LONDON METROPOLITAN UNIVERSITY

Management and Use of Local Extract Ventilation Systems Policy

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LONDON METROPOLITAN UNIVERSITY

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1. Introduction

London Metropolitan University contains a wide variety of equipment and facilities which require safe ventilation and fume extraction to ensure the safety of students and staff. There are curriculum subjects within the London Metropolitan University, which involve practical work that can generate potentially hazardous fumes, vapours, or particles. These include welding, woodworking, spraying, printing and laser cutting, solder fume extraction, fume cupboards for working with chemical reactions and microbiological safety cabinets for working with biological agents.

The Control of Substances Hazardous to Health (COSHH) Regulations require the University to prevent or adequately control exposure to hazardous substances. Local Exhaust Ventilation (LEV) should be used as an engineering control to capture and remove airborne contaminants. LEV systems must be subject to regular inspection, testing and maintenance by competent personnel at least every 14 months.

Local Exhaust Ventilation (LEV) is an extract ventilation system that takes dusts, mists, gases, vapours and fumes out of the air so that they can't be breathed in. Properly designed LEV will:

- collect the air that contains the contaminants;
- make sure they are contained and taken away from people;
- clean the air (if necessary) and get rid of the contaminants safely.

The policy covers general LEV systems, Fume Cupboards and microbiological safety cabinets (MSCs).

2. Scope

The policy is intended to identify the elements of LEV systems and their application throughout the university. In addition, it describes the legal and safety requirements that must be met to ensure that LEV systems are able to capture released hazardous airborne substances and safely dispose of them.

3. Definitions

The following definitions are provided to support application of this policy. They focus on the key terms used in relation to the management, use, inspection and testing of Local Exhaust Ventilation (LEV) systems. **This list is not exhaustive.**

a) **Local Exhaust Ventilation (LEV)**
   An engineering control system designed to capture and remove airborne contaminants at or near their source before they enter the atmosphere.
b) **LEV System**
   A system designed to control airborne contaminants and typically comprising a hood or enclosure, ducting, air cleaner or filter, air mover and discharge point.

c) **Airborne Contaminant**
A substance present in the air that may present a risk to health, including dust, fume, mist, vapour, gas or aerosol.

d) **Owner**
The person or organisation with responsibility for an LEV system, including ensuring that it is appropriately commissioned, maintained, inspected, tested and safely used.

e) **User**
A person who operates or works with an LEV system and who has received appropriate information, instruction and training for its safe use.

f) **Competent Person**
A person with the appropriate knowledge, skills, training and experience to undertake the relevant LEV activity safely and effectively, including inspection, testing, maintenance or assessment.

g) **Commissioning**
The process of testing and verifying a newly installed or substantially modified LEV system to confirm that it meets its design specification and provides effective control of exposure.

h) **Thorough Examination and Test (TExT)**
A systematic examination and test of an LEV system by a competent person to determine whether it remains effective and in efficient working order.

i) **Risk Assessment**
A systematic assessment of the hazards, potential exposure and risks associated with an activity, together with the implementation of appropriate control measures.

j) **Control Measure**
A measure used to prevent or adequately control exposure to substances hazardous to health, including engineering controls such as LEV.

k) **Fume Cupboard**
A partially enclosed LEV system designed to capture and remove hazardous gases, vapours, fumes or dusts generated during work within the enclosure.

l) **Ducted Fume Cupboard**
A fume cupboard in which contaminated air is extracted through ductwork and discharged to a suitable location outside the building.

m) **Recirculating Fume Cupboard**
A fume cupboard that captures contaminants and passes the extracted air through appropriate filters before returning the treated air to the workplace.

n) **Microbiological Safety Cabinet (MSC)**
A ventilated containment device designed to provide protection to personnel, the environment and/or the work from biological hazards, depending on its classification and design.

o) **Spray Booth**
An enclosed or partially enclosed ventilated area designed to control airborne contaminants generated during spraying, including paint mist, aerosols and vapours.

p) **Capture**
The process by which an LEV system draws airborne contaminants into a hood, enclosure or other collection point at or near their source.

q) **Face Velocity**
The average velocity of air passing through the working opening of a fume

cupboard or other partially enclosed LEV system.

r) **User Manual**
The manufacturer's or supplier's instructions describing the LEV system, its intended use, operating requirements, maintenance, inspection and other information necessary for safe and effective operation.

4. Roles and Responsibilities

Directors of Department/ Deans of School

Directors and Deans shall:

- Ensure arrangements for reporting, daily and weekly inspections and managing LEVs are documented and kept by the local manager.
- Ensure where ducted or non-ducted LEV is planned, staff involved in procurement and design are sufficiently competent and follow the requirements of HSG 258.
- Notify Estates of any LEV equipment (which has been a responsibility of the Estates) which is donated, relocated, or permanently taken out of use.
- Fulfil the Owner's responsibilities as indicated above, for LEV equipment owned by the School/Dept.

Estates

The Estates Department is responsible for making sure the supplier is competent to install the LEV systems. In addition, it will check if the supplier's plans are within the LEV system specification.

Estates are responsible for the statutory testing of all ducted LEV systems and for arranging testing of non-ducted LEV systems where specifically agreed with the School/Dept.

Users

Users have day to day responsibility for the safe operation of LEV systems and shall:

- Attend any training/induction provided in the use of the equipment
- Clean the work areas.
- Operate LEV systems in accordance with their training, Course Leader instructions and LMU safety procedures.
- Carry out any relevant actions in case of emergency.
- Use the LEV systems within safe operating limits
- Keep records such as up to date safety checks and fill out daily user checklist and weekly user checklist provided
- Confirm the system is operating safely (within test date and passed) before each use.
- Report any faults immediately to the responsible manager and Estates (ask@londonmet.ac.uk)

Competent Person

A Competent Person is any person who is qualified and trained to carry out the inspection and testing and makes sure the works/actions identified during the inspection are rectified.
The competent person will be responsible for ensuring each LEV system has the following documentation/records readily available:

- HSE 'Clearing the air',
- A guide to purchasing LEV INDG408
- Commissioning reports
- Logbook
- User Manual
- Current COSHH/risk assessments.
- Training records for all users of LEV systems.
- Statutory thorough examination reports (for Fixed LEV, ensuring reports have been received by Estates Department, and any faults are rectified by the Owner/ Department).
- Inspection, maintenance/servicing records.

Owners

The owner is the person with budgetary responsibility for the LEV system and has legal responsibility for ensuring the system complies with relevant regulations and does not present a danger to users or other who might work in the proximity.

The owner of the LEV system will appoint a suitable member of their team with working knowledge of the requirements of HSG 258 (from within the Department/School) to ensure a current register of all ducted and Non-ducted LEV systems is readily available on request. The owner will ensure all Non-ducted LEV is asset tagged.

The owner will ensure that any plan to install a ducted LEV is project managed by the Estates Department.

The owner of the LEV is responsible for the maintenance, regular inspection and safe use of LEV equipment.
Statutory Testing Arrangements form part of the regular inspection schedule. Statutory testing of all ducted LEV is done by the Estates. In some instances, the School is the owner of non-ducted LEV systems e.g. a mobile welding extraction system in a workshop area. Unless a formal arrangement is put in place with Estates, the School is responsible for arranging any statutory testing of non-ducted system they own.
Certain equipment owned by Estates will be in School/Departmental controlled areas but will remain the responsibility of Estates.

The owner is also responsible to ensure that before the system is used the following are completed:

- Commissioning is carried out.
- A suitable and sufficient risk assessment is completed.
- A plan is in place and implemented for servicing and testing of the system.
- LEV system logbook exists relevant to the type of system used.

5. Procedures / Key Requirements

Risk Assessment

Safe use of LEV systems must be supported by suitable risk assessment. The risk assessment must identify the areas where control is required to ensure the installation and use of an effective LEV system.

Elements of LEV system

Fig. 1 represents the main components of the general LEV system which include:
An inlet/enclosure/hood – where the contaminant is captured or contained and enters the LEV. The hood/enclosure may need to be designed to capture/contain dust, fumes, mist, fibres, and vapour or gas aerosols and be structured and placed at the emission point so as to entrain/contain the emission as degree of containment around the emission point is crucial.
Ducting – conducts air and the contaminant from the hood to the discharge point.
Air cleaner or filter – filters or cleans the extracted air. Not all systems need air cleaning.
Air mover – the fan and motor that powers the extraction system.
Discharge or exhaust - releases the extracted air to a safe place.

