Manufactured in the UK

SAFELAB

Operational Safety Log Book

Recirculating Filtration Fume Cupboards

Please Read And Complete The Information In This Booklet

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Fume Cupboard Information

Establishment	
Employer	

Address	

Make and Model	
Serial Number	

Location	

Filter Type Fitted	

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1.0 - Introduction

This operational safety log book is provided to enable you to record the necessary safety and maintenance data to comply with Section 6 of HSE Health and Safety at Work etc Act 1974. Additionally, use of this log book is in accordance with CLEAPSS G9 Fume Cupboards in Schools document (formerly DfEE Building Bulletin 88) and British Standard 7989:2001 – Specification for Recirculating Filtration Fume Cupboards.

1.1 The Reason For Regular Safety Checks And Maintenance

The Control Of Substances Hazardous to Health Regulations 2002 (COSHH) dictates that it is a requirement *"that equipment to control exposure is maintained in an efficient state, in efficient working order, in good repair and in clean condition"*

The Airone R Range of Recirculating Filtration Fume Cupboards is designed to offer the highest degree of operator protection from harmful concentrations of toxic vapours, fumes and particles. In order for maximum containment and protection to be possible, the fume cupboard must be monitored and maintained.

1.2 How Often Should The Fume Cupboard Be Monitored

The Control of Substances Hazardous to Health (COSHH) 2002 regulations dictates that fume cupboards are to be maintained in effective and efficient working order and to be subject to inspection and testing **at least every 14 months** or more frequently when risk assessments identify a high risk of exposure.

In addition to this, we recommend carrying out visual inspections of the fume cupboard on a regular basis. A suggested checklist of inspection can be found in Annex A at the back of this booklet.
Airflow and Filter saturation monitoring should be carried out periodically or when the filter is suspected of being saturated, details on how to do this can be found in section 4.0, 5.0 and 6.0.

We recommend completing the Fume Cupboard Test Summary Sheet (Annex B) to allow for easy recognition of the fume cupboard status at a glance. This log book and summary sheet should be kept with the corresponding fume cupboard (when possible) to allow all users access to the important information it contains.

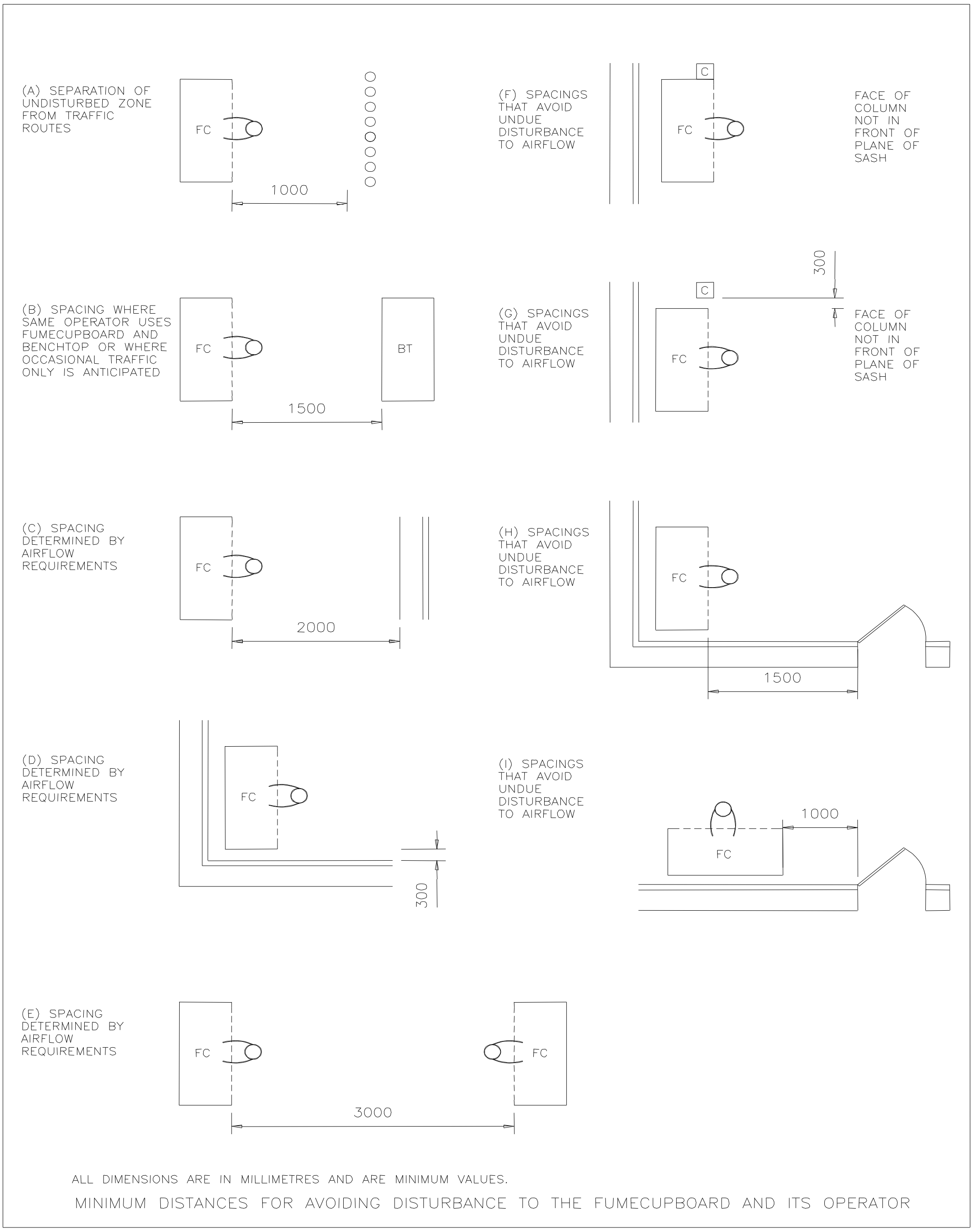
1.3 Standards And Guidelines Applicable To Airone R Range of Recirculating Filtration Fume Cupboards

