BRITISH STANDARD

BS EN
14175-4:2004

Incorporating corrigendum January 2014

Fume cupboards —

Part 4: On-site test methods

ICS 71.040.10; 91.140.30

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 14175-4:2004. Together with BS EN 14175-1:2003, BS EN 14175-2:2003, BS EN 14175-3:2003, DD CEN/TS 14175-5:2006 and BS EN 14175-6:2006, BS EN 14175-7:2012, it supersedes BS 7258-1:1994, BS 7258-2:1994, BS 7258-3:1994 and BS 7258-4:1994 which are withdrawn.

The UK committee advises that prior to purchasing a fume cupboard, a risk assessment should be performed to assess the risks associated with the substances that are to be manipulated. This would ensure that the fume cupboard is suitable for its intended purpose and that current exposure limits for toxic substances are not exceeded. It is suggested, therefore, that users may need to draw up a specification appropriate to their particular requirements, within the overall permissible limits of this standard and the information on installation included in the National Annex. For users with little experience of purchasing fume cupboards, it may be helpful for trade associations, employers' bodies or other organizations associated with a particular activity to give guidance on a suitable specification. An example would be Building Bulletin 88 from the Architects & Building Branch of the Department for Education and Employment, which is currently under revision and to be published in future as G9a Fume Cupboards in Schools by CLEAPSS.

The UK participation in its preparation was entrusted by Technical Committee LBI/1, Laboratory safety and equipment to subcommittee LBI/1/1, Laboratory furniture and fittings.

A list of organizations represented on LBI/1/1 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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Fume cupboards - Part 4: On-site test methods

Sorbonnes - Partie 4: Méthodes d'essai sur site

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This European Standard was approved by CEN on 22 July 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This document (EN 14175-4:2004) has been prepared by Technical Committee CEN/TC 332 “Laboratory equipment”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2005, and conflicting national standards shall be withdrawn at the latest by March 2005.

The tests established in this standard should be carried out by trained personnel.

This European Standard EN 14175 consists of the following parts, under the general title *Fume cupboards*

— Part 1: Vocabulary

— Part 2: Safety and performance requirements

— Part 3: Type test methods

— Part 4: On-site test methods

— Part 5: Recommendations for installation and maintenance (in preparation)

— Part 6: Variable air volume fume cupboards (in preparation)

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This document specifies a selection of on-site test methods for the following general purpose fume cupboards:

— Fume cupboards designed in accordance with Part 2 of this European Standard and type tested in accordance with Part 3 of this European Standard.

— Fume cupboards designed in accordance with Part 2 of this European Standard and not type tested.

The test methods are designed to be used at the place of installation of the fume cupboard, usually a laboratory. They are used for commissioning after installation, for maintenance and for qualification purposes. For certain customer requirements additional or modified test methods may be necessary.

It is in the responsibility of the purchaser or user of a fume cupboard to decide which tests are to be performed. The commissioning testing can be selected and carried out from the type test methods. For routine testing, the number of test methods selected can be further reduced.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14175-1:2003, *Fume cupboards – Part 1: Vocabulary.*

EN 14175-2:2003, *Fume cupboards – Part 2: Safety and performance requirements.*

EN 14175-3:2003, *Fume cupboards – Part 3: Type test methods.*

EN 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications (IEC 61672-1:2002).*

EN ISO 11202, *Acoustics – Noise emitted by machinery and equipment – Measurement of emission sound pressure levels at a work station and at other specified positions – Survey method in situ (ISO 11202:1995).*

ISO 5221, *Air distribution and air diffusion -- Rules to methods of measuring air flow rate in an air handling duct*.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14175-1:2003 and EN 14175-3:2003 apply.

NOTE Attention is drawn to EN 14175-3 where some definitions given in EN 14175-1 have been modified.

4 General on-site test conditions

Windows and doors of the room shall remain closed during measurements. There shall be no unnecessary obstructions or equipment in neighbourhood of the fume cupboard under test.

The general and the specific test conditions during all on-site tests, including make-up air sources and all extract air openings, shall be carefully considered and documented in the on-site test report according to Clause 9.

5 Commissioning testing of type tested fume cupboards

5.1 Scope and purpose

The following test methods are considered to be appropriate for the commissioning test after installation of a fume cupboard which has been type tested in accordance with EN 14175-3 before installation. It is the aim of commissioning testing to show the correct installation of the fume cupboard and to check adverse effects of the room air flow and of the extract system on the performance of the installed empty fume cupboard under its intended design conditions.

The final purpose and extent of the commissioning test should be agreed upon between purchaser and supplier.

5.2 Inspections

5.2.1 Inspections are usually optical inspections, if appropriate, aided by simple measurement equipment, such as tape-measure. The following items should be proven by inspection.

5.2.2 Observance of the manufacturer's installation instructions (see EN 14175-2:2003, 10b).

5.2.3 Protection against splashes (see EN 14175-3:2003, 6.3)

5.2.4 Sash suspension and sash stop (see EN 14175-3:2003, 6.1 and 6.4)

5.2.5 Sash displacement force (see EN 14175-3:2003, 6.2)

5.2.6 Conformity of the fume cupboard to the type tested unit

5.2.7 Services (see EN 14175-2:2003, Clause 9)

5.2.8 Materials (see EN 14175-2:2003, Clause 6)

5.2.9 Correct mechanical assembling and integrity after installation

5.2.10 Pressure relief if supplied (see EN 14175-2:2003, 7.2.4)

5.2.11 Accessibility of construction parts (see EN 14175-2:2003, 7.2.5)

5.3 Manufacturer's declarations or type test certification

5.3.1 The following items shall be covered by manufacturer's declarations.

5.3.1.1 Lighting (see EN 14175-2:2003, 9.4)

5.3.1.2 Services

5.3.1.3 Materials

5.3.2 The following items shall be proven by the type test certificate of the fume cupboard.

5.3.2.1 Containment (see EN 14175-3:2003, 5.3)

5.3.2.2 Robustness of containment (see EN 14175-3:2003, 5.4)

5.3.2.3 Air exchange efficiency (see EN 14175-3:2003, 5.5)

5.4 Face velocity test

5.4.1 Objectives

The aim of the face velocity test as part of the commissioning testing is to verify the face velocity pattern compared to the type test result in order to check either correct installation of the fume cupboard or adverse effects of the room air conditions. Another aim should be to obtain a reference value for comparison in subsequent routine tests.

5.4.2 Test equipment and probe positions

According to EN 14175-3:2003, 5.2.1 and 5.2.2.

