

INTERNATIONAL STANDARD

ISO
8573-3

First edition
1999-06-01

Compressed air —

Part 3:

Test methods for measurement of humidity

Air comprimé —

Partie 3: Méthodes d'essai pour mesurer le taux d'humidité



Reference number
ISO 8573-3:1999(E)

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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.

International Standard ISO 8573-3 was prepared by Technical Committee ISO/TC 118 *Compressors, pneumatic tools and pneumatic machines*, Subcommittee SC 4, *Quality of compressed air*.

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

- *Part 1: Contaminants and quality 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: Test methods for oil vapour and organic solvent content*
- *Part 6: Test methods for gaseous contaminant content*
- *Part 7: Test methods for viable microbiological contaminant content*

Annexes A, B, C and D are for information only.

Introduction

This part of ISO 8573 is one in a series of International Standards (planned or published) with the aim of harmonizing air contamination measurements. It is also intended to be used for reference when stating air purity class according to ISO 8573-1.

Compressed air —

Part 3: Test methods for measurement of humidity

1 Scope

This part of ISO 8573 provides guidance on selection from the available suitable methods for measurement of humidity in compressed air and specifies the limitations of the various methods.

It does not provide methods for measurement of water content in states other than vapour.

This part of ISO 8573 specifies sampling techniques, measurement, evaluation, uncertainty considerations and reporting for the air contamination parameter humidity.

It gives guidance for the conversion of humidity statements to the standard format.

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 editions of the normative documents referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 3857-1, *Compressors, pneumatic tools and machines — Vocabulary — Part 1: General*.

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

ISO 7183:1986, *Compressed air dryers — Specifications and testing*.

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

3 Terms and definitions

For the purposes of this part of ISO 8573, the terms and definitions given in ISO 3857-1 and ISO 5598 and the specific humidity terms and definitions given in ISO 7183 apply.

4 Units

For the purposes of this part of ISO 8573, the following non-preferred SI units are used:

1 bar = 100 000 Pa

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

1 l (litre) = 0,001 m³

5 Selection guide and available methods

The methods available for measuring humidity, their grade of uncertainty and their preferred range of use are listed in Table 1.

Table 1 — Methods available for measuring humidity

Methods in order of increasing uncertainty		Uncertainty ±°C	Range for humidity level expressed as pressure dew point ^c , °C							Remarks
Method	Table		-80	-60	-40	-20	0	+20	+40	
Spectroscopic	2	a	-----							Detection limit for water vapour is about 0,1 × 10 ⁻⁶ to 1 × 10 ⁻⁶ ^b
Condensation	3 and 4	0,2 to 1,0	-----							
Chemical	5	1,0 to 2,0	-----							
Electrical	6, 7 and 8	2,0 to 5,0	-----							
Psychrometer	9	2,0 to 5,0	-----							
^a The uncertainty is not yet available in °C. ^b Volume fraction. ^c Pressure dew point is defined in ISO 7183.										

6 Sampling techniques

6.1 General

Dew point can be measured at atmospheric pressure or under actual pressure conditions. The pressure to which the dew point is referred shall be stated. It is important that the air flow is controlled within the upper and lower limits to prevent damage to the probe and to ensure that a representative measurement is made.

6.2 Probe installation

6.2.1 Full flow measurement

The probe is inserted in the main air flow stream, but protected against free water and other contaminants and used within the stated lower and upper limits of flow velocity for the measurement system.

6.2.2 Partial flow measurement

6.2.2.1 Bypass

The probe is installed in a small bypass tube. In this way the flow velocity to which the probe is exposed may be controlled.

6.2.2.2 Extraction

The probe is installed in a small extraction tube which conducts an air sample from the main air flow stream into the measurement chamber, where the measurement is made under system pressure.

6.2.3 Reduced-pressure measurement

The probe is installed in a chamber into which an air flow is fed from the main air stream. Before measurement, the pressure is reduced to a suitable measuring pressure (normally atmospheric).

6.3 Requirements on sampling and measurement conditions

6.3.1 The measurements carried out depend on the reproducibility of the method and the experience of the parties involved in the provision of measurement facilities.

6.3.2 Materials used for conducting the air into the sampling system shall not affect the water vapour content of the sample. See C.2 in annex C.

6.3.3 The sampling system pressure shall be recorded during measurement.

6.3.4 The sampling system temperature shall be higher than the measured dew point.

6.3.5 The measurement system shall have reached a steady state before any measurement takes place and shall be kept steady during measurement. The readings from two consecutive measurements taken with at least 20 min interval shall not differ by more than the accuracy of the measuring system.

7 Measurement methods

Tables 2 to 9 list a number of methods for humidity measurement, including limitations on application, measurement pressure and temperature. Descriptions of the different methods can be found in annex C. Some non-preferred methods are described in annex D.

Consideration shall be given to the measurement system integrity and the calibration requirements of the measurement equipment which shall be used as described in applicable instructions and International Standards.

It shall be proven that the equipment used is capable of achieving the uncertainty required within the specified range and tolerance.

Any method shall only be used within the upper or lower limits of its range of operation.

Check and consider calibration records.

Table 2 — Spectroscopic methods — Laser diode

Characteristic applications	Atmospheric air and compressed air
Humidity range	−80 °C to +60 °C pressure dew point
Pressure range	Atmospheric pressure
Temperature range	0 °C to +40 °C
Contamination tolerance	Good

Table 3 — Chilled mirror (condensation) with manual thermometer reading

Characteristic applications	Atmospheric air and compressed air
Humidity range	−20 °C to +25 °C pressure dew point
Pressure range	0 bar(e) to 200 bar(e)
Temperature range	0 °C to +50 °C
Contamination tolerance	Poor

Table 4 — Chilled mirror (condensation) with automatic mist detection and temperature-measuring device

Characteristic applications	Atmospheric air and compressed air
Humidity range	−80 °C to +25 °C pressure dew point
Pressure range	0 bar(e) to 20 bar(e)
Temperature range	0 °C to +50 °C
Contamination tolerance	Poor

Table 5 — Chemical reaction method using direct-reading (glass) tubes with hygroscopic content

Characteristic applications	Atmospheric air and compressed air
Humidity range	−65 °C to +35 °C pressure dew point
Pressure range	Atmospheric pressure
Temperature range	0 °C to +40 °C
Contamination tolerance	Average

Table 6 — Measurement with electrical sensor based on capacitance

Characteristic applications	Atmospheric air and compressed air
Humidity range	−80 °C to +40 °C pressure dew point
Pressure range	0 bar(e) to 20 bar(e)
Temperature range	−30 °C to +50 °C
Contamination tolerance	Average

Table 7 — Measurement with electrical sensor based on conductivity

Characteristic applications	Atmospheric air and compressed air
Humidity range	−40 °C to +25 °C pressure dew point
Pressure range	0 bar(e) to 20 bar(e)
Temperature range	−30 °C to +50 °C
Contamination tolerance	Average

Table 8 — Measurement with electrical sensor based on resistance

Characteristic applications	Atmospheric air and compressed air
Humidity range	−40 °C to +25 °C pressure dew point
Pressure range	0 bar(e) to 20 bar(e)
Temperature range	0 °C to +50 °C
Contamination tolerance	Average