Standards and guidelines which are applicable to the Airone R range of recirculating fume cupboards are:

- BS 7989:2001 Specification for recirculating filtration fume cupboards
- The Control of Substances Hazardous to Health (COSHH) 2002
- BS EN 14175-5: 2006 - Fume cupboards – Part 5: Recommendations for installation and maintenance
- CLEAPSS – G9 – Fume Cupboards in Schools (*Revision of DfEE Building Bulletin 88*)

2.0 – Location of Fume Cupboards

Fume cupboard location should be chosen to minimise any undue airflow disturbances to reduce the risk of contaminants leaving the fume cupboard and to reduce the chances on anomalous results when carrying out the following maintenance checks.
A general guide to suitable distances from common airflow disturbances is shown below and if any fume cupboards are found to be exposed to these conditions, it should be noted in this log book.



3.0 – Filter Information

3.1 Filter Description

3.1.1 Pre-Filter

In order to protect the main filter-beds from particulate contamination, all Airone R Filtration Fume Cupboards are fitted with filtrete electrostatic particle filters with an efficiency of 99.5% for particles down to 1 micron and 87% from 1 to 0.3 micron in diameter.

The Filtrete high efficiency particle pre-filter should be replaced regularly as accumulation of particulate contaminants or fine dust in the pre-filters could reduce the speed of airflow. Safelab recommend that the prefilter be replaced at least once every 6 months. The airflow should be kept at the same level to which it was set during commissioning of the unit. (this may vary depending on unit, application and filter type but should never be below 0.3 m s^{-1})

See section 4.0 for details on air flow monitoring

3.1.2 Activated Carbon Filter (Impregnated & General Purpose)

An activated carbon filter is comprised of steam activated coconut shell carbon granules in a fixed filter bed. The activated carbon has a surface area between 400 and 2000 m^2 g^{-1} and will remove some chemical contaminants from the air, reducing concentrations by a minimum of 98%.

In some cases, pure activated carbon will not adsorb chemicals from the air sufficiently and so the carbon is impregnated with a chemical which will neutralise and immobilise the contaminant, thus removing it from the air stream.

The activated carbon and impregnated carbon have a limited capacity and after prolonged or extensive use will become saturated. This should be monitored and is described in sections 5.0 and 6.0 (the tests advised depends on the application and the relevant standards)

3.1.3 HEPA Filters

High Efficiency Particulate Air (HEPA) filters remove 99.97% of particles which have a particle size of 0.3 µm or larger. These filters are used to protect the operator from inhalation of hazardous substances when working with processes forming dust and powders.

The majority of fume cupboard applications do not require a HEPA filter and are fitted only with carbon filters. The methods described in this operational safety log book refer to the monitoring of fume cupboards fitted with a carbon filter. Specialist equipment is required to test the effectiveness of HEPA filters and is beyond the scope of in-house testing.

3.2 Filter Selection

It is the responsibility of Operators and the Safety Officer to carry out COSHH risk assessments whenever working with hazardous substances. Following the instructions in the log book and manual will ensure correct use of the Airone Filtration Fume Cupboard and provide maximum operator protection.

We recommend that you identify substances and establish approximate concentrations/volumes of contaminants, then select appropriate types of filters before operating Airone R Filtration Fume Cupboards.
The following **Table 1.1** is a **general guide** for the selection of appropriate filters. For specific queries and if uncertain, Safelab Systems Ltd will be happy to advise on the most appropriate filter.

Table 1 – General Guide to Filter Selection

Carbon Code	Typical Substances Handles
C-100	The majority of aliphatic and aromatic hydrocarbons, solvents, odours, adhesives and paint/varnish fumes
C-100E	Ethers
CI-200	Aldehydes (and general organics)
CI-300	Ammonia and amines
CI-400	Acids
CI-410	Sulfhur compounds and mercury vapours
CI-4120	Cyanides
CI-RI	Radioactive iodine and methyl iodine
CMS	General organics, Acids, Ammonia and Amines (for general use in schools up to and including A-level)
HEPA	Dust and particle removal

All safelab filters fitted into Airone R filtration fume cupboards are marked with the filter type. This is easily visible through a clear panel on the front of the unit.

4.0 - Filter Maintenance Tests

The Control of Substances Hazardous to Health (COSHH) 2002 regulations dictates that fume cupboards are to be maintained in effective and efficient working order and to be subject to inspection and testing at least every **14 months** or more frequently when risk assessments identify a high risk of exposure.

