INTERNATIONAL STANDARD

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Compressed-air dryers — Specifications and testing

Sécheurs à air comprimé — Spécifications et essais

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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 7183 was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 4, *Quality of compressed air*.

This second edition of ISO 7183 revises and replaces the first edition (ISO 7183:1986), together with ISO 7183-2:1996, which have been technically revised.

Introduction

The scope has been expanded to cover most current types of dryers but also to allow the use of this International Standard and its test methods for any emerging technologies. Any new technologies can then be incorporated at a later revision.

Exclusions to this International Standard are generally identified by reference to the definition of a dryer. Specific exclusions have been identified, however, for absorption dryers and dryer processes involving “over-compression” as the means of removing water from compressed air.

The process of over-compression employs the principle that water can be removed by compressing the air to a pressure higher than the intended working pressure thereby forcing out the water from the compressed air and then subsequently expanding the air back to the working pressure.

Absorption dryers are now considered to be of minor importance as a drying technique and are, therefore, not considered in this International Standard.

Compressed-air dryers — Specifications and testing

1 Scope

This International Standard specifies the performance data that are necessary to state and applicable test methods for different types of compressed air dryers. It is applicable to compressed air dryers working with an effective (gauge) pressure of more than 50 kPa (0,5 bar), but less than or equal to 1 600 kPa (16 bar) and include the following:

— adsorption dryers;

— membrane dryers;

— refrigeration dryers (including drying by cooling);

— or a combination of these.

NOTE A description of the principles of operation of the dryers within the Scope of this International Standard is given in Annex A.

This International Standard identifies test methods for measuring dryer parameters that include the following:

— pressure dew point;

— flow rate;

— pressure drop;

— compressed-air loss;

— power consumption;

— noise emission.

This International Standard also provides partial-load tests for determining the performance of energy saving devices or measures.

The mounting, operating and loading conditions of dryers for the measurement of noise are given in Annex C.

This International Standard is not applicable to the following types of dryers or drying processes:

— absorption dryers;

— drying by over-compression;

— integral dryers.

2 Normative references

The following referenced documents are indispensable for the application of this International Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 261, *ISO general purpose metric screw threads — General plan*

ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 1179 (all parts), *Connections for general use and fluid power — Ports and stud ends with ISO 228-1 threads with elastomeric or metal-to-metal sealing*

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

ISO 2602, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*

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

ISO 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering method for an essentially free field over a reflecting plane* [1)]

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

ISO 8573-3, *Compressed air — Part 3: Test methods for measurement of humidity*

ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

3 Terms and definitions

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

3.1
absorption
chemical process of attracting one substance into the mass of another, so that the absorbed substance combines with the absorbent

3.2
actual vapour pressure
partial pressure exerted by the water vapour under the actual temperature condition of the environment

3.3
adsorption
physical process in which the molecules of a gas or a vapour adhere to the surface of a solid

3.4
ambient
area surrounding the dryer under test

1) To be published. Revision of ISO 3744:1994

3.5
integral
equipment which is either physically integrated and/or functionally interlinked with the compressor

NOTE 1 Interlinking can be in terms of energy exchange, controls or sharing of other components.

NOTE 2 Typically, some of the performance characteristics, such as energy consumption or pressure drop, deviate substantially from those of free-standing air-treatment equipment.

3.6
desiccant
⟨adsorbent⟩ substance with the ability to retain water without change of state

EXAMPLES Silica gel, activated alumina or molecular sieves.

NOTE The term excludes deliquescent substances.

3.7
dew point
temperature at which the vapour pressure of the vapour in a humid gas is equal to the saturation vapour pressure over the pure liquid and at which condensate forms as a liquid on cooling the gas

3.7.1
pressure dew point
pdp
dew point measured at the actual pressure

3.8
dryer
device which lowers absolute moisture content of compressed air by reducing water vapour content such that the exit relative humidity is lower than 100 %

NOTE "Separating" devices that remove only bulk water, such as a cyclone separator, are not dryers.

3.9
peak
point at which the measured parameter takes its highest, instantaneous value

3.10
permeate
compressed air and water vapour that diffuses through a membrane

NOTE The greater the selectivity of the membrane for moisture, the lower the permeate loss.

3.11
purge air flow
volume-flow of compressed air entering the dryer minus the compressed air leaving the dryer during regeneration cycle

NOTE 1 Typically, purge air is expanded to atmospheric pressure.

NOTE 2 For membrane dryers, purge air flow is the sum of "sweep-gas" plus permeate.

3.12
regeneration
process of preparation of drying media to enable it to enter a new period of operation

3.13
relative humidity
ratio of the actual vapour pressure to the saturation vapour pressure over a plane liquid water surface at the same temperature

3.14
saturation vapour pressure
partial pressure of water vapour that is in neutral equilibrium with a plane surface of pure, condensed-phase water or ice at a given temperature

3.15
sweep gas
compressed air used in a membrane dryer to carry away moisture from the region outside the membrane

3.16
stabilization period
time taken to reach a steady state condition of an average value

3.17
test time
time taken after the stabilization period to record dryer performance

4 Symbols

4.1 Figure symbols

The symbols used in Figures 1 to 3 are in accordance with ISO 1219-1.

4.2 Symbols and units

Symbol	Term	SI unit	Other practical units
d	actual internal diameter of the tube		millimetres
l	thread length		millimetres
m	mass	kilogram	gram, milligram
P	power	watt	megawatt, kilowatt
p	pressure	kilopascal	bar
q	flow rate	cubic metres per second	cubic metres per hour cubic metres per minute litres per second
L	latent heat	joules	megajoules, kilojoules
n	number	(dimensionless)	
t	time	second	minute, hour, day
V	volume	cubic metre	cubic decimetre, cubic centimetre, cubic millimetre
W	work	joule	megajoule, kilojoule, kilowatt-hour
$\bar{X}$	average of a series of measured values, x_i of a parameter		

4.3 Subscripts

Subscript	Term
AL	air loss
Av	average
BL	blow-down loss
sum	sum
DC	dryer cycle
i	interval number
PF	purge flow
PL	purge air loss
E	electrical energy
v	vessel
ref	reference
regn	regeneration
S	steam energy
s	system
TOT	total

5 Reference conditions

Reference conditions for volume statements shall be as given in Table 1.

Table 1 — Reference conditions

air temperature	20 °C
absolute air pressure	100 kPa [1 bar (a)]
relative water vapour pressure	0
NOTE Bar(e) is used to indicate effective pressure above atmospheric.	

6 Standard rating parameters

Standard rating parameters are necessary in defining the performance of an air dryer and in comparing one dryer with another. The standard rating parameters are given in Table 2.

The standard rating parameters are assumed to be 100 % rated flow operating at 24 hours per day and seven days per week.

Table 2 — Standard rating parameters

Quantity	Unit	Value [a]			Tolerance [b]
		Option A1 [c]	Option A2 [c]	Option B	
Inlet temperature	°C	35	38	45	± 2
Inlet pressure	kPa gauge [bar(e)]	700 (7)	700 (7)	700 (7)	± 14 (0,14)
Inlet relative humidity	%	100	100	100	$^{0}_{-5}$
Cooling air inlet temperature (where applicable)	°C	25	38	35	± 3
Cooling water inlet temperature (where applicable)	°C	25	29	25	± 3
Ambient air temperature	°C	25	38	35	± 3
Flow of dryer inlet	% of rated flow	100	100	100	± 3

[a] Maintain within actual gauge value.

[b] The choice between options A and B is influenced by the intended geographical location of the equipment.

[c] Option A1 applies to a temperate climate zone and Option A2 applies to a sub-tropical zone.