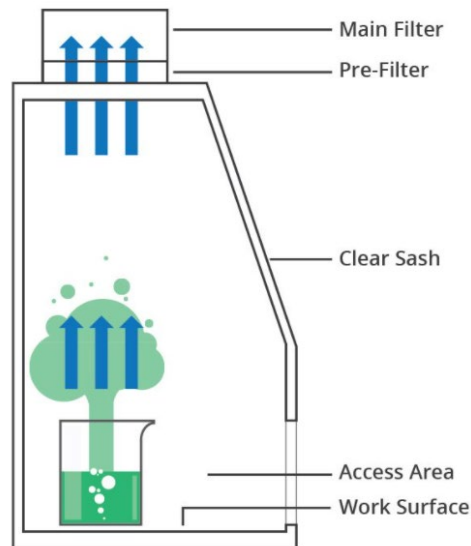


Recirculating Fume Hoods (Ductless) LEV Procedure



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1 Introduction

In general, the University uses two different types of fume hood.

- A. **Ducted fume hoods**, where a motor and fan draw hazardous substances from the hood along a duct and discharge them into the air (usually above roof level) where they are rapidly diluted and dispersed. **Refer to Ducted LEV Procedure (HS G059).**
- B. **Recirculating fume hoods (Ductless)**, which draw air from the cabinet through a filter to remove any contamination and then recirculate the clean air back into the work space.

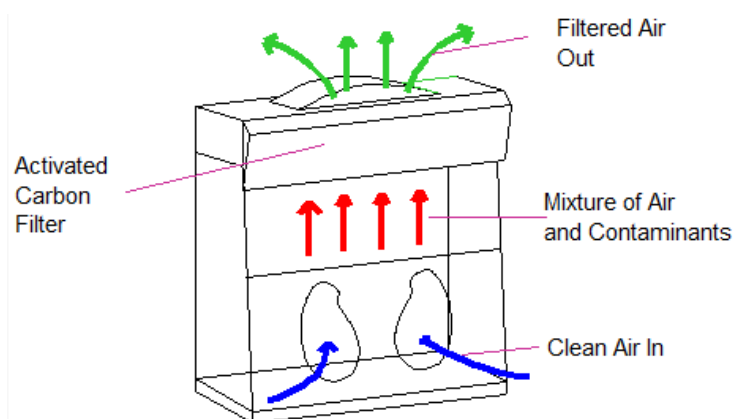
Both are effective in different ways and each type has advantages and disadvantages.

1.1 Definition

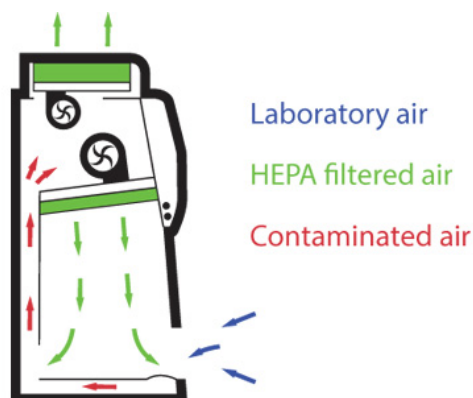
The definition of a LEV is “an engineering control system to reduce exposures to airborne contaminants such as dust, mist, fume, vapour or gas in the workplace”; it is something that sucks an airborne contaminant out of the workplace.

This procedure outlines the University approach to the safe management and use of recirculating fume hoods (ductless-) Local Exhaust Ventilation systems (LEV).

Most systems consist of the following elements:



- Hood - where the contaminant enters the LEV
- Fan - to power the system
- Discharge – to release extracted air to work environment
- Filter - to clean the extracted air (some Biological Safety Cabinets (BSC) provide filtered air to the cabinet below)



Ductless LEV is an engineering control referred to by the Control of Substances Hazardous to Health Regulations 2002 (COSHH). There are explicit requirements with regards to its use including periodic examination and testing.

