INTERNATIONAL STANDARD

ISO 9022-1

Second edition
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Optics and photonics — Environmental test methods —

Part 1: Definitions, extent of testing

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

Partie 1: Définitions, portée des essais

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

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

This second edition cancels and replaces the first edition (ISO 9022-1:1994), which has been technically revised.

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 5: Combined cold, low air pressure*

— *Part 6: Dust*

— *Part 7: Resistance to drip or rain*

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

— *Part 9: Solar radiation*

— *Part 11: Mould growth*

— *Part 12: Contamination*

— *Part 14: Dew, hoarfrost, ice*

— *Part 17: Combined contamination, solar radiation*

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

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

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

— *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 or damp heat*[1)]

1) Under preparation.

Introduction

Optical and photonic instruments, including additional assemblies from other fields (e.g. mechanical, chemical and electronic devices) are affected during their use by a number of different environmental and handling parameters which they are required to resist without significant reduction in performance, while still remaining 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 tropical and subtropical climates 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 cumulated exposure of the instrument to a range of simulated environmental parameters under controlled laboratory conditions. The cumulative combination, degree of severity and sequence of these conditions can be selected 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 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 specific 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 the relevant part of 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 the relevant part of ISO 9022 and other appropriate International Standards is necessary.

Optics and photonics — Environmental test methods —

Part 1:
Definitions, extent of testing

1 Scope

This part of ISO 9022 defines terms relating to environmental tests of optical and photonic instruments, including additional assemblies from other fields (e.g. mechanical, chemical and electronic devices), and specifies basic features of testing.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
environmental test
laboratory simulation, usually severe, of the climatic, mechanical, biological, electrical (including electrostatic) and chemical environmental influences acting on the specimen during assembly, storage, transport and operation, in order to establish any changes in the behaviour of the specimen in a short time

2.2
optical instrument
photonic instrument
instrument whose function is mainly based on optical phenomena, consisting of several assemblies and/or components, illumination systems, instruments with light conduction and instruments which, apart from optical units, contain assemblies and/or components from other fields, e.g. electronic components

2.3
optical assembly
functional unit consisting of several components, at least one of which has an optical function

2.4
component
<optical instrument> smallest unit, generally consisting of one piece and one material

2.5
representative sample
sample which differs from a component only in its geometry

EXAMPLE An optical part or piece of sheet metal.

2.6
specimen
instrument, assembly, component or representative sample which is being tested

2.7
test
procedure by which the effect of applied parameters on the properties of a specimen is determined and assessed

2.8
conditioning
sum of the external influences acting on the specimen during the test, such as the conditioning method and degree of severity employed, and of the internal influences resulting from the state of operation of the specimen, such as movements and/or temperature changes

2.8.1
conditioning method
individual or combined environmental influences to which the specimen is submitted during the test

EXAMPLE Shock or damp heat.

2.8.2
degree of severity
parameter containing all the individual quantities required for the test

EXAMPLE Temperature, humidity, conditioning time.

Note 1 to entry: Conditioning time (exposure time) is the minimum time if no tolerance is indicated in the relevant parts of ISO 9022.

2.8.3
state of operation
state defining the operating status of the specimen during conditioning

Note 1 to entry: Three states of operation are distinguished: state of operation 0, state of operation 1 and state of operation 2.

2.8.3.1
state of operation 0
state whereby the specimen is in its normal transport and/or storage container and/or shipping package respectively as provided by the manufacturer

2.8.3.2
state of operation 1
state whereby the specimen is unprotected and ready for operation, but power supply is not connected

2.8.3.3
state of operation 2
state whereby the specimen is operating during the test for a period to be determined in the relevant specification

Note 1 to entry: The mode of the operating status is given in the relevant specification. During operation, correct functioning of the specimen is checked.

2.9
examinations and tests
determination of the properties and functions of a specimen for the purpose of subsequent evaluation

Note 1 to entry: There are three types of examinations and tests: visual examination, function test and measurement.

2.9.1
visual examination
examination which uses the human eye as a detector

2.9.2
function test
determination of functionality

2.9.3
measurement
objective determination of the value of a physical quantity by comparison with a specified quantity

2.10
evaluation
comparison of the results measured either with one another or with specified tolerances to be met in initial, intermediate and final tests

2.11
relevant specification
compilation of all data referring to the specimen and necessary for testing

2.12
ambient atmospheric conditions
conditions defined by the temperature range between 15 °C and 35 °C at a relative air humidity between 30 % and 85 %

3 Procedure

3.1 Test sequence

Unless the relevant part of ISO 9022 or the relevant specification gives different directions for the test sequence, the test shall be performed in accordance with 3.2 to 3.8. Preconditioning, recovery, initial and final tests shall be carried out in as constant ambient atmospheric conditions as possible.

3.2 Preconditioning (specimen preparation)

Preconditioning brings the specimen into the state necessary for initial testing and conditioning, e.g. cleaning of the exterior of the specimen, drying of the interior of the specimen, changing of the desiccator cartridges, or greasing of the areas liable to corrosion. The temperature of the specimen shall be adjusted to the ambient temperature to within 3 K.

3.3 Initial test

After preconditioning, an examination shall be performed according to the relevant specification. This shall include a visual examination for damage, such as scratches on optical parts or cracks in other materials, which might influence the behaviour of the specimen.

3.4 Conditioning

After the initial test, the specimen shall be submitted to the conditioning method at the defined degree of severity and the state of operation given in the relevant specification.

3.5 Intermediate test (in state of operation 2 only)

The specimen shall be submitted to a test during conditioning according to the relevant specification.

