INTERNATIONAL STANDARD

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Optics and optical instruments — Environmental test methods —

Part 6:
Dust

Optique et instruments d'optique — Méthodes d'essais d'environnement —
Partie 6: Poussière

Reference number
ISO 9022-6:1994(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 9022-6 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 6: Dust

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 influence of blowing dust.

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 blowing dust, especially with a view to malfunctions of moving parts (such as sliding surfaces, bearings, contacts, operating controls, gears) or unacceptable wear of surfaces.

This test is not intended to determine the wear resistance to coarse dust.

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 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings.*

ISO 9022-1:1994[1)], *Optics and optical instruments — Environmental test methods — Part 1: Definitions, extent of testing.*

3 General information and test conditions

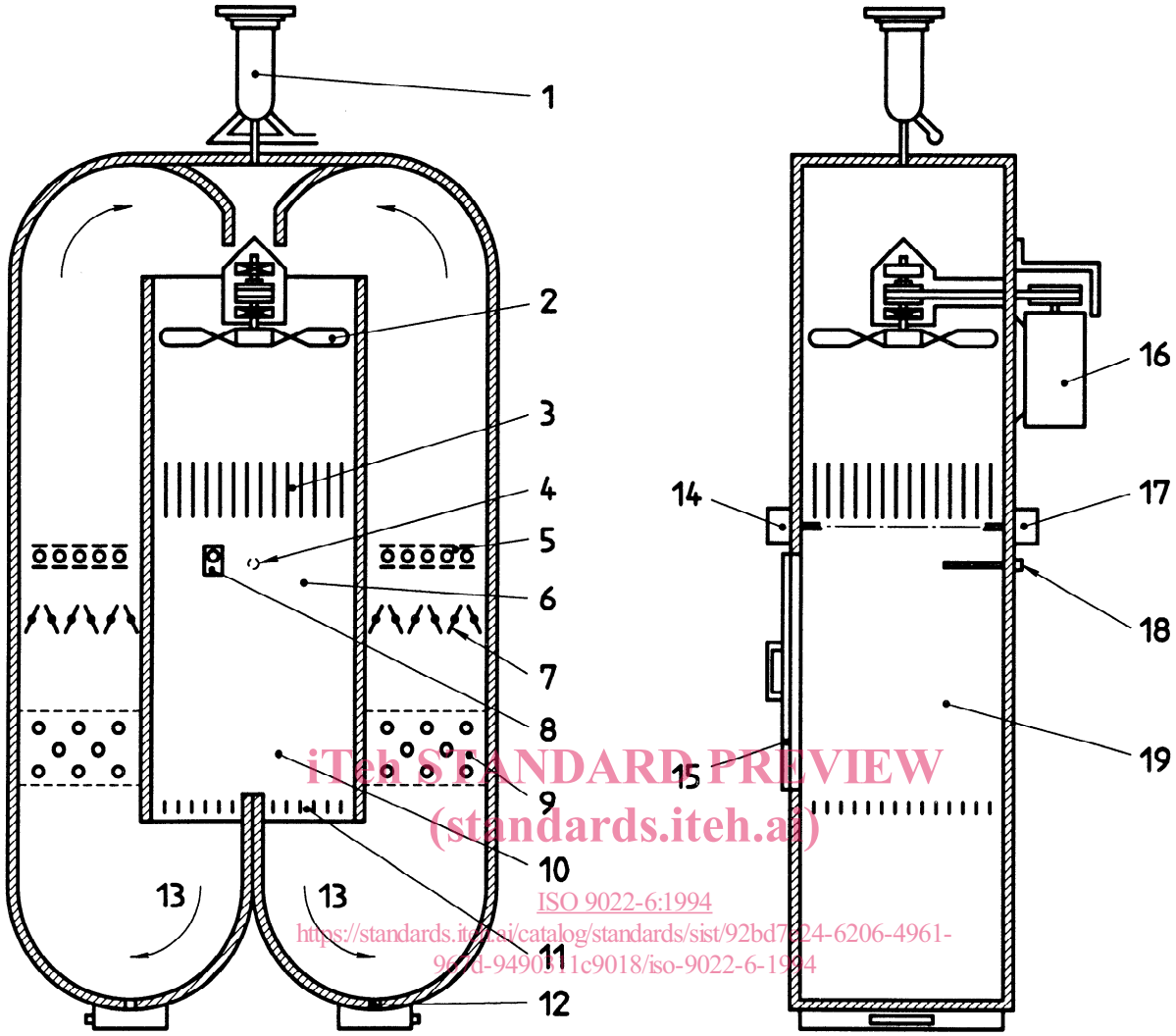
During exposure, optical surfaces shall be protected from dust by any means of covering, such as dust caps. The type of covering to be used shall be specified in the relevant specification. If the specimen is to be exposed without the optical surfaces being covered, this shall be stated in the relevant specification.

