INTERNATIONAL STANDARD

ISO 9022-23

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Optics and photonics — Environmental test methods —

Part 23: Low pressure combined with cold, ambient temperature and dry and damp heat

Optique et photonique — Méthodes d'essais d'environnement —

Partie 23: Essais combinés basse pression et froid, température ambiante et chaleur sèche et humide

Reference number
ISO 9022-23:2013(E)

Contents

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 172, *Optics and photonics*, Subcommittee SC 1, *Fundamental standards*.

This edition cancels and replaces ISO 9022-5:1994, ISO 9022-18:1994, and ISO 9022-21:1998, which have been technically revised.

ISO 9022 consists of the following parts, under the general title *Optics and photonics — Environmental test methods*:

- *Part 1: Definitions, extent of testing*
- *Part 2: Cold, heat and humidity*
- *Part 3: Mechanical stress*
- *Part 4: Salt mist*
- *Part 6: Dust*
- *Part 7: Resistance to drip or rain*
- *Part 8: High pressure, low pressure, immersion*
- *Part 9: Solar radiation*
- *Part 11: Mould growth*
- *Part 12: Contamination*
- *Part 14: Dew, hoarfrost, ice*
- *Part 17: Combined contamination, solar radiation*
- *Part 20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide*

— *Part 22: Combined cold, dry heat or temperature change with bump or random vibration*

— *Part 23: Low pressure combined with cold, ambient temperature and dry and damp heat*

Introduction

Optical instruments are affected during their use by a number of different environmental parameters which they are required to resist without significant reduction in performance and to remain within defined specifications.

The type and severity of these parameters depend on the conditions of use of the instrument (for example, in the laboratory or workshop) and on its geographical location. The environmental effects on optical instrument performance in the tropics and subtropics are totally different from those found when they are used in arctic regions. Individual parameters cause a variety of different and overlapping effects on instrument performance.

The manufacturer attempts to ensure, and the user naturally expects, that instruments will resist the likely rigours of their environment throughout their life. This expectation can be assessed by exposure of the instrument to a range of simulated environmental parameters under controlled laboratory conditions. The severity of these conditions is often increased to obtain meaningful results in a relatively short period of time.

In order to allow assessment and comparison of the response of optical instruments to appropriate environmental conditions, ISO 9022 contains details of a number of laboratory tests which reliably simulate a variety of different environments. The tests are based largely on IEC standards, modified where necessary to take into account features special to optical instruments.

It should be noted that, as a result of continuous progress in all fields, optical instruments are no longer only precision-engineered optical products, but, depending on their range of application, also contain additional assemblies from other fields. For this reason, the principal function of the instrument must be assessed to determine which International Standard should be used for testing. If the optical function is of primary importance, then ISO 9022 is applicable, but if other functions take precedence, then the appropriate International Standard in the field concerned should be applied. Cases can arise where application both of ISO 9022 and other appropriate International Standards will be necessary.

Optics and photonics — Environmental test methods —

Part 23:
Low pressure combined with cold, ambient temperature and dry and damp heat

1 Scope

This part of ISO 9022 specifies the methods relating to the environmental tests of optical instruments including additional assemblies from other fields (e.g. mechanical, chemical, and electronic devices), under equivalent conditions, for their ability to resist the influence of low air pressure combined with cold, including the potential condensation and freezing of water, ambient temperature, and dry or damp heat.

This part of ISO 9022 is applicable to optical instruments including additional assemblies from other fields, designed for operation and/or transport in high mountainous areas or on board aircraft or missiles.

The purpose of the testing is to investigate to what extent optical, climatic, mechanical, chemical, and electrical (including electrostatic) performance characteristics of the specimen are affected by combined low pressure and low, ambient, or high temperature. Furthermore, the additional effects of water condensing and freezing on the instrument or components can be determined. Examples are instruments which are installed or externally mounted on aircraft or missiles or transported inside aircraft or flying objects not providing any pressure equalization.

Annex A explains the intent of the different types of tests.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9022-1, *Optics and photonics — Environmental test methods — Part 1: Definitions, extent of testing*

ISO 9022-2, *Optics and optical instruments — Environmental test methods — Part 2: Cold, heat and humidity*

ISO 9022-8, *Optics and optical instruments — Environmental test methods — Part 8: High pressure, low pressure, immersion*

3 General information and test conditions

Ambient temperature as understood by this part of ISO 9022 is (23 ± 3) °C.

The values of temperatures and climatic conditions specified in Table 1 to Table 6 are selected from ISO 9022-2, conditioning methods 10, 11, and 12.

