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Optics and photonics — Environmental test methods —

Part 17: Combined contamination, solar radiation

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

Partie 17: Essai combiné contamination-rayonnement solaire

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Foreword

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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).

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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

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 9022-17:1994), 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 sulfide*

— *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*

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.

Optics and photonics — Environmental test methods —

Part 17: Combined contamination, solar radiation

1 Scope

This part of ISO 9022 specifies the methods relating to the environmental tests of optical instruments and including additional assemblies from other fields (e.g. mechanical, chemical, and electronic devices) under equivalent conditions, for their ability to resist the influence of 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 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.

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

ISO 9022-9, *Optics and photonics — Environmental test methods — Part 9: Solar radiation and weathering*

ISO 9022-12, *Optics and photonics — Environmental test methods — Part 12: Contamination*

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 2 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 shall be deposited in one place on the surface to form a circular spot of approximately 10 mm diameter. During the test, the test agents may not flow into each other. In the case of spreading liquids, several specimens should be used if necessary. Viscous or paste

liquids shall be spread evenly and thinly in the form of the spot described above (thickness approximately 0,1 mm). It should be noted that heating of the test agents can cause them to spread during the test. Test agents which evaporate during the test shall not be replaced.

The relevant specification might 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 shall 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 2 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 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.

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[a]	04[a]
Temperature limits within test chamber	°C t_2	55 ± 2	55 ± 2	40 ± 2	55 ± 2
	°C 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[b]	1 ± 0,1	1 ± 0,1
Total exposure time[c]	days	3	5	4	10
Irradiation[c]	kWh/m2	24	45	96	240
Test sequence[c]		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[d]			
State of operation		1			

a For testing representative specimens only.

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

c Refer to ISO 9022-9, Figures 1 to 3.

d High purity composition:

4,0 g sodium chloride
1,0 g urea
3,5 g ammonium 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[a]	02[a]
Temperatures limits within test chamber	°C t_2	40 ± 2	55 ± 2
	°C 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[b]	days	4	10
Irradiation[b]	kWh/m2	96	240
Test sequence[b]		Figure 3	Figure 3

Table 2 *(continued)*

Degree of severity	01[a]	02[a]
Number of cycles	1	
Test agents[c]	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[d]	
State of operation	1	

a For testing representative specimens only.

b Refer to ISO 9022-9, Figure 3.

c The relevant specification specifies the commercial type, if not indicated in this Table.

d Composition:

fluid paraffin, mass fraction w_1 = 65 %;

dioctylophtalate, mass fraction w_2 = 20 %;

tricresilophosphate, mass fraction w_3 = 15 %.

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 basic cosmetic substances and artificial hand sweat, solar radiation, conditioning method 90, degree of severity 02, state of operation 1, is 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 ISO 9022-12, conditioning method 89;

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.

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