INTERNATIONAL STANDARD

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Optics and photonics — Environmental test methods —

Part 14: Dew, hoarfrost, ice

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

Partie 14: Rosée, givre, glace

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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).

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

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

This second edition cancels and replaces the first edition (ISO 9022-14:1994), of which it constitutes a minor revision.

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 internal pressure, low internal pressure, immersion*

— *Part 9: Solar radiation and weathering*

— *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 sulphide*

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— *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*

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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, 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.

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 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 of both ISO 9022 and other appropriate International Standards will be necessary.

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Optics and photonics — Environmental test methods —

Part 14:
Dew, hoarfrost, ice

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 dew, hoarfrost or ice.

The purpose of testing is to investigate to what extent the optical, climatic, mechanical, chemical, and electrical (including electrostatic) performance characteristics of the specimen are affected by dew, hoarfrost, or ice.

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.

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

ISO 9022-4, *Optics and photonics — Environmental test methods — Part 4: Salt mist*

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3 General information and test conditions

Exposure to dew, hoarfrost, or ice is effected by rapid change of the environmental conditions in a chamber or by transferring the specimen from a cold chamber to a conditioned room. Instrument parts not exposed to hoarfrost or icing conditions during normal use should be protected from exposure to such conditions during test.

4 Conditioning

Table 1 shows the conditioning methods 75 (dew), 76 (hoarfrost followed by the process of thawing), and 77 (ice covering followed by the process of thawing). Conditioning method 77 (ice covering followed by the process of thawing) includes two types of ice formation (see Annex A for details):

— rime ice: degree of severity 01 applies;

— glazed ice: degrees of severity 02 to 04 apply.

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Table 1 — Degrees of severity for conditioning methods 75, 76, and 77

Conditioning method			75	76			77			
Step 1	Degree of severity		01	01	02	03	01	02	03[a]	04[a]
	Test chamber temperature	°C	10 ± 2	−10 ± 2	−25 ± 3		−15 ± 3		−25 ± 3	
	Exposure time		Until specimen has reached a temperature within 3 °C of the test chamber temperature[b].							
Step 2	Test chamber temperature	°C	Not applicable		−5 ± 2			−15 ± 3	−25 ± 3	
	Hoarfrost, rime ice, or glazed ice build-up on test surfaces[c]	mm			0,5 to 2	2 to 4	5 to 7	20 to 30	≥75	
	Exposure time				Until the specimen has reached a temperature within 3 °C of the test chamber temperature[b].					
Step 3	Test chamber temperature	°C	30 ± 2							
	Relative humidity	%	80 to 95							
	Exposure time		Until specimen has reached a temperature within 3 °C of the test chamber temperature[b].							
State of operation			1 or 2							

[a] Only applicable for outside-mounted naval equipment.

[b] Where heat-dissipating specimens are involved, temperature soaking shall be deemed to be satisfactory if, at stabilized test chamber temperature, the temperature of the specimen does not change by more than 3 °C within one hour.

[c] Test surfaces as specified by the relevant specification.

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5 Procedure

5.1 General

The test shall be conducted in accordance with the requirements of the relevant specification and with ISO 9022-1.

5.2 Preconditioning

Unless otherwise specified in the relevant specification, the surface of the specimen shall be properly cleaned using nonresidue neutral cleaning agents only. After cleaning, the specimen shall be restored to service condition (as, for instance, by applying protecting grease, etc.).

5.3 Test sequence

5.3.1 Conditioning method 75, degree of severity 01; conditioning method 76, degrees of severity 01 and 02

After temperature stabilization in step 1, immediately expose the specimen to the environmental conditions of step 3. This can be done by transferring the specimen to a conditioned room or changing the test chamber conditions.

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5.3.2 Conditioning method 76, degree of severity 03

After temperature stabilization of the specimen in step 1, proceed to step 2 and heat the test chamber to −5 °C. Produce hoarfrost by directing water vapour or atomized spray against the specimen, using a fine nozzle spray gun arranged at a distance of 0,5 m from the specimen.

If state of operation 2 is required, perform an intermediate test after completion of step 2, immediately proceed to step 3, and perform another intermediate test during the process of thawing.

5.3.3 Conditioning method 77

5.3.3.1 Degree of severity 01

After temperature stabilization of the specimen during step 1, proceed to step 2 and heat the test chamber to −5 °C. Produce a build-up of opaque rime ice, as thick as required, on the specimen by directing a spray of atomized-water, pre-cooled to 5 °C, against the specimen (using a coarse nozzled spray gun arranged at a distance of 0,2 m to 0,3 m from the specimen).

Continue as specified in 5.3.2.

5.3.3.2 Degrees of severity 02 to 04

After temperature stabilization of the specimen in step 1, proceed to step 2 and procedure a build-up of glazed ice on the specimen as required. This can be achieved by sprinkling or pouring freezing water on the specimen (in several layers, if necessary).

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If the test solution (salt water) specified in ISO 9022-4 is to be used for producing the build-up of glazed ice when testing to degrees of severity 03 and 04, the relevant specification shall include an appropriate note.

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Continue as specified in 5.3.2.

5.4 Recovery

Unless otherwise specified in the relevant specification, superficially dry the specimen after removal from the test chamber. Do not use compressed air for drying. Restore specimen to ambient temperature.

5.5 Final test

Condensed moisture visible on optical surfaces within the specimen shall be acceptable provided that such films vanish within the time interval specified in the relevant specification. Unless penetrated water can be detected by visual inspection, the relevant specification shall specify an appropriate method of verification.

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 hoarfrost, conditioning method 76, degree of severity 03, state of operation 1, is identified as:

Environmental test ISO 9022-76-03-01

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