INTERNATIONAL STANDARD

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Filters for compressed air — Methods of test —

Part 4: **Water**

Filtres pour air comprimé — Méthodes d'essai —

Partie 4: Eau

Reference number
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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 12500-4 was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 4, *Quality of compressed air*.

ISO 12500 consists of the following parts, under the general title *Filters for compressed air — Test methods*:

— *Part 1: Oil aerosols*

— *Part 2: Oil vapours*

— *Part 3: Particulates*

— *Part 4: Water*

Introduction

Water is a typical contaminant found in compressed air streams. Water-removal devices are designed to remove water from compressed air.

The most important performance characteristics are the ability of the water-removal devices to remove water from the air stream and the amount of pressure drop resulting from the process.

This part of ISO 12500 provides a means of comparing the performance of water removal devices.

Filters for compressed air — Methods of test —

Part 4: Water

1 Scope

The test method described in this part of ISO 12500 is designed to determine the water-removal efficiency and operational pressure drop of any device designed for water removal from compressed air described as wall flow in accordance with ISO 8573-2.

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.

ISO 1219-1:2006, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 5598, *Fluid power systems and components — Vocabulary*

ISO 8573-1:2001, *Compressed air — Part 1: Contaminants and purity classes*

ISO 8573-2, *Compressed air — Part 2: Test methods for oil aerosol content*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8573-1 and ISO 5598 apply.

4 Units and symbols

General use of SI units (Système international d'unités; see ISO 1000) as given throughout this International Standard is recommended. However, in agreement with accepted practice in the pneumatic field, some non-preferred SI units, accepted by ISO as a duel reference, are also used.

1 bar = 100 000 Pa

NOTE bar(e) is used to indicate effective pressure above atmospheric.

1 L (litre) = 0,001 m^3.

Symbols used are generally in accordance with ISO 1219-1.

5 Reference conditions

The reference conditions for gas volumes shall be as follows:

air temperature	20 °C;
absolute air pressure	100 kPa (1 bar) (a);
relative water vapour pressure	0.

6 Standard rating parameter

The standard rating parameters are as given in Table 1.

Table 1 — Standard rating parameters

Reporting parameters	Units SI (USC)	Rating conditions	Maintain within actual gauge value	Instrument accuracy
Inlet temperature	°C	20	± 5 °C	± 2 °C
Inlet pressure	kPa (bar) (e)	700 (7)	± 10 kPa (0,1 bar)	± 10k Pa (0,1 bar)
Injected water per air flow	ml/min per L/s	2	± 0,2 ml/min per L/s	Not applicable
Ambient temperature	°C	20	± 5 °C	± 2 °C
Air flow for testing	L/s	25 %, 50 %, 75 % 100 % 125 % of rated flow	± 2%	± 4 % of gauge reading
Pressure drop	Pa (mbar)	Not applicable	Not applicable	± 10 % of gauge reading
Minimum compressed air purity	3 6 3; see ISO 8573-1:2001			
NOTE The reference conditions are as given in Clause 5.				

The preferred test pressure is 700 kPa (7 bar)(e).

Where the manufacturers' maximum pressure rating is higher than 700 kPa (7 bar)(e), use 700 kPa (7 bar)(e) as the test pressure and recalculate the flow as the test flow, q_{test}, expressed in litres per second, for the test conditions given in Table 1 according to Equation (1);

$$q_{\text{test}} = Z_{\text{pr}}\, q_{\text{rated}} \left(\frac{p_{\text{test}} + 100}{p_{\text{rated}} + 100} \right) \tag{1}$$

where

Z_{pr} is the compressibility factor of air at rated pressure and 20 °C;

q_{rated} is the rated flow at the manufacturer’s rated pressure, expressed in litres per second;

p_{test} is test pressure, expressed in kPa (e);

p_{rated} is the manufacturer’s rated pressure, expressed in kPa (e).

Where there is insufficient flow capacity to satisfy the flow rating at standard pressure, the test pressure can be reduced using Equation (1) until the test flow is within the available flow capacity.

