INTERNATIONAL STANDARD

ISO 8573-1

Second edition
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Compressed air —

Part 1: Contaminants and purity classes

Air comprimé —

Partie 1: Polluants et classes de pureté

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 3.

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 part of ISO 8573 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8573-1 was prepared by Technical Committee ISO/TC 118, *Compressors, pneumatic tools and pneumatic machines*, Subcommittee SC 4, *Quality of compressed air*.

This second edition cancels and replaces the first edition (ISO 8573-1:1991), which has been technically revised.

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

— *Part 1: Contaminants and purity classes*

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

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

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

— *Part 5: Determination of oil vapour and organic solvent content*

— *Part 6: Determination of content of gaseous contaminants*

The following parts are in preparation:

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

— *Part 8: Contaminants and purity classes (by mass concentration of solid particles)*

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

Introduction

This part of ISO 8573 is one in a series of standards (planned or published), with the ambition of harmonizing air contamination measurements.

The source of odours from a compressed air supply may be present due to a number of factors. The presence of an odour results in discomfort to personnel using breathing equipment. The means of detection is the human olfactory system and the person involved bases the quantification on a subjective analysis. No reliable measurement methods are available therefore each situation must be treated as an individual case and appropriate action taken to minimise the discomfort. For the time being there will be no separate part of ISO 8573 dealing with odours.

Compressed air —

Part 1:
Contaminants and purity classes

1 Scope

This part of ISO 8573 specifies purity classes of compressed air in respect of particles, water and oil regardless of the source of the compressed air.

This part of ISO 8573 identifies microbiological and gaseous contaminants.

The gaseous contaminants included in this part of ISO 8573 are carbon monoxide, carbon dioxide, sulfur dioxide, nitrogen dioxide, nitric oxide and hydrocarbons with carbon atoms in the range C_1 to C_5.

NOTE Other contaminants are taken into consideration for specific applications, e.g. air used for breathing, medical, food and beverage purposes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8573. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8573 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7183, *Compressed air dryers — Specifications and testing*.

ISO 8573-2, *Compressed air for general use — Part 2: Test methods for aerosol oil 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: Determination of oil vapour and organic solvent content.

3 Terms and definitions

For the purposes of this part of ISO 8573, the terms and definitions given in ISO 7183 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
dewpoint
temperature at which water vapour begins to condense

3.4
microbiological organisms
viable colony forming units which may be a bacteria, fungi or yeasts

3.5
oil
mixture of hydrocarbons composed of 6 or more carbon atoms (C_6)

3.6
particle
a small discrete mass of solid or liquid matter

3.7
particle size
d
length of the greatest distance between two external boundaries.

3.8
relative water vapour pressure
relative humidity
ratio of the partial pressure of water vapour to its saturation pressure at the same temperature

3.9
vapour
gas which is at a temperature below its critical temperature and which therefore can be liquefied by isothermal compression

4 Measurement of contaminants

For the purpose of assessing the purity class of a compressed air sample, measurements shall be made in accordance with the appropriate part of ISO 8573:

— Part 2 for measuring oil aerosols and oil liquid content of compressed air;

— Part 3 for measuring humidity;

— Part 4 for measuring solid particles;

— Part 5 for measuring oil vapour and organic solvent content;

Further parts of ISO 8573 are under preparation for measuring gaseous contaminant content (Part 6), for determining viable microbiological contaminant content (Part 7) and for measuring solid particles (Part 8) and liquid water content (Part 9). In their absence, other recognized standards shall be used for the measurement of the various contaminants, if possible, and the following rules apply:

— measurements shall be based on a number of samples taken during a suitable length of time;

— measurements should be carried out at the actual operating pressure and temperature;

— the purity classes of a compressed air system should be based on the mean value of an agreed number of measurements (see note);

— the purity classes are relevant only at the point of measurement (see note).

The content of particles, water and oil in compressed air varies due to sudden changes in the intake air, to the wear of components as well as to changes in flow, pressure, temperature and ambient conditions.

It is not possible to measure the full flow area of a compressed air stream using most test methods and therefore it is necessary to take samples of the air. Care should be exercised to ensure that the sample taken is representative of the compressed air purity.

NOTE Measurements should be carried out at the actual operating conditions as otherwise the balance between impurities in liquid, aerosol or gaseous form will be altered. Liquid oil and free water in particular tend to cling to pipe and tube walls where they form a film or thin rivulets.

5 Standard atmosphere

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

Table 1 — Reference conditions

Air temperature	20 °C
Air pressure	1 bar [a] absolute
Relative water vapour pressure	0
[a] 1 bar = 0,1 MPa	

6 Contaminants

6.1 General

The three major impurities in compressed air are solid particles, water and oil. They influence each other (e.g. solid particulate agglomerates in the presence of oil or water to form larger particles, oil and water form an emulsion) and are sometimes deposited or condensed (e.g. oil vapour or water vapour) inside the pipework of a compressed air system. Other contaminants are also considered, including microbiological organisms and gaseous contaminants.

