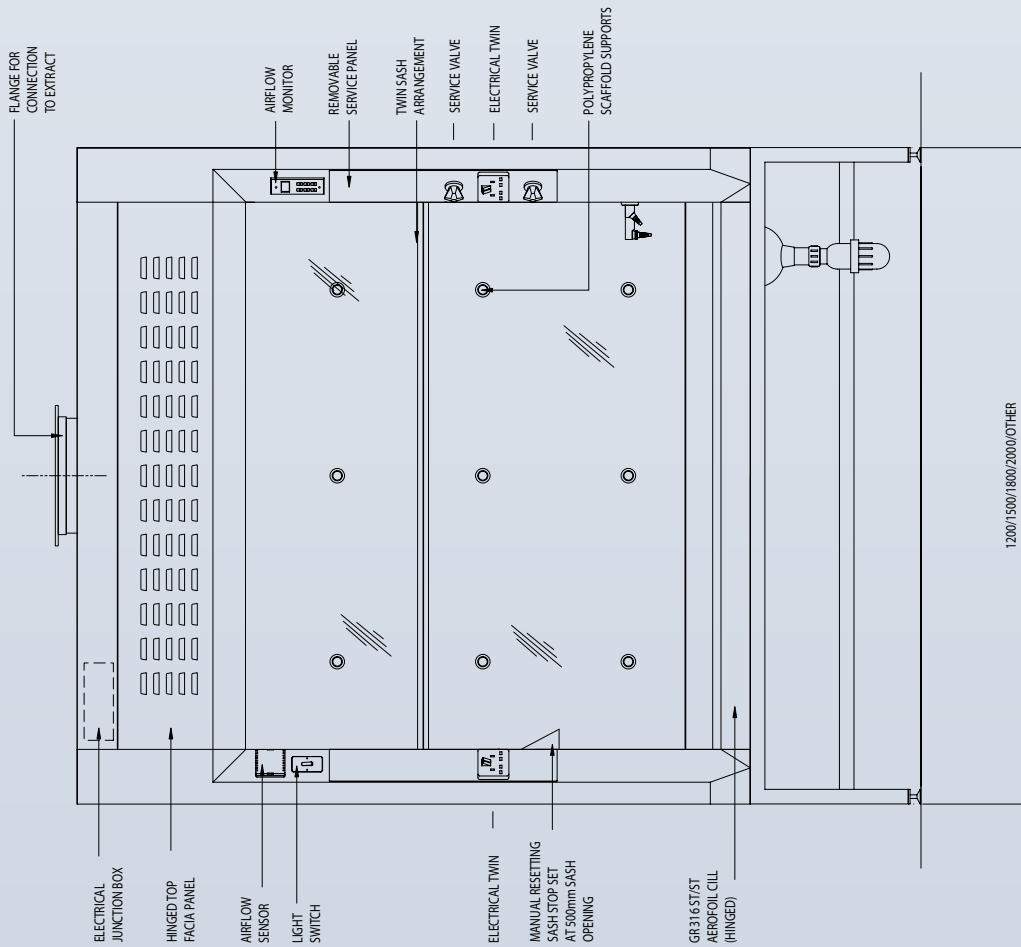
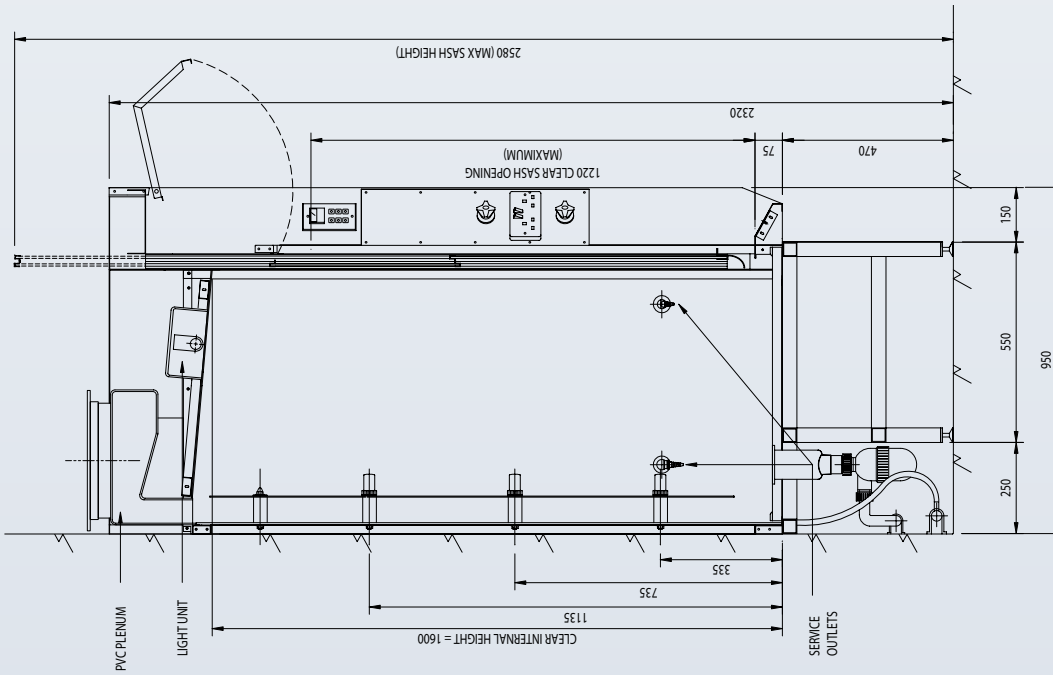
The low level or 'distillation' Enterprise fume cupboard is manufactured according to BS7258 : 1994 and is available in a range of sizes, as detailed on attached table. The table lists the available options.

