INTERNATIONAL STANDARD

ISO 9022-2

Redline version compares Third edition to Second edition

Optics and photonics — Environmental test methods —

Part 2: Cold, heat and humidity

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

Partie 2: Froid, chaleur et humidité

Reference number
ISO 9022-2:redline:2015(E)

IMPORTANT — PLEASE NOTE

This is a mark-up copy and uses the following colour coding:

Text example 1	— indicates added text (in green)
~~Text example 2~~	— indicates removed text (in red)
	— indicates added graphic figure
	— indicates removed graphic figure
1.x ...	— Heading numbers containg modifications are highlighted in yellow in the Table of Contents

DISCLAIMER

This Redline version provides you with a quick and easy way to compare the main changes between this edition of the standard and its previous edition. It doesn't capture all single changes such as punctuation but highlights the modifications providing customers with the most valuable information. Therefore it is important to note that this Redline version is not the official ISO standard and that the users must consult with the clean version of the standard, which is the official standard, for implementation purposes.

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Foreword

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~~International Standards are~~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 ~~rules given in~~editorial rules of the ISO/IEC Directives, Part ~~3~~2 (see www.iso.org/directives).

~~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.~~

Attention is drawn to the possibility that some of the elements of this ~~part of~~document ~~ISO 9022~~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).

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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

~~International Standard~~The committee ~~ISO 9022-2 was prepared by Technical Committee~~responsible for this document is ISO/TC 172, *Optics and ~~optical instruments~~photonics*, Subcommittee SC 1, *Fundamental standards*.

This ~~second~~third edition cancels and replaces the ~~first~~second edition (ISO 9022-2:~~1994~~2002), ~~Tables 2, 3 and 7 of which have been technically revised~~of which it constitutes a minor revision.

ISO 9022 consists of the following parts, under the general title *Optics and ~~optical instruments~~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 ~~5: Combined cold, low air pressure~~6: Dust*
- ~~*Part 6: Dust*~~
- *Part 7: ~~Drip,~~ Resistance to drip or rain*
- *Part 8: High internal pressure, low internal pressure, immersion*
- *Part 9: Solar radiation and weathering*
- ~~*Part 10: Combined sinusoidal vibration and dry heat or cold*~~

— *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 heat22: 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 ~~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~~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~~is to 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 photonics — Environmental test methods —

Part 2: Cold, heat and humidity

1 Scope

This part of ISO 9022 specifies ~~methods for the testing~~ the methods relating to the environmental tests of optical instruments ~~and instruments containing optical components~~ including additional assemblies from other fields (e.g. mechanical, chemical, and electronic devices), under equivalent conditions, for their ability to resist the influence of temperature and ~~air~~/or humidity.

The purpose of the testing is to investigate to what extent ~~the~~ optical, ~~thermal~~ climatic, mechanical, chemical, and electrical (including electrostatic) performance characteristics of the specimen are affected by temperature and/or humidity.

2 Normative ~~reference~~ references

The following ~~normative document contains provisions which, through reference in this text, constitute provisions of this part of~~ documents, in whole or in part, are normatively referenced in this document and are indispensable for its application ~~ISO 9022~~. For dated references, ~~subsequent amendments to, or revisions of, this publication do not apply. However, parties to agreements based on this part of~~ only ~~ISO 9022 are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below~~ the edition cited applies. For undated references, the latest edition of the ~~normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.~~ referenced document (including any amendments) applies.

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

3 General information and test conditions

The specimen is exposed to climatic stress in conditioning chambers or cabinets providing air circulation.

The size of the specimens and their arrangement shall be such as to ensure a uniform conditioning of all specimens. Where ~~moisture~~ condensation is likely to occur, the condensate shall be prevented from dripping onto the specimen.

Where heat-dissipating specimens are involved, the relevant specification shall state the number, method of installation and location of the heat sensors.