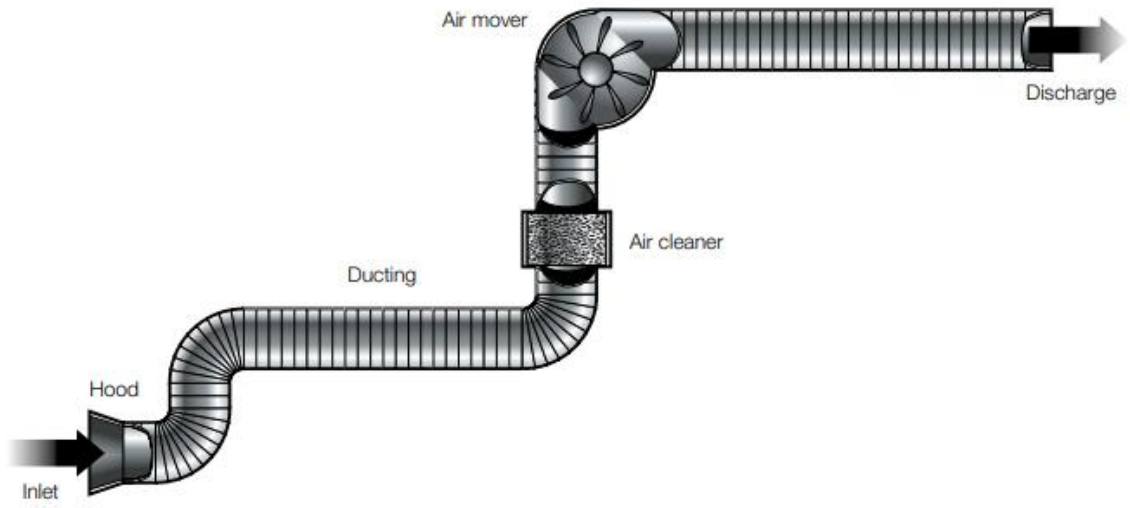


Fig. 1 Components of the LEV. *(Source: HSE, 2017, HSG 258)*

Types of Hoods

The hoods can be classified in different categories according to Fig. 2 below.

A non-exhaustive list of the types of LEV system used by London Met University include:

- Ducted Fume Cupboards
- Recirculating / Filtered Fume Cupboards
- Fume Extract Arms and Hoods
- Dust Extract Systems for Woodworking
- Fume Extraction Systems for Metalworking and Welding
- Laser Cutter Filtered Fume Extraction
- Solder Extract Fume Extraction
- Chemical Stores Rooms & Cabinets
- Microbiological safety cabinets
- 3D printing enclosures
- Powder weighing stations
- Kitchen Hoods

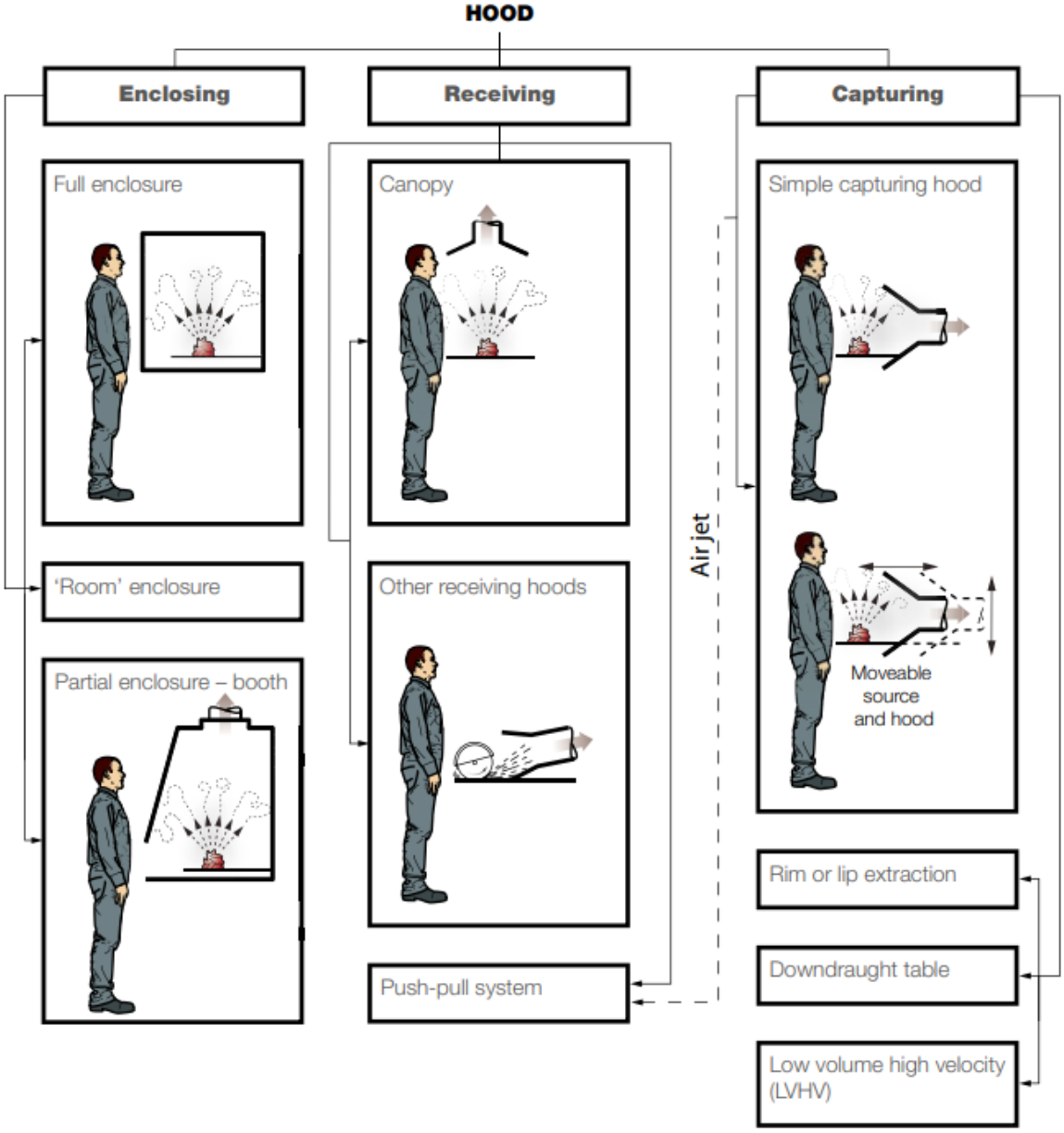


Fig. 2. Extracting hood classification according to HSG 258

Selection

The enclosure /hood selection process must take into consideration health and safety aspects such as obstructions and ergonomic disorders (e.g. manual-handling limitations or over-reaching). Also, the hood/enclosure may need to be designed to capture/contain dust, fumes, mist, fibres, and vapor or gas aerosols. Further advice on the selection of the LEV systems is provided in HSG 258.

Please refer to Appendix 2. Documents from the supplier for what documents the supplier needs to provide.

Safety Checks

Appendix 3. LEV System Checks sets out the safety checks that need to be performed on a regular basis.

Type of tests and equipment

Please refer to Appendix 4. LEV Systems Testing

Maintenance and Inspection

L5 the Control of Substances Hazardous to Health Regulations 2002 (COSHH): Approved Code of Practice and Guidance recommends that weekly visual checks should be organized to identify any obvious defects.

COSHH Regs 2002 require a regular schedule of fume extraction test and maintenance on the LEV systems carried out by qualified personnel. Appendix 5. Inspection, Maintenance and Service Schedule sets up an inspection and maintenance requirements.

COSHH Regs 2002 defines competent persons as ‘people who have enough training and experience or knowledge and other qualities to enable them ‘properly to assist in undertaking the measures referred to’.

The frequency of examination and tests should be linked to the type of engineering control in use, the size of the risk if it failed or deteriorated and how likely it is to fail or deteriorate. Any defects should be put right as soon as possible or within a time laid down by the competent person who carries out the examination. The person carrying out the thorough examination and test should provide a record, which needs to be kept by the employer **for at least five years**.

The employer should ask the examiner to attach a test label with the date of the test to each hood when tested where appropriate. Staff from the Estates and LEV systems users need to know if an examination has been done or when it is due.