The standard dimensions are available from stock metalwork. Other special internal depths, widths and heights can be made to order.

Standard colour finish is white (RAL 9010). Other RAL colours are available to order.



# ENTERPRISE LOW LEVEL





### **Introduction to Enterprise DynamicFlow™ Fume Cupboard**

Whilst the safety of laboratory personnel is paramount, the amount of heated/conditioned air consumed by conventional fume cupboards is a constant area of concern to many laboratory managers.

Surprisingly, fume cupboard design has changed little since the 1970s. The conventional operation specification for fume cupboard is to provide an average face velocity of 0.5 m/sec across the open sash area.

Traditionally this has been taken as a minimum and can actually range up to 0.75 m/sec in certain circumstances. Where

a number of fume cupboards are grouped together the total extract volume is very high which results in a large volume of make-up air being required to balance the laboratory pressure.

Over the past 10 years, it has become standard practice to address this problem not at the fume cupboard itself but by designing sophisticated extract and air input systems, often referred to as variable air volume systems (VAV). These typically use complex sensing and feedback controls to monitor the instantaneous demand at each fume cupboard in order to calculate and adjust the correct volumes required.

Although the VAV approach has proved successful and cost effective in many cases, it does not address the problem at source, namely the volume of air required by an individual fume cupboard to maintain the containment performance.

Premier's new Enterprise DynamicFlow(™) fume cupboard addresses this problem in a radical and innovative way, achieving the same excellent containment performance as a conventional fume cupboard design, but at a face velocity of 0.25m/sec i.e 50% lower than the standard product.

# DYNAMICFLOW HIGH CONTAINMENT / LOW ENERGY

## Principles of Enterprise DynamicFlow Fume Cupboard

The primary philosophy behind the development of the Enterprise DynamicFlow fume cupboard was to achieve high levels of containment of hazardous substances providing safe operating conditions without resorting to high air velocities. The aim was to reduce the overall operational face velocities from the customarily accepted 0.5 m/sec to 0.25 m/sec and in turn reduce the volume of supply and extract air by 50%.

The starting point for the new design was to take Premier's proven Enterprise model and, in a radical departure from previous practice, redesign the fume cupboard critical construction details. The following Computerised Fluid Dynamic (CFD) analysis diagrams (Figs 1 & 2) show how this was accomplished. The resulting innovative design features are now protected by a worldwide patent.



Fig 1: Airflow within the Enterprise DynamicFlow Fume Cupboard with Sash Open.



Fig 2: Airflow within the Enterprise DynamicFlow Fume Cupboard with Sash Open and an operator in position.

## Testing and Validation

When type tested to the laboratory fume cupboard standard BS 7258 :1994 Part 4, the Enterprise DynamicFlow fume cupboard recorded excellent containment results, specifically: highest maximum < 0.010 ppm, highest mean < 0.005 ppm.

The fume cupboard has recently been independently type tested to the new European standard EN 14175 - part 3. The main difference between the BS standard and the EU standard is that the robustness test (which is not included within the BS at present) is a more realistic test in that it induces disturbance at the face of the fume cupboard during the containment test.

