INTERNATIONAL STANDARD

ISO 9022-9

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Optics and optical instruments — Environmental test methods —

Part 9: Solar radiation

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

Partie 9: Rayonnement solaire

Reference number
ISO 9022-9:1994(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 9022-9 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*

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 9:
Solar radiation

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 the effects of simulated solar radiation. It is applicable to instruments that may be exposed to sunlight during operation or unsheltered storage on the earth's surface, or in the lower atmosphere.

The purpose of testing is to investigate to what extent the optical, thermal, mechanical, chemical and electrical performance characteristics of the specimen are affected by solar radiation.

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.*

IEC 68-2-9:1975 *Environmental testing — Part 2: Tests — Guidance for solar radiation testing.*

3 General information and test conditions

A radiation source capable of generating irradiance as specified in table 1 on the specimen surface or in a plane specified in the relevant specification is installed in a heated test chamber. The data shall include any radiation reflected from the test chamber walls but not infrared radiation emitted from the chamber walls on account of the wall temperature.

Ozone generated during exposure shall be removed from the test chamber.

The position and mounting of the specimen, the characteristics of its support and the location of the test points for measuring the radiation and the temperature within the exposure zone shall be specified in the relevant specification.

In addition to the requirements specified above, IEC 68-2-9 applies.

1) To be published.

4 Conditioning method 20: Solar radiation

See table 2.

NOTES

1 An irradiance of 1 kW/m^2 corresponds to the intensity of global radiation. The latter is the total radiation incident upon a horizontal area of the earth's surface and is, with the sun being at the zenith, composed of direct solar radiation and solar radiation diffusely reflected from the atmosphere. The global radiation is not constant and has therefore been determined by the International Commission on Illumination (CIE) on the basis of solar constant $I_0 = 1{,}35$ kW/m^2 (see CIE No. 20/1972).

2 Degree of severity 01 represents extreme natural stress and is preferably used to determine thermal influences. Degree of severity 02 represents medium-degree natural stress over a long period and is preferably used to determine thermal, photomechanical and ageing influences. Degrees of severity 03 and 04 do not represent true influences but are preferably used to determine photochemical influences and to achieve artificial ageing. In addition, heating effects on specimens of low thermal capacity may be determined.

Table 1 — Spectral energy distribution of the radiation source

Spectral range		**Ultraviolet**		**Visible**			**Infrared**
Wavelength band	nm	280 to 320	beyond 320 to 400	beyond 400 to 520	beyond 520 to 640	beyond 640 to 780	beyond 780 to 3 000
Irradiance	W/m^2	5 ± 2	63 ± 15	200 ± 20	186 ± 20	174 ± 20	492 ± 100

Table 2 — Degrees of severity for conditioning method 20: Solar radiation

Degree of severity		01	02	03 [1]	04 [1]
Temperature limits within test chamber	°C t_2	55 ± 2	55 ± 2	40 ± 2	55 ± 2
	°C t_1	25 ± 2			
Relative humidity	%	⩽ 25			
Recirculating air speed	m/s	1,5 to 3			
Irradiance	kW/m^2	1 ± 0,1	0 to 1,0 [2]	1 ± 0,1	1 ± 0,1
Total exposure time [3]	d	3	5	4	10
Irradiation [3]	kWh/m^2	24	45	96	240
Test sequence [3]		See figure 1	See figure 2	See figure 3	
Number of cycles		3	5	1	
State of operation		1 or 2		1	

1) For testing representative specimens only.

2) Tolerance for intermediate irradiance levels and upper limit: ± 0,1 kW/m^2.

3) See figures 1 to 3.

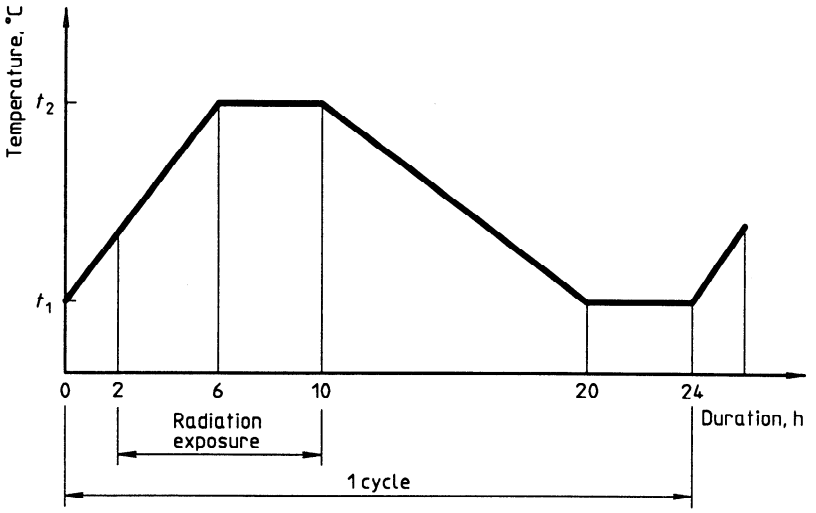

Figure 1 — Test sequence of controlled test chamber temperature and period of radiation exposure for degree of severity 01 (one of three cycles required)

