INTERNATIONAL STANDARD

ISO 8573-1

Third edition
2010-04-15

Compressed air —

Part 1: Contaminants and purity classes

Air comprimé —

Partie 1: Polluants et classes de pureté

Reference number
ISO 8573-1:2010(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 8573-1 was prepared by Technical Committee ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 4, *Compressed air purity specification and compressed air treatment equipment*.

This third edition cancels and replaces the second edition (ISO 8573-1:2001), which has been technically revised. It also incorporates the Technical corrigendum ISO 8573-1:2001/Cor.1:2002.

ISO 8573 consists of the following parts, under the general title *Compressed air*:

— *Part 1: Contaminants and purity classes*

— *Part 2: Test methods for oil aerosol content*

— *Part 3: Test methods for measurement of humidity*

— *Part 4: Test methods for solid particle content*

— *Part 5: Test methods for oil vapour and organic solvent content*

— *Part 6: Test methods for gaseous contaminant content*

— *Part 7: Test method for viable microbiological contaminant content*

— *Part 8: Test methods for solid particle content by mass concentration*

— *Part 9: Test methods for liquid water content*

Introduction

This part of ISO 8573 is the key element of the ISO 8573 series of documents, which provides a classification system for the main contaminants of a compressed air system and identifies how other contaminants can be identified in addition to the classification system.

This part of ISO 8573 is supplemented by other parts that provide measurement methods for a wide range of contaminants.

As an important addition to this part of ISO 8573, Annex A has been added to provide the user with guidance on a number of aspects of the classification system and topics related to the associated measurement methods.

Compressed air —

Part 1:
Contaminants and purity classes

1 Scope

This part of ISO 8573 specifies purity classes of compressed air with respect to particles, water and oil, independent of the location in the compressed air system at which the air is specified or measured.

This part of ISO 8573 provides general information about contaminants in compressed air systems as well as links to the other parts of ISO 8573, either for the measurement of compressed air purity or the specification of compressed air purity requirements.

In addition to the above-mentioned contaminants of particles, water and oil, this part of ISO 8573 also identifies gaseous and microbiological contaminants.

Guidance is given in Annex A as to the application of this part of ISO 8573.

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 7183, *Compressed-air dryers — Specification and testing*

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

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

ISO 8573-4, *Compressed air — Part 4: Test methods for solid particle content*

ISO 8573-5, *Compressed air — Part 5: Test methods for oil vapour and organic solvent content*

ISO 8573-6, *Compressed air — Part 6: Test methods for gaseous contaminant content*

ISO 8573-7, *Compressed air — Part 7: Test method for viable microbiological contaminant content*

ISO 8573-8, *Compressed air — Part 8: Test methods for solid particle content by mass concentration*

ISO 8573-9, *Compressed air — Part 9: Test methods for liquid water content*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7183, ISO 8573-7 and the following apply.

3.1
aerosol
suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having negligible fall-velocity/settling-velocity

3.2
agglomerate
group of two or more particles combined, joined or formed into a cluster by any means

3.3
lubricant/coolant
fluid used to remove heat and reduce friction in a compressor

3.4
dewpoint
temperature at which water vapour begins to condense

3.5
hydrocarbon
organic compound consisting mainly of hydrogen and carbon

3.6
microbiological contaminants
viable colony-forming units, which can be of bacteria, fungi or yeasts

3.7
oil
mixture of hydrocarbons composed of six or more carbon atoms (C_{6+})

3.8
particle
small discrete mass of solid or liquid matter

3.9
particle size
d
length of the greatest distance between two external boundaries

3.10
pressure dewpoint
dewpoint of the air at the specified pressure

3.11
relative water vapour pressure
relative humidity
ratio of the partial pressure of water vapour to its saturation pressure at the same temperature

3.12
vapour
gas that is at a temperature below its critical temperature and that, therefore, can be liquefied by isothermal compression

4 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

5 Compressed air purity classes

5.1 General

The three major contaminants in compressed air are solid particles, water and oil; these are categorized by compressed air purity classes.

These compressed air purity classes group the concentrations of each of the above contaminants into ranges, each range being given its own purity class index. The range limits are aligned to those figures found in practice.

When required, all other contaminants should be stated directly by the specific concentrations allowed, or determined within the compressed air supply; see 6.4.