Results achieved from the containment tests carried out were as follows:-

**Outer plane – <0.005ppm**

(UK recommendation <0.005ppm)

**Inner plane – <0.005ppm**

(UK recommendation <0.005ppm)

**Robustness – <0.040ppm**

(UK recommendation <0.100ppm)

From above results you will see that our DynamicFlow fume cupboard complies with recommendations for UK i.e 0.005 ppm for inner and outer plane containment tests and 0.100 ppm for the robustness test. It is worth noting that these results are specified for fume cupboards operating in the range of 0.40 to 0.50 m/sec and we achieve these at a face velocity of 0.30 m/sec.

You will also note the high level of containment performance achieved during the robustness test i.e 0.040 ppm as opposed to the UK standard of 0.100 ppm (Note, German standard is 0.650 ppm!!!).

Another important test which is carried out and is of particular

# FUME CUPBOARDS

## DYNAMICFLOW HIGH CONTAINMENT / LOW ENERGY

interest on low volume fume cupboard is the 'air efficiency test'. This measures the time involved with respect to the removal of all fumes within the chamber. The minimum requirement is 15 seconds and the DynamicFlow fume cupboard recorded less than this timescale when tested at 0.30m/sec.

### Summary of User Safety Testing

- Independently tested to BS 7258: Part 4: 1994, achieved excellent containment levels
- Independently tested to new EU standard EN14175-part 3, achieved high level of

containment performance.

- The containment performance of the Enterprise DynamicFlow fume cupboard has been proved by computer modelling
- Containment is unaffected when an operator moves in front of the fume cupboard
- Containment is unaffected when bulky equipment is placed within the fume cupboard

### Summary of User Benefits

- Save up to 50% (£1000.00 /annum/fume cupboard) on energy costs
- No need for complex, expensive air management systems

- Air supply/extract plant, simpler, therefore less costly to install
- Provides 100% diversity (fume cupboard use) capability
- Can be retro-fitted into existing laboratories with increased numbers of fume cupboards utilising existing ventilation plant
- Less air movement means greater user comfort and very low noise levels
- Lower velocity eases handling of fine powders and weighing of substances
- No costly annual maintenance required



## Energy Conservation Calculations

It is a simple calculation to compare the energy consumption of an installation using conventional fume cupboards and an installation utilising Premier's new Enterprise DynamicFlow fume cupboards. The following calculations are based on a typical installation employing thirty 2m wide fume cupboards.

The volume of air consumed by a conventional fume cupboard is a constant figure calculated by:-

***Sash open width (m) x sash open height (m) x face velocity (m/sec).***

***So for a 2m wide cupboard:-***

***1.7 (m) x 0.5 (m) x 0.5 (M/sec) = 0.425 m3/sec.***

The total extract volume from a laboratory equipped with thirty conventional fume cupboards would therefore be:-

***30 x 0.425 m3/sec = 12.75 m3/sec (45,900 m3/hour).***

This volume of air will be replaced by the supply air system plus a small quantity of air drawn from adjacent areas to maintain a negative pressure within the laboratory. This air would be heated/cooled from the ambient air temperature to the desired laboratory air temperature (typically 21°C).

Assuming an average day time temperature for the UK of 9°C over the whole year, the average energy consumption per hour is given by the formula:-

***Volume (m3/sec) x temperature rise (t°C) x 1.21 (constant for air)***

In this case:-

***Average Consumption = 12.75 m3/sec x 12°C x 1.21 = 185 kW (per hour)***

Assuming a fume cupboard usage of 8hrs/day, 5 days/week and 48 weeks/year, the average annual energy consumption for a conventional fume cupboard would be:-

***Annual Consumption = 185kW x 8 hrs/day x 5 days/week x 48 weeks/yr = 355,200 kWh/yr.***

As the Enterprise DynamicFlow fume cupboard operates on a face velocity of 0.25 m/sec as opposed to 0.5 m/sec the required volume is 50% lower than the equivalent conventional fume cupboard.

Therefore

***Average Energy Consumption = 355,200 x 0.5 = 177,600 kWh/yr***

The above figures are given as a guide to the potential energy savings when utilising Enterprise DynamicFlow instead of conventional fume cupboards.

The calculations do not include for any cooling requirements which can be calculated using a similar method.

The typical cost per kWh used in the UK is £0.10 and is based on a combination of direct fuel costs, plant maintenance, and depreciation of plant, ie a true cost of energy.

