

# SLOVENSKI STANDARD oSIST prEN ISO 29461-7:2021

01-september-2021

# 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)

# iTeh STANDARD PREVIEW

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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Other standards related to rotating machinery

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en,fr,de

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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/DIS 29461-7:2021(E)

Page

Intro	duction		<b>v</b>	
1	Scope		1	
2	Norm	ative references	1	
3	Terms	s and definitions		
4	Symbo	ols and abbreviated terms		
5	Gener	al requirements		
6	Test condition			
U I	6.1	Test air	4	
	6.2	Test water	5	
7	Test rig and equipment			
	7.1	Test rig	5	
	7.2	Water spray device	6	
	7.3	Humidifying device	6	
	7.4	water collecting groove	6	
8	Qualification of test rig and apparatus			
	8.1	Ainter a system test	6	
	8.Z 9.2	Air relocity uniformity in the test duct	6	
	0.3 8.4	Pressure drop of test duct with no test filter installed	0 6	
	8.5	Stability of wet environment		
	8.6	Water fog concentration and sedimentation check	7	
	8.7	Water tightness test with no test filter installed 5760-4d48-366	7	
	8.8	Water droplets size distributions	7	
	8.9	Summary of qualification requirements		
	8.10	Apparatus maintenance	8	
9	Test procedure			
	9.1	Preparation of filter to be tested	8	
	9.2	Initial pressure drop	9	
	9.3	Test procedure for water endurance performance of filter elements	9	
		9.3.1 General	9	
		9.3.3 Water fog test	9	
	9.4	Water penetration ratio		
10	Test r	enort	10	
10	10.1	General		
	10.2	Interpretation of test reports		
	10.3	Summaries of test results		
	10.4	Water fog mass and pressure drop		
	10.5	Marking	12	
Annex	<b>x A</b> (info	ormative) Resistance to air flow and water generation mass calculation		
Annex	<b>x B</b> (info	ormative) Water endurance test for vertical installed air filters	14	
Annex	<b>x C</b> (info	ormative) Water endurance of air filter elements without wet equilibrium		
	pretre	eatment		
Annex	<b>x D</b> (nor	mative) Water penetration ratio test		
Annex	<b>x E</b> (info	ormative) Leak detection and first water droplet detection procedure		
Annex	<b>x F</b> (info	ormative) Examples of completed test reports		

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# Foreword

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

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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 <u>www.iso.org/members.html</u>.

# 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.

(standards.iteh.ai) 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:

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- product development for filter manufacturers;<sup>so-29461-7-2021</sup>
- 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.

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# 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.

# iTeh STANDARD PREVIEW

# 2 Normative references (standards.iteh.ai)

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 <u>https://www.iso.org/obp</u>
- IEC Electropedia: available at <u>https://www.electropedia.org/</u>

# 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]

# ISO/DIS 29461-7:2021(E)

# 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

#### iTeh STANDARD PREVIEW final test pressure drop

maximum pressure drop of the filter up to which the filtration performance is measured (standards.iten.ai)

[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

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#### 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 iTeh STANDARD PREVIEW 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

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#### Symbols and abbreviated terms 4

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

c <sub>wm</sub>	water fog mass concentration, g/m <sup>3</sup>
d	saturated wet air moisture content, g/kg
$d_0$	ambient air moisture content, g/kg
m <sub>p</sub>	water mass penetrated through tested filter at the end of test, kg
m <sub>tot</sub>	total water fog generation amount, kg
m <sub>u</sub>	sedimentary water mass upstream of filter, kg
m <sub>wm</sub>	total water fog generation amount per hour, kg/h
m <sub>wm, 1</sub>	water fog generation amount per hour at saturated humidifying air, kg/h
m <sub>wm, 2</sub>	water fog generation amount per hour, kg/h
р	atmospheric pressure, Pa
p <sub>a</sub>	absolute air pressure upstream of filter, Pa
$p_{\rm w}$	partial vapour pressure of water in air, Pa

# oSIST prEN ISO 29461-7:2021

# ISO/DIS 29461-7:2021(E)

$p_{\rm ws}$	saturated vapour pressure of humidifying air, Pa
$q_{\rm v}$	volumetric flow of non-humidifying air, m <sup>3</sup> /h
t <sub>d</sub>	temperature downstream of filter, °C
$t_0$	dry bulb temperature of ambient air, °C
t <sub>u</sub>	temperature upstream of filter, °C
t <sub>wb</sub>	wet bulb temperature of ambient air, °C
Т	testing time, min
T <sub>tot</sub>	total testing time, min
$\Delta p_{\mathrm{b}}$	filter initial pressure drop at the test airflow rate, Pa
$\Delta p_{\mathrm{f}}$	filter final test pressure drop at the test airflow rate, Pa
$\Delta p_{\mathrm{T}}$	filter pressure drop at the test airflow rate at the <i>T</i> time after spraying, Pa
$\eta_{ m p}$	water penetration ratio
ρ	ambient air density, kg/ m <sup>3</sup>
ρ <sub>a</sub>	air density upstream of filter, kg/m³ DARD PREVIEW
$ ho_{s}$	saturated wet air density, kgmandards.iteh.ai)
arphi	relative humidity, % oSIST prEN ISO 29461-7:2021
$\varphi_{\mathrm{u}}$	relative humidity upstread ion filter, %/standards/sist/1f0e99f1-57b0-4d48-a366- eaae4cc7b2cf/osist-pren-iso-29461-7-2021
$\varphi_{\rm d}$	relative humidity downstream of filter, %
DEHS	liquid (DiEthylHexylSebacate) used for generating the DEHS test aerosol
ISO	International Organization for Standardization

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#### **General requirements** 5

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.

#### **Test condition** 6

# 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.