SLOVENSKI STANDARD
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Zračni filtrski sistemi rotacijskih strojev - Preskusne metode - 7. del: Preskus vzdržljivosti filtrskih elementov v okolju z meglo in sparino (ISO/DIS 29461-7:2021)

Air filter intake systems for rotary machinery - Test methods - Part 7: Filter element endurance test in fog and mist environments (ISO/DIS 29461-7:2021)

Systèmes de filtration d'air d'admission pour machines tournantes - Méthodes d'essai - Partie 7: Essai d'endurance d'élément filtrant en brouillard et environnement brumeux (ISO/DIS 29461-7:2021)

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Air intake filter systems for rotary machinery — Test methods —

Part 7:
Filter element endurance test in fog and mist environments

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

Partie 7: Essai d'endurance d'élément filtrant en brouillard et environnement brumeux

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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.*

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

ISO 29461 series of standards will provide a way to compare these products in a similar method and define what criteria are important for air intake filter 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.

Air intake filter system of rotary machinery is an important part of the whole gas turbine and air compressor systems. It usually consists of filter elements with a suitable way to be installed. The operating environment of rotary machinery including gas turbine and compressor and their air intake filtration units are complicated and challenging. Air filters intercept water mist and droplets when air pass through the air filter unit in case the equipment is working in rainy, fog, haze or other high humidity environment or local production environment which contains large amount of water vapour, for example the cooling tower. If excessive water holds up, the performance of filters may be affected, pressure drop raises up rapidly, even causes shut down in severe cases.

Reliability and non-break down operation of rotary machinery is regarded as top priority for end user, the pressure drop raises up rapidly in high humidity conditions is usually their main concern. There are rotary machinery operating accidents caused by high humidity conditions all over the world, no matter it's inland or along the river or coastal.

To meet the requirements of production and operation, water endurance performance of air filter elements shall be considered besides assessing the performance of initial pressure drop, filtration efficiency and dust-holding capacity, especially the air filter elements are used in high-humidity environments or intake air contains a large quantity of liquid droplets.

This document provides a water endurance test method for filter elements and can be used for evaluating performance variation trend of filter elements when encounter water and fog. This standard can be used for:

— product development for filter manufacturers;

— supplier selection for end users;

— development of water endurance media by media manufacturers.

This document provides a repeatable, easy to conduct and economic test method, which shall be applied for pulse-jet cleaning filter elements, and also for filter elements for general ventilation.

Air intake filter systems for rotary machinery — Test methods —

Part 7: Filter element endurance test in fog and mist environments

1 Scope

This part of ISO 29461 specifies general test requirements, test rig and equipment, test materials, test procedure and report for determining water endurance performance of air filter elements used in air intake filter systems for rotary machinery such as stationary gas turbines, compressors and other stationary internal combustion engines.

The test evaluates water endurance performance of air filter elements under laboratory conditions. The performance results obtained in accordance with this part of ISO 29461 cannot be quantitatively applied (by themselves) to predict performance in service with regard to water endurance and lifetime.

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 29464:2017, *Cleaning of air and other gases — Terminology*

ISO 16890-2:2016, *Air filters for general ventilation — Part 2: Measurement of fractional efficiency and air flow resistance*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24964 and the following 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/

3.1 Air flow and pressure drop

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

[SOURCE: ISO 29464:2017, 3.1.24]

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

[SOURCE: ISO 29464:2017, 3.1.27]

3.1.3
test air flow rate
volumetric airflow rate used for testing

[SOURCE: ISO 29464:2017, 3.3.2]

3.1.4
pressure drop
pressure differential across the filter element at the test airflow rate

[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
final test pressure drop
maximum pressure drop of the filter up to which the filtration performance is measured

[SOURCE: ISO 29464:2017, 3.3.15]

3.1.7
final test pressure drop recommended
maximum operating pressure drop of the filter to terminate the test as recommended at rated airflow

3.2 Filters

3.2.1
test device
filter element being subjected to performance testing

[SOURCE: ISO 29464:2017, 3.1.38]

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]

3.2.4
downstream
D/S
area or region into which fluid flows on leaving the test device

[SOURCE: ISO 29464:2017, 3.1.11]

3.2.5
static filter
air filter that will be removed (exchanged) after it has reached its final test pressure drop and that is not cleaned with jet pulse or other means in order to fully, or partially, retrieve its initial performance (pressure drop and efficiency)

[SOURCE: ISO 29464:2017, 3.3.12]

3.2.6
pulse-jet filter
cleanable air filter, that typically is cleaned with air jet pulse to provide a longer service life

[SOURCE: ISO 29464:2017, 3.3.11]

3.3
test duration
period of reaching a certain pressure drop or other termination conditions to end the test

3.4 Test materials

3.4.1
water fog
water droplets and mist generated by water spray device

3.4.2
saturated air
air that contains the maximum amount of water vapour it can hold at its temperature and pressure

3.4.3
water fog mass concentration
mass of liquid water droplets per unit volume of air

4 Symbols and abbreviated terms

For the application of this document, the following symbols and abbreviated terms apply.

c_{wm}	water fog mass concentration, g/m^3
d	saturated wet air moisture content, g/kg
d_0	ambient air moisture content, g/kg
m_p	water mass penetrated through tested filter at the end of test, kg
m_{tot}	total water fog generation amount, kg
m_u	sedimentary water mass upstream of filter, kg
m_{wm}	total water fog generation amount per hour, kg/h
$m_{wm,\ 1}$	water fog generation amount per hour at saturated humidifying air, kg/h
$m_{wm,\ 2}$	water fog generation amount per hour, kg/h
p	atmospheric pressure, Pa
p_a	absolute air pressure upstream of filter, Pa
p_w	partial vapour pressure of water in air, Pa

p_{ws}	saturated vapour pressure of humidifying air, Pa
q_v	volumetric flow of non-humidifying air, m^3/h
t_d	temperature downstream of filter, °C
t_0	dry bulb temperature of ambient air, °C
t_u	temperature upstream of filter, °C
t_{wb}	wet bulb temperature of ambient air, °C
T	testing time, min
T_{tot}	total testing time, min
Δp_b	filter initial pressure drop at the test airflow rate, Pa
Δp_f	filter final test pressure drop at the test airflow rate, Pa
Δp_T	filter pressure drop at the test airflow rate at the T time after spraying, Pa
η_p	water penetration ratio
ρ	ambient air density, kg/m^3
ρ_a	air density upstream of filter, kg/m^3
ρ_s	saturated wet air density, kg/m^3
φ	relative humidity, %
φ_u	relative humidity upstream of filter, %
φ_d	relative humidity downstream of filter, %
DEHS	liquid (DiEthylHexylSebacate) used for generating the DEHS test aerosol
ISO	International Organization for Standardization

5 General requirements

Air filter systems normally use multiple stages of coarse and fine filter elements to protect the machinery. The scope of this part of ISO 29461 includes methods for water endurance test of individual filter elements. It does not include methods for the direct measurement of the performance of entire systems as installed in service except in cases where they can meet the qualification criteria for the test assembly.

The test client can refer to the test results to rank the water endurance performance of multiple candidate filters.

6 Test condition

6.1 Test air

Room air or outdoor air is used as the test air source. The air temperature shall be in the range of 10 °C to 38 °C (before wet equilibrium pretreatment). The exhaust flow shall be discharged outdoors, indoors or re-circulated. Filtration of the exhaust flow is recommended when test aerosol or loading dust may be present.