5.4.3 Test procedure and test results

The fume cupboard shall work with the intended working conditions. No other equipment than the test equipment shall be present inside the fume cupboard. The measurements and the calculation of the test results shall be performed at the type test opening(s) and at the actual air volume flow rate in accordance with EN 14175-3:2003, 5.2.3 and 5.2.4.

If the air volume flow rate is other than that established in the type test, it shall be noted.

NOTE Such a deviation can affect the face velocity pattern.

5.4.4 Test report

The calculated test results and the deviation of these test results from those specified in the type test certificate shall be reported (see 9.1).

5.5 Extract volume flow rate test

5.5.1 Objectives

The aim of the extract volume flow rate test as part of the commissioning testing is to verify the extract air volume flow compared to the intended volume flow and the correct installation of the fume cupboard. Additional purpose of the test is to obtain reference values for easy and fast routine testing (see Clause 6).

The extract volume flow discharged from a fume cupboard can generally be measured according to ISO 5221. When the requirements for the use of this method are not fulfilled, one of the following methods can be applied.

5.5.2 Average face velocity method

5.5.2.1 Principle, test equipment and probe positions

This method determines the extract volume flow by measuring the face volume flow in the sash opening by making sure that all the extract air is flowing through the sash opening. Test equipment and probe positions in accordance with EN 14175-3:2003, 5.2.1 and 5.2.2.

5.5.2.2 Preparation

Any significant leakage, slit or opening of the fume cupboard, except of the test sash opening, shall be sealed by adhesive tape or appropriate air tight material. The sealing material shall be removed after the face velocity measurement.

The test shall be carried out with the fume cupboard's sash(es) set at one of the type test sash opening(s) (see EN 14175-3:2003, 4.4.2).

5.5.2.3 Test procedure and test results

According to EN 14175-3:2003, 5.2.3 and 5.2.4.

5.5.2.4 Expression of results

Multiply the average face velocity at the sash opening with the area of the sash opening and report the resulting volume flow rate in m^3/h together with the average face velocity, the sash area and the chosen sash opening.

If the face velocity test according to 5.4 has been performed, a correlation factor for the face velocity of the sealed and non-sealed fume cupboard can be calculated and documented in the commissioning test report as reference value for subsequent routine testing (see 6.3).

5.5.3 Calibrated pressure difference method

5.5.3.1 Principle and test equipment

This method depends on the availability of manufacturer specified reference points. The method determines the extract volume flow by measuring the pressure difference between two reference points specified by the fume cupboard's manufacturer. Test equipment in accordance with EN 14175-3:2003, 5.6.2.

5.5.3.2 Positioning of pressure tap(s) and test procedure

The test shall be carried out with the fume cupboard's sash(es) set at one of the type test sash opening(s) (see EN 14175-3:2003, 4.4.2). The pressure tap(s) shall be fitted to the reference point(s) specified and marked by the fume cupboard's manufacturer. Test procedure according to EN 14175-3:2003, 5.6.5.

5.5.3.3 Expression of results

Take the extract volume flow corresponding to the measured pressure difference from the table or diagram supplied in the manufacturer's documentation. Report the measured pressure difference and the evaluated extract volume flow in m^3/h together with the manufacturer's documentation identification and the reference measuring point(s).

5.6 Pressure drop test

5.6.1 Objectives

The aims of the pressure drop test as part of the commissioning testing are to obtain reference values for subsequent routine testing (see 6.4) and to verify the pressure drop at the current installation of the fume cupboard, compared to the intended pressure drop.

5.6.2 Test equipment and test procedure

According to EN 14175-3:2003, 5.6.2 to 5.6.5. If the fume cupboard's installation allows, the pressure taps shall be positioned as specified in EN 14175-3:2003, 5.6.4.

5.6.3 Expression of results

According to EN 14175-3:2003, 5.6.6. The pressure drop measured shall be documented in the commissioning test report (see 9.1) together with the corresponding extract volume flow rate. Differences from the type test and possible causes shall be reported.

5.7 Air flow visualization

5.7.1 Objectives

The aim of the air flow visualisation as part of the commissioning testing is to obtain qualitative information regarding room air flow and the interaction of the fume cupboard's air flow with the room air flow. Based on the test result, it should be decided whether subsequent tests, such as room air velocity test (see 5.8), are necessary.

5.7.2 Test procedure

Air flows around the installed fume cupboard and in the sash opening area should be visualized to check if there are any disturbances, e. g. by the room make-up air, that could affect the performance of the fume cupboard. Visualization shall be performed with generation of visible tracers, such as smoke, about 400 mm in front of the fume cupboard with release upwards to the ceiling. The density of the tracer shall be close to the room air density. The tracer shall be distributed with low impulse and not faster than 0,2 m/s.

5.7.3 Expression of results

Air movements around the working aperture shall be visualized and any kind of disturbance shall be documented in the commissioning test report (see 9.1).

5.8 Room air velocity test

5.8.1 Objectives

The aim of the room air inspection as part of the commissioning testing is to quantify the air flow in the surroundings of the fume cupboard. Room air flows exceeding 0,2 m/s can cause reduced containment (see 5.10) of the fume cupboard. This test should be carried out alongside other tests.

5.8.2 Test equipment

According EN 14175-3:2003, 5.2.1, with the exception that the anemometer shall be able to measure omnidirectional air speed.

5.8.3 Probe positions

The measurements shall be performed in a vertical plane about 400 mm in front of the fume cupboard's plane of sash (see EN 14175-3:2003, 3.1). The anemometer probe shall be positioned at points formed by the intersection of lines on this measurement plane as follows:

a) Two horizontal lines approx. 900 mm and 1400 mm above floor level.

b) Five vertical lines, two of them aligned with the side walls of the fume cupboard, a third one in the middle between this two lines (aligned with the centre of the fume cupboard) and another two ones approx. 250 mm to the left and to the right of the side wall aligned lines.

5.8.4 Test procedure and test results

The sash of the fume cupboard shall be set to one of the test sash openings (see EN 14175-3:2003, 4.4.2.)

The mean speed in meter per second at each measurement point shall be calculated and the result rounded to the second decimal place.

5.9 Alarm system test

5.9.1 Alarm by overriding the vertical sash stop

The vertical sash shall be opened beyond the maximum operational sash opening marked on the fume cupboard. It is to verify that audible and visual alarms operate, if installed, the visual alarm remaining as long as the sash is beyond this operational limit. The audible alarm may be silenced once alarmed. When the sash is reset below the maximum operational sash opening the alarm should be reset automatically.

