SLOVENSKI STANDARD
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Zračni filtrski sistemi rotacijskih strojev - Preskusne metode - 3. del: Mehanska celovitost filtrskih elementov (ISO/DIS 29461-3:2023)

Air filter intake systems for rotary machinery - Test methods - Part 3: Mechanical integrity of filter elements (ISO/DIS 29461-3:2023)

Ansaugfiltersysteme von Rotationsmaschinen - Prüfverfahren - Teil 3: Mechanische Unversehrtheit der Filterelemente (ISO/DIS 29461-3:2023)

Systèmes de filtration d'air d'admission pour machines tournantes - Méthodes d'essai - Partie 3: Intégrité mécanique des éléments filtrants (ISO/DIS 29461-3:2023)

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Air filter intake systems for rotary machinery — Test methods —

Part 3:
Mechanical integrity of filter elements

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

Partie 3: Intégrité mécanique des éléments filtrants

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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.

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 142, *Cleaning equipment for air and other gases,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 195, *Air filters for general air cleaning,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 29461 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In rotating machinery applications, the filtering system, typically a set of filter elements arranged in a suitable manner, is 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 effective 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 process is often described as “erosion”, “fouling” and “hot corrosion” where salt and other corrosive particles are known as potential problems. Other particulate 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 particulate contamination is very wide, ranging from deserts to humid rain forests to arctic environments. The requirements on these filter systems are obviously different depending on where they are operated.

This document 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 field 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 results from larger particles (> 1,0 µm).

Turbo-machinery filters, comprises a wide range of products, ranging from filters preventing from coarse particles to filters for very fine and even sub-micron particles. The range of products varies from self-cleaning to depth and 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 filters, self-cleanable and depth loading filter cartridges or pleated media surface filter elements.

This series of standards will provide a way to compare these products in a standardized way and define the criteria important for air filter intake systems for rotary machinery performance protection. The performance of products in this broad range must be compared according to a standardized procedure. Comparing different filters and filter types must be done with respect to the overall conditions they finally operate in.

If a filter or a filter system is meant to operate in an extreme, very dusty environment the real particulate efficiency of this filter cannot be predicted since the dust loading of the filter becomes important.

In an ideal filtration process, each particle would be permanently arrested at its first contact with a media fibre, but incoming particles may impact on a captured particle and detach it into the air stream. Fibres or particles from the filter itself could also be released, due to mechanical forces.

Another worst-case scenario in abnormal operating environments which leads to unusual high pressure drops is the burst or damage of the filter element accompanied with a sudden release of parts of the filter element or high amounts of dust captured.

Part 3 will provide methods to determine the mechanical integrity of filters under defined conditions that may be encountered in abnormal operating environments.

This part of ISO 29461 describes the test methods for filter units, independent of any ageing procedures like pulsing, loading, temperature cycles, wet conditions or others.

For multi-stage systems which use a number of components (e.g. equipment for cleaning, filters), each filter element has to be tested separately.

Air filter intake systems for rotary machinery — Test methods —

Part 3: Mechanical integrity of filter elements

1 Scope

ISO 29461 specifies methods and procedures to determine the performance of particulate air filters used in air intake filter systems for rotary machinery such as gas turbines, compressors and other internal combustion engines.

The ISO 29461-3 specifies a method and procedure to test the mechanical integrity ("Burst Test") of individual filter elements up to an abnormal final test pressure drop of maximum 6 250 Pa. Any other customer defined final pressure drop up to a higher pressure drop shall be reported as variation from the standard. Nevertheless, it is within the ability of the user to define the maximum possible value (lower or higher) for a certain application and to define the burst strength requirements for this test procedure. As the pressure drops under typical operating conditions are on a much lower level, it is not intended to specify a final pressure drop for any application within this procedure.

This procedure is intended for all types of filter elements (e.g. V-bank cassette filters or filter cartridges) used in the final stage(s) of an Air Intake Filter Systems for Rotary Machinery in various environmental conditions, as e.g. in marine applications. These filters are operating at flow rates within the range of 0,24 m^3/s (850 m^3/h) up to 2,36 m^3/s (8 500 m^3/h), no matter if used in a static or pulse cleaned air intake system.