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2 Purpose

To provide the critical information to the stakeholders engaged in the use, maintenance and testing of recirculating fume hoods (ductless-) LEV.

This procedure includes

- Where supplementary School processes and procedures are required e.g. Containment level 2 facilities, where a number of tasks need to be scheduled at the same time and require specific decontamination.
- Statutory testing (at least once every 14 months, some BSCs are every 6 months).
- Processes to follow for passing/failing statutory testing, which includes the process to ensure repairs are completed and function is verified before reuse.
- Safe use by users.
- Issues and reporting –a decision if issue needs equipment to be taken from use.
- Local user or School checks.
- Planned Preventative Maintenance (PPM) (usually on system elements e.g. filters and motor belts).
- Record keeping
 - Up to date list of ductless LEV
 - Records held for 5 years for each piece of LEV including any repairs made.
- Competence and training.
- Roles and responsibilities.

This procedure excludes

- Ducted fume hoods. These are primarily used in laboratories for using hazardous chemicals via the respiratory route.
- Ducted trunking with a capture hood (used in engineering machinery, e.g. welding).
- Ducted cabinets (used around devices such as laser cutters).
- Ducted Biological Safety Cabinets (BSC) (used for handling higher hazard microorganisms.)
- Contractor control
- Permit to work system
- COSHH Programmes
- Make-up air supplied to the room that replaces the air extracted from the room.
- General ventilation.

For ducted LEVs, please refer to Refer to Ducted LEV Procedure (HS G056).

3 Procedure

3.1 Guidance for the Safe Use of Fume Hoods

A **recirculatory fume hood** (sometimes called a recirculatory fume *cupboard* or *BSC*) is a primary means of protection of workers from the inhalation of hazardous substances or biological agents in the form of particles and vapours. It consists of an enclosed working chamber with a clear window (sash) at the front. The hood's contaminated air is extracted through a filter via a fan that is contained within the cabinet. Hazardous particles and vapours are captured by the filter and the filtered air is exhausted into the local workspace environment.

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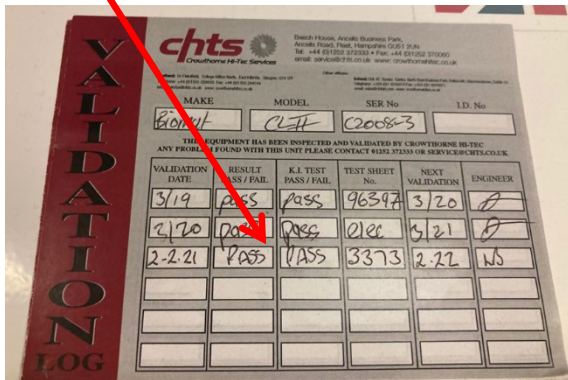


Chemistry – Chi III



Before conducting work in a fume hood ensure that the hood is displaying a current test certificate (pass). (Failed fume hoods should not be used).

Every hood has a flow rate monitor/alarm. This lets you know that the flow rate is safe.



Before working check the meter is on and is showing a flow rate **within the specification** of the recirculatory fume hood or BSC. Unsafe flow rates or high sash will be shown with lights and an audible alarm. If there are a bank of fume hoods with a shared duct, the system must be able to operate all fume hoods safely and simultaneously.



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Safe working

- The type of ductless LEV should be assessed as suitable for the activity in the activity risk assessment (typically a COSHH Assessment).