5.9.2 Air flow indicator

Given the variety of air flow indication methods the manufacturer of the air flow indicator shall specify the method to test the air flow indicator in accordance with the requirements given in EN 14175-2:2003, 8.2.

The test shall be performed as specified and described by the manufacturer of the air flow indicator and it is to verify that the audible and visual alarm operate. The audible alarm may be silenced once alarmed. Once the air flow is in the correct operating parameters of the fume cupboard the alarm may be reset.

5.10 Containment test

5.10.1 Objectives

The aim of a containment test as part of the commissioning testing is to verify the correct function of the fume cupboard at the place of installation by quantification of the containment under the prevailing working conditions.

5.10.2 Test equipment, test procedure and data analysis

According EN 14175-3:2003, 5.3. The containment test can either be performed in the inner measurement plane, or in the outer measurement plane or in both planes (see EN 14175-3:2003, 5.3.3 and 5.3.4).

The test equipment shall be according to EN 14175-3, 5.3.1 with the following exception: detection level of the gas analyser may be $\leq 2{,}5 \times 10^{-8}$ instead of $\leq 10^{-8}$.

5.10.3 Test report

The calculated test results and the deviation of these test results from those specified in the type test certificate shall be reported (see 9.1).

5.11 Sound pressure measurement

5.11.1 Objectives

The aim of the sound pressure measurement is to provide the user with the sound pressure levels when the fume cupboard is in use.

5.11.2 Test procedure

The measurement of the sound pressure level should be performed as A weighted sound pressure level in dB(A) using a sound level meter conforming to EN 61672-1 in the following position in front of the fume cupboard which should be equipped for the intended use:

— 150 cm height from the ground floor,

— 30 cm in front of the sash plane,

— in the center of the plane parallel to the sash plane.

The sound level meter shall be calibrated in accordance with the manufacturer's instructions. The measurement method shall be in accordance with EN ISO 11202.

5.11.3 Test report

The result of measurement and the position of the sash shall be reported in the on-site test report as A weighted sound pressure level.

6 Routine testing of type tested fume cupboards

6.1 Scope and purpose

The following test methods are considered to be appropriate for the routine test of a fume cupboard which has been type tested in accordance with EN 14175-3 before installation. It is assumed that the fume cupboard has been commissioning tested after installation according to Clause 5 and that a commissioning test report according

to 9.1 is available. An aim of the routine test can be to check whether the performance of the empty fume cupboard is maintained. The test can also be used to check the performance of the fume cupboard under working conditions.

The final extent of the routine test should be specified by the party responsible for routine testing, taking into account the recommendations given by the fume cupboard's manufacturer (see EN 14175-2:2003, 10d). The non-availability of a commissioning test report can enlarge the extent of the routine testing.

6.2 Face velocity test

6.2.1 Objectives

The aim of the face velocity test in the routine testing is to determine any variation from the type test and/or commissioning test results.

6.2.2 Test equipment and test procedure

An anemometer with a measuring range suitable for the fume cupboard under test and capable of measuring air velocities with an accuracy of 10 % shall be used. The fume cupboard shall be operating under actual working conditions.

The probe positions shall be as in EN 14175-3:2003, 5.2.2. For vertical sashes the measurements shall be performed in all points in the horizontal middle row in the inner measurement plane (if the number of rows are even, the one above the centre). For horizontal sashes the measurements shall be performed at all points in the vertical middle row in the inner measurement plane (if the number of rows is even, choose one and report the position). Measurements shall be made at each probe position for at least 30 s.

6.2.3 Test report

Calculate the average velocity in m/s and round the result to the second decimal place.

6.3 Extract volume flow rate test

6.3.1 Objectives

The aim of the extract volume flow rate test as part of the routine test is to verify whether the extract volume flow rate is maintained, using one of the methods described in 5.5 or the method in 6.3.2. The sealing of the fume cupboard's leakages (see 5.5.2.2) is not necessary, provided a correlation factor for the sealed and non-sealed face velocity has been established for the methods and conditions used.

6.3.2 Sequential average face velocity test

6.3.2.1 Principle, test equipment and probe positions

This method determines the extract volume flow rate by measuring the face velocity in the sash opening of a fume cupboard using an anemometer. The anemometer shall be of an integrating type and shall be capable of measuring unidirectional air velocities down to 0,3 m/s or better. The accuracy of an individual reading shall be better than 0,02 m/s + 5 % of the reading. The anemometer should also be able to calculate the results in terms of air volume flow rates.

6.3.2.2 Test procedure and test results

The test should be carried out with the fume cupboard’s sash set to a sash opening of 100 mm.

The test is to be carried out within the resulting area of opening. The anemometer shall be continuously oriented so that the velocity component perpendicular to the plane of opening is measured. Move the anemometer using a constant speed to scan the length of the opening. The time for scanning and integrating should be 60 s.

6.3.2.3 Test report

Note the measurement value in meter per second. Multiply the average face velocity at the opening plane with the area of the opening plane and report the resulting volume flow rate in cubic meter per hour together with the average face velocity and the opening plane's area.

6.4 Pressure drop test

According to 5.6.

6.5 Air flow visualization

According to 5.7.

6.6 Alarm system test

According to 5.9.

6.7 Inspections

Appropriate inspections according to 5.2 should be performed. In addition, work surface damages and corrosion should be inspected.

7 Qualification testing of non type tested fume cupboards

7.1 Scope and purpose

The following test methods are considered to be appropriate for the test after installation of a fume cupboard which has not been type tested. The test is intended for qualification, that the safety and performance requirements of the fume cupboard, specified in Part 2 of this European Standard, are fulfilled in its particular installation environment. The final extent of the qualification test should be specified by the party responsible for the qualification of the fume cupboard.

7.2 Inspections

According to 5.2 where appropriate.

7.3 Manufacturer's declarations

According to 5.3 where appropriate.

7.4 Face velocity test

According to EN 14175-3:2003, 5.2 where appropriate.

7.5 Extract volume flow rate test

According to 5.5 where appropriate.

7.6 Pressure drop test

According to 5.6 where appropriate.

7.7 Air flow visualization

According to 5.7. In addition, air movements through any other opening of the fume cupboard than the sash opening should be visualized and documented in the qualification test report (see 9.3).

7.8 Room air velocity test

According to 5.8 where appropriate.

7.9 Alarm system test

According to 5.9 where appropriate.

7.10 Containment test

According to 5.10 where appropriate.

7.11 Robustness of containment

A robustness test according to EN 14175-3:2003, 5.4, should be included in the qualification test when the circumstances at the installation place of the fume cupboard allow for it. The procedure shall be adjusted according to the installation place and the on-site conditions in the laboratory and any deviation from the type test procedure shall be documented in the qualification test report (see 9.3).