Note It should be considered that the pressure drop increase versus dust loading of filter elements with lower efficiencies (e.g. not the final stage(s) of the filter system) is relatively low and can lead to protracted test durations. The user should define the filter stage(s) relevant to withstand abnormal high pressure drops in application.

Filter elements with a lower efficiency than ISO T5 (ePM_{10}) according to ISO 29461-1 are excluded.

As a standard to ensure the comparability of the test results only new filter elements or those loaded up to 625 Pa or maximum 800 Pa according to ISO 29461-1 shall be tested.

In general, it is possible to use this procedure also after any previous ageing procedure if it is clearly described as a variation from the standard test procedure. An ageing procedure is defined as an appropriate customer defined durability test which can affect the stability of media, adhesives, construction etc. and is important for the evaluation at its real application. Test results of filter elements after different ageing procedures may not be quantitively compared.

Examples of conditioning are:

— Climatic conditioning at high or low temperatures and/or defined relative humidity levels

— Wet conditions with water droplets or condensing water over a defined time period

— Any kind of dust loading and pulsing procedure over a certain duration or number of pulses

— Operation at real conditions etc.

The "Burst Test" itself is considered as an independent procedure to evaluate the integrity of a filter element to resist a defined high pressure drop without collapsing, losing or releasing any parts of its construction into the downstream while keeping its filtration efficiency.

The ISO 29461-3 does not describe a standardized method to measure the fractional or gravimetric efficiency. It is recommended to test the efficiency of the filter element according to ISO 29461-1.

The performance results obtained in accordance with this standard cannot be quantitatively applied (by themselves) to predict performance in real use[1)]. The test procedure does not include methods for the direct measurement of the performance of entire systems as installed, e.g. systems with use of multiple stages of coarse and fine filter elements.

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.

ISO 5167 (all parts), *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduit running full*

ISO 5011, *Inlet air cleaning equipment for internal combustion engines and compressors — Performance testing*

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

ISO 16890-2:2022, *Air filters for general ventilation — Part 2: Measurement of fractional efficiency and air flow resistance*

ISO 16890-3, *Air filters for general ventilation — Part 3: Determination of the gravimetric efficiency and the air flow resistance versus the mass of test dust captured*

ISO 29461-1, *Air intake filter systems for rotary machinery — Test methods — Part 1: Static filter elements*

ISO 29461-2, *Air intake filter systems for rotary machinery — Test methods — Part 2: Filter element endurance test in fog and mist environments*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

Terms and definitions for different filter classes can be found in ISO 29461-1

3.1 Test parameter

3.1.1
air flow rate
volume of air flowing through the filter per unit time

[SOURCE: ISO 29464:2017; 3.1.24]

1) For example may a damaged, vertically installed pulse-jet filter perform differently in real operation conditions compared to what can be detected by a horizontal, non-pulsing test as described in this document.

3.1.2
rated flow
flow rate through a test device, either as stated by the manufacturer for defined conditions of use, or as agreed between the interested parties for a particular installation

Note 1 to entry: the manufacturer's rated flow may differ from the test air flow rate.

[SOURCE: ISO 29464:2017; 3.1.27]

3.1.3
test airflow rate
volumetric air flow rate used for testing

[SOURCE: ISO 29464:2017; 3.3.2]

3.1.4
pressure drop
difference in absolute (static) pressure between two points in a system

Note 1 to entry: resistance to air flow is measured in Pa.

[SOURCE: ISO 29464:2017; 3.1.36]

3.1.5
initial pressure drop
pressure drop of the clean filter operating at the test airflow rate

[SOURCE: ISO 29464:2017; 3.3.17]

3.1.6
initial test pressure drop
pressure drop of the filter element operating at the test airflow rate at start of the test

3.1.7
final pressure drop
maximum test pressure drop of the filter specified by the requestor of the test

3.1.8
final test pressure drop
maximum operating pressure drop of the filter to terminate the test as recommended at rated airflow

3.2 Filter to be tested

3.2.1
filter to be tested / test filter
filter element to be tested

3.2.2
filter element
structure made of the filtering material, its supports and its interfaces with the filter housing

[SOURCE: ISO 29464:2017; 3.2.77]

3.2.3
upstream, U/S
area or region from which fluid flows as it enters the test device

[SOURCE: ISO 29464:2017; 3.1.39]