The thorough examination and testing (TEXT) of LEV is carried out in three stages. Stage 1 involves the thorough visual and structural examination to verify the LEV is in efficient working order, in good repair and in a clean condition.

In stage 2 a review of the technical performance to check conformity with commissioning or other sources of relevant information is carried out. Whereas in stage 3 the assessment of control effectiveness is performed. (HSE, 2017, HSG 258)

Appendix 6. Thorough examination and Test Recording Requirements includes details of the report that should be issued by the examiner and kept by the Estates or School for further reference.

LEV examiners must have the appropriate equipment such as Pitot tubes, a smoke generator, a dust lamp, an anemometer and, sometimes, equipment for air sampling.

Training

Please refer to Appendix 7. Safe Use of LEV Systems Training Records for training requirements form.

5.1 Fume Cupboards

Specification for fume cupboard systems

A fume cupboard is intended to minimize exposure to hazardous gases, vapours or dusts and they are classified as Partial enclosure LEV Systems. It operates independently of the general laboratory ventilation system. Each fume cupboard is connected to the extract system.

Ducted Fume cupboard

The ducted fume cupboard is taking contaminated air away from the user through a system of ducts and discharge fans. The fans are usually mounted externally, and the ducts are often routed internally sometimes through tortuous routes.

Re-circulatory fume cupboard

The air flowing through a recirculating filtration fume cupboard collects contaminants released within the operational area and then passes through a filter that removes most of the contaminants before the air is discharged back into the operational area. These devices are not recommended when using highly toxic chemicals and regular use of toxic and/or flammable solvents in large quantities. Filters must be rated appropriately for the types of chemicals to be used.

It is recommended that the filter(s) be changed at intervals specified by the supplier or manufacturer and **at least on an annual basis, based on risk assessment**, unless the supplier recommends in writing that this is not necessary. The decision for filter change intervals must be justified in the relevant risk assessment.

Ductwork

Ductwork should be made of chemical and physical resistant materials and follow a direct route from fume cupboard to the fan. In addition, it is required to have a smooth, obstruction free interior and should be circular in cross-sections. The air velocities in the ducts should not exceed 7.5 m/s where the noise level is low and should not exceed 5.0 m/s for single unit systems and branches on multiple fume cupboards, 5.5 m/s for main ducts within the buildings and 6.0 m/s for external ducts.

Fan

Should be selected and installed as per Clause 16 of BS 848:1197 and be able to achieve near to the maximum efficiency. The most common ones are backward curve centrifugal type. The fans should be coupled, or belt driven and resistant to the maximum expected temperature. There should be considered means of access for cleaning all parts of the fan.

Fume discharge point

It is placed in a vertical direction at min 1.25m x the building height or 3 m above the highest point of the building. The discharge velocity must be vertical and not less than 7m/s.

Make up air
There must be adequate provision for make-up air in order for air flow through the face of the fume cupboard to be satisfactory. If it is inadequate that presents a risk of hazardous gases release in a fume cupboard and escaping into the room.

Siting and Installation

The Fume Cupboards shall be manufactured and installed to meet requirements of BS EN 14175: Parts 1-7. According to the BS EN 14175 the fume cupboard shall have a *radiused aerodynamic profile* similar to a curved rocket to achieve a laminar airflow.

Pre-installation requirements

Positioning the fume cupboard (FC) within a room will influence its ability to contain contaminants the following features present in the nearby must be considered: walls, columns, cabinets, work benches, or other features likely to disturb the flow of air through the enclosure and the traffic routes through the laboratory. Fig. 3. Depicts main consideration when positioning the FC.

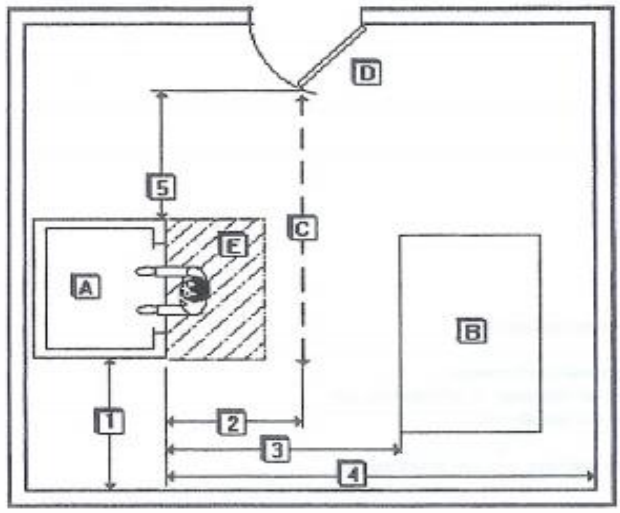


Fig. 3. Positioning of the FC: A) FC enclosure, B)Workbench, C) Traffic route, D) Door, E) Undisturbed operator zone. Minimum recommended distances: 1=300mm, 2= 1300mm; 3 = 1500 mm, 4 = 2000mm, 5 = 1000mm (Source NERC, 2007)

Adequate facilities must be provided and be in place in order to replace the air extracted from the room by the fume cupboard by either positioning grilles in walls or doors to allow low velocity induction of treated air from adjacent offices or corridors or drawing the air from outside and then conditioned by a dedicated air handling unit.

The powered make-up air can cause high velocity currents in the proximity of the fume cupboard aperture can have an adverse effect on the containment performance of the cupboard.

The effect of the walls, columns, cabinets, work benches, or other features must be considered as they are likely to disturb the flow of air through the enclosure, and the walkways can be reduced by ensuring that there is an undisturbed zone where the

user can work at the enclosure.

A fume cupboard should be placed away from the walkways. Passers-by create eddies, which may cause a release from the fume cupboard and distract, or even walk into its user. It is important to bear in mind the need for a clear area in front of a fume cupboard when siting one in a preparation room. There should be no opposing wall or other opposing obstruction likely to affect air flow within 1300 mm of the sash.

The distance between the sash and the bench opposite should be at least 1500 mm. If more than one operator uses the same bench opposite, this distance may need to be greater. When a demonstration is organized there must be set up an unobstructed working zone of radius 1300 mm from the centre of the fume cupboard is recommended to allow students watching or waiting to use it. The provision of the minimum working zone of 1300 mm will generally ensure that the minimum distances from walls and doors quoted above are satisfied. The minimum distance from the sash to any part of the laboratory frequently used by other personnel in moving from one part of the laboratory to another should be at least 1000 mm.

The overall width of fume cupboards shall be a multiple of 100 mm with preferable dimensions of 1200 mm and 1500 mm. The overall depth of fume cupboards shall be between 600 mm and 1200 mm. The minimum internal height for a fume cupboard is 750mm, preferably 900 mm. 750 mm is required for the tallest apparatus likely to be used. The maximum working height should be 400 mm, or perhaps a little more, with a sash stop at the maximum working height which can be over-ridden for cleaning purposes.

The aperture should not be closed completely because this could prevent the flow of air and be unsafe.

Safe Use of Fume Cupboard

Risk and COSHH Assessment

Fume cupboard type must be established by risk assessment, undertaken by a competent person. Separate risk assessments (to include chemical and other hazards e.g. work from height, mechanical, electricity, repetitive work, etc.) of the maintenance work should be completed. Information about the chemicals used should be provided by fume cupboard users from their COSHH assessments record, material data sheet and fume cupboard logbook.

Safety Checks

The safety checks must be performed at different stages of fume cupboard operation by the user who can be a student or academic member of staff as:

1. Pre-use checks
2. Operation checks
3. After use checks
4. Emergency procedures in case of operational failures

A safety checks form can be found in Appendix 8a Fume Cupboard - Weekly Inspection Checklist

Thorough Inspection and Testing (TEXT)

Legal Requirements

The COSHH regulations require employers to ensure that control measures are 'maintained in an efficient state, efficient working order, in good repair and in a clean condition'; therefore, **a regular, routine maintenance schedule in addition to the annual testing is recommended**.

Individuals carrying out maintenance activities on fume cupboard systems must be made fully aware of the hazards they may encounter. Where maintenance is likely to interrupt the normal operation of the fume cupboard a permit to work may be issued.

This is essential when maintenance work is carried out on systems used for radiation work. These units are labelled accordingly.

Thorough Inspection

All fume cupboards need to be given simple regular user checks (see Appendix 8b) to see that they are functioning correctly. In addition, all LEV must be given a thorough examination and test, at least every 14 months as set up in Appendix 4. Inspection, Maintenance and Service Schedule.