The Following test should be carried out on all Airone R Recirculating Filtration Fume Cupboards regardless of application.

4.1 Pre-Filter Monitoring - Airflow Test

In order to maintain airflows at an appropriate rate, we recommend **changing the pre-filter every 6 months**. A visual inspection of the filter can also be carried out in between changes, to determine whether the pre-filter is covered with dust/particles.
All fume cupboards in the Airone R range are fitted with low airflow indicators, this safety feature will indicate a drop in face velocity which suggests the pre-filter may have become blocked. However, it is still recommended to monitor airflows periodically using the method described below.

The following test procedure is In accordance with CLEAPSS G9 – Fume Cupboards in Schools and BS7989:2001 Specification for Recirculating Filtration Fume Cupboards

Objective: To determine the face velocity of the fume cupboard as an indicator of blockages or malfunction and to ensure appropriate containment is achieved.

Equipment: A calibrated anemometer (Vane anemometer or hot wire anemometer) e.g. Airflow LCA301

Preparation:

- Arrange the ventilation in the room so that it is most unfavourable (windows and doors shut, other extraction units switched on)
- Remove all obstructions from inside the fume cupboard

Procedure:

1. Lift the sash window to a height of 400 mm and imagine the aperture of the fume cupboard to be divided into nine sections (the grid lines can be modified for trapezoidal aperture)

A	B	C
D	E	F
G	H	I

2. Stand to one side or as far away as possible from the fume cupboard with the sensing head of the anemometer in the plane of the sash and take airflow rate readings at the centre of each of the 9 sections.
3. Record for each rectangle the approximate average reading over a period of at least 10 seconds (applying any correction from the calibration chart supplied with the meter.)

Result: Record Airflow results in **Table 2** provided on pg 9

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- Fail if any reading is below 0.3 m s^{-1}
- Fail if the variation is excessive (e.g. more than 30%) or if there is less variation (eg, 20%) but it tends to be at one side

Table 2 – Air Flow Monitoring Results

Serial Number:______________________________

Air Flow Meter Used:_________________________

Date of Check	Readings in each of the cells as above.									Average (m/s)	Pre-Filters Clean?	Visual Check for Damage	Tested By	Conclusion (Pass/Fail)
	a	b	c	d	e	f	g	h	i					

If the fume cupboard fails due to airflow, check the pre-filter and replace if it is blocked. Repeat the Airflow test. If the fume cupboard still fails, contact Safelab Systems Servicing Department to discuss a diagnostic and repair visit.

It may be useful to attach a copy of this page to the fume cupboard so that gradual changes over time can be easily recognised.

5.0 – Filter Safety Monitoring Tests for Schools

The methods described here are adapted from CLEAPSS G9 – Fume Cupboards in Schools Document (revision of DfEE Building Bulletin 88) document which is available online from http://www.cleapss.org.uk. These tests are recommended by CLEAPSS to be carried out on recirculating filtration fume cupboards which are used in schools.

5.1 Filter Seating and Seal Test

When to do the Test:

- Filter seating and seal should be tested upon commissioning or when a new filter is fitted
- If there are reasons to suspect the filter is not absorbing a sufficient fraction of the contaminant e.g. because of complaints about odours.

Objective: To determine the filter seating and seal, to prevent breakthrough of harmful gases.

Equipment:

- A gas detection kit (e.g. Accuro Pump from Draeger Safety UK Ltd with appropriate sampling tube)
- A balance weighing to 0.1 g or better
- About 25 to 35 ml of a polychloroethene (*either* tetrachloroethene (preferred) *or* trichloroethene
- A stop clock
- A 100 ml narrow-neck conical flask and a bung
- Anti-bumping granules
- 250 ml beaker with about 25 ml of cold water
- A cloth (or paper towel)
- An electric hot plate or a Bunsen burner, tripod, gauze and heat-resistant mat

Procedure:

- Locate the exhaust vent or port.
- Pour about 25 ml of your chosen polychloroethene into the conical flask containing a few anti-bumping granules.
- Insert the bung and find the overall mass, *m*1 grams.
- In the fume cupboard either switch on the hotplate or set up the Bunsen burner, tripod andgauze and light the gas. Switch on the fumecupboard, remove the bung from the flask and place the flask on the hot plate or gauze.
- As the polychloroethene begins to boil, the vapour condenses on the cooler parts of the flask forming a boundary line. When the boundary reaches the top of the flask, start the stop clock.
- After about 60 seconds, begin to take a reading of the concentration of polychloroethene in the exhaust gas, using the pump and analyser tube. If the seal around thefilter is poor, excess harmful vapour may be emitted from the exhaust. If this occurs, the operator should stop the test, open the windows, leave the room and report the problem to her/his line manager.
- Record the reading on the detection tube (*c* ppm)
- After taking the reading on the detection tube, switch off the hot plate or turn off the Bunsen burner.
- Stop the clock and record the time of the run, *t* seconds.
- Handling the hot conical flask with care (use the cloth), place it into the beaker of cold water in the fume cupboard and replace the bung
- After about 3 minutes, remove the flask from the water, dry the outside of the conical flask and find the mass of the flask, contents and bung, ***m2*** in g .