Procedure

- Turn on hood (if it has on/off controls) and wait for flow to stabilise.
- Raise the sash to its **safe certified height** (indicated by sticker on side of opening). (When not working in the hood, the sash should be lowered).
- Fume hood should be not overloaded in order that the airflows are unobstructed. Equipment should be more than 15cm from the front of the hood.
- Do not override or disable hood face velocity monitors/alarms. If the alarm sounds, contact your supervisor or local senior technician.
- Avoid putting your head in the fume hood.
- Exercise extreme caution when using ignition sources and when flammables are being used.
- Keep storage to a minimum. Overloaded hoods will have disrupted airflows.
- Do not use the hood as a waste disposal route (e.g. evaporation of chemicals); use the approved disposal route.
- Do not disrupt airflows - keep movements slow and deliberate to avoid disrupting airflows. Avoid side-draughts by keeping nearby windows closed.
- All work being conducted in the hood should be covered by an active COSHH risk assessment.

Emergency procedures

If alarms sound or you feel the hood is not operating safely: make safe your work, close sash and alert other workers. Evacuate lab if necessary. Contact your supervisor or local senior technician.

- For spillages, follow procedures outlined in relevant COSHH assessment.

3.2 Document management

- School to hold a full list of Recirculating Fume Hoods (Ductless) LEV items and systems with clear indication as to who is responsible for completion of the statutory tests and examinations, where responsibilities are shared e.g. the cabinet compared with motors and ducts running through plant rooms, Planned Preventative Maintenance frequencies, names of technical leads in Schools. This will be made available via a shared Box folder with the UoS Health and Safety Team and owned by the School to maintain their own LEV register.
- For each ductless LEV item and system there are 5-year records held which include:
 - Statutory tests undertaken by a competent person.
 - Maintenance and repairs undertaken on the items or system.
 - Original commissioning data, where available.
 - System changes or updates / rebalancing system data and information.
 - Records of periodic checks e.g. monthly checks on fume cupboards
 - In addition, for complex systems e.g. multiple LEV elements served by one duct and exhaust, a drawing or system description to ensure there is clear understanding of the interconnecting system.
- For each item element of LEV (e.g. each fume cupboard) should have its function checked with these local test or inspection records being held by the School but available for the person completing the test and examination.

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- Documents and record availability:
 - The current statutory inspection should be available for LEV users. This can be via a copy of the most recent record being positioned on the equipment or copies held in a locally accessible file (can be electronic or hard copy). Examples of how this can be achieved include holding a copy of the test certificate on the actual equipment, an accessible file held by the technical services lead.
 - The main five-year records can be held as hard copies or electronic copies by the School who arranges these visits. This is specified in the list of Recirculating Fume Hoods (Ductless) LEV. These must be held in a coherent way that allows easy access or copies when requested, with clear record keeping indicating gaps.
 - The current statutory record and any repairs undertaken since the last inspection should be available for the competent inspector on their visits.

- Each item of LEV to have a small sticker or similar indicating last statutory test and its status at that time e.g. Pass or Fail.

- Each item of LEV has a unique identification number. This number should be marked on each piece of equipment. ID numbers do not always follow logical order. Any changes should be subject to a full change control assessment to ensure historic documents and new documents can be collated and cross referenced without the risk of causing confusion.

- All required repairs must be logged via technical services to ensure an electronic record of requests and status is maintained.

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3.3 Statutory test and examination

The standard frequency of these statutory tests and examinations must not exceed 14 months, and must be completed by a competent contractor. There are applications where this may be required more frequently. These include, but are not limited to, LEV used for safeguarding the handling of hazard group 3 microorganisms.

The requirements for statutory test and examinations are:

- For works to be completed by a competent contractor.
- To be maintained in accordance with BS 7989:2001: Specification for recirculatory filtration fume cupboards. This states testing of Recirculatory fume cupboards must include particular filter and seal integrity testing and gaseous phase filter capacity testing. (Biological Safety Cabinets standards are different and are referenced below).
- To include any related checks e.g. make up air, proximity to windows or drafts.
- To work to a schedule agreed between the teams responsible for the operation of the building e.g. technical teams; users e.g. researchers; and teams responsible for engaging and coordinating the scheduling of the competent contractor to undertake the statutory test and examination.
- For schedules will be communicated to local areas.
- To provide a clear and agreed communication and coordination of the activities undertaken by the contractor completing the test and examination, which should include but is not limited to:
 - Parties responsible for the building activities are aware and have agreed access and equipment isolation.
 - Expected condition of equipment.
 - Agreed notice of works. Some equipment available at short notice but some equipment will require many weeks' notice.
 - Agreed communication routes e.g. mobile phone numbers provided to the contractor.
 - The contractor to be aware of what has been provided safe access to, and anything not explicitly stated, should not be worked upon without explicit permission.
 - Confirmation with the equipment users to ensure they are not using the systems and to ensure they are in a clean and safe condition to be examined and tested.
 - Who and how to return the equipment to use from the contractor to the users for the equipment, likely to involve the team responsible for the building operations.
 - Some contractors ask for a user signature or similar. Where this is requested, the purposes of this handover signature should be clear. This individual is unlikely to be competent to review or interpret the readings
 - Process for equipment fail and how to ensure not taken back into use until safe to do so. (See separate "Fail" process.)
 - These steps will form part of an overall safe system of work to ensure safe completion of test and examination, including hand back of equipment.
- The test certificates to be forwarded to the pre-agreed recipient who has engaged the contractor. These will then be forwarded to those responsible for the building operations and users (as specified in the ducted LEV spread sheet for all equipment). The recipient of the certificate should:
 - Review the results to ensure no obvious errors have been made e.g. an out of scope air flow but still showing as a pass.
 - Update the five-year document file.
 - Organise and complete any remedial works. Any remedial works that cannot be completed must be advised both to the School and local users. These records form part of the five-year record for the equipment.
 - Diarise the next scheduled test and examination date, likely to be part of the PPM scheduling system.
 - Filters removed from the hoods must be disposed as hazardous waste.

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3.4 Routine checks and testing

It is important that performance of systems is monitored between the formal tests and examinations that are undertaken every 14 months for most pieces of equipment.

Routine checks and testing encompass a broad range of equipment from fume cupboards (most commonly used equipment), to ducted engineering extract systems and specialised biological safety cabinets. The routine checks and testing guidance is broad to cover the breadth of equipment used. These tests can include, but are not limited to:

- A user checking the equipment appears to be operating in a satisfactory condition. Depending on the equipment this may include visual observation that fumes or generated dust is visibly extracted; any indicators are showing in range; no unexpected odours, no obvious damage or kinks in flexible ducts. This can be supplemented by a daily inspection check record.
- There should be clear criteria on what is acceptable, and what requires the equipment to be taken out of use. This will form part of the local procedure for the School's equipment.
- Some local procedures will specify air flow checks. The method, acceptable range and resulting actions for out-of-scope readings should form part of the School procedure. In addition, they may include:
 - Routine face velocity, airflow alarm and visual checks on fume hoods and identify any deterioration.
 - Use of smoke pencils or other similar devices.
- If an unacceptable test result is obtained it should lead to the equipment being taken out of use and users instructed to stop work. Where equipment is taken out of use there should be a clear process to indicate the equipment is out of use e.g. signage and a process to escalate via the local technical lead. The issue must be logged with the School.
- Any repair records and associated revalidation of the equipment should form part of the five-year equipment records.
- Local procedures for checks should be documented, including any test standards and criteria building used for checks.

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3.5 Roles and responsibilities

The table below lists key responsibilities linked to the safe use, testing and management of Recirculating (ductless) Local Exhaust Ventilation systems. This provides a high-level overview of who is responsible for the various tasks. General role descriptors have been used because different Schools have different role titles. To ensure that roles are absolutely clear, the Health and Safety Team will work with the Schools to update a master spread sheet, available via Box, to all ductless LEV stakeholders.

Each School will have someone assigned under the broad heading of “building responsible person”. This is often technical services staff, who will coordinate between the contractor completing statutory testing and the researchers and staff using the equipment. Where required this will include the coordination of any preparation of the equipment prior to the visit. They will act as the school point of contact during and after testing as equipment is handed back.