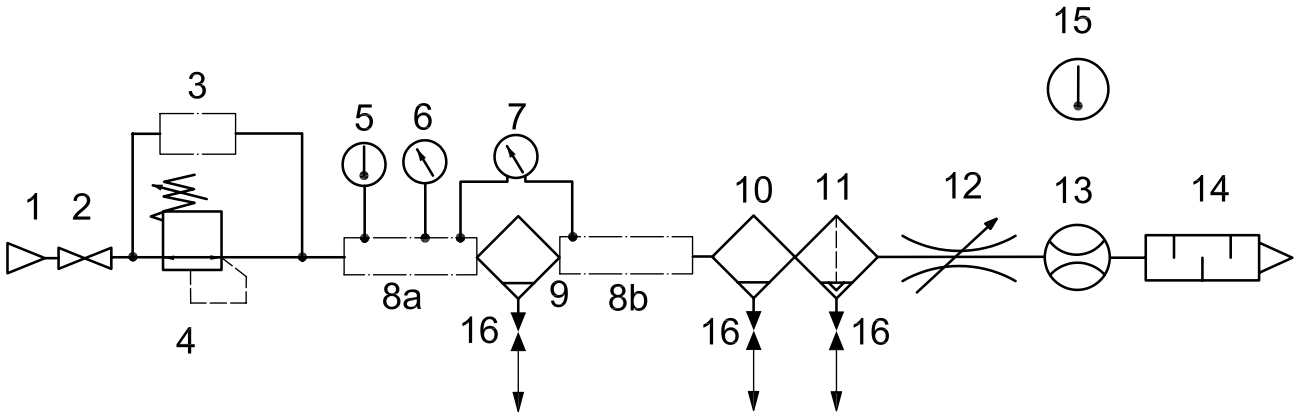
If the rated flow is not specified, it shall be taken from Table 2.

Table 2 — Test Flow at rated conditions

Supply pressure kPa (bar)	Port size								
	$^1/_8$	¼	$^3/_8$	½	¾	1	1 ¼	1 ½	2
	Flow rate, L/s								
700 (7,0)	2,7	6,3	13,9	25,8	38,7	72	147	223	431

7 Test equipment arrangement

Assemble the device being tested as shown in Figure 1.



Key

1	compressed air source[a]	9	water-removal device under test
2	full-flow ball valve	10	downstream water separator (optional)
3	water injection apparatus[b] (see Annex A)	11	high-efficiency coalescing filter (recommended)
4	pressure reducing valve[b]	12	multi-turn flow control valve
5	temp sensing/measuring	13	flow sensing/measuring
6	pressure sensing/measuring	14	silencer
7	pressure differential sensing/measuring	15	ambient temperature-sensing/measuring
8a	upstream pressure measuring tube[c]	16	shut-off valve
8b	downstream pressure measuring tube[c]		

[a] It can be necessary for the compressed air supply pressure at "1" to exceed the test pressure and be capable of delivering the required over-pressure to the water reservoir in "3". If the test pressure is 700 kPa (7 bar) (e), then typically a 1 000 kPa (10 bar) (e) supply is adequate.

[b] Pressure regulation is required at "4" and in "3" to ensure stability of the supply pressure, thus preventing variation in the delivered water flow rate.

[c] Details of the construction of the measuring tubes are given in ISO 7183:2007, Annex D.

Figure 1 — Typical test arrangement

Means other than that shown in Figure 1 of introducing the water can also be used, for example via a dosing pump; the only consideration is that water is not converted into aerosol form in the process of injection.

The amount of water collected shall be measured directly by mass. System pressure and flow control is achieved by the use of a flow-control valve, which may be positioned upstream or downstream of the flow-meter.

8 Test method

The following method shall be used to perform the test.

a) Assemble the test apparatus as shown in Figure 1.

b) Establish steady-state air flow conditions at the test pressure of interest.

c) Introduce the water at a flow rate of 2 mL/min of water per litre per second of air flow.

d) The test period is at least 10 min.

e) The amount of collected water is determined by direct reading of mass.

f) Perform the measurements at flow conditions of 25 %, 50 %, 75 %, 100 % and 125 % of rated flow for the device at the test pressure of interest.

g) Three tests shall be performed at each flow rate.