7.12 Air exchange efficiency

According to EN 14175-3:2003, 5.5 where appropriate.

7.13 Sound pressure measurement

According to 5.11.

7.14 Illuminance test

According to EN 14175-3:2003, Clause 9, where appropriate.

8 Routine testing of qualified fume cupboards

According to Clause 6. It is required that the fume cupboard has been qualified after installation according to Clause 7.

9 On-site test reports

9.1 Test report for commissioning testing of type tested fume cupboards (see Clause 5)

The commissioning test report shall include the following items as a minimum:

a) the name and/or trade mark of the fume cupboard's manufacturer and/or supplier;

b) the type designation including the year of production;

c) the date of commissioning testing and the reference to the type test report;

d) the general room air conditions during air flow tests, including temperature, barometric pressure, air humidity and pressure difference between room and the adjacent space as well as make-up air and room extract air;

e) the status of fume cupboards and other extract devices in the room and the specific position of the tested fume cupboard;

f) the results of the inspections (see 5.2);

g) the results of the tests performed during the commissioning testing in accordance with the test result requirements specified for each test (see 5.4 to 5.11);

h) a reference to this document EN 14175-4 and the test method(s) from this document which has/have been performed.

Those test results intended to serve as reference values for subsequent routine testing should be documented in an additional table under the header "Reference values for routine testing".

9.2 Test report for routine testing of type tested fume cupboards (see Clause 6)

The routine test report shall include the following items as a minimum:

a) individual identification number of the fume cupboard and date of test;

b) the reference to the type test report, the commissioning test report and the last routine test report, if available;

c) the general room air conditions during air flow tests, including temperature, barometric pressure, air humidity and pressure difference between room and the adjacent space as well as make-up air and room extract air;

d) the status of fume cupboards and other extract devices in the room and the specific position of the tested fume cupboard;

e) the results of the inspections (see 6.7);

f) the results of the tests performed during the routine testing in accordance with the test result requirements specified for each test (see 6.2 to 6.6);

g) a reference to this document EN 14175-4 and the test method(s) from this document which has/have been performed.

9.3 Test report for qualification testing of non type tested fume cupboards (see Clause 7)

According to 9.1 as far as applicable.

9.4 Test report for routine testing of qualified fume cupboards (see Clause 8)

The routine test report shall include the following items as a minimum:

a) individual identification number of the fume cupboard and date of test;

b) the date of qualification testing, the reference to the qualification test report and the last routine test report, if available;

c) the general room air conditions during air flow tests, including temperature, barometric pressure, air humidity and pressure difference between room and the adjacent space as well as make-up air and room extract air;

d) the status of fume cupboards and other extract devices in the room and the specific position of the tested fume cupboard;

e) the results of the inspections (see 6.7);

f) the results of the tests performed during the routine testing in accordance with the test result requirements specified for each test (see Clause 6);

g) a reference to this document EN 14175-4 and the test method(s) from this document which has/have been performed.

National annex NA (informative)
Recommendations for the exchange of information and recommendations for installation

NA.1 Introduction

The requirements contained in the BS EN 14175 series of standards for laboratory fume cupboards supersede the BS 7258 series of standards and these are now withdrawn. However, to ensure completeness of the requirements in the British implementation of these European standards, the safeguards contained in the BS 7258 series (i.e. recommendations for the exchange of information, installation, selection, use and maintenance) are retained. This informative national annex reproduces clauses **2.1**, **2.2**, **2.3**, **2.4**, **3.2** and **3.3** of BS 7258-2:1994, plus clauses **4.2** and **5** of BS 7258-3:1994.

NA.2 Exchange of information

NOTE Clause NA.2 reproduces clauses **2.1**, **2.2**, **2.3**, **2.4**, **3.2** and **3.3** of BS 7258-2:1994.

NA.2.1 *General*

It is strongly recommended that, for laboratory fume cupboards, the information given in clauses **NA.2.2** to **NA.2.4** of this national annex should be exchanged by the purchaser and the vendor/installer.

NA.2.2 *Information to be obtained from the purchaser by the vendor/installer*

NOTE For the purposes of this British Standard, it is assumed in this clause that the vendor is the same party as the installer. If this is not the case both parties should obtain the information listed in items a) to g) but it is necessary only for the installer to obtain the information listed in items h) to n).

The following information should be obtained from the purchaser by the vendor/installer:

a) the material of construction for any part of the fume cupboard that will be affected by fumes emanating from the processes for which the fume cupboard will be used;

b) any specific requirements such as minimum flow rate;

c) the minimum dimensions of the work surface;

d) the normal sash working height, the maintenance sash height, and the width of the opening in the plane of the sash;

e) the services to be fitted;

f) the maximum external dimensions of the fume cupboard, and its dismantled components if appropriate, and the dimensions available for access into the building and internal access to where the fume cupboard is to be installed;

g) whether the fume cupboard is to be used for manipulation of highly flammable liquids or other particularly hazardous substances;

h) the following details of the siting of the fume cupboard:

1) general details of the building in which the fume cupboard is to be installed, the location of the laboratory and the intended siting of the fume cupboard(s) within the laboratory;

2) the locations of doors, windows, other fume cupboards, other laboratory furniture, ventilation grilles, diffusers, or other air moving equipment;

3) the absence of any features listed in item 2);

i) general details of the intended method of supplying laboratory make-up air and of the room ventilation existing or to be provided;

j) the environment requirements of the laboratory including:

1) requirements for the room in which the fume cupboard is to be installed including maximum sound-pressure levels;

2) requirements, e.g. noise levels, for other rooms in the building;

3) requirements under the Environmental Protection Act 1990 [1] for emission exterior to the building;

k) the accommodation spaces, routes available and any specific design requirements of the fume extract system, including the range of working temperatures and the fittings to be provided, such as flow control devices, alarms and indicators, condensate collectors, and duct washing facilities;

l) the locations and details of any existing mechanical, electrical, plumbing and drainage services to be utilized in connection with the complete fume cupboard installation;

m) the following details of the fume cupboard:

1) the required air extract volume flow rates, corresponding face velocity(ies) and pressure drops across the fume cupboard(s);

2) whether a facility to vary the set extract volume flow rate is required and, if so, the range that is required;

3) whether the fume cupboard extract system is to be for continuous or intermittent use;

n) the commissioning tests to be undertaken by the installer.