The test chamber shall be sufficiently large to ensure that the specimen occupies no more than 50 % of the cross-sectional area (normal to the air flow) and 50 % of the useful volume of the test chamber.

Figure 1 shows an example of a test chamber configuration.

The mineral dust shall consist of sharp-edged particles, not less than 97 % (*m/m*) silicon dioxide (SiO_2). The particle size distribution and the wire mesh sieve required for the analysis shall be in accordance with table 1.

1) To be published.



Key

1 Dust feeder, including metering and dehumidifying devices
2 Fan
3 Flow straighteners
4 Temperature sensor
5 Heating element
6 Hygrometer
7 Air velocity controlling throttles
8 Photoelectric dust concentration meter
9 Dehumidification (cooling)
10 Test chamber
11 Floor grating
12 Dust evacuation
13 Feedback
14 Photoelectric dust concentration meter
15 Test chamber door
16 Fan motor
17 Standard light source
18 Temperature sensor
19 Test chamber

Figure 1 — Example of test chamber configuration (schematic view)

Each exposure shall be run with fresh dust. The specimen shall be placed as near the centre of the test chamber as possible. In the event that more than one specimen is to be tested simultaneously, they shall be arranged at right angles to the air flow, at a distance of not less than 100 mm from each other and from the test chamber walls. The specimen shall be positioned in such a way that the most vulnerable surfaces face the blowing dust. The position of the specimen may be reoriented during exposure in order to expose different surfaces to the air flow. The position and number of surfaces to be exposed to the air flow shall be specified in the relevant specification. Allot equal portions of the exposure period to each surface to be exposed.

4 Conditioning method 52: Blowing dust

See table 2.

Table 1 — Dust particle size distribution and wire mesh sieves

Fine dust particle size distribution % (*m/m*) ± 2 %	Particle size mm		Test sieve in accordance with ISO 565 µm
	from	to	
2	0,1	0,14	140
8	0,071	0,1	100
15	0,045	0,071	71
75	< 0,045		45

Table 2 — Degrees of severity for conditioning method 52: Blowing dust

Step	Parameter	Unit	Degree of severity 01	02 [1]	03 [2]
1	Temperature	°C	18 to 28	18 to 28	18 to 28
	Relative humidity	%	< 25	< 25	< 25
	Air velocity	m/s	8 to 10	8 to 10	8 to 10
	Sand concentration	g/m^3	5 to 15	5 to 15	5 to 15
	Exposure time	h	6	6	6
2 [3]	Temperature	°C	Not applicable	Not applicable	55 to 65
	Relative humidity	%			< 25
	Air velocity	m/s			1 to 3
	Exposure time	h			16
3	Temperature	°C	Not applicable	35 to 45	55 to 65
	Relative humidity	%		< 25	< 25
	Air velocity	m/s		8 to 10	8 to 10
	Sand concentration	g/m^3		5 to 15	5 to 15
	Exposure time	h		6	6
State of operation			1 or 2		

1) Steps 1 and 3 shall follow one another immediately.

2) Steps 1 to 3 shall follow one another immediately.

3) Sand feed discontinued.

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

In the absence of provisions in the relevant specification for preconditioning, the specimen shall be clean and dry.

5.3 Recovery

Unless otherwise specified in the relevant specification, the accumulated dust shall be removed from the specimen by shaking, wiping or brushing, taking care to avoid introduction of additional dust into the specimen. Do not remove dust from specimens by either air-blast or vacuum cleaning.

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 blowing dust, conditioning method 52, degree of severity 01, state of operation 2, shall be identified as:

Environmental test ISO 9022-52-01-2

7 Specification

The relevant specification shall contain the following details:

a) environmental test code;

b) number of specimens;

c) optical surfaces to be exposed unprotected;

d) position and number of specimen surfaces to be exposed to the air flow;

e) preconditioning of specimen, if other than as described in 5.2;

f) type and scope of initial test;

g) period of operation for state of operation 2;

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

i) recovery, if other than as described in 5.3;

j) type and scope of final test;

k) criteria for evaluation;

l) type and scope of test report.

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