If maintenance work is likely to influence fume cupboard performance, suitable containment or face velocity tests should be carried out on completion of the work.

Testing

The policy provides the basic conditions for satisfactory performance, but only commissioning tests will confirm whether the performance of a fume cupboard is acceptable with any given situation.

Containment test

Containment testing using tracer gas provides a quantitative measure of fume cupboard containment under normal working conditions by analysing the escape of a tracer gas (e.g. sulphur hexafluoride) from within the fume cupboard. It is advisable to carry out containment testing and robustness of containment testing on newly installed equipment and following any major repair work.

Face velocity measurements

These tests measure the average rate at which air is drawn through the opening of the fume cupboard and is the conventional method for measuring fume cupboard performance. For standard work with hazardous substances, the face velocity should be 0.5 m/s ±10% with the sash set to 500mm height.
When face velocities fall below 0.45 m/s the unit should be removed from use until remedial work has been completed. (Cleaps, 2014)

Room air velocity test

The scope of the test is to measure up the air flow in the surroundings of the fume cupboard. If the room airflow exceeds 0.2m/s this can cause reduced containment.

Alarm system test

The British European Standard 14175 requires that fume cupboards should incorporate an airflow indicator to show unambiguously the correct functioning of the fume cupboard's air flow.
Audible and visual alarms need to be included to warn the operator of incorrect operation of the fume cupboard such as vertical alarm sash stop overriding and air flow indicator. When performing the test, the audible alarm may be silenced once alarmed.
However, if the operating height is clearly marked on the cupboard and if is a reliable visual indication of the air flow rate (i.e. an air velocity meter) and clear operating procedures the Fume Cupboard may not need the alarms settings incorporated.

Test Report

A routine test report should be completed and include the following as minimum:

- Fume Cupboard Number
- Date of test
- Type of test carried out
- General room conditions during the test
- Results of fume cupboard visual and technical inspection.
- List of any remedial actions necessary.

Records Keeping

Maintenance records must be kept by the Owner for 5 years.

5.2 Microbiological Safety Cabinet

Types of Microbiological Safety Cabinets

The type of microbiological safety cabinet (MSC) to be used is to be determined in the risk assessment for the activity and will require consultation with EH40 regarding the Hazard Group of the biological material/ Category of the GMO. See Biological Safety Policy for more information.

Class I

Class I MSCs (Fig. 4) are effectively open fronted fume cupboards with the addition of a High Efficiency Particulate Air (HEPA) filter on the exhaust and are designed to prevent dispersal of contaminated aerosols into the environment of the laboratory or outside the building. The most common HEPA filter is class H14 that is designed to retain not less than 99.995% of challenge particles. It provides protection to the operators and environment, but not product protection.

The exhaust air is ducted to outside air. They offer worker protection, but do not protect the work from contamination as they pull in a flow of unfiltered air which passes over the working area, which then is discharged, normally through a single HEPA filter to the exterior of the building.

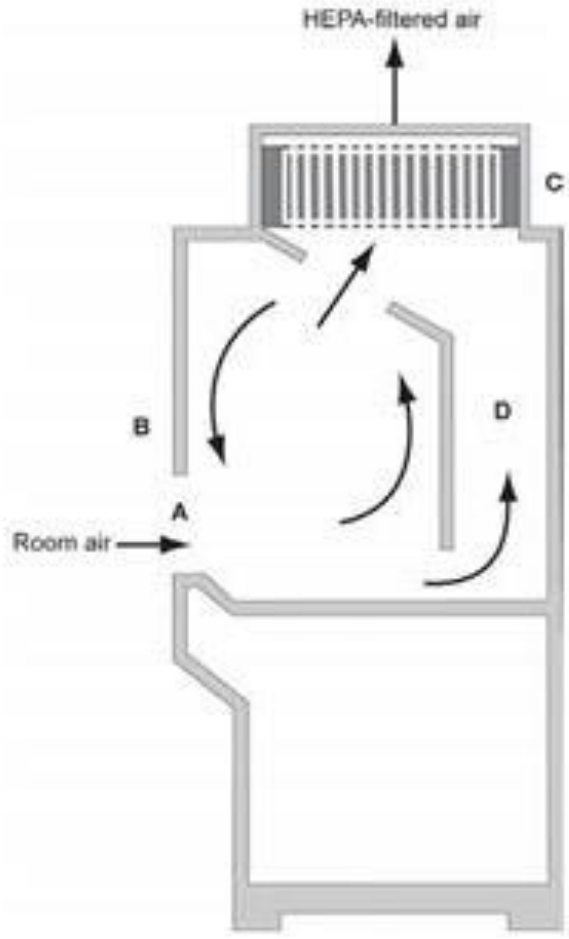


Fig. 4. Class I MSC: A) front opening, B) sash, C) Exhaust HEPA filter and D) exhaust plenum

Class II

Class II MSCs (Fig. 5-7) are open fronted and offer protection benefit of a working environment held at negative pressure, with the protection of bathing the work area in a flow of “sterile” (HEPA filtered) air, therefore offering protection to both, the operator and the content. Class II cabinets may either be ducted, or discharge filtered air into the laboratory.

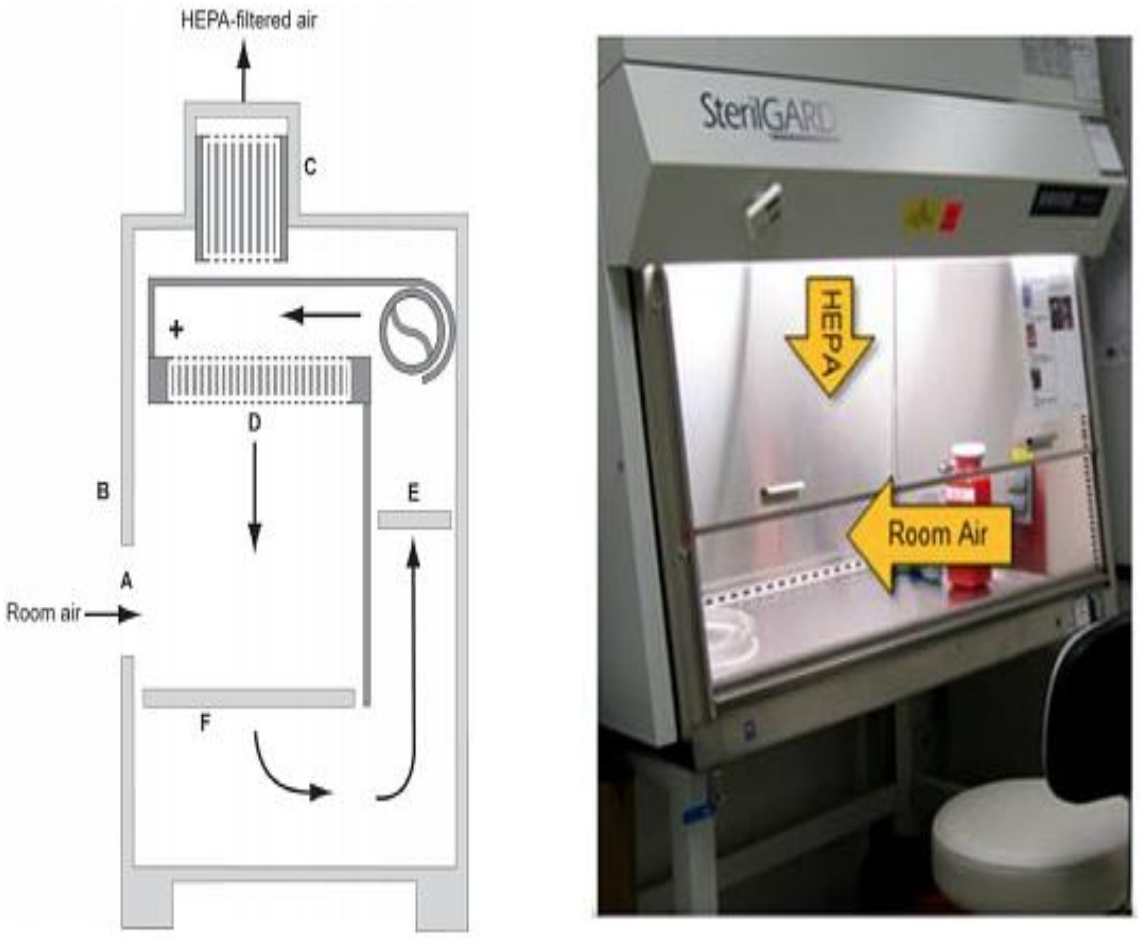


Fig. 5. MSC Class II Type A. A) Front opening, B) Sash, C) Exhaust HEPA filter, D) Supply HEPA filter, E) Positive pressure common plenum, F) Negative pressure plenum.