NA.2.3 ***Further exchange of information before installation***

NOTE For the purposes of this British Standard, it is assumed in this clause that the vendor is the same party as the installer. If this is the case, the information listed should be supplied to the purchaser by the vendor/installer. If this is not the case, the vendor should supply the information listed to the purchaser, and the installer should obtain the information listed from the purchaser (who will have received it from the vendor).

The following information should be exchanged before the fume cupboard is installed (see note):

a) dimensioned drawings of the fume cupboard (including maximum sash opening for access and normal maximum working sash opening corresponding to the sash positions at the maintenance sash height and the normal maximum sash height respectively);

b) an identification of all materials of construction;

c) fume cupboard type and serial number;

d) all the information reported on successful completion of the type test procedure;

e) operating and maintenance instructions for all the equipment provided, including the pressure loss characteristics of the fume cupboard;

f) any specific limitations on use.

NA.2.4 ***Information to be supplied to the purchaser upon installation***

The following information should be supplied to the purchaser upon installation of the fume cupboard:

a) drawings showing the complete final installation provided;

b) an identification of the materials of construction of the extract system;

c) the results of the commissioning tests undertaken by the installer, and any proposed amendments to the purchaser's requirements;

d) operating and maintenance instructions for the extract system and for any laboratory make-up air systems provided by the installer.

NA.2.5 Fume extract systems

NA.2.5.1 ***General***

NA.2.5.1.1 *The primary function of the fume extract system is to safely contain and convey potentially dangerous or obnoxious fumes from the fume cupboard to an outside discharge point from which they can be adequately dispersed at an acceptably low concentration.*

NA.2.5.1.2 The extract system comprises a connection or connections to each fume cupboard, the ductwork, a fan or fans and a discharge flue or multi-flue stack. It may, as appropriate, also include equipment for regulating and indicating the extract rate, preventing reverse flow, preventing spread of fire and smoke, fume filtration, fume scrubbing, heat recovery, condensate collection, washdown and drainage. A satisfactory installation can be achieved only if all the obligations of these interrelated aspects are met.

NA.2.5.1.3 The extract system (together with the arrangements for laboratory make-up air) should be so designed as to minimize the sensitivity of the fume cupboard to the effects of outdoor wind and other sources of air disturbance. The discharge flue should be sited with due regard to the flow pattern of air around the building and should be sufficiently high to minimize the risk of fumes being drawn into buildings through open windows or air intake grilles.

NA.2.5.1.4 When in use, the extract system within the building should be at negative pressure. Fans should be mounted at roof level with their outlets connected to the discharge flues and their inlets connected to the ductwork. If a fan and its associated equipment cannot be accommodated on the roof, it should be installed at ground level, or on an easily accessible platform and the connections arranged such that, in use, a negative pressure is still maintained in all ductwork within the building. If ductwork is unavoidably under positive pressure it is essential that it is so arranged that if a leak does occur it cannot create a hazard.

NA.2.5.1.5 The design of the ductwork (and its resulting resistance to the passage of air) and the fan should be such as to satisfy the maximum air flow requirement at operating temperatures for all fume cupboards served by the system. Fan capacities should exceed the operating requirements by at least 10%.

NOTE Where highly toxic materials are handled, automatic changeover to a standby fan may be desirable.

NA.2.5.1.6 Extract systems should incorporate an air flow control device for each fume cupboard served. If the control device is mounted in an easily accessible position it may be necessary to incorporate a locking arrangement to prevent unauthorized interference.

NA.2.5.1.7 It is often the case that not all the fume cupboards in a building are in use at any one time, and economies in running costs can be achieved by providing independent extract systems for groups of fume cupboards. Flues beyond the extract fans may be grouped and encased in multi-flue discharge stacks but usually at the expense of longer and more complicated flue runs and higher discharge stacks.

In order to prevent mixing of fumes that could give rise to unacceptable hazards such as risk of fire or explosion, fume cupboards should be grouped according to the processes to be undertaken.

However, the connection of more than one fume cupboard to an extract fan involves the provision of larger and usually more complicated ductwork with an increased maintenance liability. The need for a standby fan and additional controls and indicators should be considered.

A collection/dilution system may be used for the dispersal of fumes from a number of individual extract systems or from common extract systems. The collection/dilution duct, discharge fan and common discharge flue should have a capacity (after allowing for the frequency of fume cupboard use) in excess of the total capacity of the extract fans connected to the duct, this excess depending on the quantity of air needed to be drawn in at the open end of the duct in order to restore the concentration of fumes in the common sections of the system to an acceptable working level. With this arrangement also, the need for a standby fan and additional safety controls and indicator should be considered.

NA.2.5.2 ***Ductwork***

NA.2.5.2.1 Ductwork should have a smooth, obstruction-free interior and should be circular in cross-section.

NOTE For recommendations regarding services accommodation ducts see BS 5588-9 and BS 8313.

NA.2.5.2.2 The cross section of the ductwork and the routeing of the ducts within the building should be such that the noise level is within the environmental requirements of the laboratory. Air velocities within the ducts should not exceed 7,5 m/s and where the noise level requirement is low, the air velocity should not exceed:

a) 5,0 m/s for single unit systems and branches to fume cupboards on multiple unit systems;

b) 5,5 m/s for main ducts within buildings;

c) 6,0 m/s for external ducts.

Air velocities exceeding 6,0 m/s may be necessary for fume cupboards intended for handling large quantities of aerosol or dust, in order to minimize the accumulation of deposits at bends and joints. In these cases, specialist advice should be obtained.

NA.2.5.2.3 Ductwork should follow the most direct route from fume cupboard to fan. Bends should be kept to a minimum number and have the largest radii practicable. There should be a minimum of horizontal runs and where such runs are unavoidable, they should have an in-built slope towards a drainage point. Drainage points should be provided at all low points of the extract system.

NA.2.5.2.4 The materials of construction for the ductwork should be chosen to give the best resistance to the chemical and physical conditions to which they will be subjected, and which cost and practicability will allow.

NOTE 1 No material is completely resistant to all forms of chemical attack.

Materials should be selected from the following.

a) *Rigid polyvinyl chloride (PVC).* This is the most widely used material where service temperatures up to 60 °C are envisaged. It should have been tested in accordance with BS 2782-1: Method 140E and should comply with flame spread classification class 1 of BS 476-7.

The material may be reinforced externally by the application of glass fibre/resin laminate [glass-reinforced plastics materials (GRP)] to impart additional structural strength and to increase useful temperature range.