3.6 Recovery

Recovery shall bring the specimen into the state required for final testing, e.g. temperature adjustment to within 3 K of the preconditioning temperature.

3.7 Final test

After recovery, a test shall be carried out according to the relevant specification.

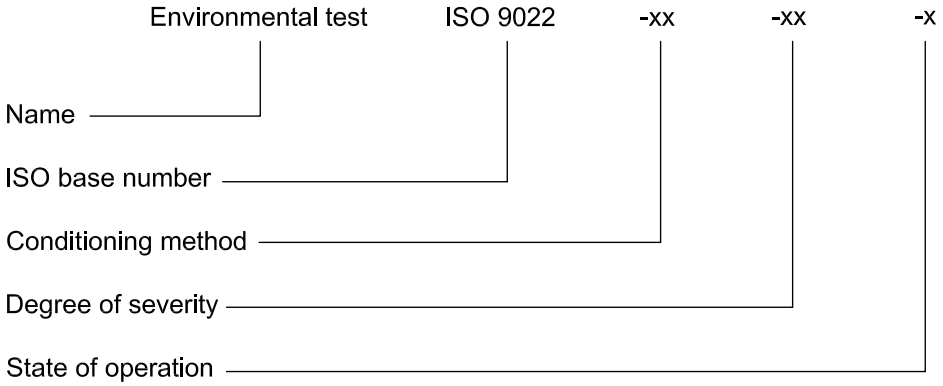
3.8 Evaluation

The specimen shall have passed the test if all evaluation criteria laid down in the relevant specification have been met.

4 Environmental test code

The code for environmental tests shall be formed as follows:

NOTE Conditioning methods are shown in Annex A.



Annex A
(informative)

List of relevant parts of ISO 9022 and conditioning methods

ISO 9022-2: Cold, heat and humidity

Conditioning method
- 10: Cold
- 11: Dry heat
- 12: Damp heat
- 13: Condensed water
- 14: Slow temperature change
- 15: Rapid temperature change
- 16: Damp heat, cyclic

ISO 9022-3: Mechanical stress

Conditioning method
- 30: Shock
- 31: Bump
- 32: Drop and topple
- 33: Free fall
- 34: Bounce
- 35: Steady-state acceleration, centrifugal
- 36: Sinusoidal vibration
- 37: Random vibration (wide band) digitally controlled

ISO 9022-4: Salt mist

Conditioning method
- 40: Salt mist

ISO 9022-5: Combined cold, low air pressure[2)]

Conditioning method
- 50: Combined cold, low air pressure including hoarfrost and dew
- 51: Combined cold, low air pressure without hoarfrost and dew

ISO 9022-6: Dust[3)]

Conditioning method
- 52: Blowing dust

ISO 9022-7: Resistance to drip or rain

Conditioning method
- 72: Drip
- 73: Steady rain
- 74: Driving rain

2) Preliminary work is underway in ISO/TC 172/SC 1 towards consolidating ISO 9022-5, ISO 9022-18 and ISO 9022-21 into one single new part, ISO 9022-23. It is anticipated that this will lead to conditioning methods 50 and 51 (currently in ISO 9022-5), conditioning methods 47, 48 and 49 (currently in ISO 9022-18) and conditioning methods 45 and 46 (currently in ISO 9022-21) being found in ISO 9022-23.

3) For additional dust and rain conditioning methods, see IEC 60529.

ISO 9022-8: High pressure, low pressure, immersion

Conditioning method
80: High internal pressure
81: Low internal pressure
82: Immersion

ISO 9022-9: Solar radiation

Conditioning method
20: Solar radiation

ISO 9022-11: Mould growth

Conditioning method
85: Mould growth

ISO 9022-12: Contamination

Conditioning method
86: Basic cosmetic substances and artifical hand sweat
87: Laboratory agents
88: Production plant resources
89: Fuels and resources for aircraft, naval vessels and land vehicles

ISO 9022-14: Dew, hoarfrost, ice

Conditioning method
75: Dew
76: Hoarfrost, followed by process of thawing
77: Ice covering, followed by process of thawing

ISO 9022-17: Combined contamination, solar radiation

Conditioning method
90: Basic cosmetic substances and artificial hand sweat, combined with solar radiation
91: Fuels and other resources for aircraft, naval vessels and land vehicles, combined with solar radiation

ISO 9022-18: Combined damp heat and low internal pressure[1)]

Conditioning method
47: Damp heat and low internal pressure, pressure difference low
48: Damp heat and low internal pressure, pressure difference medium
49: Damp heat and low internal pressure, pressure difference high

ISO 9022-20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide

Conditioning method
41: Humid atmosphere containing sulfur dioxide (SO_2)
42: Humid atmosphere containing hydrogen sulfide (H_2S)

ISO 9022-21: Combined low pressure and ambient temperature or dry heat[1)]

Conditioning method
45: Combined low pressure and ambient temperature
46: Combined low pressure and dry heat

ISO 9022-22: Combined cold, dry heat or temperature change with bump or random vibration

Conditioning method
22: Cold, dry heat or temperature change combined with bump or random vibration

ISO 9022-23: Low pressure combined with cold, ambient temperature and dry or damp heat

Conditioning method	45: Combined low pressure and ambient temperature 46: Combined low pressure and dry heat 47: Damp heat and low internal pressure, pressure difference low 48: Damp heat and low internal pressure, pressure difference medium 49: Damp heat and low internal pressure, pressure difference high 50: Combined cold, low air pressure including hoarfrost and dew 51: Combined cold, low air pressure without hoarfrost and dew

Bibliography

[1] IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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