Results:

- Calculate the rate of release of polychloroethene vapour from the conical flask, *R,* according to the following equation:

$$R = \frac{m1 - m2}{t} \times f \text{ cm}^3 \text{ s}^{-1}$$

Where f = 145 for tetrachloroethene or f=183 for trichloroethene

- Compare the measured concentration to the calculated rate according to **Table 3** below:

Table 3 – Acceptable Concentration Reference Values (polychloroethene)

Rate of Polychloroethene vapour release/cm^3 s^{-1}	Maximum permitted concentration of polychloroethene vapour in the exhaust gas / ppm
10	4
15	6
20	9
25	11
30	13
35	16
40	18
45	20

If the concentration of polychloroethene vapour at the relevant release rate is greater than the corresponding value in **Table 3**, the filter is not properly seated or a new filter is required.

5.2 Acid Gas Saturation Test – For Schools CMS Filters

When to do the Test:

- If there are reasons to suspect the filter is not absorbing a sufficient fraction of the contaminant e.g. because of complaints about odours.
- Test at the regular 14-month thorough examination and test
- This test is not needed if a decision has been made to replace the filter at regular intervals and if there is no reason to suspect the filter is not absorbing a sufficient fraction of the contaminant
- Also not needed if a decision has been made to replace the filter automatically even before the normal replacement period

Objective: To determine if the filter is saturated for removal of acidic gases

Equipment:

- Rowdered roll sulfur (150 - 200 g)
- A mortar and pestle
- A flat-bottom, porcelain evaporating basin
- A gas detection kit
- A balance weighing to 0.1 g or better
- Two gauze mats with ceramic centres
- A stop clock
- A ruler
- A Bunsen burner, tripod and heat-resistant mat

Procedure:

- Wear eye protection.
- Take 150 – 200g of roll sulfur and powder it in a mortar with a pestle.
- Fill the flat-bottom porcelain evaporating basin with the sulfur so that it is level with the rim.
- Weigh the porcelain basin containing the sulfur with one of the gauzes

Record this mass, ***m1*** **g**.

- Set up the Bunsen burner, tripod, the **other** gauze and the evaporating basin on a heat resistant mat so that the centre of the basin is **5 cm inside the front rim of the fume cupboard aperture.** This places the sulfur in the maximum incoming draught and encourages complete combustion. Switch on the fume cupboard.
- Light the Bunsen burner with the gas tap half-open and the collar open enough so that the flame is non-luminous. The incoming draught may require that the burner is placed slightly further forward rather than directly under the centre of the basin. The sulfur will melt slowly to a pale amber liquid. **Extreme care is now required not to knock the tripod base with your hands or the Bunsen burner; molten sulfur can cause severe burns.**
- Adjust the collar of the Bunsen burner so that it is now half open. (The liquid will quickly darken.) Changes in the appearance of the liquid surface indicate that burning is about to start. Sulfur burns with a blue flame. It often catches fire on its own but if not, apply a lighted wooden splint to the surface.
- **Start** the stop clock when half of the surface of sulfur is burning
- **Immediately turn off the Bunsen burner at the gas tap.** The flame above the sulfur often has two coloured areas, the inner brown flame of incomplete combustion and the outer blue flame of complete combustion. Extinguishing the Bunsen burner should cause the area of brown flame to diminish, leaving the blue flame covering almost the entire surface.
- After 60 seconds, take a reading of the concentration of the sulfur dioxide being emitted through the exhaust with the gas detection kit surface*.*

A slight smell of sulfur dioxide should be ignored but, if the exhaust gas causes breathing difficulties, stop the test, open the windows, leave and lock the room. This incident should be reported to the line manager as it means that the filtration fume cupboard is not performing adequately.

- Record the reading on the detection tube ***c* ppm**.
- Place the **other** gauze (the one which was used in the weighing) on top of the basin. The gauze puts out the flame but some sulfur condenses onto it, which is why it should be included in the weighing.)
- **Immediately**, stop the clock and record the time of the run**, *t* seconds**.
- Allow the sulfur to cool down and solidify for about 20 minutes. Reweigh the basin, the remaining sulfur and the gauze (see *Figure 9.10 (i)*). Record the mass, *m2* g.
- The sulfur and dish may be kept and used the next time the test is carried out. More powdered roll sulfur will need to be added to make up for that lost in this test.
- Work out the rate of release of sulfur dioxide, *R*, according to the following equation:

$$R = \frac{m1 - m2}{t} \times 175 \text{ cm}^3 \text{ s}^{-1}$$

The factor of 751 arises to convert the mass of sulfur burnt into the volume of sulfur dioxide vapour.

Results:

Compare the calculated value of the rate, *R*, and th5e concentration of sulfur dioxide in the exhaust gas with the data in *Table 9.2*. If the concentration of sulfur dioxide at the relevant release rate is **greater** than the corresponding value in **Table 4**, the filter is not absorbing acidic gases efficiently enough and a new filter is required (or there is a leak around the seal). This assumes that the efficiency of the filter has fallen to 98% for sulfur dioxide; at this level, the fume cupboard will still not emit a dangerous level of gas in a well-ventilated laboratory, although its odour may be detected.

