INTERNATIONAL STANDARD

ISO 9022-18

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Optics and optical instruments — Environmental test methods —

Part 18:
Combined damp heat and low internal pressure

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

Partie 18: Essai combiné chaleur humide-pression interne basse

Reference number
ISO 9022-18:1994(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 9022-18 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, dry heat or cold*

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— *Part 11: Mould growth*

— *Part 12: Contamination*

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

— *Part 14: Dew, hoarfrost, ice*

— *Part 15: Combined random vibration wide band: reproducibility medium, in dry heat or cold*

— *Part 16: Combined bounce or steady-state acceleration, in 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*

Annex A of this part of ISO 9022 is for information only.

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 the 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 18:
Combined damp heat and low internal pressure

1 Scope

This part of ISO 9022 specifies methods of testing of optical instruments and instruments containing optical components under equivalent conditions, for their ability to resist combined damp heat and low internal pressure.

The purpose of testing is to investigate to what extent the optical, thermal, chemical and electrical performance characteristics are affected by combined damp heat and low internal pressure. Annex A explains further the intention of the different types of tests.

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[1], *Optics and optical instruments — Environmental test methods — Part 1: Definitions, extent of testing.*

ISO 9022-8:1994, *Optics and optical instruments — Environmental test methods — Part 8: High pressure, low pressure, immersion.*

1) To be published.

3 General information and test conditions

Exposure of the specimen to the combined stress conditions renders the test much more severe than separate exposure to any of the environmental conditions cited.

Three different test methods are used to test the combined damp heat and low internal pressure resistance of optical instruments.

4 Conditioning

The required exposure time shall not commence until all parts of the specimen have reached a temperature within 3 K of the test chamber temperature. Dew on the specimen is admissible. The individual test steps shall be performed directly one after another. Interruption of the test is not admissible.

4.1 Conditioning method 47: Damp heat and low internal pressure, pressure difference low

See table 1 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.

4.2 Conditioning method 48: Damp heat and low internal pressure, pressure difference medium

See table 2.

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 1 — 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		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			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			Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
State of operation				1					