Applied to the examples above, the total running cost for a 'conventional' versus an Enterprise DynamicFlow installation can be stated in general terms as follows:

Fume Cupboard Type	Energy Costs (per yr)
Conventional:	£35,520
Enterprise DynamicFlow:	£17,760
Saving:	£17,760

# FUME CUPBOARDS

## DYNAMICFLOW HIGH CONTAINMENT / LOW ENERGY

Bench-Mounted 'DynamicFlow' Fume Cupboard				
	Standard	✓	Options	✓
overall width	1200 mm			
	1500 mm			
	1800 mm			
	2000 mm			
width of side walls	150 mm			
overall depth	950 mm			
overall height	2320 mm		top cover panels: specify height	
internal clear height	1150 mm			
lining	solid grade laminate		epoxy resin - laminate	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
			Glass	
extract plenum with flange spigot connection	1200 – Ø200		underbench extraction	
	1500 – Ø200		vacuum pump extract	
	1800 – Ø250		other	
	2000 – Ø250			
extract control	constant volume		constant with diversity	
warning panel	airflow/sash		include fan on/off	
			others	
worktop	solid grade laminate		ceramic	
			cast epoxy resin	
			polypropylene/PVC	
			Gr 316 stainless steel	
drip cup	round/oval		L/H	R/H
	sink/trough		L/H	R/H
support	table frame		storage units	
storage cupboards	underbench unit on plinth		corrosives/acid	
			solvents/flammable	
	50% or 100%		movable on castors	
services specify requirements	cold water		argon	
	natural gas		H P water	
	comp. air		helium	
	vacuum		other	
	nitrogen		other	
electrical services	240 V twin (2 No.)		additional MCB/RCD incomer	
clients special requirements	auto sash		Firetrace	
	pass thro' ports		scaffold frame	
	horizontal sash		others	

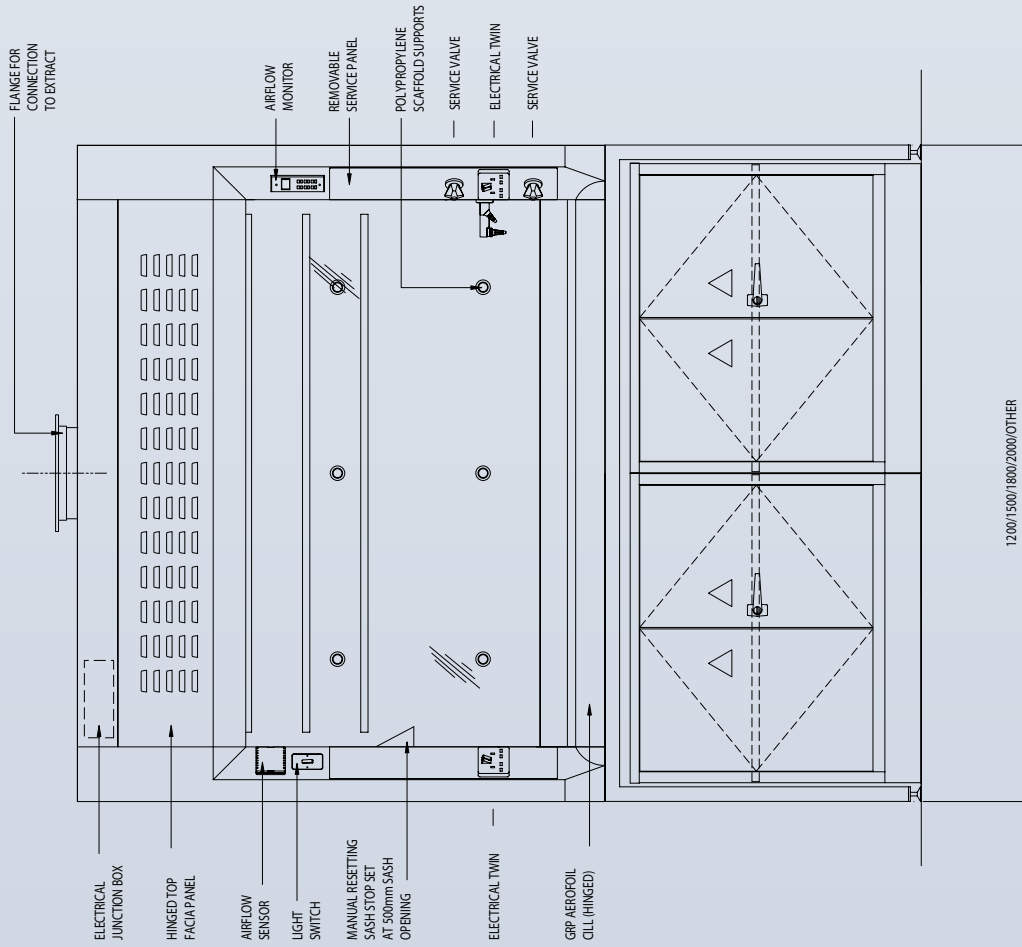
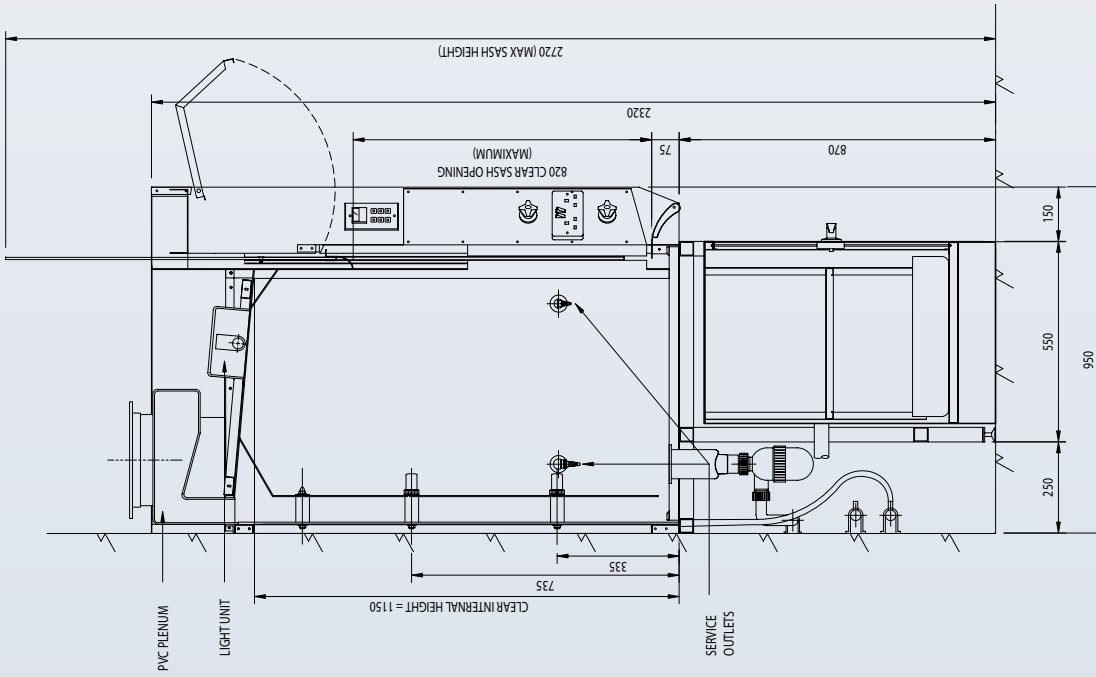
**Note:** Please tick boxes with your requirements.

