INTERNATIONAL STANDARD

ISO 9022-16

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Optics and optical instruments — Environmental test methods —

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

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

Partie 16: Essai combiné secousse ou accélération constante et chaleur sèche ou froid

Reference number
ISO 9022-16:1998(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 9022-16 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 1, *Fundamental standards.*

This second edition cancels and replaces the first edition (ISO 9022-16:1994), which has been technically revised.

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*

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— *Part 9: Solar radiation*
— *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 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 16:
Combined bounce or steady-state acceleration and dry heat or cold

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 bounce or steady-state acceleration and dry heat or cold.

The purpose of the testing is to investigate to what extent the optical, thermal, mechanical, chemical and electrical performance characteristics of the specimen are affected by combined bounce or steady-state acceleration and dry heat or cold.

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*.

ISO 9022-3:1998, *Optics and optical instruments — Environmental test methods — Part 3: Mechanical stress*.

IEC 60068-2-47:1982, *Environmental testing — Part 2: Tests — Mounting of components, equipment and other articles for dynamic tests including shock (Ea), bump (Eb), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance*.

3 General information and test conditions

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

The values of temperature specified in the tables are selected from ISO 9022-2, conditioning methods 10 and 11.

The test shall be conducted in accordance with the requirements of ISO 9022-3.

The fixture for the specimen shall meet the requirements of IEC 60068-2-47 and shall be thermally insulated, if appropriate.

If the specimen is mounted on shock absorbers, time shall be allowed for temperature stabilization of the absorber elements.

The test for bounce resistance (conditioning methods 57 and 58) shall be performed on instruments in their transport packing, or in their storage or carrying case.

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 shall not begin until the temperature of the specimens changes not more than 1 K within one hour 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 Conditioning method 57: Combined bounce, dry heat

See table 1.

Table 1 — Degrees of severity for conditioning method 57: Combined bounce, dry heat

Degree of severity		01	02	03	04	05	06	07	08	09	10	11	12
Test chamber temperature	°C	63 ± 2			85 ± 2			40 ± 2			55 ± 2		
Relative humidity	%	< 40											
Exposure time	min	15	60	180	15	60	180	15	60	180	15	60	180
	Acceptable deviation	± 10 %											
State of operation		0											
NOTE The period of exposure shall be allocated in equal portions to each of the surfaces to be exposed.													

4.3 Conditioning method 58: Combined bounce, cold

See table 2.

Table 2 — Degrees of severity for conditioning method 58: Combined bounce, cold

Degree of severity		01	02	03	04	05	06	07	08	09	10	11	12
Test chamber temperature	°C	− 25 ± 3			− 35 ± 3			− 55 ± 3			− 65 ± 3		
Exposure time	min	15	60	180	15	60	180	15	60	180	15	60	180
	Acceptable deviation	± 10 %											
State of operation		0											
NOTE The period of exposure shall be allocated in equal portions to each of the surfaces to be exposed.													

4.4 Conditioning method 59: Combined steady state acceleration, dry heat

See table 3.

Table 3 — Degrees of severity for conditioning method 59: Combined steady-state acceleration, dry heat

Degree of severity		01	02	03	04	05	06	07	08	09
Test chamber temperature	°C	40 ± 2			55 ± 2			63 ± 2		
Relative humidity	%	< 40								
Acceleration	m/s²	50	100	200	50	100	200	50	100	200
	g_n multiples	5	10	20	5	10	20	5	10	20
Exposure time along each axis and each direction	s	> 10*)								
State of operation		0 or 1 or 2								
*) The exposure time begins after reaching the rated number of revolutions.										

4.5 Conditioning method 60: Combined steady state acceleration, cold

See table 4.

Table 4 — Degrees of severity for conditioning method 60: Combined steady-state acceleration, cold

Degree of severity		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Test chamber temperature	°C	− 10 ± 3			− 20 ± 3			− 25 ± 3			− 35 ± 3			− 55 ± 3			− 65 ± 3		
Acceleration	m/s²	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
	g_n multiples	5	10	20	5	10	20	5	10	20	5	10	20	5	10	20	5	10	20
Exposure time along each axis and each direction	s	> 10*)																	
State of operation		0 or 1 or 2																	
*) The exposure time begins after reaching the rated number of revolutions.																			

5 Procedure

5.1 General

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

5.2 Test sequence

The time of exposure to test temperatures depends upon the thermal behaviour of the specimen and on the specified time of exposure to bounce or steady-state acceleration.

The specimen may be repositioned, for bounce or steady-state acceleration, along another axis, at any temperature between ambient and test temperature, provided that there is no formation of condensate, hoarfrost or ice.

5.3 Temperature soaking of specimen in conditioning methods 57 and 58

For conditioning the specimen, the bounce testing machine should preferably be mounted inside a cold or heat chamber. If conditioning is performed outside the chamber, care should be taken to ensure that the temperature of the specimen remains within permitted limits during the conditioning.

5.4 Temperature soaking of specimen in conditioning methods 59 and 60

Installation of the centrifuge for the uniform acceleration of the specimen inside a cold or heat chamber is not necessary, especially in view of the short exposure time. Care should however be taken to ensure that the temperature of the specimen remains within permitted limits during the conditioning.

Suitable ways of ensuring this are, for example, heating the fixture for the specimen device to a temperature exceeding that of the specimen and the use of temperature-regulated or preconditioned insulating domes. It may be specified in the relevant specification that the time pattern followed by the temperature change in the thermally insulated specimen — outside the chamber — is to be determined. This establishes the time available for mounting and conditioning within which the temperature change occurring in the specimen remains within permitted limits.

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 bounce, dry heat, conditioning method 57, degree of severity 03, state of operation 0, is identified as:

Environmental test ISO 9022-57-03-0

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) number of specimens;

c) conditioning methods 57 and 58: type and scope of packing and surfaces to be exposed;