Table 4 – Acceptable Concentration Reference Values (sulphur dioxide)

Rate of sulfur dioxide released/ cm^3 s^{-1}	***Maximum permitted concentration of sulfur dioxide in the exhaust gas / ppm***
5	1
10	2
15	3
20	4
25	5

5.3 Alkaline Gas Saturation Test – For Schools CMS filter

When to do the test:

- If the filter is suspected of being saturated, eg because of complaints about odours.
- This test is not needed if a decision has been made to replace the filter at regular intervals and if there is no reason to suspect the filter not be absorbing a sufficient fraction of the contaminant.
- (optionally) at the regular 14-month thorough examination and test (if large amounts of ammonia are used in the fume cupboard, it would be wise to carry out this test to check the efficiency of the absorption of alkaline gases but is not normally necessary in most schools).

Objective: To determine if the filter is saturated for removal of alkaline gases

Equipment:

- A gas detection kit
- A balance weighing to 0.1 g or better
- About 40 ml concentrated ammonia solution (see CLEAPSS *Hazcard* 6)
- 400 ml beaker with about 25 ml of hot water from the tap
- A 100 ml conical flask and a bung
- Anti-bumping granules
- A stop clock
- A cloth (or paper towel)
- A magnetic/stirrer hot plate
- A magnetic follower
- Thermometer (–10 to 110 °C)

Procedure

- Switch on the fume cupboard. Place a heater/stirrer in the fume cupboard. Turn up the heater control to about half a full turn.
- Wearing goggles, pour about 40 ml of concentrated ammonia solution (CORROSIVE solution with TOXIC and CORROSIVE vapour) in a 100 ml conical flask. Add the magnetic stirrer bar and thermometer. Place the conical flask in the 400-ml beaker containing about 25 ml of hot water from the hot water tap. Place the beaker on the heater stirrer and start the stirring at a gentle pace.
- When the temperature reaches about 35 to 40 °C and is reasonably constant, remove the thermometer and add a stopper to the flask. Remove the flask from the beaker and wipe the flask with a cloth to dry it. Weigh the conical flask with the stopper and the warm concentrated ammonia. Record the mass, ***m1* in g**.
- Place the conical flask back in the beaker on the heater/stirrer which is in the fume cupboard. Remove the stopper and start the stop clock.
- After 60 seconds, take a reading of the concentration of the ammonia being emitted through the exhaust with the gas detection kit.

A slight smell of ammonia should be ignored but, if the exhaust gas causes breathing difficulties, stop the test, open the windows, leave and lock the room. This incident should be reported to her/his line manager as it means that the filtration fumecupboard is not performing adequately.

- Record the reading on the detection tube ***c* in ppm**.
- **Work quickly.** Stop the clock and **immediately** place the stopper in the flask. Remove the stoppered flask from the beaker and wipe the outside with a cloth to dry it. Record the time on the stop clock, ***t* in seconds.**
- Weigh the conical flask with remaining concentrated ammonia. Record the mass, ***m2* in g**.

- Place the ammonia back in the fume cupboard and remove the stopper. To dispose of the ammonia solution either pour it down the fume cupboard sink with plenty of running water or pour the ammonia in a bucket of cold water and pour it down the sink.
- Calculate the rate of release of ammonia vapour from the conical flask, *R*, according to the following equation.

$$R = \frac{m1\text{-}m2}{t} \times 1412 \text{ cm}^3 \text{ s}^{-1}$$

The factor of 1412 arises to convert the mass of ammonia into the volume of ammonia vapour.

Results:

Compare the calculated value of the rate of release of ammonia, *R*, and the concentration of ammonia in the exhaust gas with the data in **Table 5** If the concentration of ammonia at the relevant release rate is **greater** than the corresponding value in **Table 5**, the filter is not absorbing alkaline gases efficiently enough and a new filter is required40 (or there is a leak around the seal)

Table 5 – Acceptable Concentration Reference Values (Ammonia)

Rate of ammonia gas released, $cm^3 s^{-1}$	**Maximum permitted concentration of ammonia gas in the exhaust gas / ppm**
2	1
4	2
6	3
8	4
10	5
12	6
14	7
16	8

6.0 – Filter Safety Monitoring Tests for Industrial Applications

The Control of Substances Hazardous to Health (COSHH) 2002 regulations dictates that fume cupboards are to be maintained in effective and efficient working order and to be subject to inspection and testing at least every **14 months** or more frequently when risk assessments identify a high risk of exposure. The following filter tests are suggested for fume cupboards used in an industrial (or university) environment and we recommend carrying out these tests at least once every 14 months. The filter tests methods described here-in are recommended in BS7989:2001 – Specification for recirculating filtration Fume Cupboards

6.1 Isopropanol Saturation Monitoring (gaseous phase) – For Industrial Applications

Principle: This test is used in order to monitor the saturation of the gaseous phase (activated carbon) filter and to determine if the filter is saturated.