Bench mounted high containment / low volume 'DynamicFlow' fume cupboard is manufactured according to BS7258 : 1994 and available in different styles, tailor-made for each special field of application. The following table lists the available options.

Standard colour finish is white (RAL 9010). Other RAL colours are available to order.



# DYNAMICFLOW HIGH CONTAINMENT / LOW ENERGY



# EXTRACT SUPPLY

## FUME EXTRACTION



*University of Strathclyde*

An integral part of the fume cupboard and any LEV, is the extract system that provides the required volume to ensure safe containment performance is achieved.

Premier Laboratory Systems Ltd uses the latest CAD technology to design and produce layout drawings to allow full integration within the constraints of the building envelope.

Attenuation is incorporated within the system to ensure noise levels are reduced to expectable levels.

Filtration of the fumes may be required particularly when the systems are required to handle hydrofluoric / perchloric acid and for radioactive applications.

Fume extraction systems are most commonly installed using uPVC material. Preformed duct and fittings are used on sizes up to and including 600 mm diameter. Rectangular ductwork and circular ductwork fittings above 600 mm diameter are fabricated from sheet material. We recommend that all joints are fusion welded as opposed

*Cambridge University, Discharge Stack Enclosures*



# FUME EXTRACTION



to solvent welding (gluing) which ensures complete joint integrity. Where necessary due to fire regulations and for additional rigidity, ductwork can be glass fibre reinforced.

Fume extraction systems can also be manufactured from Polypropylene ductwork and fittings, which enhances both heat and chemical resistance.

The extract fan fitted to the system is normally a centrifugal type which provides the required volume and pressure capability at low noise levels. All materials of construction is polypropylene, therefore is unaffected by any condensate that may form. Electric motors are fitted outwith the air stream and are either single or 3 phase. Units can be directly driven via inverter or indirectly driven.

All fume extraction systems are manufactured and installed to conform to the latest specifications contained within DW 154, LGC 1614 and BS 7258.

*Heriot Watt University*



*Rothamstead Research  
– Harpenden*