WARNING ~~—~~ — Persons entering test chambers with dew-point temperatures of equal to or greater than 38 °C must be equipped with breathing apparatus (e.g. conditioning methods 12, 13, and 16).

4 Conditioning

4.1 General

The required exposure time shall not commence until all parts of the specimen have reached a temperature within at least 3 K of the test chamber temperature. For heat-dissipating specimens, the period of exposure or dwell time (conditioning methods 14 and 15) shall not begin, or end, until the temperature of the specimen changes not more than 1 K within 1 h at the stabilized test chamber temperature. The last hour of the temperature soaking time shall be considered to be the first hour of the exposure period.

4.2 Constant stress conditions

4.2.1 General

During exposure to constant stress conditions, the temperature shall be changed sufficiently slowly to prevent the specimen from being damaged. When testing to conditioning methods 11 and 12, the maximum relative humidity also applies to the temperature change phase. The relevant specification shall state whether condensation of dewdew formation (condensation) on the specimen is acceptable.

4.2.2 Conditioning method 10: Cold

See Table 1.

Table 1 — Degrees of severity for conditioning method 10: Cold

Degree of severity		01	02	03	04	05	06	07	08	09	10
Test chamber temperature	°C	0 ± 3	-10 ± 3	-15 ± 3	-20 ± 3	-25 ± 3	-30 ± 3	-35 ± 3	-40 ± 3	-55 ± 3	-65 ± 3
Exposure time	h	16									
State of operation		0 or 1 or 2[a]									0 or 1

[a] When testing to degree of severity 09 is required, state of operation 2 should be justified in the relevant specification.

Table 1 — Degrees of severity for conditioning method 10: Cold

Degree of severity		01	02	03	04	05	06	07	08	09	10
Test chamber temperature	°C	−0 ± 3	−10 ± 3	−15 ± 3	−20 ± 3	−25 ± 3	−30 ± 3	−35 ± 3	−40 ± 3	−55 ± 3	−65 ± 3
Exposure time	h	16									
State of operation		0 or 1 or 2[a]									0 or 1

[a] When testing to degree of severity 09 is required, state of operation 2 should be justified in the relevant specification.

4.2.3 Conditioning method 11: Dry heat

See Table 2.

Table 2 — Degrees of severity for conditioning method 11: Dry heat

Degree of severity		01	02	03	04	05	06	07	08
Test chamber temperature	°C	10 ± 2	40 ± 2	55 ± 2	63 ± 2	70 ± 2	85 ± 2	70 ± 2	85 ± 2
Relative humidity	%	<40							
Exposure time	h	16				6	6	2	2
State of operation		0 or 1 or 2					0 or 1	0 or 1 or 2	0 or 1

Table 2 — Degrees of severity for conditioning method 11: Dry heat

Degree of severity		01	02	03	04	05	06	07	08
Test chamber temperature	°C	10 ± 2	40 ± 2	55 ± 2	63 ± 2	70 ± 2	85 ± 2	70 ± 2	85 ± 2
Relative humidity	%	<40							
Exposure time	h	16				6	6	2	2
State of operation		0 or 1 or 2					0 or 1	0 or 1 or 2	0 or 1

4.2.4 Conditioning method 12: Damp heat

See Table 3.

~~**Table 3 — Degrees of severity for conditioning method 12: Damp heat**~~

Degree of severity	01	02	03	04	05	06	07
Climatic conditions	40 °C ± 2 °C and 90 % to 95 % r.h.					55 °C ± 2 °C and 90 % to 95 % r.h.	
Exposure time	24 h	4 d	10 d	21 d	56 d	6 h	16 h
State of operation	0 or 1 or 2[a]						

[a] State of operation 2 during the last 4 h of exposure only.

