INTERNATIONAL STANDARD

ISO 9022-20

First edition
1997-06-15

Optics and optical instruments — Environmental test methods —

Part 20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide

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

Partie 20: Atmosphère humide contenant du dioxyde de soufre ou de l'hydrogène sulfuré

Reference number
ISO 9022-20:1997(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 9022-20 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*
— *Part 11: Mould growth*
— *Part 12: Contamination*

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X.400 c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

— *Part 13: Combined shock, bump or free fall, dry heat or cold*

— *Part 14: Dew, hoarfrost, ice*

— *Part 15: Combined digitally controlled broad-band random vibration (medium reproducibility) and 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*

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

Annexes A and B of this part of ISO 9022 are for information only.

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 20:
Humid atmosphere containing sulfur dioxide or hydrogen sulfide

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 sulfur dioxide (SO_2) or hydrogen sulfide (H_2S) in a humid atmosphere.

The purpose of the test is to investigate to what extent optical, mechanical, chemical and electrical performance characteristics of the specimen are affected by sulfur dioxide or hydrogen sulfide.

This part of ISO 9022 is not applicable to the testing of material and surface coatings for their corrosion resistance using high concentrations of sulfur dioxide, for which representative samples are generally used as specimens. The appropriate material standards apply to tests of this type.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 9022. At the time of publication, the edition indicated was 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 edition of the standard 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.*

3 General requirements

The sulfur dioxide and the hydrogen sulfide used as the test gases shall be chemically pure, taken from commercially available compressed gas cylinders. A suitable test facility is described in annex A. The test specimen shall not be exposed to direct sunlight during conditioning. No condensation shall be produced in the test chamber or on the specimen itself during conditioning. Prior to insertion into the test chamber, the test specimen shall therefore be heated to 2 K or 3 K above the temperature of the test chamber which has already been set to the test temperature. If several specimens are to be tested at the same time, they shall not touch each other or the walls of the test chamber. The total volume of the specimens shall not be more than 50 % of the volume of the test chamber (exposure zone). The required conditioning values shall be attained by the test specimen(s) within 2 h after commencement of the test. The test shall not be interrupted during the required exposure time.

When the test gases are changed, the test gas last used shall be exhausted in its entirety from the test chamber. No materials which absorb sulfur dioxide or hydrogen sulfide shall be used in the test chamber.

4 Conditioning

The required exposure time shall begin as soon as the required conditioning values have been attained in the test chamber.

4.1 Conditioning method 41: Humid atmosphere containing sulfur dioxide (SO_2)

See table 1.

Table 1 — Degrees of severity for conditioning method 41: Humid atmosphere containing sulfur dioxide (SO_2)

Degree of severity	01	02	03	04	05	06	07	08
SO_2 content of test atmosphere, cm^3/m^3	1 to 2		20 to 30			10 to 15		
Test chamber temperature, °C	25 ± 2					35 ± 2		
Relative humidity, %	70 to 80							
Exposure time, days	21	56	4	10	21	1	4	10
State of operation	1 or 2 [1]							
1) Mainly for checking electrical functional safety.								

4.2 Conditioning method 42: Humid atmosphere containing hydrogen sulfide (H_2S)

See table 2.

Table 2 — Degrees of severity for conditioning method 42: Humid atmosphere containing hydrogen sulfide (H_2S)

Degree of severity	01	02	03	04	05	06	07	08	09
H_2S content of test atmosphere, cm^3/m^3	0,5 to 1		10 to 15				4 to 6		
Test chamber temperature, °C	25 ± 2						35 ± 2		
Relative humidity, %	70 to 80								
Exposure time, days	21	56	1	4	10	21	1	4	10
State of operation	1 or 2 [1]								
1) Mainly for checking electrical functional safety.									

5 Procedure

5.1 General

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

5.2 Preconditioning

If not specified in the relevant specification, the greasing of areas at risk of corrosion as stipulated in ISO 9022-1 shall not be required.

6 Environmental test code

The environmental test code shall be as defined in ISO 9022-1.

EXAMPLE

The environmental test of optical instruments for their resistance to sulfur dioxide in a humid atmosphere, in accordance with conditioning method 41, degree of severity 02, state of operation 1, shall be identified as:

Environmental test ISO 9022-41-02-1

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) number of specimens;

c) preconditioning;

d) type and scope of initial test;

e) period of operation for state of operation 2;

f) type and scope of intermediate test for state of operation 2;

g) recovery;

h) type and scope of final test;

i) criteria for evaluation;

j) type and scope of test report.