Equipment:

- Gas detection kit
- Propan-2-ol
- Anti-bumping granules
- Balance (weighing to 0.1 g or less)
- Stopclock
- 250 mL conical flask, with stopper
- Hotplate

Procedure:

- Determine the air volume flow rate through the fume cupboard (see section 4.1) and record the value as F_a in m^3/min
- Pour about 100 mL of propan-2-ol into a pre-weighed, stoppered, conical flask containing a few anti-bumping granules. Record the weight of solvent added as M_1 in g.
- Set up the hotplate in the fume cupboard. Switch on the fume cupboard, remove the stopper from the flask and place the flask on the hotplate.
- As the propan-2-ol begins to boil, the vapour condenses on the cooler parts of the flask forming a boundary line. When the boundary line reaches the top of the flask, start the stopclock.
- After 60 s, take a reading of the concentration of propan-2-ol in the exhaust gas emitted by the fume cupboardusing a gas detection kit with a suitable tube.
- Repeat the measurement at 5 min and record the highest concentration in ppm.
- Convert the highest value from ppm to mg m^{-3} using the following equation, and record the result as C_e:

$$Concentration\ (mg\ m^{-3}) = \frac{Concentration\ (ppm) \times 60.1}{24}$$

Results:

- Calculate the total volume (V_a) in m^3 of air passed through the fume cupboard during the test using:

  $V_a = \frac{F_a - t}{60}$ Where: F_a is flow rate ($m^3\ min^{-1}$) and t is time (s)

- Calculate the challenge concentration (C_o) in mg m^{-3} using:

  $C_o = \frac{1000 \times M1}{V_a}$ Where: M_1 is mass of solvent and V_a is volume of air

- Calculate the filter efficiency (%) using:

$$Filter\ Efficiency = \frac{100\ (C_o - C_e)}{C_o}$$

Where: C_o is challenge concentration and C_e highest concentration detected

If the filter efficiency has fallen below 98% then a new filter should be fitted. Although a filter efficiency below 98% may not pose a direct health threat, it indicates that the filter is becoming saturated and therefore not removing a sufficient proportion of the chemical contaminant.

6.2 Sulfur Dioxide (acidic gas) Saturation Monitoring – For Industrial Applications

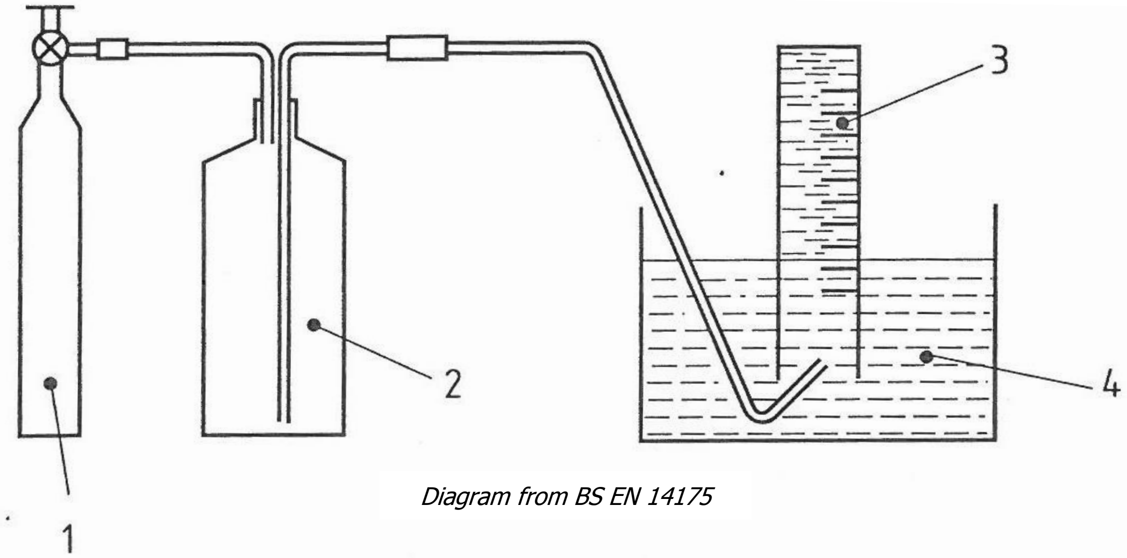

Diagram from BS EN 14175

1. Sulfur Dioxide Cylinder
2. 500 mL Bottle
3. 100 mL Measuring Cylinder
4. Water

Principle: This test is used in order to monitor the saturation of the filter for acidic gases. This test should be performed on CI-400 and CMS filters.

Equipment:

- Gas detection kit
- Sulfur dioxide cylinder
- Balance (weighing to 0.1 g or less)
- Stopclock
- Apparatus for measuring sulphur dioxide release rate.

Procedure:

- Determine the air volume flow rate through the fume cupboard (see section 4.1) and record the value as F_a in m^3/min
- Find the mass of the sulphur dioxide cylinder and record the mass as M_1 in grams.
- Slowly open the valve of the gas cylinder. When bubbles begin appearing in the measuring cylinder, start the stop clock. Adjust the valve so that 100 mL of gas is being released over a period of 10 to 20 seconds.
- Without touching the valve, disconnect the gas cylinder from the apparatus
- After 60 s, take a reading of the concentration of sulphur dioxide in the exhaust gas emitted by the fume cupboard, using a gas detection kit with suitable tube.
- Repeat the measurement at 5 min.
- Convert the highest value from ppm to mg m^{-3} using the following equation, and record the result as C_e:

$$Concentration\ (mg\ m^{-3}) = \frac{Concentration\ (ppm) \times 64.1}{24}$$

- Close the valve on the gas cylinder and stop the clock, noting the time of the run as t in seconds.

