SLOVENSKI STANDARD
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Zračni filtrski sistemi rotacijskih strojev - Preskusne metode - 1. del: Statični filtrski elementi (ISO/DIS 29461-1:2010)

Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements (ISO/DIS 29461-1:2010)

Prüfmethoden für Luftfiltereinlasssysteme von Rotationsmaschinen und stationäre Verbrennungsmaschinen - Teil 1: Testmethoden und Klassifizierung von statischen Filterelementen (ISO/DIS 29461-1:2010)

Systèmes de filtration d'air d'admission pour machines tournantes - Méthodes d'essai - Partie 1: Éléments filtrants pour filtres statiques (ISO/DIS 29461-1:2010)

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Air intake filter systems for rotary machinery - Test methods - Part 1: Static filter elements (ISO/DIS 29461-1:2010)

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This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 195.

If this draft becomes a European Standard, 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.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (prEN ISO 29461-1:2010) has been prepared by Technical Committee ISO/TC 142 "Cleaning equipment for air and other gases" in collaboration with Technical Committee CEN/TC 195 “Air filters for general air cleaning” the secretariat of which is held by UNI.

This document is currently submitted to the parallel Enquiry.

Endorsement notice

The text of ISO/DIS 29461-1:2010 has been approved by CEN as a prEN ISO 29461-1:2010 without any modification.

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Air intake filter systems for rotary machinery — Test methods —

Part 1:
Static filter elements

Systèmes de filtration d'air d'admission pour machines tournantes — Méthodes d'essai —

Partie 1: Éléments filtrants pour filtres statiques

ICS 29.160.99

ISO/CEN PARALLEL PROCESSING
This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO-lead** mode of collaboration as defined in the Vienna Agreement. This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five-month enquiry. Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 29461-1 was prepared by Technical Committee ISO/TC 142, *Cleaning Equipment for Air and other Gases*.

ISO 29461 consists of the following parts, under the general title *Air intake filter systems for rotary machinery — Test methods*:

— *Part 1: Static filter elements*

— *Part 2: Cleanable (Pulse jet) and surface loading filters*

— *Part 3: Mechanical integrity of filter elements*

— *Part 4: In-situ testing*

— *Part 5: Marine and Offshore environment filter systems*

The test method concerning particle efficiency, pressure drop and reported values are the same for all filters, except for loading characteristics and cleaning procedure that is different for cleanable surface loading filters (Part 2). The third part, Part 3 is describing how to test the mechanical integrity of filters at various conditions that may be of interest in certain operating environments. Part 4 describes methods of testing filters in real operating conditions (In- situ testing) and part 5 is covering test methods for the specific requirement of offshore and Marine application and provides the sea salt removal efficiency of individual filters and / or complete filter systems.

This part of the ISO - standard “Air intake filter systems for rotary machinery — Test methods — Part 1: Static filter elements”, is describing the test methods of static filter units, typically of the depth loading type, see definitions, 3.43 and 3.44. All filters can be tested in the same manner to get results that are possible to compare. However, for surface loading filters, reverse pulse filters, Marine and offshore filter systems as well as other filter systems that are not regarded as static filter units the part 2 shall be used.

For multi-stage systems that are using a number of components (cleaning equipment, filters etc.) this standard can be used as long as the qualification of the test rig is acceptable. This means that connections and additional ducting that may be needed to connect the air cleaning system to the test duct must be implemented so the qualification requirements are fulfilled. This may be difficult depending on the size and the technical solution of the system to be tested. In cases where it is not possible to make the adjustments in such way that the qualification of the test duct is acceptable it is suggested to instead use the part 4 – In-situ testing.

Annexes A and D and E form a normative part of this standard.

Annexes B and C are for information only.

Introduction

Filters in power generating/compressor applications

In rotating machinery applications, the filtering system, typically a set of filter elements arranged in a suitable manner, are an important part of the whole turbine/compressor system. The development of turbine machinery used for energy production or others has led to more sophisticated equipment and therefore the importance of good protection of these systems has become more important in the recent years. It is known that particulate contamination can deteriorate a turbine power system quite substantially if not taken care of. This event is often described as “erosion” - “fouling” and “hot corrosion” where salt and other corrosive particles are known as potential problems. Other particle matters may also cause significant reduction of efficiency of the systems. It is important to understand that air filter devices in such systems are located in various environmental conditions. The range of climate and particle contamination is very wide, ranging from deserts to humid rain forests to arctic environments. The requirements on these filter system are obviously different depending on where they will be operating.

This standard has based the performance of the air intake filter systems not only upon heavy dust collection but also particulate efficiency in a size range that is considered to be the problematic area for these applications. Both ultra-fine and fine particles, as well as larger particles should be considered when evaluating turbine fouling. In typical outdoor air, ultra-fine and fine particles in the size range from 0,01 to 1 µm are contributing to > 99% of the number concentration and to > 90% of the surface contamination. The majority of the mass normally comes from larger particles (> 1,0 µm).

