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Omare za recirkulacijsko filtriranje dima

Recirculatory Filtration Fume Cupboards

Umluft-Filter-Einhausung

Sorbonnes à recirculation

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Recirculatory Filtration Fume Cupboards

Sorbonnes à recirculation

Umluft-Filter-Einhausung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 332.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17242:2018) has been prepared by Technical Committee CEN/TC 332 “Laboratory equipment”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

1 Scope

This document applies to Recirculatory Filtration Fume Cupboards (RFFC).

Recirculation Filtration Fume Cupboards are devices intended to protect their users by means of:

— the ability to contain potentially hazardous materials;

— the ability to remove potentially hazardous materials from air exhausted from within the fume cupboard by means of filtration before the air is recirculated (to the room in which the fume cupboard is located).

This document includes design and manufacturing requirements together with type testing procedures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Fume cupboards — Part 1: Vocabulary*

EN 14175-2, *Fume cupboards — Part 2: Safety and performance requirements*

EN 14175-3, *Fume cupboards — Part 3: Type test methods*

EN 14175-4, *Fume cupboards — Part 4: On-site test methods*

EN 14175-6, *Fume cupboards — Part 6: Variable air volume fume cupboards*

EN 1822-1, *High efficiency air filters (EPA, HEPA and ULPA) — Part 1: Classification, performance testing, marking*

EN ISO 14644-3:2005, *Cleanrooms and associated controlled environments — Part 3: Test methods (ISO 14644-3:2005)*

EN ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration (ISO 14644-1)*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 14175-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
filtration system
assembly of components that are used to remove/trap airborne contaminants

Note 1 to entry: It can be arranged to remove/trap particulates and/or gases/vapours by means of a single filter or a combination of two or more filters.

3.2
filtration fume cupboard
FFC
fume cupboard equipped to remove materials from the exhaust air stream

3.3
recirculation filtration fume cupboard
RFFC
fume cupboard equipped to remove materials from the exhaust air stream before recirculation to the room in which it is located

3.4
gas and vapours filter
filter used to remove vapours or gases from an air stream

Note 1 to entry: It could for example, be an activated carbon filter.

3.5
particulate filter
filter used to remove particulates from an air stream

Note 1 to entry: It could for example, be HEPA filter.

3.6
pre-filter
intial stage of filtration used to remove particulates and/or gases/vapours prior to other components (of a filtration system) having higher removal efficiencies

3.7
limit value
exposure limit of the challenge chemicals

Note 1 to entry: Expressed in 10^{-6} (ppm V) or in mg/m^3.

Note 2 to entry: In this standard the value is the lowest published limit in GESTIS databases.

4 Classification of Recirculatory Filtration Fume Cupboards

The filtration fume cupboard of the present standard has the following 3-part classification:

X (general type of application) / **Y** (filters class) / **Z** (monitoring arrangements)

The details are set out below.

General type of application:

— Class A: RFFCs with integral filters;

— Class B: RFFCs with associated filters.

Filters:

— 1: particulate filter;

— 2: gas and vapour filter;

— 3: particulate and gas and vapour filters;

— 4: other filtration devices or arrangements including those for FFCs having internal, filtered recirculation.

Filter monitoring arrangements:

— 0: no filter condition monitoring arrangements;

— 1: in-built continuous filter condition monitoring arrangements.

EXAMPLE

Examples for the designation of a RFFC with integral particulate and chemical filters and continuous filter conditioning monitoring would be:

Class A / 3 / 1 .

5 Requirements of Recirculation Filtration Fume Cupboards

5.1 General requirements

Filtration fume cupboards shall fulfil the requirements as given in EN 14175-2 with addition of the following chapters.

NOTE In many cases the life and efficiency of filters can be extended by pre-treatment of the extracted air.

5.2 Gas and vapour filtration

The chemicals that can be removed by the filtration system shall be identified by a label carrying the same information as that given to the operator in Clause9 Marking.

For filtration evaluation reference should be made to the GESTIS International Limit Values from which the lowest limit values should be used. When a particular chemical under consideration is not in this list, an individual risk assessment shall be carried out to establish the suitability of filtration fume cupboard.

The filtration system of filtration fume cupboards shall be resistant to chemical agents allowed of being used in the filtration fume cupboards.