For each area an, individual or group will be assigned as having ‘responsibility for engaging the specialist contractor’. Schools organise their own statutory testing; the person who organises this will be specified in the master spreadsheet.

Activity	Tasks	Responsibility
Update of the Recirculating Fume Hoods (Ductless) LEV Procedure	Redrafting, updating and publishing the procedure. Checking function of current procedure (via inspection, reactive reports or audit). Formal procedure Governance.	H&S H&S and Users Hazardous Agents Safety Sub- Committee and the SSHEMG
Maintenance of five-year LEV Records	These documents must be held in either an accessible format; or in a format to allow records to be provided if required within a few days in an easy to interpret format. These groups must be listed on the H&S Website to ensure clarity on these responsibilities.	Building responsible person
Maintenance of LEV register	<ul style="list-style-type: none"> Maintain a full list of Recirculating Fume Hoods (Ductless) LEV items such as, Responsibility for completion of statutory tests, Lifecycle of LEV asset from commissioning to decommissioning, Make available via shared folder with the UoS Health and Safety Team, Owned by the School to maintain their own LEV register. 	Building responsible person
Engage the competent specialist contractor.	Assess and appoint competent contractor. Coordinate site attendance with building users and equipment users. Produce schedule of tests to be completed in the coming year.	The group with responsibility for engaging the specialist contractor to complete statutory test and examination.

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Complete statutory test and examination	<p>Prepare equipment for safe test and examination.</p> <p>Meet contractor on site and ensure scope of work understood.</p> <p>Coordinate with building responsible person and equipment users.</p> <p>Complete the test and examination; this includes reporting back to person responsible for the area or building (named).</p> <p>Allows equipment use to restart or taken out of use. Involves coordination with equipment users.</p> <p>Equipment accepted back by user School.</p>	<p>Equipment user.</p> <p>Team who engaged contractor.</p> <p>Team who engaged contractor.</p> <p>Contractor or other competent person.</p> <p>Person responsible for building.</p>
Ensure Person responsible for building is competent	<p>Awareness and understanding of H&S legal requirements for LEV (Ductless).</p> <p>Experience of operating LEV (Ductless) systems.</p> <p>Consulting HSE and relevant Industry LEV (Ductless) guidance</p>	<p>H&S</p> <p>Person responsible for building</p> <p>Person responsible for building</p>
Routine checks of equipment	<p>Create local procedure (including frequencies), commensurate for the type of equipment, including reporting and record keeping.</p> <p>Undertake checks or tests.</p> <p>Maintain anemometer service and in-calibration</p>	<p>Building responsible person (BRP).</p> <p>BRP or user</p> <p>BRP or user</p>
Ensure BRP or users are competent	<p>Awareness and understanding of H&S legal requirements for LEV (Ductless).</p> <p>Where identified by training needs analysis, specific LEV (Ductless) technical / safety training (internal and/or external)</p>	<p>H&S</p> <p>H&S or external</p>
System PPMs	<p>Any elements of the systems that need periodic PPMs e.g. filters etc.</p> <p>Add to five-year records for the system.</p> <p>Work to be coordinated in the same way as statutory test and examination. PPM frequencies shown on master LEV spread sheet.</p> <p>The building responsible person must be advised prior to PPMs and any anticipated adverse impacts on the system.</p>	<p>Building responsible person (BRP).</p>
Taking equipment out of use	<p>If a significant fault found.</p> <p>Must be reported to the technical services lead for the building.</p> <p>Escalates issue and coordinates repairs.</p> <p>Equipment needs repair and revalidation before going back into use.</p>	<p>Whoever finds the fault.</p> <p>Whoever finds the fault.</p> <p>Whoever finds the fault.</p> <p>Building technical lead.</p>

