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In situ test methods for high efficiency filter systems in industrial facilities

Méthodes d'essai in situ pour les systèmes filtrants à très haute efficacité dans les installations industrielles

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www. iso. org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

This document was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases*.

This corrected version of ISO 16170:2016 incorporates the following corrections.

All figures have been replaced with higher quality diagrams.

In C.3.2 the key and cross-references within the text to Figure C.3 have been corrected.

Introduction

Methods for measuring the performance of high efficiency gas cleaning devices are described in a number of existing standards. These specify procedures for quality assurance following manufacture (e.g. ISO 29463 and EN 1822).

Some other standards specify the filter medium used in such devices, how they are constructed and how they are installed within industrial facilities.

Installations of high efficiency particulate filters are extensively used within nuclear and toxic material processing plants and laboratories to confine these materials within the facility and prevent their discharge to the environment.

Radioactive and other toxic materials are confined within processing facilities inside containment zones bordered by barriers. Air and gases vented from these zones are decontaminated by passage through a series of highly efficient particulate filters before final discharge to the environment. The membrane (filter medium) of the filters acts as part of the containment barrier. In view of its perceived fragility, confirmation of its integrity is required on a periodic basis because operational safety cases depend on the knowledge that the effectiveness of these filters is maintained at all times. These periodic checks are made by the procedure(s) known as “in-situ” or “in-place” testing.

The basic principles of *in situ* tests on installed filters are the same as for laboratory tests, such as those described in EN 1822 and ISO 29463, insofar as known quantities of a challenge aerosol are dispersed into the airstream upstream of the filter installation; the particulate contents of the unfiltered and filtered air are sampled and analysed to determine whether the integrity of the filters has been compromised.

In the case of testing a single unit (manufacturer’s production test or in the case of a laboratory testing on a single filter unit), the purpose is to confirm that the unit performance [efficiency/penetration at Most Penetrating Particle Size (MPPS) and other parameters] lies within specified limits, and further, that the results are globally reproducible. To achieve this requires the use of a laboratory test rig setup with full dispersion of a challenge aerosol, prescribed geometry of the test rig, and to obtain and analyse fully representative particulate samples both upstream and downstream of the test filter. Some ventilation systems are highly complex and it should be noted that many facilities use ventilation systems in which a high percentage of the air is recirculated.

The purpose of an *in situ* test is to detect any adverse change in the filtration performance of the installation and to compare it with the expected efficiency or decontamination factor. Such a change might be caused by deterioration of a unit or units or a faulty sealing system and would be manifested by the appearance of a proportion of unfiltered aerosol in the effluent airstream. Testing methodologies developed in this International Standard do not cover the other requirements that relate to filters in terms of mechanical resistance, burst strength or temperature and moisture resistance.

It is neither fully necessary nor useful for the results of an *in situ* test to replicate the results of production tests on the individual filters in the installation, nor is it necessary to confine the test aerosol size distribution to one which replicates that used in production tests.

No International Standard for general *in situ* testing of high efficiency filters has been produced before, explaining the needs for such an International Standard.

This International Standard describes the requirements for test equipment, data interpretation and reporting for the *in situ* testing of HEPA and ULPA air cleaning installations designed for the removal of airborne particulate contamination in high-integrity ventilation systems.

This International Standard includes specification of the test interval, aerosol type, aerosol mixing and measurement methods, i.e. the following:

— aerosol: solid or liquid, monodisperse or polydisperse;

— mixing: degree of mixing, mixing lengths, etc.;

— method: injection, detection.

This International Standard proposes an outline testing philosophy to highlight the following:

— principle of the method;

— prerequisites;

— preparatory conditions;

— injected aerosol properties;

— qualification and selection of measuring devices;

— qualification of test personnel;

— test setup;

— test sequence;

— evaluation and reporting.