The design of the filtration system shall be such that filters can be changed by someone suitably trained without them requiring physical contact with the filter itself. Safe methods of changing filters shall be fully described in the product manual.

The filter installation date and its latest projected replacement date shall be indicated on the front of the FFC or in the fume cupboard log book attached to the fume cupboard manual.

NOTE Back-up gas and vapour filters, located after the primary gas and vapour filter can be requested by regulations, guidelines or recommendation in some countries.

RFFCs of classes A or B shall be submitted to the following tests:

— in the case of filters designed to be used with volatile organic chemicals: two successive types tests shall be made, one with cyclohexane (C_6H_{12}; CAS n°110-82-7) and the other with isopropanol (C_3H_8O; CAS n° 67-63-0). Each test shall be performed with a new filter following the procedure described in 6.2;

— in the case of filters designed to be used with acid vapours: a type test will be carried out with hydrochloric acid (HCl; CAS n° 7647-01-0) following the procedure described in 6.2;

— in the case of filters designed to be used with amines: a type test will be carried out with ammonia (NH_3; CAS n° 7664-41-7) following the procedure described in 6.2;

— in the case of filters designed to be used with formaldehyde: a type test will be carried out with formaldehyde (CH_2O; CAS n° 50-00-0) following the procedure described in 6.2.

The filtration system of RFFCs of classes A and B shall not have a release at the filter or filters exhaust of more than 1 % of the exposure limit value within the adsorption or chemisorption of the minimum quantities (LOW) of chemicals listed in 6.2.

5.3 Particulate filtration

RFFCs of classes A or B equipped with filter systems of type 1 or 3 shall have a particulates filter.

NOTE For example HEPA filters with efficiency H14 at least, as defined in EN 1822-1.

During the life of the filter its pressure drop will increase as it loads. This should be monitored to ensure that manufacture's recommendations are not exceeded.

5.4 Filter monitoring arrangements

5.4.1 Fume cupboards without continuous filter monitoring

Fume cupboards without continuous filter monitoring shall have a procedure for checking the condition of the filter. A sampling port shall be equipped on the fume cupboard in order to allow this routine testing.

NOTE This can include an audible and visual alarm triggered by an adjustable hours run counter that informs the user of the need to perform a routine test of the filters efficiency. The filter replacement interval time will typically be set following a risk assessment.

Particulate filter saturation can be checked with, for example, a manometer or a flow sensor.

Gas and vapour filters can be checked measuring the air quality at the filter exhaust using portable detection equipment such as PID, FID, GC, Colorimetric tubes or similar devises.

5.4.2 Fume cupboards with continuous filter monitoring

Fume cupboards with continuous filter monitoring shall automatically and continuously measure the efficiency of the filtering system.

In case of gas and vapour filters an audible and visual alarm shall inform the user when the concentration at the filter exhaust reaches a level of 1 % of the exposure limit used in the RFFC. When detectors are not able to achieve detection of 1 % of the exposure limit, manufacturer shall clearly inform users about detection limits of embedded sensors in its documentation.

All sensors shall be calibrated to the manufacturer's requirements and recommendations.

EXAMPLE Saturation sensors are: Photoionization sensors; electrochemical sensors; metal oxide array sensor.

In the case of particulates filters a continuous filter monitoring system that detects the degree of loading of the filter shall be installed. The RFFC shall be capable of maintaining the specified design air flow rate as filter element(s) load.

The particulate filter saturation level can be checked by measuring the face velocity at the working opening. If it is lower than any critical value declared in the product manual the filter(s) should be replaced.

NOTE Examples of sensors can include hot wire anemometers and differential manometers.

6 Performance tests for Recirculation Filtration Fume Cupboards

6.1 Test rooms and test conditions for filtration and containment test

The room air temperature shall be (20 ± 2) °C.

The test zone boundary shall extend approx. 1,5 m in front of the fume cupboard and approx. 1,0 m from the outer sidewalls of the cupboard over the full room height.

The air renewal in the test room shall be lower than 0,1 air change per hour during the test.

6.2 Filtration of gases and vapours

6.2.1 Filtration tests for gas and vapour

The RFFC to be tested shall be equipped with a new set of filters and placed into a test room of the dimensions, layout, and, arrangements according to EN 14175-3 with the exception that the ventilation system shall be turned off. Arrangements shall be put in place in order to avoid exposure of the occupants to chemicals used during testing.