NOTE 2 The material is available as extruded circular tube with a range of preformed fittings for sizes up to 800 mm diameter, as flat sheet (which may have longitudinal seams fusion welded by machine process) for fabricated ductwork, and as rod and stock.

b) *Polypropylene.* Polypropylene may be useful where service temperatures up to 90 °C are envisaged or where organic solvents in condensate form may be present. Fabrication techniques are similar to those for rigid PVC. The material burns readily when ignited by flame and drips as it burns, but is available with a glass fabric backing that allows external application of glass fibre/resin laminate (GRP), which, in certain formulations, provides similar or superior fire retardation to rigid PVC.

NOTE 3 The material is available in extruded circular tube in small sizes and as flat sheet for fabricated ductwork.

c) *Moulded glass fibre/resin laminate (GRP).*

GRP may be used for fume extract systems where a duct of high structural strength is required. Variation of the resin/glass ratio and the type of resin used leads to a very wide choice of properties. Generally, resin-rich formulations produce the best chemical resistance and a high glass fibre content produces greater strength.

NOTE 4 The high cost of moulds required for different shapes or sizes and the mainly hand processes involved in producing the ductwork makes the system very expensive.

NOTE 5 Joints may be difficult to seal under site conditions. Consistent quality of fabrication is difficult to achieve and faults may not show for some time after installation. Fire test and chemical resistance tests carried out on laboratory samples may not be consistent with tests on samples of installed ductwork.

d) *Stainless steel and coated mild steel*. Stainless steel and coated mild steel are used when very high air temperatures are envisaged; these materials give some degree of fire protection.

NOTE 6 Certain commonly used acids will attack stainless steel quite readily. Coatings can be easily damaged during installation or subsequent cleaning and this will quickly lead to chemical attack of the exposed metal. Seams may be welded and sealed joints made via flanges with gaskets. However, it is at the joints that leakage frequently occurs.

NA.2.5.2.5 The ductwork should accommodate thermal expansion and contraction. It should be leak-proof and gaskets, where fitted, should be resistant to fume and condensate. Ductwork of circular cross-section up to 500 mm diameter, or rectangular ducts up to 400 mm on the longer side, may be jointed by socket and spigot. Large round and rectangular ducts should either be joined by flanged joints or be sufficiently rigid to be satisfactorily joined by socket and spigot joints. To ensure satisfactory stiffness of socket and spigot joints, reinforcement of the ducts adjacent to joints is necessary.

NA.2.5.2.6 No ductwork should violate the fire compartmentation of the building in passing between the fume cupboard and its final discharge point. Fire dampers should be avoided and adequate fire protection provided by means of suitable treatment of the ductwork, or by enclosure of the duct within a compartmented accommodation duct, or by running the ductwork outside the building. Where fire dampers cannot be avoided they should be of suitable corrosion and fume-resistant design and they should have the damper blade clear of the air flow. They should be accessible for maintenance and replacement.

NOTE Installers should take note of the requirements of the Building Regulations: 1991 Part B Approved Document [2] (and any subsequent legislation) regarding the effect of the installation on the compartmentation of the building and on the provision of firestops. They should also take note of Regulation 10(7) of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (S.I. No. 917) [3] on ductwork intended to be a fire-resisting structure. The corresponding parts of the Building Standards (Scotland) Regulations 1990 [S.I. No. 2179 (S.187)] [4], and the corresponding part of the Building Regulations (Northern Ireland) 1990 (S.I. No. 59) [5] are also relevant.

NA.2.5.2.7 Leak-proof inspection covers should be provided as necessary to permit inspection and cleaning of the entire internal surface of the system; the ductwork should be suitably labelled at these points to indicate the nature of the hazard.

NA.2.5.3 ***Fans***

NA.2.5.3.1 Fans should be selected so that their performance is near to the point of maximum efficiency on the fan characteristic curve see Clause 16 of BS 848-1:1997). For quiet operation, the outlet velocities should be between 5,5 m/s and 7,5 m/s with impeller tip speeds within the range 10,0 m/s to 15,0 m/s. appropriately selected fans of the backward curved centrifugal type should be considered as a first choice as they are generally more efficient and generate less noise than others. They are also able to operate over a wide range of air flow without instability. Where particular performance requirements and other extract system design constraints, e.g. cost and space, preclude the use of such fans as a first choice, other types should be carefully considered.

NA.2.5.3.2 Fans may be either directly coupled or belt driven.

NOTE Belt driven fans give greater flexibility of fan performance.

NA.2.5.3.3 All parts of the fan likely to come into contact with the fume or condensate should be resistant to them and should be able to withstand the maximum expected temperature.

NA.2.5.3.4 The fan motor should be situated outside the air stream and should be suitably protected to ensure that sparks cannot be transmitted to the fume. If the motor is in a potentially explosive area it should comply with the requirements for that area (see BS EN 60079-14:2003).

NOTE Attention is drawn to Regulation 10(8) of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (S.I. No. 917) [1].

NA.2.5.3.5 A permanently plumbed-in drain should be connected to the lowest point of the fan casing to permit the disposal of condensate and liquids used for cleaning the extract system.

NA.2.5.3.6 The construction and installation of the fan should permit access for cleaning all parts of the fan, especially those in contact with fumes.

NA.2.5.4 ***Fume discharge to atmosphere***

NA.2.5.4.1 Because the vertical height of the aerodynamic wake of a building extends, typically, to about 125% of the building height above ground, the point of discharge to atmosphere, even for small discharges, should normally be above this height. However, effluent dispersion patterns can be affected considerably by the building shape and by the presence of other nearby large buildings and topographical features. Where this is likely to be the case, special advice should be sought. The required height of the point of discharge is therefore peculiar to each project, but for an isolated rectangular building of low plan ratio in flat open territory, a height above ground of 1,25 m multiplied by the highest point of the building, or 3 m above the highest point, whichever is the greater, will normally be adequate for an isolated vertical flue with plain opening. In more complex circumstances, it may be obvious that a higher point of discharge is needed. In some cases, wind tunnel smoke tests carried out on a model of the building and its surroundings may be necessary in order to arrive at the lowest safe height.

NA.2.5.4.2 High discharge velocities will ensure that the discharge will not be trapped in the aerodynamic wake of the stack itself, thereby utilizing the full height of the stack. Discharge velocities should not normally be less than 7 m/s and a design figure of 10 m/s is preferable. Higher discharge velocities are sometimes employed, especially in windy locations, but they may cause a noise problem.

NA.2.5.4.3 Dilution of the effluent in the discharge flue or stack has no effect on perceived concentrations of the effluent in the atmosphere at any distance from the source and is not normally an adequate solution to pollution problems. Open ended collection-dilution ducts for multiple fume extract systems may be resorted to, however, as a means of reducing the number of discharge points where this is necessary and for achieving safe conditions within common extract systems.