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Repair of equipment and equipment reinstatement.	<p>Reporting the issues.</p> <p>Follow up of issues from statutory test and examination. The building responsible person must be advised prior to work and any anticipated adverse impacts on the system.</p> <p>Complete repairs</p> <p>Accepting documentation to evidence equipment is safe to reinstate, formally advise technical lead, and add records to five-year record file for equipment.</p>	<p>Whoever finds the fault.</p> <p>Responsible person for engaging contractor.</p> <p>Contractor</p> <p>Responsible person for engaging contractor.</p>
User requirements	<p>Experience or knowledge of using a fume cupboard.</p> <p>Understands limitations.</p> <p>Understands how to identify and report an issue.</p> <p>Able to complete simple user checks e.g. how to read the airflow monitor. Issues result in work stopping and being reported.</p>	User and supervisor
Ensure users are competent	Check competency and provide instruction, information and training as required.	Person leading area activities.
Safe use of fume cupboard	<p>Sash used at specified maximum height; and down when not in use.</p> <p>Working airflow indicator in safe range.</p> <p>Avoid over loading fume cupboard, particularly towards the front where air flow disruption is foreseeable.</p> <p>Fume hoods to be operated to agreed local housekeeping standards.</p> <p>If a fault develops, stop work and report the issue.</p>	User
Local instructions, programmes and competence programmes	<p>Local procedures.</p> <p>Record accessible locally.</p> <p>Competence programmes, with records if required.</p> <p>Local inspections to ensure processes working.</p>	Detailed in School procedure.

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3.6 Process to remove unsafe equipment from use

Significant faults could be detected by:

- The user, either during use or during routine checks.
- The person responsible for carrying out routine checks for the School.
- The contractor conducting the statutory test and examination.

Immediate action:

- Stop using equipment.
- Make safe e.g. remove any unsafe hazardous materials and stop any hazardous experiments.
- Contact School technical lead. (Place sign on equipment to indicate out of use if unable to contact the school technical lead).

Action to take equipment out of use, make repairs and reinstate equipment:

- Technical lead to ensure equipment taken safely out of use and has appropriate signage in place.
- Report to Service Centre.
- School to coordinate repairs in conjunction with technical services. Timescales to be communicated to the technical services lead.
- Once repairs are complete and system safely reinstated and checked, documents issued to technical lead.
- Technical lead will coordinate reinstatement use of equipment.
- Records of repairs files in five-year equipment records.

3.7 Process to install new equipment

Assess the controls required to safely control the hazardous the substances

If available, use a mechanical control to exhaust contaminants outside. A recirculatory (ductless) fume hood is designed to contain only small quantities of contaminants as specified by the filter's absorbent capacity. These hoods are not suitable for work involving radioactive, highly toxic, carcinogenic or sensitising substances. A ducted LEV fume hood is usually a more suitable control.

Filter selection

A recirculatory (ductless) fume hood draws air through an open enclosure, and passes it through a replaceable molecular filter, allowing expulsion back into the room air for recirculation. The principle concerns relating to this type of equipment is the finite absorbent capacity of the filter elements. If exceeded, hazardous concentrations of contaminant will break through the filter into the room atmosphere. For this reason, the use of such a system should **only** be considered where ducted systems are not reasonably practicable. Use must only be permitted if a suitable risk assessment has been carried out with due consideration of the following recommendations:

- i) Filter selection must be appropriate for the substances to be used. Consideration must be given to the compatibility of substances.
- ii) Calculations regarding release characteristics of the contaminant should be applied to determine the maximum time the system can be used before exhausting the filter element. The date of exhaustion must be clearly displayed on the system, and communicated to all staff using the hood.
- c) Use of the system must be monitored by a System of Work, which should include the actual release of contaminant and duration of use. The record of system use should be maintained and available to any staff

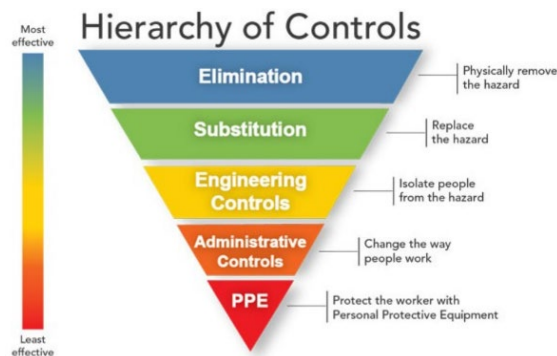
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who might use the system.

d) The System of Work must consider the handling and disposal of contaminated filter elements, which are likely to be classified as special waste.