5.2 Particle classes

The particle purity classes are identified and defined in Table 1. Measurements shall be made in accordance with ISO 8573-4 and, when required, ISO 8573-8.

Where it is determined that there are particles with a size greater than 5 µm, then the classification of 1 to 5 cannot be applied.

Table 1 — Compressed air purity classes for particles

Class[a]	**Maximum number of particles per cubic metre as a function of particle size, d**[b]		
	0,1 µm < d ⩽ 0,5 µm	0,5 µm < d ⩽ 1,0 µm	1,0 µm < d ⩽ 5,0 µm
0	As specified by the equipment user or supplier and more stringent than class 1		
1	⩽ 20 000	⩽ 400	⩽ 10
2	⩽ 400 000	⩽ 6 000	⩽ 100
3	Not specified	⩽ 90 000	⩽ 1 000
4	Not specified	Not specified	⩽ 10 000
5	Not specified	Not specified	⩽ 100 000
Class	**Mass concentration**[b] C_p mg/m^3		
6[c]	$0 < C_p \leqslant 5$		
7[c]	$5 < C_p \leqslant 10$		
X	$C_p > 10$		

[a] To qualify for a class designation, each size range and particle number within a class shall be met.

[b] At reference conditions; see Clause 4.

[c] See A.3.2.2.

5.3 Humidity and liquid water classes

The humidity and liquid water purity classes are identified and defined in Table 2. Measurements shall be made in accordance with ISO 8573-3 and, when required, ISO 8573-9.

Table 2 — Compressed air purity classes for humidity and liquid water

Class	Pressure dewpoint °C
0	As specified by the equipment user or supplier and more stringent than class 1
1	$\leqslant -70$
2	$\leqslant -40$
3	$\leqslant -20$
4	$\leqslant +3$
5	$\leqslant +7$
6	$\leqslant +10$
Class	**Concentration of liquid water**[a] C_w g/m^3
7	$C_w \leqslant 0{,}5$
8	$0{,}5 < C_w \leqslant 5$
9	$5 < C_w \leqslant 10$
X	$C_w > 10$
[a] At reference conditions; see Clause 4.	

5.4 Oil classes

The total oil purity classes are identified and defined in Table 3. Measurements for liquid oil and aerosols of oil shall be made in accordance with ISO 8573-2. It is considered that, for classes 3, 4 and X, the oil vapour content is not expected to significantly affect the total concentration; therefore, the measurement of vapour is optional. Where it is deemed necessary to measure the oil vapour, then ISO 8573-5 shall be used.

Table 3 — Compressed air purity classes for total oil

Class	Concentration of total oil[a] (liquid, aerosol and vapour) mg/m^3
0	As specified by the equipment user or supplier and more stringent than class 1
1	$\leqslant 0{,}01$
2	$\leqslant 0{,}1$
3	$\leqslant 1$
4	$\leqslant 5$
X	> 5
[a] At reference conditions; see Clause 4.	

5.5 Gaseous contaminants

No purity classes are identified for gaseous contaminants; the presentation of contaminant levels is given in 6.4. Values for gaseous contaminants shall be measured in accordance with ISO 8573-6.

5.6 Microbiological contaminants

No purity classes are identified for microbiological contaminants; the presentation of contaminant levels is given in 6.4. Values for microbiological contaminants shall be measured in accordance with ISO 8573-7.

6 Designation

6.1 Designation principle

The designation principle of the purity class of compressed air at the specified measuring point shall include the following information in the order given and separated by a colon:

ISO 8573-1:2010 [A:B:C]

where

A is the purity class for particles; see Table 1;

B is the purity class for humidity and liquid water; see Table 2;

C is the purity class for oil; see Table 3.

6.2 Unspecified designation

When a class for any particular contaminant A, B, or C is not specified, the designation shall be replaced by a hyphen. In the example given below, there is no humidity or liquid water classification.

ISO 8573-1:2010 [A:–:C]

6.3 Class X designation

When the contamination level falls within class X, then the highest concentration of the contaminant shall be given in round brackets. In the example given below, the concentration of liquid water, C_w, is 15 g/m^3.

ISO 8573-1:2010 [A:X(15):C]

6.4 Gaseous or microbiological contaminants designation (optional)

Gaseous and microbiological contaminants shall be identified as an additional item to the designation given in 6.1 as follows:

— ISO 8573-6 [contaminant & value & unit of measure];

— ISO 8573-6 [possible further contaminant & value & unit of measure];

— ISO 8573-7 [value cfu/m^3].