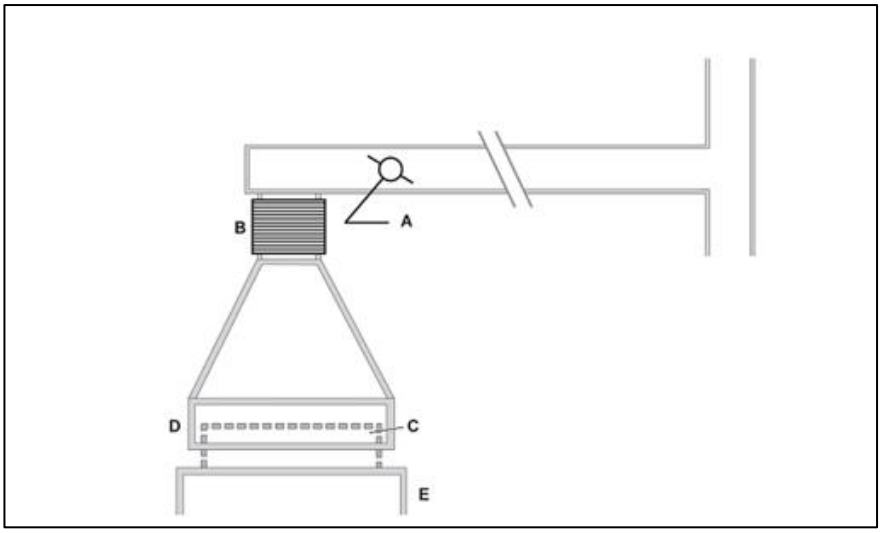


Fig. 6. MSC Class II A1 or A2. A) Balancing damper, (B) Flexible connector to exhaust system, (C) Cabinet exhaust HEPA filter housing, (D) Canopy unit, (E) Bench.

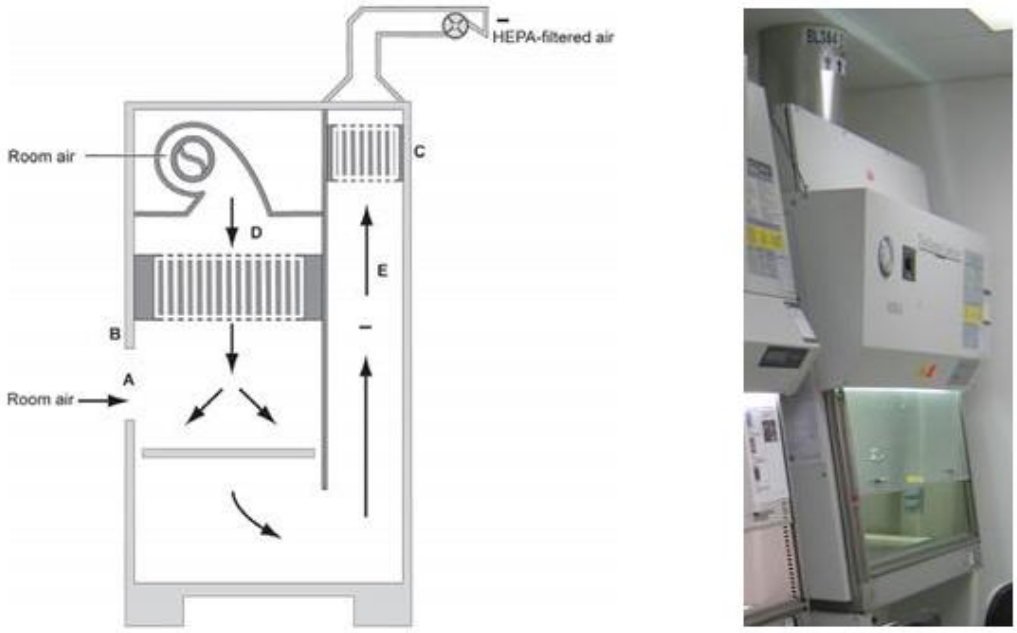


Fig. 7. MSC Class II Type 1 or B1 Front opening: A) sash, B) exhaust HEPA filter, C) supply HEPA filter, D) negative-pressure exhaust plenum

MSC Class III

Class III MSCs (Fig. 8) are closed cabinets and protect both the operator and the work by ensuring that the work is undertaken in a “sealed box” which is held at negative pressure and where the work is also bathed in a flow of sterile air. The operator must use arm-length gloves which are sealed to the front of the cabinet. The exhaust air is filtered and ducted to outside air.

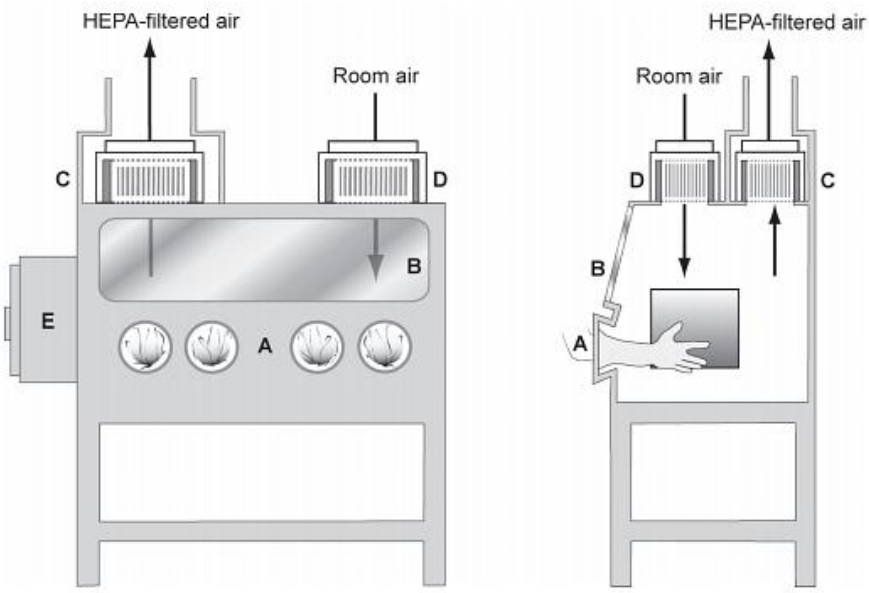


Fig. 8. MSC Class III: A) Glove ports with O-ring for attaching arm-length gloves to cabinet, (B) sash, (C) exhaust HEPA filter, (D) supply HEPA filter, (E) double-ended autoclave or pass-through box. The cabinet exhaust needs to be hard connected to an independent dedicated exhaust system. The exhaust air must be double HEPA filtered or HEPA filtered.

Safe Use of Microbiological Safety Cabinets

Risk Assessment

The risk-assessment process starts with considering three primary factors: (1) the inherent work hazard posed by the biological material or agent, (2) the susceptible hosts (i.e., receptors) that may be affected by the material or agent, and (3) the exposure pathways between the threat hazard and the susceptible host.

Emergencies

- If the ventilation system fails, immediately stop working. If safe to do so, replace lids on containers and complete any ongoing processes.
- Move away from the microbiological safety cabinet. Warn other users that there is a problem.
- Deal with spillages immediately, using the correct absorption materials. Dispose of as hazardous waste.
- Respond to fires with extreme caution.
- The use of high-pressure CO2 extinguisher may spread flames and eject items out of the fume hood.
- Only use firefighting equipment if you have been trained to use it and always make sure you use the correct one.
- Raise the alarm by activating the fire alarm (press red manual call point) and phone the emergency services (02073203333).
- Evacuate the building.

Weekly checklist

A trained and experienced member of staff must carry out visual inspection on weekly basis. Records of the visual inspections can be kept by using the form included in Appendix 9a: Microbiology Safety Cabinet - Weekly Inspection Checklist

User Checklist

User must conduct pre- and post-use checks to the MSC. Please refer to the form in Appendix 9b: MSC - User Checklist

Inspection and Maintenance

Please refer to Appendix 4 – Inspection, Maintenance and Service Schedule Inspection and Maintenance Schedule on inspection and maintenance regime of microbiological safety cabinets.