Table 3 — Degrees of severity for conditioning method 12: Damp heat

Degree of severity	01	02	03	04	05	06	07
Climatic conditions	40 °C ± 2 °C and 90 % to 95 % r.h.					55 °C ± 2 °C and 90 % to 95 % r.h.	
Exposure time	24 h	4 d	10 d	21 d	56 d	6 h	16 h
State of operation	0 or 1 or 2[a]						

[a] State of operation 2 during the last 4 h of exposure only.

4.2.5 Conditioning method 13: ~~Condensed water~~ Condensation

See Table 4.

~~**Table 4 — Degrees of severity for conditioning method 13: Condensed water**~~

Degree of severity	01	02	03	04	05	06
Climatic conditions	40 °C ± 2 °C and approximately 100 % relative humidity, including bedewing of specimens					
Exposure time	6 h	16 h	2d	4 d	8 d	16 d
State of operation	0 or 1 or 2[a]					

[a] State of operation 2 during the last 4 h of exposure only.

Table 4 — Degrees of severity for conditioning method 13: ~~Condensed water~~ Condensation

Degree of severity	01	02	03	04	05	06
Climatic conditions	40 °C ± 2 °C and approximately 100 % r.h., including condensation on specimens					
Exposure time	6 h	16 h	2 d	4 d	8 d	16 d
State of operation	0 or 1 or 2[a]					

[a] State of operation 2 during the last 4 h of exposure only.

4.3 Cycling exposure conditions

4.3.1 General

When applying conditioning methods 14 and 15, the specimens shall have reached a temperature at least within 3 K of the test chamber temperatures t_1 and t_2 not later than at the end of the dwell times shown in the respective tables. If the requirement cannot be met, owing to large-sized specimens, a pre-test may be performed to determine the dwell times required.

When applying conditioning method 15, intermediate storage (e.g. overnight) will be acceptable at t_2 only.

4.3.2 Conditioning method 14: Slow temperature change

See Table 5 and Figure 1.

~~Table 5 — Degrees of severity for conditioning method 14: Slow temperature change~~

Degree of severity			01	02	03	04	05	06	07	08	09
Test chamber temperature	°C	t_2	40 ± 2	55 ± 2	70 ± 2	55 ± 2	63 ± 2	70 ± 2	70 ± 2	70 ± 2	85 ± 2
		t_1	-10±3	-25 ± 3	-25 ± 3	-40 ± 3	-35 ± 3	-40 ± 3	-50 ± 3	-65 ± 3	-65 ± 3
Temperature difference	K		50	80	95	95	98	110	120	135	150
Number of cycles			5								
Dwell time at t_1 and t_2			Until specimen has reached a temperature at least within 3 K of the test chamber temperature but not less than 2,5 h. For heat-dissipating specimens, refer to 4.1.								
Test chamber temperature change rate			Between 0,2 K/min and 2 K/min.								
State of operation			0 or 1 or 2[a]								

[a] When testing to degrees of severity 04 to 09, state of operation 2 should be justified in the relevant specification.

Table 5 — Degrees of severity for conditioning method 14: Slow temperature change

Degree of severity			01	02	03	04	05	06	07	08	09
Test chamber temperature	°C	t_2	40 ± 2	55 ± 2	70 ± 2	55 ± 2	63 ± 2	70 ± 2	70 ± 2	70 ± 2	85 ± 2
		t_1	−10 ± 3	−25 ± 3	−25 ± 3	−40 ± 3	−35 ± 3	−40 ± 3	−50 ± 3	−65 ± 3	−65 ± 3
Temperature difference	K		50	80	95	95	98	110	120	135	150
Number of cycles			5								
Dwell time at t_1 and t_2			Until specimen has reached a temperature at least within 3 K of the test chamber temperature but not less than 2,5 h. For heat-dissipating specimens, refer to 4.1.								
Test chamber temperature change rate			Between 0,2 K/min and 2 K/min.								
State of operation			0 or 1 or 2[a]								

[a] When testing to degrees of severity 04 to 09, state of operation 2 should be justified in the relevant specification.