- Find the mass of the sulphur dioxide cylinder and record as M_2 in grams.

Results:

- Calculate the total volume (V_a) in m^3 of air passed through the fume cupboard during the test using:
  $V_a = \frac{F_a - t}{60}$ Where: F_a is flow rate ($m^3\ min^{-1}$) and t is time (s)

- Calculate the challenge concentration (C_o) in mg m^{-3} using:
  $C_o = \frac{1000 \times M1}{V_a}$
  Where: M_1 is mass of cylinder before, M_2 is mass of cylinder after and V_a is volume of air

- Calculate the filter efficiency (%) using:
  $Filter\ Efficiency = \frac{100\ (C_o - C_e)}{C_o}$
  Where: C_o is challenge concentration and C_e highest concentration detected

  If the filter efficiency has fallen below 98% then a new filter should be fitted. Although a filter efficiency below 98% may not pose a direct health threat, it indicates that the filter is becoming saturated and therefore not removing a sufficient proportion of the chemical contaminant.

6.3 Ammonia Saturation Monitoring (alkaline gases) – For Industrial Applications

Principle: This test is used in order to monitor the saturation of the filter for alkaline gases. This test should be performed on CI-300 and CMS filters.

Equipment:

- Gas detection kit
- 0.880 Ammonia
- Anti-bumping granules
- Balance (weighing to 0.1 g or less)
- Stopclock
- 100 mL conical flask, with stopper
- Hotplate

Procedure:

- Determine the air volume flow rate through the fume cupboard (see section 4.1) and record the value as F_a in m^3/min
- Pour about 25 mL of ammonia into a pre-weighed, stoppered, conical flask containing a few anti-bumping granules. Record the weight of soution added as M_1 in g.
- Set up the hotplate in the fume cupboard. Switch on the fume cupboard, remove the stopper from the flask and place the flask on the hotplate.
- As the ammonia begins to boil, the vapour condenses on the cooler parts of the flask forming a boundary line. When the boundary line reaches the top of the flask, start the stopclock.
- After 60 s, take a reading of the concentration of ammonia in the exhaust gas emitted by the fume cupboard using a gas detection kit with a suitable tube.
- Repeat the measurement at 5 min and record the highest concentration in ppm.
- Convert the highest value from ppm to mg m^{-3} using the following equation, and record the result as C_e:

$$Concentration\ (mg\ m^{-3}) = \frac{Concentration\ (ppm) \times 17.0}{24}$$

Results:

- Calculate the total volume (V_a) in m^3 of air passed through the fume cupboard during the test using:

  $V_a = \frac{F_a - t}{60}$ Where: F_a is flow rate (m^3 min^{-1}) and t is time (s)

- Calculate the challenge concentration (C_o) in mg m^{-3} using:

  $C_o = \frac{1000 \times M1}{V_a}$ Where: M_1 is mass of solvent and V_a is volume of air

- Calculate the filter efficiency (%) using:

  $Filter\ Efficiency = \frac{100\ (C_o - C_e)}{C_o}$

  Where: C_o is challenge concentration and C_e highest concentration detected

  If the filter efficiency has fallen below 98% then a new filter should be fitted. Although a filter efficiency below 98% may not pose a direct health threat, it indicates that the filter is becoming saturated and therefore not removing a sufficient proportion of the chemical contaminant.

6.4 Formaldehyde Saturation Monitoring – For Industrial Applications

Principle: This test is used in order to monitor the saturation of the filter for alkaline gases. This test should be performed on CI-200 filters.

Equipment:

- Gas detection kit
- 37% Formaldehyde solution (Formaline)
- Anti-bumping granules
- Balance (weighing to 0.1 g or less)
- Stopclock
- 100 mL conical flask, with stopper
- Hotplate

Procedure:

- Determine the air volume flow rate through the fume cupboard (see section 4.1) and record the value as F_a in m^3/min
- Pour about 50 mL of 37% formaldehyde solution into a pre-weighed, stoppered, conical flask containing a few anti-bumping granules. Record the weight of soution added as M_1 in g.
- Set up the hotplate in the fume cupboard. Switch on the fume cupboard, remove the stopper from the flask and place the flask on the hotplate.
- As the formaldehyde begins to boil, the vapour condenses on the cooler parts of the flask forming a boundary line. When the boundary line reaches the top of the flask, start the stopclock.
- After 60 s, take a reading of the concentration of formaldehyde in the exhaust gas emitted by the fume cupboard using a gas detection kit with a suitable tube.
- Repeat the measurement at 5 min and record the highest concentration in ppm.
- Convert the highest value from ppm to mg m^{-3} using the following equation, and record the result as C_e:

$$Concentration\ (mg\ m^{-3}) = \frac{Concentration\ (ppm) \times 30.0}{24}$$

Results:

- Calculate the total volume (V_a) in m^3 of air passed through the fume cupboard during the test using:

  $V_a = \frac{F_a - t}{60}$ Where: F_a is flow rate ($m^3\ min^{-1}$) and t is time (s)

- Calculate the challenge concentration (C_o) in mg m^{-3} using:

  $C_o = \frac{1000 \times M1}{V_a}$ **W**here: M_1 is mass of solvent and V_a is volume of air

- Calculate the filter efficiency (%) using:

  $Filter\ Efficiency = \frac{100\ (C_o - C_e)}{C_o}$

  Where: C_o is challenge concentration and C_e highest concentration detected

  If the filter efficiency has fallen below 98% then a new filter should be fitted. Although a filter efficiency below 98% may not pose a direct health threat, it indicates that the filter is becoming saturated and therefore not removing a sufficient proportion of the chemical contaminant.