Training requirements
See Appendix 8c for training requirements for fume hood users.

6. Information, Instruction and Training

Users of LEV systems must receive suitable information, instruction and training before using the equipment. Detailed training requirements, competency requirements and training records are set out within the relevant sections of this policy and supporting appendices.

7. Records and Monitoring

Records relating to the commissioning, inspection, testing, maintenance and safe use of LEV systems must be maintained and retained in accordance with statutory requirements. Detailed monitoring, inspection, testing and record-keeping arrangements are set out within the relevant sections of this policy and supporting appendices.

8. Legislation and Standards

List of legal requirements relevant to the management of LEV is presented in Appendix 1.

9. References

- CLEAPS, 2014, G9 Fume Cupboards in Schools
- BOSH, 2016, Practical LEV Testing
- BOSH, 2019, LEV Extracting Best Practices.
- British Standards BS EN 14175 Parts 1-7, 2019
- British Standards BS EN 12469:2000
- Health and Safety Executive, 2016 IND (G) 408, Clearing the Air: A simple guide to buying and using local exhaust ventilation
- Health and Safety Executive, 2017, HSG 258 Controlling airborne contaminants at work, a guide to local exhaust ventilation (LEV)
- Health and Safety Executive, 2010, HSG129, Health and safety in engineering workshops
- Health and Safety Authority, 2014, Local Exhaust Ventilation (LEV) Guidance
- Health and Safety Executive, 2013, L5 – Control of Substances Hazardous to Health
- Health and Safety Executive, 2013, HSG53 – Respiratory protective equipment at work a practical guide
- Health and Safety Executive, – Isocyanate paint spraying
- Health and Safety Executive, 2016, MR2 – Spraying two-pack (2K) products in a spray booth or room
- Health and Safety Executive, 2018, EH40/2005 Workplace exposure limits
- NERC, 2007, the safe use, maintenance, and testing of laboratory fume cupboards

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Appendix 1. Legal Requirements

Health and Safety at Work Act 1974 requires every employer and company supplying LEV Systems to fulfil their health and safety duties to employees and other people who may be affected by the way they carry out their work ('conduct their undertaking').

The Management of Health and Safety at Work Regulations 1999 (MHSWR) require that an employer is competent for health and safety purposes or obtains advice from competent people'. This includes anyone who: designs or selects control measures; checks, tests, and maintains control measures; or supplies goods and services to employers for health and safety purposes.

The Control of Substances Hazardous to Health Regulations 2002 places duties on the University, as an employer, to assess exposure to hazardous substances, evaluate the risks to employees, devise and implement adequate control measures, and check and maintain them.

Employers must ensure that any person (whether or not their employee) who carries out work in connection with the employer's duties under COSHH has suitable and sufficient information, instruction and training.
Persons providing advice on the prevention or control of exposure, designing control measures, or assessing their effectiveness must have the appropriate knowledge, skills and experience to be competent in carrying out those duties.

The Machinery Directive (2006/42/EC) applies to the design and construction of machinery and safety components independently placed on the market and requires that the responsible person' (the manufacturer or authorised representative) to ensure that the relevant statutory health and safety requirements are met.

The Supply of Machinery (Safety) Regulations 2008 (SMSR), which implement the Machinery Directive, require that machinery placed on the market, or put into service, is safe. Section 6 also applies to components not within scope of the Machinery Directive.

The Provision and Use of Work Equipment Regulations 1998 (PUWER) require LEV systems as work equipment, to be suitable for its intended purpose, maintained for safety and conform at all times with any essential requirements that applied when first put into service.

Many LEV systems are also machines with dangerous parts (motors, fans, rotary valves etc.) for which adequate safety measures must be taken.

The Electricity at Work Regulations 1989 is relevant to the design and continued maintenance of the electrical systems associated with fume cupboards. Regulation 5 requires the need for the mechanical integrity of electrical equipment, particularly where corrosion sometimes experienced by electrical systems may occur as a result

of environmental conditions. Additionally, when carrying out maintenance work arrangements must be in place for isolation of energy sources, and the use of effective control measures (i.e. permits-to-work) as per Regs 12 and 13 as necessary precautions.

The Gas Safety (Installation and Use) Regulations 1998 requires a programme of inspection and testing to ensure that gas supplies and fittings on science lab benches or within fume cupboards are in good working order, free of leaks or defects, and that the gas supply itself is operating at the correct pressure.

Current Standards

BS 7258, Parts 1, 2, 3 and 4 – which apply to fume cupboards installed in the work place prior to 2004 and does not cover does not cover recirculating fume cupboards which are mentioned in BS 7989: Specification for recirculatory filtration fume cupboards.

The University follows the requirements of **BS EN 14175** as:

BS EN 14175: 2003 - Part 1, 2 and 3 which defines the terminology used, safety and performance requirements and the type of test methods

BS EN 14175: 2004 Part 4 which covers on site test methods

BS EN 14175: 2006 Part 5 and 6 - 2006 with regard to the connection, installation and commissioning of fume cupboards and aspects of the variability of air volume in the fume cupboards

BS EN 14175-7:2012 Part 7 refers to specific requirements of fume cupboards in order to be used in high heat and acidic load environments

BS EN 12215:2004 + A1:2009 sets the minimum airflow required and ensure that the concentration of flammable material in the atmosphere is reduced below the lower explosive limit (LEL) everywhere other than in the immediate range of the spray gun.

BS 5726:2005 sets up recommendations on Siting and Use of Biological Safety Cabinets.

BS EN 12469:2000 provides information relating to the type, specification, and performance of the different types of Biological Safety Cabinet.

Appendix 2. Documents from the supplier

The Clearing the air - A simple guide to buying and using local exhaust ventilation (LEV) INDG 408 (Rev1), 2016 identified key documents that need to be requested from the supplier and used for further reference.

A user manual with a general specification of what the LEV system is designed to control and how it achieves that control, including:

- a description of the system with diagrams.
- performance information from commissioning.
- a description of checks and maintenance and replacement schedules, including frequency.
- a listing of replaceable parts (and part numbers).
- a detailed description of the specific statutory ‘thorough examination and test’ requirements and exposure targets.
- signs of wear and control failure.
- a description of how operators should use the system, so it works effectively.

A logbook that includes:

- schedules for regular checks and maintenance.
- records of regular checks, maintenance, replacements, and repairs.
- checks of compliance with the correct way of working with the LEV system.
- the name of the person who made these checks.

A commissioning report that includes:

- diagrams and a description of the LEV, including test points.
- details of the LEV performance specification.
- results, such as pressures and velocities at stated points.
- Calculations.
- Written descriptions of the commissioning, the tests undertaken and the outcome. Where necessary, this should include air sampling results.
- a description of how operators should use the system, so it works effectively.
- A user manual, a logbook, a commissioning report, and appropriate training will help you keep control.

Appendix 3. LEV System Checks

Type of checks	Who
Pre –installation checks	
The key properties of airborne contaminants.	System designer
What gases, vapours, dusts, and mists are present	System designer
How contaminant clouds move with the surrounding air.	System designer
The processes in the workplace which may be sources of airborne contaminants.	System designer
The needs of the students/staff working near those sources.	School
Additional control measures required.	Owner
Prepare a specification for the LEV designer.	Owner
LEV System Routine Checks	
LEV system parts function adequately.	User
LEV system is used appropriately	User
LEV system is delivered at its design performance	User
Damaged LEV parts are identified and reported	User
Safe systems of work are followed	User
Users are informed of inspections and maintenance	Owner
Users are trained into how LEV system works and how to assess hazards and risks.	User
Schedule the routine maintenance is needed as per 'user manual' or supplier's recommendations.	Owner
Contact details in case of emergency are readily available	Owner and User

Source: HSE, 2017, HSG 258 Controlling airborne contaminants at work, a guide to local exhaust ventilation (LEV)

Appendix 4. LEV Systems Testing

Table: Type of Test and Equipment

Type of test	Equipment
Pressure testing	Manometer
Air velocity testing	Anemometer, e.g. thermistor or hot wire, velometer or a pitot tube.
Testing effectiveness	Aerosol generation
Tracer gases	Detector
Fan testing	Tachometers and Power Consumption Meters.
Filter or air cleaner performance	Isokinetic and size-selective sampling, water quality test kit
Observation	Dust lamp, smoke-generation equipment, camera, fibre-optic camera, and borescope (for internal LEV examinations).