Annex A
(informative)

A.1 General

Many standards recommend the exclusive use of representative samples to test the resistance of materials and coatings to humid atmospheres containing sulfur dioxide or hydrogen sulfide. Moreover, 40 °C, 100 % relative humidity and, for example, a sulfur dioxide concentration of 200 mg/m^3 to 300 mg/m^3 are stipulated for the corrosive atmosphere. Exposure to such extreme conditions is totally unsuitable for complete optical instruments or optical assemblies and is extremely unlikely in natural environmental conditions. It does not even bear any relation to the behaviour of operative instruments or assemblies and is an extremely polluted atmosphere in natural environmental conditions. IEC 721-3-4 defines the maximum content of sulfur dioxide in the highly polluted atmosphere surrounding industrial facilities emitting chemical substances to be 40 mg/m^3 (15 cm^3/m^3).

If the values mentioned above as defined in IEC 721-3-4 are used for the test and the severity of conditioning is increased to obtain the necessary acceleration, the degrees of conditioning severity by conditioning method 41 are obtained and can be related to natural environmental conditions. Agreement with the test values stipulated by IEC 68-2-42 would be closely matched.

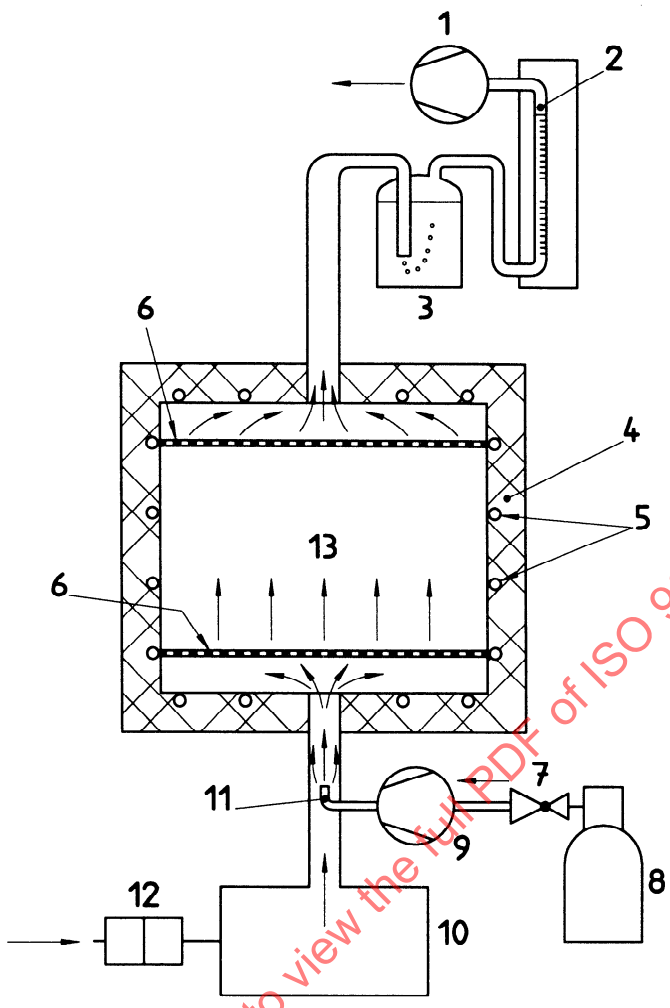
The experience gained in practice with IEC 68-2-42 for electronic products can also be applied to a large extent to optical instruments.

A.2 Test facility

The test facility shown in figure A.1 is recommended for conditioning of optical instruments or assemblies in a humid atmosphere containing sulfur dioxide or hydrogen sulfide.

The atmosphere in the test chamber shall be replaced two to four times an hour. The sulfur dioxide or hydrogen sulfide concentration in the test atmosphere shall be kept constant using the baffle plates shown in figure A.1 or by a ventilator rotating at approximately 60 min^{-1}. When testing complete instruments, it is better for the test atmosphere to enter at the top and exit at the bottom of the exposure zone, contrary to that shown in figure A.1.

Contrary to the schematic drawing in figure A.1, it is also possible to install a test facility without its own air-conditioning system inside a climatic test chamber. Contamination with the test gas is carried out inside the intake connection of the test facility, through which the air-conditioned atmosphere is sucked out of the climatic test chamber. The volume of such a test facility shall be not more than 30 % of the volume of the climatic test chamber.



Key

1	Suction pump and freezing trap
2	Air flowmeter
3	Gas wash bottle and/or adsorbent
4	Insulation
5	Heating and/or cooling device
6	Baffle plates
7	Pressure-reducing valve
8	Gas supply
9	Dosing pump
10	Air-conditioning plant
11	Corrosive gas injector
12	Fresh air filter
13	Exposure zone

Figure A.1 — Schematic representation of a test apparatus