Turbo-machinery filters, comprises a wide range of products from filters for very coarse particles to filters for very fine, sub-micron particles. The range of products varies from self-cleaning to depth and/or surface loading systems. The filters and the systems have to withstand a wide temperature and humidity range, very low to very high dust concentration and mechanical stress. The shape of products existing today can be of many different types and have different functions such as droplet separators, coalescing products, filter pads, metal filters, inertial filters, filter cells, bag filters, panel-type, self-cleanable and depth loading filter cartridges and pleated media surface filter elements.

The series of standards will provide a way to compare these products in a similar way and define what criteria are important for air filter intake systems for rotary machinery performance protection. The performance of products in this broad range must be compared in a good manner. Comparing different filters and filter types must be done with respect to the operating conditions they finally will be used in. For instance, if a filter or a filter system is meant to operate in an extreme, very dusty environment the real efficiency of such filter is indicated by the initial and final efficiency, where the dust loading of the filter plays an important role. On the other hand, if the same filter or system is placed in a more common environment where the majority of particles in the air are small and originating from combustion etc., the “conditioned” efficiency would be the important performance factor to look at.

Filtration characteristics

Initiatives to address the potential problems of particle re-entrainment, shedding and the in-service charge neutralisation characteristics of certain types of media have been included in Annexes A and B.

Certain types of filter media rely on electrostatic effects to achieve high efficiencies at low resistance to air flow. Exposure to some types of challenge, such as combustion particles or other fine particles may inhibit such charges with the result that filter performance suffers. The normative test procedure, described in Annex A, provides techniques for identifying this type of behaviour. This procedure is used to determine whether the filter efficiency is dependent on the electrostatic removal mechanism and to provide quantitative information about the importance of the electrostatic removal. The procedure was selected because it is well established, reproducible, it is easy to perform, relatively fast and because an acceptable alternative procedure is not available.

In an ideal filtration process, each particle would be permanently arrested at the first contact with a filter fibre, but incoming particles may impact on a captured particle and dislodge it into the air stream. Fibres or particles from the filter itself could also be released, due to mechanical forces. From the user's point of view it might be important to know this, see Annex B.

Filters with a low initial or conditioned efficiency (< 35%) for sub-micron particles (0,4 µm) that does not increase their efficiency during the operation, will typically not provide any major protection for the operating machinery when challenged with typical atmospheric aerosols where the majority of particles are smaller than 1,0 µm. However, in some cases with aerosols having a dominant fraction of coarse particles, filters with low efficiencies at sub-micron particles can serve as a protection for later filter stages and can also have a higher average efficiency (f. ex surface loading filters) at 0,4 µm due to the dust loading. Therefore a gravimetric test can provide some information about capacity and efficiency for those aerosols. In general, a lower total filtration level than 35% at 0,4 µm should not be recommended for an air intake filter system for rotary machinery when the aerosol loading of the filters are not contributing to a significant increase of the efficiency during the operation.

Air intake filter systems for rotary machinery — Test methods —

Part 1:
Static filter elements

1 Scope

This standard covers methods on how to test air filters and air filter intake systems for rotary machinery like gas turbines, compressors and for stationary internal combustion engines against particle contamination. The envelope for testing is in the range of 0,25 m^3/s (900 m^3/h) up to 1,67 m^3/s (6000 m^3/h).This international standard applies to air filters having an initial efficiency up to 99,5% with respect to 0,4 μm particles. Filters in the higher end and above 99,95% initial efficiency are tested and classified according to other standards.

This part (part 1) of the standard refers to static (barrier) filter systems but can be applied to other filter types and systems when applicable. Two methods of determining the efficiency are used in this standard:

- Particle efficiency (efficiency measured in respect to particle number and size)
- Gravimetric efficiency (The weighted mass removal of loading dust).

Also a flat sheet media sample or media pack sample - from an identically - filter shall be conditioned (discharged) to provide information about the intensity of the electrostatic removal mechanism. After determination of its initial efficiency the untreated filter is loaded with dust in steps until its final test pressure drop is reached. Information on the loaded performance of the filter is then obtained.

The performance results obtained in accordance with this standard cannot be quantitatively applied (by themselves) to predict performance in service with regard to efficiency and lifetime. Other factors influencing performance to be taken into account are described in Annex A, D (normative) and Annex B, C (informative).

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.

ASHRAE 52.2:1999, *Method of testing general ventilation air-cleaning devices for removal efficiency by particle size*

EN 779:2002, *Particulate air filters for general ventilation – Determination of the filtration performance*

EN1822 - 2007, *HEPA and ULPA filters*

IEST – RP – CC001.4, *HEPA and ULPA filters*

ISO 5167:2003, *Measurement of fluid flow by means of pressure differential devices - Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full (ISO 5167-1:1991).*

IEST-RP-014:2006, *Equipment calibration or validation procedure*

ISO 2854, *Statistical interpretation of data - Techniques of estimation and tests relating to means and variances.*

ISO 12103-1:1997, *Road vehicles - Test dust for filter evaluation - Part 1: Arizona test dust.*

ISO 14644-3:2005, *Metrology & Test Methods.*

ISO 21501-4 *Determination of particle size distribution – Single particle light-interaction methods - Part 4: Light scattering airborne particle counter for clean spaces.*