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Appendix 5. Inspection, Maintenance and Service Schedule

Extraction System	Inspection and Testing		Maintenance					Checks			
	Thorough Examination	Testing	Pre filter replacement	UV lamp replacement	Service	Cleaning	Filters	Booth and door seals	Duct Fans and Filters	Pressure	Smoke generator
LEV System	14 Months	14 Months	At least 12 Months**	N/A	As per manufacturers specification/ risk assessment	As per manufacturers specification/ risk assessment	Monthly or as per risk assessment	Monthly*	12 Months	Daily	N/A
Ducted Fume Cupboard	14 Months	14 Months	None	N/A	12 Months	After use	N/A	N/A	Monthly	N/A	N/A
Recirculatory Fume Cupboards	14 Months	14 Months	Determined by Risk Assessment	N/A	12 Months	After use	As per manufacturers specification/ risk assessment	N/A	As per manufacturers specification/ risk assessment	N/A	N/A
Microbiological Safety Cabinet	14 Months	14 Months	3 Months	12 Months	12 Months	After Use	N/A	N/A	N/A	N/A	N/A
Spray Booth	14 Months	14 Months	As per manufacturers specification/ risk assessment	N/A	12 Months	Before spraying. After spraying (and drying). Once a week.	As per local exhaust ventilation (LEV) a user manual or logbook	Daily	Weekly	Daily	Monthly

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Appendix 6. Thorough examination and Test Recording Requirements

A suitable record should contain the following details:

- Name and address of the employer responsible for the LEV.
- Date of the thorough examination and test.
- Date of the last thorough examination and test.
- Identification and location of the LEV and the process and hazardous substance(s) concerned.
- Operating conditions at the time of the test and whether this was normal production or special conditions.
- A simple diagram of the LEV layout and location, with test points.
- General condition of the LEV system, including hood serial numbers and, where appropriate, photographs of relevant parts.
- Information about the LEV plant which shows: its intended operating performance for adequately controlling hazardous substance(s) for the purposes of COSHH regulation 7.
- Whether the plant is still achieving the same performance.
- Methods used to measure performance and the action to be taken to achieve that performance, e.g. visual, smoke test, airflow measurements, pressure measurements, dust lamp, air sampling, tests to check the condition and effectiveness of the filter.
- The results of any air sampling relevant to LEV performance.
- Information on the way operators use the LEV.
- Information on general system wear and tear and whether components may need repair or replacement before the next test.
- Name, job title and employer of the competent person carrying out the examination and test.
- Signature of the person carrying out the examination and test.
- Minor adjustments or repairs carried out to make the LEV system effective.
- Critical defects identification

Appendix 7. Safe Use of LEV Systems Training Records

Name	Job Title	Type of training				Date	Signature
		LEV System	FC	MSC	Spray booth		

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Appendix 8a. Fume Cupboard - WEEKLY INSPECTION CHECKLIST

Weekly Visual Inspections: to be carried out by the responsible technical staff. Where there are any observations or comments arising from any operational issues, the cabinets are to be taken out of service until further checks are carried out and resolved. This should be done by contacting the Helpdesk on email: ask@londonmet.ac.uk

Username	**Job title (if applicable)**	**Date**
Room Reference	**Serial Numbers**	**Modules using the fume cupboard**

WEEKLY CHECKLIST	**YES**	**NO**	**OBSERVATIONS/COMMENTS**
Any signs of damage, internal or external			
Cracking or deterioration of sealant at edges			
Build-up of debris on ventilation grille to the rear of the cabinet			
Sash is free to move through its full range, and remains at the position it is released at (no rising or falling)			
Sash alarm is operational, giving visual and audible alarm when raised above safety point			
Where an air flow rate reading is possible, record this (NA)			
Sash high limit is functioning			
No internal or external obstructions to air flow into the cabinet			
Lights are functional			
Flush water supply to cabinet for 2 minutes			
Vacuum pump is functional			

Technician's name (print):	**Technician's signature:**	**Date of Inspection:**

Appendix 8b. Fume Cupboard - USER CHECKLIST

Pre and Post Use Checks: to be carried out by staff supervising the activity. Where there are any observations or comments arising from any operational issues, the cabinets are to be taken out of service until further checks are carried out and resolved. This should be done by contacting the Helpdesk on email: ask@londonmet.ac.uk

Username	**Job title (if applicable)**	**Date**
Room Reference	**Serial Numbers**	**Modules using the fume cupboard**

Pre-Use Checklist	**YES**	**NO**	**OBSERVATIONS/COMMENTS**
Ensure that a suitable risk assessment is in place for work involving hazardous substances			
Is there an in date (within 14 months) test sticker fixed to the front of the cabinet?			
Ensure that you have enough space to conduct the experiment			
When using flammable materials, check that you know the location of the nearest suitable fire extinguisher			
Does the air flow sensor indicate satisfactory air flow?			
Does the extraction system make any unusual noise?			
Ensure experimental materials/equipment are placed at least 150 mm inside the plane of the sash to ensure efficient containment and protection from splashes from a spill.			
Have you completed a 'leave on form' for overnight experiments?			
Carry out a quick visual check of the fume cupboard and report any findings if there are: • Signs of damage to any ducting, especially if flexible. • Signs of any damage to the services. • Ease of movement of the sash. • Signs of damage to the cupboard itself.			

If the sink is clogged, log a call with Ask (ask@londonmet.ac.uk).			
Post Use Checklist			
Keep the extraction system running until you are sure that there are no hazardous contaminants being generated and those generated have been removed.			
Have you cleared away and safely disposed of any hazardous substances?			
Return any equipment to its correct storage area.			
Ensure that the fume cupboard is left in a clean and safe condition, free of any substances and equipment.			
When not in use, fume cupboard sashes should be closed if permitted by the Technical Team to minimize air flow and provide maximum containment.			
Check whether the glazing, especially inside, has become obscured by deposits and needs to be wiped clean.			
Staff name (print)	**Staff signature**		**Date of Inspection**

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Appendix 8c. Training Requirements for Fume Hood users

Subjects to confirm the knowledge	Item covered		Competency assessed	
	Yes	No	Yes	No
This guidance has been read				
Control panel, alarms, and indicators – what they all mean				
Safe operating parameters for air velocity				
How to turn the fume hood on and off				
The importance of lowering the sash to the lowest position possible when working at the hood				
The importance of shutting the sash whenever the operator does not need access to within the hood				
Techniques to avoid disrupting the airflow				
Local rules on whether the hood can be left on or off				
Permitted equipment allowed within the hood				
Dealing with waste within the fume hood, do not let it accumulate or use the hood for waste storage, if sinks are in the hood what can be disposed of to drain				
Restrictions on what work can be carried out in a recirculating hood				
Dealing with spillages within the hood				
Emergency actions – what to do if the power or airflow fails				
Routine cleaning of the hood after use				
Principles of airflow, performance testing and containment testing				
Who to report to if the hood is “out of test date”				

Both trainer and trainee agree that the above training has been fully completed and that the trainee is considered to be competent to use the fume hood for the specific project/work			
Position	**Name**	**Signature**	**Date**
Trainer			
Trainee			
Trainee			
Trainee			
Trainee			

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Appendix 9a. Microbiology Safety Cabinet - WEEKLY INSPECTION CHECKLIST

Weekly Visual Inspections: to be carried out by Technical staff. Where there are any observations or comments arising from any operational issues, the cabinets are to be taken out of service until further checks are carried out and resolved. This should be done by contacting the Helpdesk on email: ask@londonmet.ac.uk

Username	**Job title (if applicable)**	**Date**
Room Reference	**Serial Numbers**	**Modules using the fume cupboard**

WEEKLY CHECKLIST	**YES**	**NO**	**OBSERVATIONS/COMMENTS**
Any signs of damage, internal or external			
Cracking or deterioration of sealant at edges			
Build-up of debris on ventilation grille to the rear of the cabinet			
Where an air flow rate reading is possible, record this (NA)			
Gas tap operational – No leakage (press finger over outlet with tap shut and check for any build-up of pressure)			
No internal or external obstructions to air flow into the cabinet			
Lights are functional			