Perform a COSHH assessment to find the most effective controls considering:

- Hazardous substances
- Activity or process
- Exposure routes
- Controls
- Monitor and review



Recirculation is acceptable, providing the air is thoroughly cleaned. Air cleaner (filter(s)) must match the contaminant and its concentration. Failure in the system can result in dangerous conditions. Any recirculation system should incorporate:

- Monitoring and alerts
- Alarm for a blocked or failed filter

Recirculatory Fume Hood Filter types.

- General Purpose – generally used for removal of organic vapours with molecular weights greater than 30 and boiling points above 60°C.
- Inorganic Acids – alkali impregnated to neutralise inorganic acid vapours.
- Formaldehyde – impregnated with an agent to oxidise formaldehyde to formate salts and glutaraldehyde.
- Ammonia and Amines- impregnated with copper compounds to remove ammonia vapour and low molecular weight amines.
- Diethyl Ether
- Hydrogen Sulphide and organosulphur compounds
- Hydrogen Cyanide
- HEPA – High Efficiency Particulate Filtration.



Filters must be matched to the class of hazardous agent used. Filters have a limited absorbent capacity. Care must be taken to ensure this limit is not exceeded as it can result in the release of hazardous agents into the work environment.

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Fume Hood or Biological Safety Cabinet?

A Biological Safety Cabinet (BSC) is sometimes referred to as a ductless fume hood. The BSC does not protect from chemical vapours. Recirculatory ductless fume hoods are **not** Biological Safety Cabinets, but can protect from particulates when fitted with HEPA filters (differences shown below).

FUME HOOD OR BIOLOGICAL SAFETY CABINET *Which Is The Best Choice For You And Your Lab?*

	Fume Hood	Biological Safety Cabinet (BSC)
		
Protection	Protect user from toxic or volatile chemicals	Protect user, product and environment
Airflow	Away from the user, filtered and through building exhaust	Vertical unidirectional within the work area
Applications	Odorous materials, toxic gases, reactive materials, chemicals that can spatter, aerosols, carcinogens, flammables or other toxic and volatile materials	Infectious microorganisms or other hazardous particulates
Configurations	Vertical or horizontal (or both)	Vertical
Filters	Added HEPA/ULPA filter	HEPA
Usage	Laboratories, educational facilities, and forensic laboratories	Life science research, cell culture processing and other applications where protection of the user, work product, the environment and mitigation of cross contamination on the work surface are needed

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3.8 Other types of non-ducted LEV



3d printer



Saw



Spray booth



Saw



Soldering

4 References

- Controlling airborne contaminants at work A guide to local exhaust ventilation (LEV) HSG 258: <https://www.hse.gov.uk/pubns/priced/hsg258.pdf>
- BS 7989:2001 Specification for recirculatory filtration fume cupboards.
- BS EN 12469 Bio-Technology Performance Criteria for Biological Safety Cabinets
- Controlling airborne contaminants at work A guide to local exhaust ventilation (LEV) HSG 258 <https://www.hse.gov.uk/pubns/priced/hsg258.pdf>
- BS 5726:2005 Recommendations on Siting and Use of Biological Safety Cabinets (as BS EN 12469 does not cover installation or commissioning of BSCs)
- [The Control of Substances Hazardous to Health Regulations 2002 Approved Code of Practice and guidance](#)

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