The size of the test chamber and the setup of the specimens shall be chosen in such a way that a uniform temperature for all specimens within the test chamber is ensured.

For conditioning methods 45, 46, 50, and 51, air circulation in low-pressure cabinets or low-pressure chambers is required. The low-pressure chamber, itself, can either be equipped as a thermal chamber or be installed in a thermal chamber.

For conditioning methods 47 to 49, a climatic test chamber is required. Three different test methods are used to test combined damp heat and low internal pressure resistance of optical instruments. Dew on the specimen is admissible. The individual test steps shall be performed directly one after another. Interruption of the test is not admissible.

In addition for conditioning method 47, if condensation is produced, the specimens shall be protected against falling drops.

In addition for conditioning method 48, a low-pressure container is also required.

In addition for conditioning method 49, the specimens shall have a test connection for evacuation and pressure measurement, as described in ISO 9022-8.

Changes in temperature shall be effected sufficiently slowly not to cause any damage to the specimen. Shock-type air pressure changes shall be avoided unless they are likely to be encountered in the natural environment.

4 Conditioning

4.1 Conditioning method 45 — Combined low pressure and ambient temperature

See Table 1.

Table 1 — Degrees of severity for conditioning method 45 — Combined low pressure and ambient temperature

Degree of severity		**01**	**02**	**03**	**04**
Test chamber temperature	°C	23 ± 3	23 ± 3	23 ± 3	23 ± 3
Pressure	hPa	800 ± 30	700 ± 30	600 ± 30	500 ± 30
Time of pressure reduction and pressure increase	min	≤ 15			
Period of conditioning	h	≥ 1[a]			
State of operation		2	2	2	2

[a] With thermally active specimens after the steady-state temperature of the specimen has been reached.

4.2 Conditioning method 46 — Combined low pressure and dry heat

See Table 2.

Table 2 — Degrees of severity for conditioning method 46 — Combined low pressure and dry heat

Degree of severity		**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**
Test chamber temperature	°C	40 ± 3	40 ± 3	55 ± 3	55 ± 3	63 ± 3	63 ± 3	85 ± 3[a]	85 ± 3[a]	40 ± 3	55 ± 3	63 ± 3	85 ± 3[a]
Pressure	hPa	100 ± 5								10 ± 1			
Time of pressure reduction and pressure increase	min	≤ 15								≤ 80			
Mean temperature change during heating/cooling	K/min	0,2 to 2											
Exposure time	h	24	72	24	72	24	72	24	72	24	24	24	24
State of operation		1 or 2											

[a] State of operation 1 only.

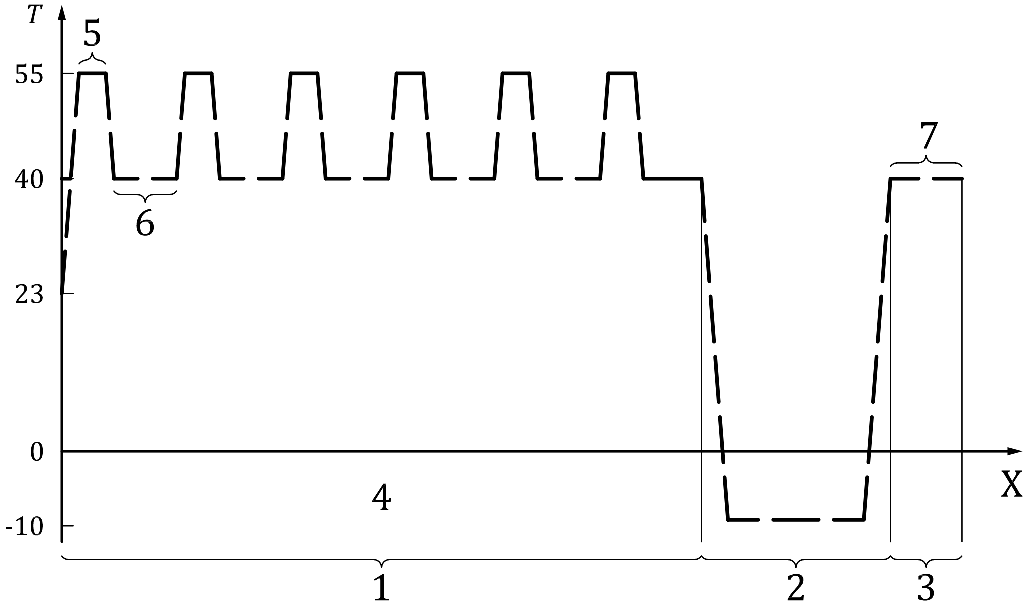
4.3 Conditioning method 47 — Damp heat and low internal pressure, pressure difference low

See Table 3 and Figure 1.