6.2 Solid particles

6.2.1 General

Solid particle properties are important and are characterized by density, shape, size and by hardness.

It is essential to eliminate the influence of water on particle size and number in order to obtain a correct reading.

6.2.2 Measuring parameters

6.2.2.1 Particle size

Particle size shall be measured in accordance with recognized methods.

6.2.2.2 Particle concentration

Concentration of particles shall be measured in accordance with ISO 8573-4. Mass concentration of particles shall be measured in accordance with a recognized standard (see clause 4).

6.2.2.3 Humidity

The actual humidity level shall be measured in accordance with ISO 8573-3.

6.3 Water

6.3.1 General

Atmospheric air always contains water vapour. When atmospheric air is compressed the partial pressure of the water vapour increases but, owing to the increase in temperature caused by the compression, no water precipitates. When the air is subsequently cooled (e.g. in an intercooler or aftercooler, in the distribution pipework or during the expansion process in a pneumatic tool) water will condense to liquid, but the air will be fully saturated with water vapour.

6.3.2 Measuring parameters

Humidity measurement shall be in accordance with ISO 8573-3 and for liquid water in accordance with a recognized standard (see clause 4).

6.4 Oil

6.4.1 General

For the purposes of this part of ISO 8573, oil in compressed air can belong to one or more of three categories: liquid, aerosol or vapour.

When considering oil vapour content of compressed air it is important to reference the temperature as this affects the ratio of vapour to total oil content.

Testing for vapour should be carried out in conjunction with the test for aerosols and bulk liquid so the various phase concentrations may be discerned. Due to the complex organic molecules, which may be involved, the calibration procedure of the measurement equipment shall be clearly stated.

6.4.2 Measuring parameters

6.4.2.1 Oil liquid, aerosol or vapour

The measurement of oil aerosol and liquid shall be in accordance with ISO 8573-2. The measurement of oil vapour shall be in accordance with ISO 8573-5.

6.4.2.2 Humidity

The actual humidity level shall be measured in accordance with ISO 8573-3.

6.5 Gaseous contaminants

Atmospheric air contains not only those common contaminants generally identified for treatment but also gaseous contaminants which may be present in varying amounts depending on location. Concentration of gaseous contaminants shall be measured in accordance with a recognized standard (see clause 4).

6.6 Microbiological organisms

Microbiological organisms are generally considered to be solid contaminants, which can be present in the atmospheric air. These organisms may be introduced into the compressed air by a number of means. If the microbiological organism is to be identified as a solid particle then the measurement method identified in ISO 8573-4 is used. If the colony forming activity of bacteria, fungi or yeasts is important then this can be identified using a recognized standard (see clause 4).

7 Compressed air purity classes

7.1 Solid particle classes

The solid particle classes are defined in Table 2. Values for classes 0 to 5 shall be measured in accordance with ISO 8573-4 and for classes 6 and 7 in accordance with a recognized standard (see clause 4).

Table 2 — Solid particle classes

Class	Maximum number of particles per m^3 (see clause 5)				Particle size	Concentration
	Particle size, d µm				µm	mg/m^3
	$\leqslant$ 0,10	0,10 $< d \leqslant$ 0,5	0,5 $< d \leqslant$ 1,0	1,0 $< d \leqslant$ 5,0		
0	As specified by the equipment user or supplier and more stringent than class 1				Not applicable	Not applicable
1	Not specified	100	1	0		
2	Not specified	100 000	1 000	10		
3	Not specified	Not specified	10 000	500		
4	Not specified	Not specified	Not specified	1 000		
5	Not specified	Not specified	Not specified	20 000		
6	Not applicable				$\leqslant$ 5	$\leqslant$ 5
7	Not applicable				$\leqslant$ 40	$\leqslant$ 10

NOTE A filtration ratio (β) related to a particle size class is the ratio between the number of particles upstream of the filter and the number of particles downstream. This can be expressed as ($\beta = 1/P$), where P is the penetration of the particles expressed as the ratio of down stream particle concentration to upstream particle concentration. The particle size class is used as an index, e.g. $\beta_{10} = 75$ means that the number of particles of size 10 µm (β m) and larger is 75 times higher upstream of the filter than downstream.

7.2 Humidity and liquid water classes

The humidity classes are defined in Table 3 and liquid water classes in Table 4. Values for pressure dewpoints shall be determined according to ISO 8573-3 and liquid water content according to a recognized standard (see clause 4). When lower dewpoints are required they shall be clearly specified.

Table 3 — Humidity classes

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	$\leqslant +10$