Technician's name (print):	**Technician's signature:**	**Date of Inspection:**

Appendix 9b. Microbiology Safety Cabinet - USER CHECKLIST

Pre and Post Use Checks: to be carried out by staff supervising the activity. Where there are any observations or comments arising from any operational issues, the cabinets are to be taken out of service until further checks are carried out and resolved. This should be done by contacting the Helpdesk on email: ask@londonmet.ac.uk

Username	**Job title (if applicable)**	**Date**
Room Reference	**Serial Numbers**	**Modules using the fume cupboard**

Pre-Use Checklist	**YES**	**NO**	**OBSERVATIONS/COMMENTS**
Ensure that a suitable risk assessment is in place for work involving hazardous substances			
Is there an in date (within 14 months) test sticker fixed to the front of the cabinet?			
Ensure that you have enough space to conduct the experiment			
An emergency shut off valve should be easily accessible near to the cabinet in case of an emergency.			
The Bunsen burner is placed as far into the cabinet working space as possible to minimize its effect on the cabinet performance.			
Carry out a quick visual check of the cabinet and report any findings if there are: • Signs of damage to the cupboard itself. • alarm checks • basic airflow measurements etc.			
The microbiological safety cabinet average face velocity should be between 0.3 – 1.0 m/s.			
Wear gloves for hand protection			
Surface decontaminate the work surface and load the cabinet with all items required prior to starting work and surface decontaminate			
Purge the work zone air for a few minutes before commencing work			

Keep all apparatus at least 15 centimeters inside the microbiological safety cabinet.			
Bio-hazardous collection bags should be placed inside the cabinet instead of outside			
Post Use Checklist			
The work area is clean and tidy.			
Return chemicals to its correct storage area.			
Return any equipment to its correct storage area.			
Use absorbent pads on the work surface where appropriate to minimize splatter and aerosol generation in case of a spillage			
Surface decontaminate before removing potentially contaminated items from the interior			
Allow work zone air to purge			
When available: install front closure or close sash and activate UV lamp			

Staff's name (print)	**Staff's signature**	**Date of Inspection**

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Appendix 9c. Training requirements for MSC users

Subjects to confirm the knowledge	Item covered		Competency assessed	
	Yes	No	Yes	No
This guidance has been read				
Principles of how MSC's work, the airflow, and limitations of MSC performance				
Control panel, alarms, and indicators – what they all mean				
How to turn the MSC on and off and how to work at MSC safely?				
Techniques to avoid disrupting the airflow				
Local rules on whether the hood can be left on or off				
Permitted equipment allowed within the MSC				
Dealing with waste within the MSC, do not let it accumulate or use the MSC for waste storage.				
Restrictions on what work can be carried out in a MSC				
Dealing with spillages within the MSC				
Emergency actions – what to do if the power or airflow fails				
Routine cleaning of the MSC after use				
Principles of airflow, performance testing and containment testing				
Who to report to if the MSC is "out of test date"				
Free velocity measurement checks				

Both trainer and trainee agree that the above training has been fully completed and that the trainee is considered to be competent to use the fume hood for the specific project/work

Position	Name	Signature	Date
Trainer			
Trainee			
Trainee			
Trainee			
Trainee			

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Appendix 10. Spray Booth Inspection Checklist

Department / School							
Location							
Competent person	**Name**			**Job Title**	**Contact Details**		**Signature**
Date							
	Compliant			Actions taken	Job no	By Whom	Completion Date
	Yes	NO	N/A				
Are all exposures from dust, fumes, etc., controlled?							
Is local ventilation adequate?							
Is the local ventilation examined thoroughly every 14 months?							
Is the compressed air for cleaning under 30 psi?							
Is personal protective equipment (PPE) provided free of charge and used?							
Is correct type of respirator being worn by the users?							
Are all chemicals used in spray painting operations labelled?							

When mechanical ventilation is provided during spraying operations, is it so arranged that it will not circulate the contaminated air?							
Is spray booth completely ventilated before using the drying apparatus?							
Do all drying spaces have adequate ventilation?							
Is the electric drying apparatus properly grounded?							
Are lighting fixtures for spray booths located outside of the booth and the interior lighted through sealed clear panels?							
Are electric motors for exhaust fans placed outside booths or ducts?							
Are belts and pulleys inside the booth fully enclosed?							
Do ducts have access doors to allow cleaning?							
Is the spray area free of hot surfaces?							
Is the spray area at least 20 feet from flames, sparks, operating electrical motors, and other ignition sources?							
Are portable lamps used to illuminate spray areas suitable for use in a hazardous location?							
Is approved respiratory equipment provided and used when appropriate during spraying operations?							

Are protective goggles or face shields provided and worn where there is any danger of flying particles or corrosive materials?							
Are approved safety glasses required to be worn at all times in areas where there is a risk of eye injuries such as punctures, abrasions, contusions, or burns?							
Are protective gloves, aprons, shields, or other means provided against cuts, corrosive liquids, and chemicals?							
Are employees who need corrective lenses (glasses or contacts) in working environments having harmful exposures required to wear only approved safety glasses, protective goggles, or use other medically approved precautionary procedures?							
Is storage of combustibles with SDSs acceptable?							
Inspect electrical cords, belts, pulleys?							
Is the respiratory equipment easily accessible?							
Is emergency lighting operable?							
Is each spray booth at least 3 feet from other operations?							
Are all fire extinguishers accessible, and their locations clearly designed?							
Are all fire extinguishers inspected and recharged regularly, and noted on the inspection tag?							
Do solvents used for cleaning have a flash point of 38 degC or more?							
Are fire control sprinkler heads kept clean?							

Are “No Smoking” signs posted in spray areas, paint rooms, paint booths, and paint storage areas?							
Is the spray area kept clean of combustible residue?							
Are spray booths constructed of metal, masonry, or other substantial non-combustible material?							
Are spray booth floors and baffles non-combustible and easily cleaned?							
Is infrared drying apparatus kept out of the spray area during spraying operations?							
Are spray painting operations done in spray rooms or booths equipped with an appropriate exhaust system?							
Are all tools used for cleaning purposes made of non-sparking material							
Are emergency eye wash and shower facilities within the immediate work area where students/staff are exposed to injurious corrosive materials?							

Source: Health and Safety Executive, 2013, HSG53 Respiratory protective equipment at work a practical guide,

http://www.hse.gov.uk/pUbns/priced/hsg53.pdf

Health and Safety Executive, 2014 Isocyanate paint spraying, safely managing spray booths and rooms
https://www.hse.gov.uk/pubns/books/hsg276.htm

Appendix 11. Spray Booth – User Checklist (HSG 276)

User Checklist						
Pre-Use Checks	**Compliant**			**Action Taken**	**Job No**	**Completion date**
	Yes	**No**	**N/A**			
Ensure that the air inlet filters are clean and free from obstructions.						
Ensure all sources of ignition and miscellaneous items are removed from the booth						
Turn on the exhaust fan. Where more than one fan is present all fans must be operating.						
Turn on the inlet air fan (if present)						
Keep unprotected people away while you are using the spray booth.						
Check the extraction is switched on and working properly.						
Look for signs of leaks, wear, and damage before every use of spray booth.						
Check that your airline breathing apparatus works properly every time you put it on.						
Use, maintain and store your PPE in accordance with instructions.						
Dispose of single use gloves every time you take them off.						
Wash your hands before eating, drinking, smoking, and using the toilet.						
Never use solvents to clean your skin.						
Use skin creams provided as instructed.						
Operating Checks						
Never remove your face piece for any reason until the						

spray booth has cleared.						
Never lift or remove your face-piece or airline visor to check paint quality.						
Decontaminate spills immediately, then clear them up as soon as possible.						
If you find any problems, tell your class supervisor. Do not just carry on working.						
Co-operate with health surveillance. (staff only)						
Never use solvents to clean your skin.						
Paint should always be sprayed in the direction of the extraction						
After						
Check that your airline breathing apparatus works properly every time you put it on.						
Discard single use gloves every time you take them off.						
Wash your hands before eating, drinking, smoking, and using the toilet.						
Use skin creams provided as instructed.						
Notify Course tutor/ Workshop technician of any problems or malfunctions so that they may be repaired and / or replaced.						
Good Practice						
Use, maintain and store your PPE in accordance with instructions.						
never remove full face mask and breathing apparatus during the process of spraying						
Return equipment, personal protective equipment, paint cans and solvent to their appropriate locations.						