NA.2.5.4.4 Effluent treatment before discharge may be advantageous in some cases. However, the various effluent treatment methods commercially available, e.g. wet scrubbing, filtering or incineration, tend to be effective for quite specific ranges of materials and no universal treatment can be recommended. Specialist advice should be sought if a specific form of treatment is considered. It should also be remembered that all treatment systems leave some residual effluent, and safe discharge of this to the atmosphere is still required (see note 3).

NOTE 1 Attention is drawn to the Planning and Compensation Act 1991 [6], the Town and Country Planning General Development Order 1988 [7] and the corresponding Acts and Orders for Scotland and Northern Ireland regarding the erection of tall chimneys.

NOTE 2 Attention is drawn to the Environmental Protection Act 1990 regarding the noise emitted at the nozzle, and the Control of Noise (Measurements and Registers) Regulations 1976 (S.I. No. 37) [8]. See also BS 4142.

NOTE 3 Attention is drawn to the Environmental Protection Act 1990, [2] the Clean Air Act, 1993 [9] and Section 3 of the Health and Safety at Work etc. Act, 1974 [10] regarding discharges of polluted air into the outside air, and the Radiating Substances Act, 1993 [11]

NA.2.6 *Laboratory make-up air systems*

NA.2.6.1 A fume cupboard should not be installed without first considering the provision of the laboratory make-up air system necessary to replace all of the air entering the fume cupboards in the laboratory. The fume cupboards and other extract points together with the laboratory make-up air supply in the laboratory should be regarded as an integral system. It is therefore of paramount importance that the air supply system does not compromise the performance of the fume cupboards and, consequently, operator protection.

NA.2.6.2 The high air change rate in a laboratory resulting from a multiple fume cupboard installation, or from a single installation in a small laboratory, necessitates careful selection of the method of supplying laboratory make-up air. Insufficient space may preclude the use of conventional equipment, and special diffusers, grilles, or a perforated ceiling, may be required to achieve low room-air velocities.

NA.2.6.3 Arrangements for the supply of laboratory make-up air should be consistent with the purchaser's requirements for protection from fire and smoke and the achievement of the environmental conditions required for the laboratory.

NA.2.6.4 The opening of the windows should not be relied upon for the supply of laboratory make-up air because staff may omit to open them, particularly in cold weather, and draughts from windows in the vicinity of a fume cupboard may prevent the attainment of the level of performance required by the purchaser. The ingress of untreated air from outside the building may also result in unwelcome contamination, particularly in urban situations.

NA.2.6.5 Sufficient openings, louvres or transfer grilles should be provided in walls and doors for laboratory make-up air to be infiltrated into the room from its surroundings, preferably from adjacent heated corridors. The locations and sizes of these openings, louvres or transfer grilles should be chosen to ensure the avoidance of discomfort due to draughts and to ensure that the opening and closing of doors does not affect the performance of the fume cupboards. The use of "damped" door closure devices can help to reduce sudden air movement. The drawing in of contaminated air, e.g. from adjacent laboratories, should be avoided and the general quality of the air should be consistent with the achievement of the environmental conditions required for the laboratory by the purchaser.

NA.2.6.6 The objective of the laboratory make-up air distribution system (and any other mechanical ventilation system) should be to introduce the required volume of air into the room with the minimum possible disruption to the fume cupboard air flow pattern. In other words, the laboratory make-up air supply system should not reduce the degree of protection afforded to the operator of the fume cupboard. In general, air diffusers, grilles or terminal units (whether ceiling, wall or floor mounted) should not discharge directly towards or across the fume cupboard face. It is unlikely that the room air movement pattern employed in the performance type testing procedure (i.e. air approaching a fume cupboard normal to the plane of the sash with relatively uniform and low velocities) could be released in the majority of actual installations. However, every effort should be made to prevent the occurrence of supply jets of relatively high velocities (above 0,3 m/s) anywhere in the occupied zone of the room housing the fume cupboard.

NA.2.6.7 A fan-assisted source of laboratory make-up air should be filtered, heated, and otherwise treated as necessary, to maintain the environmental conditions required for the laboratory by the purchaser. It is common practice to prevent pressurization of the laboratory (which would cause the spread of contaminated air into other areas) by supplying less fan-assisted make-up air than the total extract rate. When, in such an installation, there is for any reason a significant reduction in the rate of (or a complete loss of) air extraction from the room by the fume cupboard installation, the fan-assisted laboratory make-up air rate should be correspondingly reduced, or discontinued, either automatically or manually following an automatic alarm.

NA.2.6.8 If the air change rate induced by the fume cupboard would be adequate to ventilate the laboratory and if the laboratory is to be occupied when the fume cupboard is not in use, separate arrangements made to meet the level of room ventilation required by the purchaser.

NA.2.6.9 Air extracted from a room in which a fume cupboard is situated should not be recirculated.

NA.3 Health and safety

NOTE Clauses NA.3 and NA.4 reproduce clauses **4.2** and **5** of BS 7258-3:1994.

NA.3.1 *General*

Purchasers should give careful consideration to the following health and safety issues when selecting a fume cupboard for a particular application (or when planning to extend or change the application of an existing fume cupboard):

a) whether the design, siting and use of the fume cupboard will be such that it will achieve adequate control of exposures of persons to the airborne toxic substances involved in that application;

b) whether the fume cupboard and the extract system will be otherwise safe and suitable for the application in question, e.g. with respect to the following:

1) materials of construction;

2) provisions for electrical and other services;

3) cleaning and maintenance provisions;

4) location and design of arrangements for the discharge of air from the fume cupboard system.

Since a fume cupboard can be expected to last many years, it can confidently be assumed that a wide variety of processes are likely to be carried out within it. The selection, therefore, should have regard to the most hazardous of these likely processes.

NA.3.2 *Regulations*

Under section 2 of the Health and Safety at Work etc. Act 1974 [10] it is the employers' duty to take all reasonably practicable measures to ensure the health and safety of their employees, and under sections 3 and 4 it is their duty to take the same measures for others. Section 6 puts a duty on manufacturers, designers and suppliers of fume cupboards, being articles supplied for use at work, to ensure that they are constructed and designed to be as safe as reasonably practicable. Thus a fume cupboard should be suitable both for the process to be undertaken and for the hazards to the users.