EXAMPLE ISO 8573-1:2010 [A:B:C]

— [$SO_2 \leqslant 0{,}01$ mg/kg];

— [$CO_2 \leqslant 1$ mg/kg];

— [$CO \leqslant 0{,}1$ mg/kg];

— [5 (cfu)/m^3] (where cfu designates colony-forming units).

Annex A
(informative)

Guidance

A.1 Air purity specifications

The air purity classification given in this part of ISO 8573 is intended to provide a guide to the air purity expected in the compressed air system rather than resulting from the inclusion of a single air treatment component. It should be recognized that achieving any given air purity specification cannot be done exclusively by a combination of equipment; the specification of the correct lubricants/coolants and the correct control of physical parameters, such as temperature, are also required. The correct control of such parameters as temperature has an effect on the physical state of the liquids, which can become aerosols or vapours. To maintain the air purity within a compressed air system, it is considered essential that suppliers' recommendations regarding maintenance intervals be followed.

A.2 Special applications

This part of ISO 8573 might not be suitable to fully define the requirements of special applications. It can be the case that, for applications such as breathing air, medical air, food and beverage, it is required to consider controlling other contaminants not identified in a classification or not included as a contaminant, to fully specify that requirement. It can be necessary to consult other sources of information, such as a pharmacopoeia, breathing air specifications and clean-room standards, before an air purity specification can be established. In addition, national in-use requirements can also stipulate regular testing for applications such as breathing air supplies.

A.3 Contaminants

A.3.1 General

Contaminants can exist in solid, liquid or gaseous form. They influence each other (e.g. solid particulates agglomerate in the presence of oil or water to form larger particles; oil and water form an emulsion) or condense (e.g. oil vapour or water vapour) inside the pipework of compressed air systems.

A.3.2 Solid

A.3.2.1 General

Contaminants in solid form originate from many different sources, e.g. dust particles from the surrounding atmosphere drawn in by the compressor air intake or by abrasion or corrosion within the compressed air system. They can range from very large, granular to extremely small submicron-sized particles. Furthermore, solid particles can be either inert particles or viable colony-forming units.

A.3.2.2 Particle classes 6 and 7

Industrial tools and pneumatic-fluid power-operated machines have traditionally been supplied with air filtered by general-purpose filters with a notional particle size rating of 5 µm (class 6) and 40 µm (class 7). These ratings were applied many years ago before the latest particle-size-measuring systems were developed and have given satisfactory service while keeping the pressure losses (and therefore the power losses) to a minimum.

The ratings are not absolute particle removal ratings and the air purity delivered by these filters is provided by filters with removal efficiency ratings of at least 95 % of the rated particle, i.e. 95 % of 5 µm particles for class 6 and 95 % of 40 µm particles for class 7, when tested as described in ISO 12500-3.

A.3.3 Liquid

Contaminants in liquid form within the compressed air system are mainly water and compressor lubricant/coolant. Other liquid contaminants can be present by being drawn into the compressor air intake from the surrounding atmosphere. Their concentration is dependent on temperature and pressure. Therefore, liquids can be present due to the condensation of their vapours. Their concentration can range from high concentrations of liquid wall flow to droplets and extremely small submicron-sized aerosols.

Liquid contaminants can promote corrosion, especially in the case of water, within the compressed air distribution system generating further contaminants. Liquid contaminants generated from compressor lubricants/coolants should be compatible with seals and non-ferrous piping, including aluminium and plastic.

A.3.4 Gaseous

Contaminants in gaseous form are generally comprised of water vapour and compressor lubricant/coolant vapour, the concentration of which is dependent on both the temperature and the pressure of the gas. Other gaseous contaminants can be present by being drawn into the compressor air intake from the surrounding atmosphere. Gaseous contaminants can dissolve in liquids that are present or can themselves condense into liquid form by temperature reduction or increasing pressure.

Bibliography

[1] ISO 3649, *Cleaning equipment for air or other gases — Vocabulary*

[2] ISO 12500-3, *Filters for compressed air — Test methods — Part 3: Particulates*

[3] *A guide to the measurement of humidity*, National Physical Laboratory, UK, ISBN 0-904457-24-9

ICS 71.100.20

Price based on 9 pages