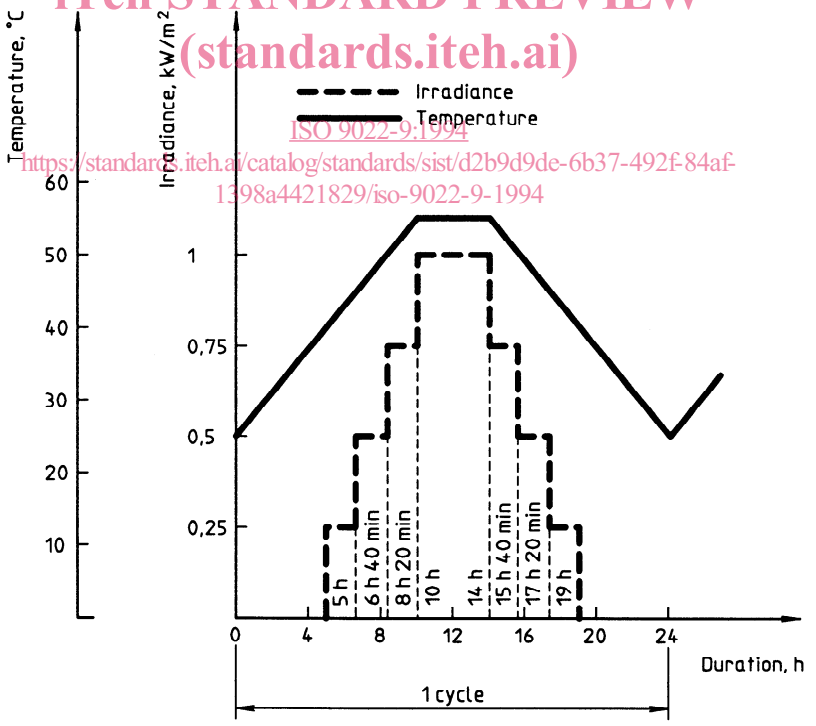

Figure 2 — Test sequence of irradiance and controlled test chamber temperature for degree of severity 02 (one of five cycles required)

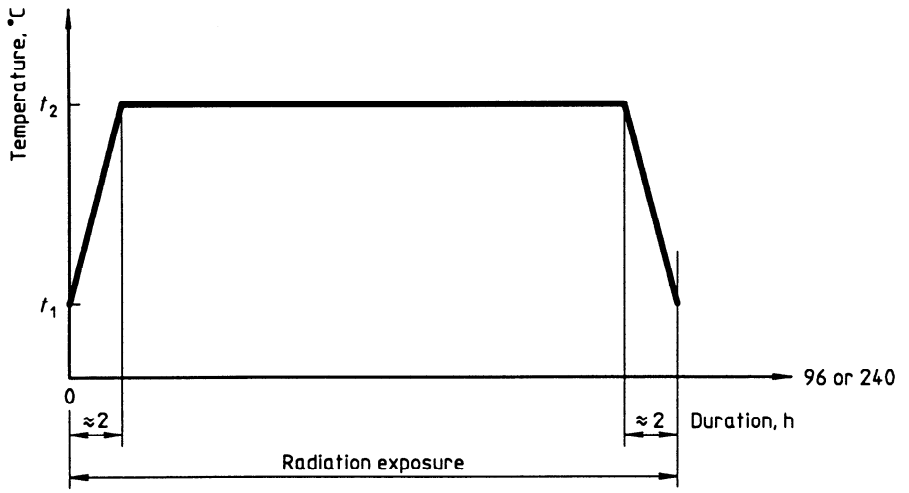

Figure 3 — Test sequence of controlled test chamber temperature and period of radiation exposure for degrees of severity 03 and 04

5 Procedure

5.1 General

The test shall be conducted in accordance with the requirements of the relevant specification and with ISO 9022-1 and IEC 68-2-9.

5.2 Preconditioning

Unless otherwise specified in the relevant specification, the surface of the specimen shall be properly cleaned prior to exposure. No cleaning agents shall be used for this purpose, other than non-residual neutral agents which do not attack the surface of the specimen.

6 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 solar radiation, conditioning method 20, degree of severity 02, state of operation 1, shall be identified as:

Environmental test ISO 9022-20-02-1

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) number of specimens;

c) specimen surface to be irradiated;

d) position of the irradiation measuring plane;

e) mounting and support of specimen;

f) location of the test points for measuring irradiance and test chamber temperature;

g) preconditioning if other than specified in 5.2;

h) type and scope of initial test;

i) state of operation 2: period of operation;

j) state of operation 2: type and scope of intermediate test;

k) recovery;

l) type and scope of final test;

m) criteria for evaluation;

n) type and scope of test report.

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