6.5 If the filter fails

If the filter maintenance tests have been carried out and the main filter is deemed to be saturated or not removing an appropriate percentage of the chemicals to remain below the respective Occupational exposure limits (OEL, MEL, OES, TLV, MAK, VME), **the fume cupboards must not be used**.

We recommend keeping spare sets of pre-filters, HEPA filters and main carbon filters in the laboratory to replace used filters. Instructions on removal and replacement of filters can be found in the instruction manual supplied with the fume cupboard.

6.6 Filter disposal

We recommend placing the used filters into the bag and box in which the new replacement filters were sealed. Different waste disposal companies have different rules on the disposal of filters and there is debate on whether or not used filters are considered as hazardous waste. We recommend contacting your waste disposal provider to determine their exact rules.

Annex A - Fume cupboard visual inspection

The results of these visual inspections are to ensure the fume cupboard is maintained properly in order to extend the overall lifetime. There is no reason to fail a fume cupboard due to minor defects which de not pose health risks. However, if the fume cupboard is in a state of disrepair, we recommend contacting our service department to arrange a quote for repair or replacement parts.

Inspection Check	Notes
Is there any damage to the work surface or lining?	
Glazing: Is the glazing dirty or clouded? Are there any cracks or other damage?	
Baffle: Is the baffle clean and free from dust build up? Is there any damage to the baffle (cracks or splits)?	
Sash Mechanism: Is the sash functional (i.e. does not require excessive force to open or close, stays closed by itself) Is there any sign of damage to the sash cable?	
Sash Limits: Are there functional stops to limit the aperture to the correct maximum height? Are there functional stops to prevent the sash being closed completely?	
Services (electricity, gas, water, waste): Is there any corrosion or damage which may make the services unsafe? Check the drip cup and drain for signs of leakage or blockage Check the service connections are clean and free from damage (including any quick-connections and docking stations)	
Fan: Check for excessive noise or any changes in noise since previous inspection (this could be a sign of a blocked filter or damaged fan)	

Annex B – Fume Cupboard Test Summary Sheet (*it may be useful to attach a copy of this sheet to the fume cupboard*)

Date of Test	**Tested By**	**Average Face Velocity (Air Flow)**	**Filter Seating Test**	**Filter Saturation Test**				**Visual Inspection**	**Notes**	**Pass/Fail**
				Gaseous Phase (%)	Acidic Gases (%)	Alkaline Gases (%)	Formaldehyde (%)			

Date of Test	Tested By	Average Face Velocity (Air Flow)	Filter Seating Test	Filter Saturation Test				Visual Inspection	Notes	Pass/Fail
				Gaseous Phase (%)	Acidic Gases (%)	Alkaline Gases (%)	Formaldehyde (%)			

Date of Test	Tested By	Average Face Velocity (Air Flow)	Filter Seating Test	Filter Saturation Test				Visual Inspection	Notes	Pass/Fail
				Gaseous Phase (%)	Acidic Gases (%)	Alkaline Gases (%)	Formaldehyde (%)			

Service & Maintenance

Safelab will contribute significantly in helping you achieve a safe, high performance laboratory. Our service personnel are trained to the highest standards and have intrinsic working knowledge of laboratory safety equipment ranging from fume cupboards (ducted and filtration) through to biohazard safety cabinets.

Our clients benefit because we have built a dedicated team of qualified engineers who provide:

- Answers to your technical queries quickly via telephone, e-mail or fax
- Professional safety & maintenance inspection
- Rapid response to equipment breakdown calls

Choosing Safelab as your service provider ensures that your laboratory equipment will be tested to comply with the relevant British and European Standards. Our engineers follow strict testing procedures which challenge the equipment's performance and proves whether it's safe for use. Should your equipment fail during testing we are able to supply approved replacement parts and repair the equipment quickly ensuring that safety levels are restored and optimum performance achieved.

We believe in giving our customers:

- Peace of mind
- Reliable high quality service
- Value for money

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Service & Maintenance

Filter Replacement

Safelab Service holds the position of being able to offer replacement filters for the majority of other manufacturers' fume cupboards, downflow benches, safety cabinets and laminar flow systems.

We have in-house experts who can offer a filter advice service if you are unsure about filter size, type or any other filter queries.

Service Programs

Safelab offer a choice of service programs because we understand you need flexibility in planning regular, routine inspections and maintenance visits that fit into your working schedule. Specialist testing is also provided for clients that need additional certification of their laboratory equipment's performance.

Free technical advice and support is available by phoning: 01934 421 340.

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