The Control of Substances Hazardous to Health Regulations 2004 (S.I. No. 3386) [12] requires that local exhaust ventilation systems should be thoroughly examined and tested at least every 14 calendar months. Whilst not specifically mentioned in the Regulations, fume cupboards can be regarded as local exhaust ventilation equipment and will therefore be subject to this legal requirement. Paragraph 61 of the associated Approved Code of Practice [13] gives details of records to be kept of each thorough examination and test.

Attention is drawn to the Certificate of Approval No. 1 (F 2434) made in pursuance of the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (S.I. No. 917) [1] and required where flammable materials are to be manipulated or used. Attention is also drawn to BS 476.

There are some occasions where these Regulations will not apply to specific premises but nevertheless the same hazards will exist and therefore the same standards should be applied.

In addition to these Regulations, the Electricity at Work Regulations 1989 [14] will also be relevant, and particularly so when flammable concentrations may be present.

NA.3.3 *Assessment of risk from toxic materials*

For guidance on the risk in particular applications, the purchaser should refer to both the long and short term exposure limits for airborne chemical substances, which are published annually by the Health and Safety Executive (HSE) [15]. These limits provide guidance on the levels (in terms of concentration and time) to which exposures to airborne toxic substances should be controlled. Reference should also be made to the Control of Substances Hazardous to Health Regulations 1988 (S.I. No. 1657) [12].

NA.3.4 *Assessment of risk from highly toxic gases and vapours*

A fume cupboard is only a partial enclosure and cannot provide absolute protection against inhalation of substances used within it. In addition, the degree of protection given to the user is highly dependent on other factors, such as the system of work and the nature of the operations to be performed. For highly toxic substances, an assessment, e.g. a containment test may indicate that the likely protection to be afforded to the user by the proposed work is inadequate. In such cases, the work should not be done in a fume cupboard and a complete enclosure such as that provided by a glove box will be more appropriate.

NA.3.5 *Assessment of risk from flammable substances*

In the case of a fume cupboard application involving the use of a highly flammable liquid, the purchaser should determine whether the manufacturer's recommended airflow rate (Q) (in m^3/s) needs to be increased in order to dilute the concentration of the vapours of that liquid to a safe level. It is recommended that the concentration in the body of the fume cupboard and any duct work should not exceed 10% of its lower explosion limit (see BS EN 60079-14:2003) and for the flammable material in question). The required air flow rate can be calculated by estimating the maximum likely rate of evaporation of the liquid during the intended processes and substituting this value into the following equation: where

$$Q_{\text{req}} = \frac{22{,}4r(t + 273)}{ME_{\text{L}}273}$$

where

E_{L} is the lower explosion limit [in %];

M is the relative molecular mass of the liquid;

Q_{req} is the required air flow rate (in m^3/s);

r is the rate of evaporation of the liquid (in g/s);

t is the air flow temperature (in °C).

NOTE 1 This equation assumes a uniform dilution of the flammable vapour with air, a constant rate of evaporation and a single substance. Where these conditions do not apply other calculations will be necessary.

If the required air flow rate, Q_{req}, can be achieved throughout the fume cupboard (including the ventilation ductwork) the materials of construction need not be fire-resisting to a specific British Standard, e.g. BS 476. They should nevertheless be of as low a combustibility as possible. Where flammable concentrations of vapour can be reasonably expected, the enclosure and/or ducting should be of half-hour fire resistance.

NOTE 2 This is a legal requirement in premises subject to the Highly Flammable Liquids and Liquefied Petroleum Gases Regulations 1972 (S.I. No. 917)[1].

Fixed electrical equipment within the fume cupboard should be to the Zone 2 requirements of those Regulations.

NA.4 ***Use***

NA.4.1 *Assessment of potential risk before use*

Before commencing use, assess the potential hazard posed by the intended procedure.

NOTE 1 Advice on potential risk is given in Clause **4**.

If the assessment shows that the fume cupboard will not give adequate protection and a cupboard with the required performance is not available, the work should not be undertaken unless the potential risk can be reduced to an acceptable level, e.g. by the following methods:

a) working with a reduced sash opening;

b) using reduced quantities of the substances involved;

c) using a lower reaction rate, e.g. by adjusting the process temperature, which will reduce the release rate of the fumes;

d) reducing the amount of substances released into the airflow, e.g. by fitting cold traps, absorption columns or scrubbers.

If none of the above methods reduces the risks sufficiently, seek advice from the laboratory safety officer or individual responsible for safety matters for devising alternative means of carrying out the work.

NOTE 2 Such advice might lead to the use of a total enclosure or the wearing of special clothing and respiratory protection.

NA.4.2 ***Preparation of use***

NA.4.2.1 *Safety precautions*

If the risks warrant it, have somebody nearby. Make sure that those nearby know the hazards likely to be met.

Unless the fume cupboard is fitted with an automatic fire system, check that a suitable fire extinguisher is at hand if flammable materials are to be handled. Make sure that those nearby have adequate first aid equipment and any antidotes appropriate to the hazard, and that they know how to use them.

Lower the sash until the user's face is fully protected. The user may also wear eye protection. The sash should be kept lowered except when actually manipulating apparatus, etc. When the fume cupboard is to be used for work with flammable liquids, treat the interior of the fume cupboard as a Zone 2 area in accordance with BS EN 60079-14:2003 or the purpose of selection and use of any electrical apparatus in connection with the work.

NA.4.2.2 *Air movement*

Check that the fume cupboard is in a fit condition for use. Report promptly any defects found (see Control of Substances Hazardous to Health Regulations 1988 (S.I. No. 1657) [12]).

If leaving any doors and windows open reduces the performance of the fume cupboard, shut them.

Check that ventilation grilles are not obstructed and that the ventilation is working correctly.

Look at the airflow indicator.

NOTE It is not enough to know that it is switched on.

NA.4.2.3 *Organization of work*

Where practicable, place everything needed inside the fume cupboard before starting. This reduces the number of arm movements into and out of the working aperture, a major cause of fume escape. Position apparatus and materials in the fume cupboard so as to minimize disturbance to the airflow at the working aperture. If there is a choice of such bulky items as ovens and hot plates, choose those with legs as they allow air to pass underneath. Make sure that there is enough room in the fume cupboard to do what is required. Tidy or remove unwanted apparatus.

NOTE If possible, specially designed ventilated cupboards should be used for storage. They are cheaper to run and safer to use.

NA.4.3 ***After use***

Adopt the laboratory's procedure for disposing of substances that should not be poured down the drains.

Leave the fume cupboard in a clean and tidy state.

After finishing the process, lower the sash. Leave the fan on until all release of fume has ceased and the fume cupboard is completely purged.

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