The challenge chemicals to be used for the test shall be evaporated within the RFFCs so as to obtain a constant concentration during all operating phases of:

— 200 ppm for the isopropanol test;

— 200 ppm for the cyclohexane test;

— 100 ppm for the hydrochloric acid test;

— 100 ppm for the formaldehyde;

— 100 ppm for ammonia.

For the certified fume cupboard:

— when equipped with specific filter(s) characterised to trap organic solvents, it shall be tested with isopropanol and cyclohexane;

— when equipped with specific filter(s) characterised to trap inorganic acids, it shall be tested with hydrochloric acid;

— when equipped with specific filter(s) characterised to trap ammonia and/or amines, it shall be tested with ammonia;

— when equipped with specific filter(s) characterised to trap formaldehyde and/or other aldehydes, it shall be tested with formaldehyde.

When the tests are carried out they are not necessarily continuous. The test shall be of the minimum of 8 h and if stopped and subsequently restarted they shall be an interval of at least 12 h. This cycle shall be repeated until a chemical breakthrough occurs.

NOTE The total duration of the test will vary, being dependent on the performance characteristics of particular filters.

The chemical agent concentration at the filtration system exhaust shall be measured at least every twenty minutes during the testing period of the RFFC and shall be expressed as ppm.

6.2.2 Analysers and detectors

For gases and vapours the selected analyser shall be capable of resolving less than 1 % of the exposure limit value of the challenge chemical.

NOTE The sampling procedure and analysing methods could be, for example, one of those or other essentially equivalent methods:

— Hydrochloric Acid fume sampling is performed by gas bubbling a known volume of air to be taken (flow rate known, sampling time known) in a buffered $Na_2CO_3/NaHCO_3$ solution. The sample so prepared is then analyzed by ionic chromatography (IC);

— Organic fume sampling (cyclohexane or isopropanol) is performed by trapping a known volume (flow rate known, sampling time known) of air to be taken from an adsorbing cartridge (Tenax or activated carbon). The prepared sample is then desorbed by a disulfide carbon solution (CS_2) before it is analysed by a gas phase chromatograph equipped with an appropriate detector;

— Ammonia: Air contaminated with ammonia can be sampled through solid sorbent tubes pre-treated by sulfuric acid. The sample is desorbed by ammonia free deionized water, and then can be analysed by ionic chromatography;

— Formaldehyde: The detection and analysis of very low concentrations of formaldehyde can present difficulties. 2,4-dinitrophenyldydrazine (DNPH) is, however, known to react with aldehyde. It is therefore possible to sample air contaminated by formaldehyde by passing it through a column of silica gel impregnated with DNPH. After sampling, formaldehyde is desorbed by an acetonitrile/dichloromethane mixture. The final analysis is performed by HPLC. It is highly important to maximize sampling time and flow rate of sampling in order to achieve the requested sensitivity.

6.2.3 Test procedure

Tests shall be performed at a temperature of (20 ± 2) °C and at a relative humidity level between 40 % and 70 %. The temperature and relative humidity of the test room shall be measured and recorded at least every twenty minutes during the testing period of the RFFC.

The device, for example a hot plate, used to evaporate the selected chemical agent shall not increase the temperature in sampling zone 2 by more than 5 °C. The temperature shall be measured and recorded at least every twenty minutes during the testing period of the RFFC.

The challenge chemical used for the test shall be released at the centre of the work surface, no higher than 20 cm from the surface.

The first measurement shall be made at least 30 min after the beginning of the evaporation.

NOTE 1 An example of a suitable evaporation method is given in Figure 2.

It is important to take all necessary precautions during testing to avoid changes in the sample between the sampling zone and the analyser. In particular:

— the tubing material shall be selected to avoid pollution of the air sample or loss of sample by adsorption of the challenge chemical on its surface;

— fittings between tube, analysers, traps and other items shall be arranged to avoid leakage and resulting dilution of the air sample;

— the distance between each probe port and the analyser should be the same in order to avoid different pressure drop in the tubes since these could affect the measurement of chemical concentrations. A potentially suitable arrangement is shown in Figure 1.