
**Optics and photonics —
Environmental test methods —**

**Part 20:
Humid atmosphere containing sulfur
dioxide or hydrogen sulfide**

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

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

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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.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 9022-20:1997), 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*

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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 20:

Humid atmosphere containing sulfur dioxide or hydrogen sulfide

1 Scope

This part of ISO 9022 specifies the methods relating to the environmental tests of optical instruments including additional assemblies from other fields (e.g. mechanical, chemical, and electronic devices), under equivalent conditions, for their ability to resist the influence of sulfur dioxide (SO₂) or hydrogen sulfide (H₂S) in a humid atmosphere.

The purpose of the testing is to investigate to what extent optical, climatic, 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 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*

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 (SO₂)

See [Table 1](#).

Table 1 — Degrees of severity for conditioning method 41: Humid atmosphere containing sulfur dioxide (SO₂)

| 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 ^a | | | | | | | |

^a Mainly for checking electrical functional safety.

4.2 Conditioning method 42: Humid atmosphere containing hydrogen sulfide (H₂S)

See [Table 2](#).

Table 2 — Degrees of severity for conditioning method 42: Humid atmosphere containing hydrogen sulfide (H₂S)

| Degree of severity | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
|--|---------------------|----|----------|----|----|--------|----|----|----|
| H ₂ S 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 ^a | | | | | | | | |

^a 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, 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 their resistance to sulfur dioxide in a humid atmosphere, in accordance with conditioning method 41, degree of severity 02, state of operation 1, is 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.

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Annex A (informative)

Explanatory notes

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/m³ to 300 mg/m³ 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/m³ (15 cm³/m³).

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 60068-2-42 would be closely matched.

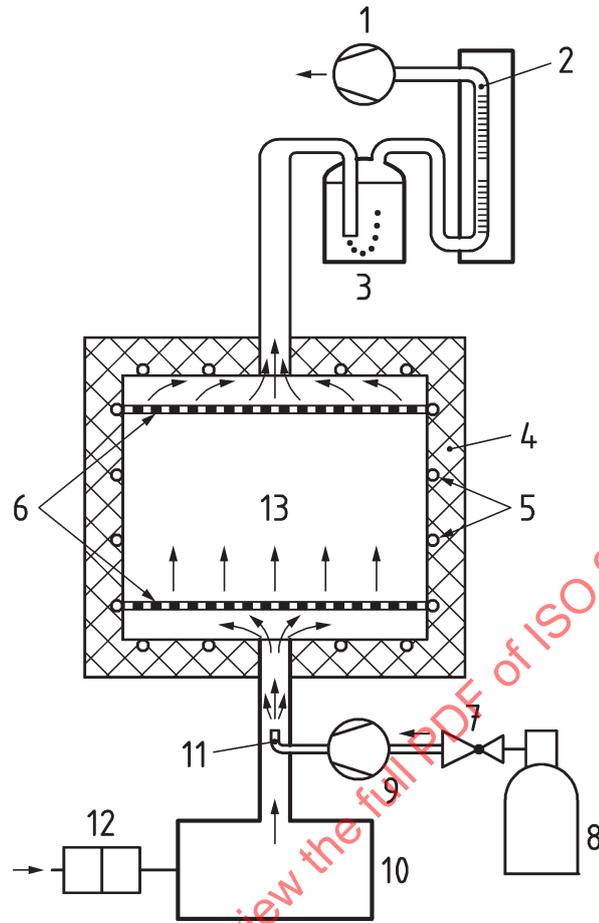
The experience gained in practice with IEC 60068-2-42 for electronic products can also be applied to a large extent to optical instruments.

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 | 8 gas supply |
| 2 air flow meter | 9 dosing pump |
| 3 gas wash bottle and/or adsorbent | 10 air-conditioning plant |
| 4 insulation | 11 corrosive gas injector |
| 5 heating and/or cooling device | 12 fresh air filter |
| 6 baffle plates | 13 exposure zone |
| 7 pressure-reducing valve | |

Figure A.1 — Schematic representation of a test apparatus