INTERNATIONAL STANDARD

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Optics and optical instruments — Environmental test methods —

Part 17: Combined contamination, solar radiation

Optique et instruments d'optique — Méthodes d'essais d'environnement —
Partie 17: Essai combiné contamination-rayonnement solaire

Reference number
ISO 9022-17:1994(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 9022-17 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 17:
Combined contamination, solar radiation

1 Scope

This part of ISO 9022 specifies methods of testing of optical instruments and instruments containing optical components under equivalent conditions, for their ability to resist combined contamination and solar radiation. "Contamination" as used in this part of ISO 9022 means the contact of optical instruments with corrosive chemical substances (hereafter called test agents).

Complete instruments or assemblies are, however, not be tested to this part of ISO 9022 except for special reasons (refer to ISO 9022-12). As a rule, representative substrates are used as specimens.

The tests described in this part of ISO 9022 are designed for the selection of materials and components for instruments likely to be subjected to combined contamination and solar radiation during service life, rather than for regular production control.

The purpose of testing is to investigate the resistance of an instrument, and in particular, of instrument surfaces, coatings, or synthetic materials, to **a short-time** exposure to the test agents combined with 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.*

ISO 9022-9:1994, *Optics and optical instruments — Environmental test methods — Part 9: Solar radiation.*

ISO 9022-12:1994, *Optics and optical instruments — Environmental test methods — Part 12: Contamination.*

1) To be published.

3 General information and test conditions

3.1 General

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

The test shall be conducted in ambient atmospheric conditions in accordance with ISO 9022-1.

The test agents listed in tables 1 and 3 were selected from ISO 9022-12, conditioning methods 86 and 89.

The test shall be conducted in accordance with the requirements of ISO 9022-9 and ISO 9022-12.

The surface of the specimens shall be orientated so that the test agents do not flow away during testing. If liquid test agents are used, enough drops should be deposited in one place on the surface to form a circular spot of approximately 10 mm diameter. During the test, the test agents should not flow into each other. In the case of spreading liquids, several specimens should be used if necessary. Viscous or paste liquids should be spread evenly and thinly in the form of the spot described above (thickness approximately 0,01 mm). It should be noted that heating of the test agents may cause them to spread during the test. Test agents which evaporate during the test shall not be replaced.

The relevant specification may require testing of a complete instrument or assembly if such instrument or assembly would be likely to encounter, during its service life, complete flooding rather than partial contamination only. After having preconditioned such specimens as described in ISO 9022-12, the surface should be completely and copiously sprayed, by means of an atomizer, with a test agent specified in the relevant specification. Any test agent evaporating during exposure shall not be replaced.

3.2 Specimens

For specimens, see ISO 9022-12.

4 Conditioning

Tables 1 and 3 show combinations of degrees of severity from ISO 9022-9 and test agents from ISO 9022-12, conditioning methods 86 and 89.

4.1 Conditioning method 90: Basic cosmetic substances and artificial hand sweat, combined with solar radiation

See table 1.

4.2 Conditioning method 91: Fuels and other resources for aircraft, naval vessels and land vehicles, combined with solar radiation

See table 2.

5 Procedure

5.1 General

The test shall be conducted in accordance with the requirements of the relevant specifications and of the reference documents.

5.2 Preconditioning, recovery, evaluation and general level for acceptance

For preconditioning, recovery, evaluation and general level for acceptance, see ISO 9022-12.

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 combined basic cosmetic substances and artificial hand sweat, solar radiation, conditioning method 90, degree of severity 02, state of operation 1, shall be identified as:

Environmental test ISO 9022-90-02-1

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) type and number of specimens;

c) test agents not to be used and/or test agents to be used in addition;

d) test agents to be used for testing complete instruments or assemblies; identification of the

commercial type of the test agents specified for conditioning method 89, of ISO 9022-12;

e) type and scope of initial test;

f) preconditioning if other than described in ISO 9022-12;

g) recovery if other than described in ISO 9022-12;

h) type and scope of final test;

i) criteria for evaluation taking account of ISO 9022-12;

j) type and scope of test report.

Table 1 — Degrees of severity for conditioning method 90: Basic cosmetic substances and artificial hand sweat, combined with 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
		t_1	25 ± 2			
Relative humidity	%		< 40			
Recirculating air speed	m/s		1,5 to 3			
Irradiance	kW/m²		1 ± 0,1	0 to 1,0 [2]	1 ± 0,1	1 ± 0,1
Total exposure time [3]	days		3	5	4	10
Irradiation [3]	kWh/m²		24	45	96	240
Test sequence			Figure 1	Figure 2	Figure 3	Figure 3
Number of cycles			5	5	1	
Test agents			Paraffin oil, high purity Glycerine, high purity Vaseline, white Lanoline (unguentum molle) Cold cream (unguentum lenlens) Artificial hand sweat[4]			
State of operation			1			

1) For testing representative specimens only.

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

3) Refer to figures 1 to 3 of ISO 9022-9.

4) High purity composition:

4,0 g sodium chloride
1,0 g urea
3,5 g amonium chloride
3,0 ml lactic acid
0,5 ml acetic acid
0,5 ml pyruvic acid
1,0 ml butyric acid

Add sufficient distilled water to make 1 000 ml of solution.

Table 2 — Degrees of severity for conditioning method 91: Fuels and other resources for aircraft, naval vessels and land vehicles, combined with solar radiation

Degree of severity			01 [1]	02 [1]
Temperature limits within test chamber	°C	t_2	40 ± 2	55 ± 2
		t_1	25 ± 2	
Relative humidity	%		< 40	
Recirculating air speed	m/s		1,5 to 3	
Irradiance	kW/m²		1 ± 0,1	1 ± 0,1
Total exposure time [2]	days		4	10
Irradiation [2]	kWh/m²		96	240
Test sequence [2]			Figure 3	Figure 3
Number of cycles			1	
Test agents [3]			Petrol, super-grade Fuel oil (diesel oil) Turbine fuel for aircraft Turbine lubricating oil, synthetic Combustion engine lubricating oil Lubricating grease for aircraft and instruments Hydraulic oil, mineral-base Hydraulic fluid, phosphoric-ester-base Damping fluid, silicone-oil-base Brake fluid for motor vehicles De-icing and defrosting fluids Antifreeze agent Fire-extinguishing agent (bromochlorodifluoromethane) General purpose detergent Potassium hydroxide (KOH) (alkaline battery electrolyte, mass quota w (KOH) = 0,35 Sulfuric acid (H_2SO_4) (acid battery electrolyte), mass quota w (H_2SO_4) = 0,34 Diester mixture[4]	
State of operation			1	

1) For testing representative specimens only.

2) Refer to figure 3 of ISO 9022-9.

3) The relevant specification specifies the commercial type, if not indicated in this table.

4) Composition:

fluid paraffin, mass fraction w_1 = 65 %
dioctylophtalate, mass fraction w_2 = 20 %
tricresilophosphate, mass fraction w_3 = 15 %

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