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Optics and photonics — Environmental test methods — Part 23: Low pressure combined with cold, ambient temperature and dry or damp heat

Optique et photonique — Méthodes d'essais d'environnement — Partie 23: Basse pression combinée à la température ambiante et froide et à la chaleur sèche ou humide

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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.

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~~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~~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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see ~~www.iso.org/iso/foreword.html~~www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172, *Optics and Photonics*, Subcommittee SC 1, *Fundamental standards*.

This third edition cancels and replaces the second edition (ISO 9022-23:2016), which has been technically revised.

The main changes are as follows:

— Introductory sentences of 5.3, 5.4 and 5.5 were clarified,

— Clause 3 was included and the document renumbered.

A list of all parts in the ISO 9022 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at ~~www.iso.org/members.html~~www.iso.org/members.html.

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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, ~~the~~ ISO 9022 ~~series~~ (all parts) 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.

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 is to be assessed to determine which International Standard should be used for testing. If the optical function is of primary importance, then ~~the~~ ISO 9022 ~~series~~ (all parts) is applicable, but if other functions take precedence, then the appropriate International Standard in the field concerned should be applied. Cases may arise where application of both ~~the~~ ISO 9022 ~~series~~ (all parts) and other appropriate International Standards will be necessary.

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Optics and photonics — Environmental test methods — Part 23: Low pressure combined with cold, ambient temperature and dry or damp heat

1 Scope

This document 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 pressure combined with cold, including the potential condensation and freezing of moisture, ambient temperature, and dry or damp heat.

This document 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 moisture 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 are referred to in the text in such a way that some or all of their content constitutes requirements 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.

~~<std>~~ISO 9022-1, *Optics and photonics — Environmental test methods — Part 1: Definitions, extent of testing*~~</std>~~

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

ISO 9022-8, *Optics and photonics — Environmental test methods — Part 8: High internal pressure, low internal pressure, immersion*~~</std>~~

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp

— IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

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4 General information and test conditions

Ambient temperature as understood by this document 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 specified 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.

5 Conditioning

5.1 Conditioning method 45 — Low ambient pressure combined with ambient temperature

See Table 1.

Table 1 — Degrees of severity for conditioning method 45 — Low ambient pressure combined with ambient temperature

Degree of severity		01	02	03	04
Test chamber temperature	°C	23 ± 3	23 ± 3	23 ± 3	23 ± 3
Test chamber 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.

5.2 Conditioning method 46 — Low ambient pressure combined with dry heat

See Table 2.

~~Table 2 — Degrees of severity for conditioning method 46 — Low ambient pressure combined with dry heat<Tbl_-></Tbl_->~~

Table 2 — Degrees of severity for conditioning method 46 — Low ambient pressure combined with 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]
Test chamber 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.

5.3 Conditioning method 47 — Low internal pressure combined with damp heat, 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. Examples of instruments with low pressure differences would be systems that comply with the requirements of the degrees of severity 01, 02, 07, or 08 of conditioning method 81 in ISO 9022-8.

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Table 3— Degrees of severity for conditioning method 47 — Low internal pressure combined with damp heat, 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					