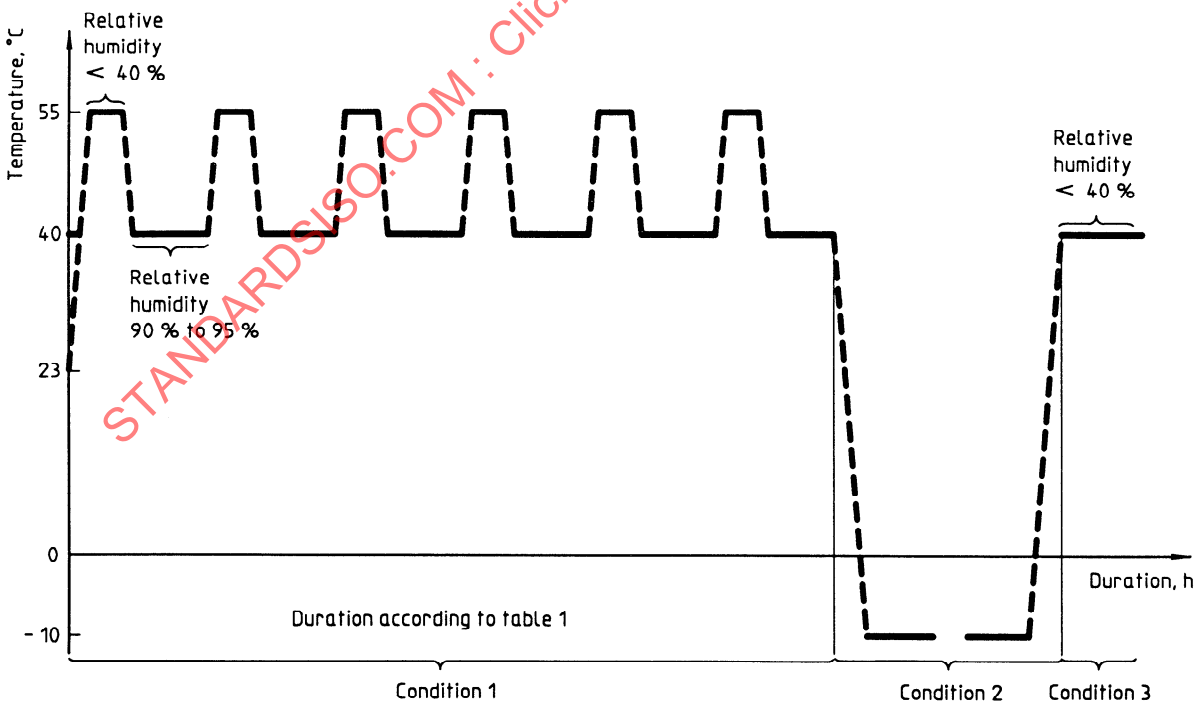

Figure 1 — Cycling curve for conditioning method 47, using example of degree of severity 01

4.3 Conditioning method 49: Damp heat and low internal pressure, pressure difference high

See table 3.

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.

Table 2 — Degrees of severity for conditioning method 48: Damp heat and low internal pressure, pressure difference medium

Degree of severity				01	02	03	04	05	06
Condition 1	Step 1	Test chamber temperature	°C	40 ± 2					
		Test chamber pressure	mbar	800		650		500	
		Exposure time	h	⩾ 1					
	Step 2	Climatic conditions		40 °C ± 2 °C and 90 % to 95 % relative humidity.					
		Exposure time	h	⩾ 1,5					
	Number of cycles			3	6	3	6	3	6
Condition 2	Test chamber temperature		°C	− 10 ± 3					
	Exposure time			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			Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
State of operation				1					

Table 3 — Degrees of severity for conditioning method 49: Damp heat and low internal pressure, pressure difference high

Degree of severity			01	02	03	04	05	06
Condition 1	Climatic conditions		40 °C ± 2 °C and 90 % to 95 % relative humidity.					
	Constant pressure reduction in specimen interior referred to surrounding pressure	mbar	200		350		500	
	Exposure time during constant pressure reduction	h	⩾ 2	⩾ 4	⩾ 2	⩾ 4	⩾ 2	⩾ 6
Condition 2	Climatic conditions		40 °C ± 2 °C and 90 % to 95 % relative humidity.					
	Exposure time after termination of constant pressure reduction (Vacuum pump disconnected)	h	⩾ 4				⩾ 6	
Condition 3	Test chamber temperature	°C	− 10 ± 3					
	Exposure time		Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
Condition 4	Test chamber temperature	°C	40 ± 2					
	Relative humidity	%	< 40					
	Exposure time		Until specimen has reached a temperature at least within 3 K of the test chamber temperature.					
State of operation			1					

5 Test equipment

5.1 For conditioning method 47

5.1.1 Climatic test cabinet or **chamber with air circulation**.

5.1.2 Heating or **freezing cabinets** or **corresponding chambers with air circulation**.

The size of the test chamber and the arrangement of the specimens shall be selected so that unifom conditioning of all specimens is ensured.

If condensation is produced, the specimens shall be protected against falling drops.

5.2 For conditioning method 48

In addition to the test equipment for conditioning method 47 (see 5.1.1), a low-pressure container is also required.

5.3 For conditioning method 49

In addition to the test equipment for conditioning method 47 (see 5.1.1), the specimens shall have a test connection for evacuation and pressure measurement as described in ISO 9022-8.

6 Procedure

6.1 General

The test shall be conducted in accordance with the requirements of the relevant specification and of the reference documents.

6.2 Procedure for conditioning method 47

6.2.1 Preliminary test 1

Prior to commencement of testing, all specimens shall be inspected for interior moisture caused by excessive humidity during assembly.

The specimens shall be cooled at a test chamber temperature of − 10 °C long enough for all parts of the specimen to reach a temperature within at least 3 K of the test chamber temperature. The specimens shall then be heated immediately in a pre-heated test chamber at approximately 40 °C. The specimens shall be closely observed during heating, and any in which a coating of moisture appears, even briefly, shall be excluded from the test.