Conditioning method 47 shall be used for optical instruments where demands made on their sealing (low pressure resistance) are low, e.g. instruments which comply with the requirements of the degrees of severity 01, 02, 07, and 08 of conditioning method 81 in ISO 9022-8.

Table 3 — Degrees of severity for conditioning method 47 — Damp heat and low internal pressure, pressure difference low

Degree of severity				**01**	**02**	**03**	**04**	**05**	**06**
Condition 1	Step 1	Test chamber temperature	°C	55 ± 2		63 ± 2		70 ± 2	
		Relative humidity	%	< 40					
		Exposure time	h	Until the internal air of the specimen has reached a temperature at least within 3 K of the test chamber temperature.					
	Step 2	Climatic conditions		40 °C ± 2 °C and 90 % to 95 % relative humidity.					
		Exposure time	h	≥ 1					
	Number of cycles			6	12	6	12	6	12
Condition 2	Test chamber temperature		°C	−10 ± 3					
	Exposure time		h	Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
Condition 3	Test chamber temperature		°C	40 ± 2					
	Relative humidity		%	< 40					
	Exposure time		h	Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
State of operation				1					



Key

1 condition 1
2 condition 2
3 condition 3
4 duration according to Table 1
5 relative humidity, < 40 %
6 relative humidity, 90 % to 95 %
7 relative humidity, < 40 %
X duration, h
T temperature, °C

Figure 1 — Cycling curve for conditioning method 47, using example of degree of severity 01

4.4 Conditioning method 48 — Damp heat and low internal pressure, pressure difference medium

See Table 4.

Conditioning method 48 shall be used for optical instruments where demands made on their sealing (low pressure resistance) are medium, e.g. instruments which comply with the requirements of the degrees of severity 03, 04, 09, and 10 of conditioning method 81 in ISO 9022-8.

Table 4 — Degrees of severity for conditioning method 48 — Damp heat and low internal pressure, pressure difference medium

<table>
<tr><th colspan="4">Degree of severity</th><th>01</th><th>02</th><th>03</th><th>04</th><th>05</th><th>06</th></tr>
<tr><td rowspan="6">Condition 1</td><td rowspan="3">Step 1</td><td>Test chamber temperature</td><td>°C</td><td colspan="6">40 ± 2</td></tr>
<tr><td>Test chamber pressure</td><td>hPa</td><td colspan="2">800</td><td colspan="2">650</td><td colspan="2">500</td></tr>
<tr><td>Exposure time</td><td>h</td><td colspan="6">≥ 1</td></tr>
<tr><td rowspan="2">Step 2</td><td>Climatic conditions</td><td></td><td colspan="6">40 °C ± 2 °C and 90 % to 95 % relative humidity.</td></tr>
<tr><td>Exposure time</td><td>h</td><td colspan="6">≥ 1,5</td></tr>
<tr><td colspan="3">Number of cycles</td><td>3</td><td>6</td><td>3</td><td>6</td><td>3</td><td>6</td></tr>
<tr><td rowspan="2">Condition 2</td><td colspan="2">Test chamber temperature</td><td>°C</td><td colspan="6">−10 ± 3</td></tr>
<tr><td colspan="2">Exposure time</td><td>h</td><td colspan="6">Until specimen has reached a temperature at least within 3 K of the test chamber temperature.</td></tr>
<tr><td rowspan="3">Condition 3</td><td colspan="2">Test chamber temperature</td><td>°C</td><td colspan="6">40 ± 2</td></tr>
<tr><td colspan="2">Relative humidity</td><td>%</td><td colspan="6">< 40</td></tr>
<tr><td colspan="2">Exposure time</td><td>h</td><td colspan="6">Until specimen has reached a temperature at least within 3 K of the test chamber temperature.</td></tr>
<tr><td colspan="4">State of operation</td><td colspan="6">1</td></tr>
</table>

4.5 Conditioning method 49 — Damp heat and low internal pressure, pressure difference high

See Table 5.

Conditioning method 49 shall be used for optical instruments where demands made on their sealing (low pressure resistance) are high, e.g. instruments which comply with the requirements of the degrees of severity 05, 06, 11, 12, and 13 of conditioning method 81 in ISO 9022-8.