INTERNATIONAL STANDARD

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Optics and optical instruments — Environmental test methods —

Part 21: Combined low pressure and ambient temperature or dry heat

Optique et instruments d'optique — Méthodes d'essais d'environnement —

Partie 21: Essai combiné basse pression et température ambiante ou chaleur sèche

Reference number
ISO 9022-21:1998(E)

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.

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 9022-21 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 1, *Fundamental standards.*

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

— *Part 1: Definitions, extent of testing*

— *Part 2: Cold, heat, humidity*

— *Part 3: Mechanical stress*

— *Part 4: Salt mist*

— *Part 5: Combined cold, low air pressure*

— *Part 6: Dust*

— *Part 7: Drip, rain*

— *Part 8: High pressure, low pressure, immersion*

— *Part 9: Solar radiation*

— *Part 10: Combined sinusoidal vibration and dry heat or cold*

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— *Part 11: Mould growth*

— *Part 12: Contamination*

— *Part 13: Combined shock, bump or free fall and dry heat or cold*

— *Part 14: Dew, hoarfrost, ice*

— *Part 15: Combined digitally controlled broad-band random vibration and dry heat or cold*

— *Part 16: Combined bounce or steady-state acceleration and dry heat or cold*

— *Part 17: Combined contamination, solar radiation*

— *Part 18: Combined damp heat and low internal pressure*

— *Part 19: Temperature cycles combined with sinusoidal or random vibration*

— *Part 20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide*

— *Part 21: Combined low pressure and ambient temperature or dry 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.

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 may arise where application of both ISO 9022 and other appropriate International Standards will be necessary.

Optics and optical instruments — Environmental test methods —

Part 21:
Combined low pressure and ambient temperature or dry heat

1 Scope

This part of ISO 9022 specifies methods for the testing of optical instruments and instruments containing optical components, under equivalent conditions, for their ability to resist combined low pressure and ambient temperature or dry heat.

The purpose of the testing is to investigate to what extent optical, thermal, mechanical, chemical and electrical performance characteristics of the specimen are affected by combined low pressure and ambient temperature or dry heat; examples are instruments which are installed or transported inside aircraft or flying objects not providing any pressure equalization.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9022. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9022 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9022-1:1994, *Optics and optical instruments — Environmental test methods — Part 1: Definitions, extent of testing.*

ISO 9022-2:1994, *Optics and optical instruments — Environmental test methods — Part 2: Cold, heat, humidity.*

3 General information and test conditions

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

The values of temperature specified in table 2 are selected from ISO 9022-2, conditioning method 11.

Conditioning uses air circulation in low-pressure cabinets or low-pressure chambers. The low-pressure chamber can itself either be equipped as a thermal chamber or be installed in a thermal chamber. 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.

If heating is required to achieve the test temperature, heating shall be started before the pressure is reduced. The test temperature shall have been reached before the test pressure is set at the very latest.

When the pressure is rising, no condensation shall occur on the specimen; this can be achieved by using repurified nitrogen or dry air for the ventilation of the test chamber.

Temperature changes shall be brought about so slowly as to prevent any damage to the specimen. When the pressure is changed, abrupt changes are to be avoided in so far as they do not correspond to natural conditions.

The period of conditioning shall start when all parts of the specimen have adjusted to the temperature of the test chamber to within 3 K and the pressure required has been reached. Thermally active specimens shall be subjected to the test temperature until the temperature of the specimen changes by no more than 1 K per hour during constant test chamber temperature. After this, the reduction in pressure shall be started. Intrinsic heating of the specimen during this procedure shall be admissible. The period of conditioning shall start as soon as the test pressure required has been reached. After completion of conditioning, the rise in pressure is initiated and the test chamber starts cooling down. The temperature shall be measured in the test chamber and on the specimen. The location of the temperature measurement on the specimen shall be stipulated in the relevant specification.

With conditioning method 45, the thermally active specimen — unless the relevant specification stipulates otherwise — shall be put into operation after the test pressure has been reached. These specimens shall be subjected to the test pressure until the temperature of the specimen increases by no more than 1 K within one hour (steady-state temperature).

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
Temperature of test chamber	°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 *)			
State of operation		2	2	2	2

*) 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
Temperature of test chamber	°C	40 ± 3	40 ± 3	55 ± 3	55 ± 3	63 ± 3	63 ± 3	85 ± 3*)	85 ± 3*)	40 ± 3	55 ± 3	63 ± 3	85 ± 3[1)]
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											

*) State of operation 1 only.

5 Procedure

The test shall be performed according to the directions given in the relevant specifications and in accordance with ISO 9022-1.

6 Environmental test code

The environmental test code shall be as defined in ISO 9022-1, giving a reference to ISO 9022 and the codes for the conditioning method chosen, the degree of severity and the state of operation.

EXAMPLE

The environmental test of optical instruments for resistance to combined low pressure and ambient temperature, conditioning method 45, degree of severity 02 and state of operation 2 is identified as:

Environmental test ISO 9022-45-02-2

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) number of specimens;

c) location and number of temperature measuring points;

d) preconditioning;

e) type and scope of initial test;

f) state of operation 2: period of operation;

g) state of operation 2: method and extent of intermediate test;

h) recovery;

i) type and scope of final test;

j) criteria for evaluation;

k) type and scope of test report.