9 Results

Percentage water removal efficiency, w_{H_2O}, expressed as a percentage mass fraction, is calculated as given in Equation (2):

$$w_{H_2O} = \frac{m_D \times 100}{m_I} \tag{2}$$

where

m_D is the mass of water separated by the device under test, expressed in grams;

m_I is the mass of water injected, expressed in grams.

Express the results as an average of the three measurements.

10 Test report

10.1 Statement

Performance data shall be stated at reference conditions and as a minimum shall include the data in Table 1. The results shall include those obtained under test conditions.

10.2 Technical data

Technical data presentation shall include at least the following:

— statement that the data were obtained during testing in accordance with ISO 12500-4;

— model number of separator device;

— mean value of the water-removal efficiency at each flow rate tested;

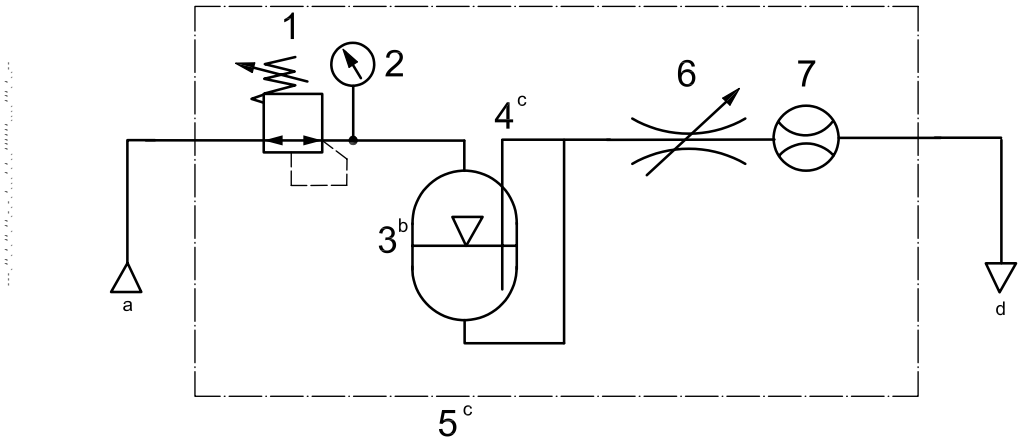
— pressure drop, Δp, at each flow rate tested.

A sample test report form is found in Annex B.

Annex A
(informative)

Design guide for the water injection apparatus

The equipment includes a pressure vessel with sufficient water volume to supply water for the duration of the test. High pressure applied to the head space above the water in the receiver causes water to flow out of the base or via the use of a dip tube from below the water surface to the flow control valve and flow meter.



Key

1 pressure-reducing valve
2 pressure sensing/measuring
3 water reservoir
4 water injection outlet
5 alternative water injection outlet
6 multi turn flow control valve
7 flow sensing/measuring

a From un-regulated supply.
b The water reservoir is placed on a mass balance so that the amount of injected water can be determined.
c Either connection point may be employed but only one should be used.
d To water-removal device under test.

Figure A.1 — Typical water injection apparatus (detail of key item 3, Figure 1)

Annex B
(informative)

Sample test report form

(Click here to access an electronic interactive version of this form)

Sample test report form	
Test date	
Test facility	
Location	
Contact	
Product tested	
Manufacturer	
Separator housing model number	
Separator element model number	
Rated flow/rated pressure	

Standard rating parameters and results summary

Reported parameter	Unit	Rated condition	Result at				
			25 % of rated flow	50 % of rated flow	75 % of rated flow	100 % of rated flow	125 % of rated flow
Air flow (reference conditions)	L/s						
Inlet test pressure	kPa (bar) (e)						
Inlet temperature	°C						
Ambient temperature	°C						
Pressure drop	Pa (mbar)	N/A					
Water removal efficiency result “a”	%	N/A					
Water removal efficiency result “b”	%	N/A					
Water removal efficiency result “c”	%	N/A					
Average water removal efficiency	%	N/A					

Notes:	
Tested by:	
Signature (tester):	Date:
Witness (manufacturer or other):	Date:

Bibliography

[1] ISO 1000, *SI units and recommendations for the use of their multiples and of certain other units*

[2] ISO 7183:2007, *Compressed-air dryers — Specifications and testing*

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