6.2.2 Preliminary test 2

In order to establish the warm-up time of the internal air during the cycling, sensing devices shall be mounted in a representative number of separate internal air spaces of the specimens. The time period to be measured is that required for the heating of the internal air in the changeover from step 2 to step 1 to a temperature within 3 K of the prescribed test chamber temperature in step 1. This time period shall be considered as the exposure time in step 1. If several sensing devices are used, the mean of the individual measurements shall be considered as the exposure time.

6.2.3 Condition 1

The instrument-specific exposure time in step 1 established in preliminary test 2 shall be kept to ± 10 % in order to avoid drying out of the instrument due to excessive exposure times. A tolerance of ± 2 min is admissible for exposure time < 20 min. The changeover from step 1 to step 2 or vice versa shall take place quickly enough to ensure that the specimen undergoes a temperature change no greater than 3 K. At the commencement of the test the required warm-up time from the room temperature to 40 °C shall be added.

6.2.4 Conditions 2 and 3

The specimen shall be subjected to condition 2 immediately after condition 1. Transfer to condition 3 shall also be performed immediately. The specimen shall be constantly observed during the warm-up period in condition 3 (intermediate test). This is to establish whether, to what extent and over what time period a coating of moisture occurs on the internal optical surfaces.

6.3 Procedure for conditioning method 48

6.3.1 Preliminary test

The preliminary test as described in 6.2.1 shall be carried out.

6.3.2 Condition 1

The low-pressure container with the specimen shall be installed directly in the humidity chamber. The humidity chamber shall be set to the climatic conditions of step 2. The low pressure appropriate to the required degree of severity shall then be set inside the low-pressure container and maintained for the duration of the exposure time required on step 1. In the changeover to step 2, the ventilation of the low-

pressure container shall be performed using the circulated air of the humidity chamber. When the low-pressure chamber is opened, the specimen shall be maintained for the prescribed exposure time under the climatic conditions in step 2. This procedure is repeated two or five times (3 or 6 cycles).

6.3.3 Conditions 2 and 3

Conditions 2 and 3 shall be performed as described in 6.2.4.

6.4 Procedure for conditioning method 49

6.4.1 Preliminary test

The preliminary test as described in 6.2.1 shall be carried out.

The specimen shall be evacuated after reaching the test temperature in condition 1. After the prescribed exposure time, the specimen shall be sealed and stored under the same climatic conditions for the duration of the exposure time as that prescribed for condition 2.

6.4.2 Conditions 3 and 4

Conditions 3 and 4 shall be performed as described in 6.2.4 for conditions 2 and 3.

6.5 Initial and final test

A visual inspection shall be performed with a × 6 to × 10 magnification against a dark background. The illumination during the check shall be provided by an illumination device consisting of a halogen lamp (100 W power at least) with a reflector and condensor, or equivalent equipment for the generation of a parallel light beam. Subsequent to 24 h storage at room temperature, the surfaces of the dismantled optical components shall be tested for the nature and extent of any change in the optical surfaces that may have occurred, using a magnification equal to or greater than × 150 in incident light darkfield, and appropriate illumination (e.g. a 7,5 W xenon lamp).

7 Environmental test code

The environmental test code shall be as defined in ISO 9022-1.

EXAMPLE

The environmental test of optical instruments for resistance to combined damp heat and low internal pressure, pressure difference high, conditioning method 49, degree of severity 03, state of operation 1, shall be identified as:

Environmental test ISO 9022-49-03-1

8 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, taking account of 6.2.2;

e) type and scope of initial test, taking account of 6.5;

f) method and extent of intermediate test, taking account of 6.2.4;

g) recovery;

h) type and scope of final test, taking account of 6.5;

i) criteria for evaluation, e.g. duration of moisture deposition, nature and extent of any changes occurring on optical surfaces;

j) type and scope of test report.