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Optics and optical instruments — Environmental requirements —

Part 7: Test requirements for optical measuring instruments

Optique et instruments d'optique — Conditions d'environnement —

Partie 7: Spécifications d'essai pour instruments de mesure optiques

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this part of ISO 10109 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 10109-7 was prepared by Technical Committee ISO/TC 172, *Optics and optical instruments*, Subcommittee SC 1, *Fundamental standards*.

ISO 10109 consists of the following parts, under the general title *Optics and optical instruments — Environmental requirements*:

— *Part 1: General information, definitions, climatic zones and their parameters*

— *Part 4: Test requirements for telescopic systems*

— *Part 6: Test requirements for medical optical devices*

— *Part 7: Test requirements for optical measuring instruments*

— *Part 8: Test requirements for extreme conditions of use*

— *Part 11: Optical instruments for outdoor conditions of use*

Introduction

Optical measuring instruments as understood by this part of ISO 10109 are instruments, the functioning of which is based on optical principles, such as photometry, interferometry, geometrical optics, holography, refractometry, etc. but which can be supplemented or extended by peripheral methods.

Optical measuring instruments measure physical, geometric or material properties. Examples of optical measuring instruments include:

— chemo-physical analysis instruments (spectrometers, colour-measuring instruments);

— optical measuring instruments such as one-coordinate or multi-coordinate measuring machines, surface-measuring instruments, numerical measuring instruments for machine tool control, autocollimation telescopes, contour-measuring instruments, etc.

Nominal values of properties and performance characteristics as understood in this part of ISO 10109 are predetermined by specifications provided by the manufacturer, technical terms of delivery and instrument standards.

This part of ISO 10109 is the basis for the specification of environmental requirements and environmental tests in instrument standards. If necessary, these requirements and tests may be amended in the instrument standards.

Optics and optical instruments — Environmental requirements —

Part 7:
Test requirements for optical measuring instruments

1 Scope

This part of ISO 10109 specifies requirements to be met with regard to resistance of the optical, mechanical, chemical and electrical properties or performance data of instruments to environmental influences and hence determines geographical and technical areas of application. It applies to optical instruments and instruments with optical components including accessories in the field of optical metrology for laboratories, production plants and testing.

Environmental test methods as specified in ISO 9022 are assigned to the various areas of application for the purpose of ascertaining the suitability of the instruments in their respective area of application.

This part of ISO 10109 does not apply to instruments which are covered by other parts of ISO 10109.

This part of ISO 10109 does not deal with the requirements to be met by the packaging of the instrument during transport from the manufacturer to the user.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 10109. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 10109 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 9022-2:1994, *Optics and optical instruments — Environmental test methods — Part 2: Cold, heat, humidity*

ISO 9022-3:1998, *Optics and optical instruments — Environmental test methods — Part 3: Mechanical stress*

ISO 9022-7:1994, *Optics and optical instruments — Environmental test methods — Part 7: Drip, rain*

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

ISO 9022-20:1997, *Optics and optical instruments — Environmental test methods — Part 20: Humid atmosphere containing sulfur dioxide or hydrogen sulfide*

ISO 10109-1:1994, *Optics and optical instruments — Environmental requirements — Part 1: General information, definitions, climatic zones and their parameters*

3 Terms and definitions

For the purposes of this part of ISO 10109, the terms and definitions given in ISO 9022-1 and ISO 10109-1 apply.

4 Subdivision of the instrument group

The group number of optical measuring instruments to which this part of ISO 10109 refers is 06.

Group number 06 is subdivided into instrument types and the type numbers are given in Table 1.

Table 1 — Subdivision of group 06

Type number	Instrument type [a]
01	Optical measuring instruments for mobile or stationary outdoor use; not weather-protected; e.g. aligning telescopes for industrial use, analytical measuring instruments for mobile use in measuring vehicles; contour-measuring instruments.
02	Optical measuring instruments for mobile or stationary outdoor use; weather-protected; e.g. aligning telescopes for industrial use, analytical measuring instruments for mobile use in measuring vehicles; contour-measuring instruments.
03	Optical measuring systems for use in difficult conditions, weather-protected; e.g. numerical measuring systems, such as linear and rotary encoders on machine tools.
04	Optical measuring instruments for use in rooms without air-conditioning; e.g. length and angle-measuring instruments, measuring and aligning telescopes for industrial use, analytical measuring instruments, contour-measuring instruments.
05	Optical measuring instruments for use at production plants, laboratories and measuring rooms; e.g. high-precision measuring instruments for length, angle, shape and surface measurements, analytical measuring instruments. If required for accuracy or technological reasons, instruments for use in climatic chambers or cleanrooms are also included.

[a] Existing product standards or specifications shall primarily be taken into consideration.

5 Designation of environmental requirements and of environmental test

The relevant specification and other technical documents shall indicate the environmental requirements required by this part of ISO 10109, using the designation in accordance with ISO 10109-1.

An example of the designation of environmental requirements for optical measuring instruments belonging to group 06, of instrument type 02 and requiring the extent of testing T, is:

Environmental requirements ISO 10109-06-02-T

In relevant specifications and other technical documentation, tests carried out in accordance with the environmental requirements given in this part of ISO 10109 shall be designated by the environmental test code as specified in ISO 9022-1.

6 Specification of technical requirements, environmental tests and suitability indices

For the purposes of this part of ISO 10109, the acceleration of free fall shall be taken as $g = 9{,}81\ m/s^2$.

Standard climates are specified in ISO 10109-1.

6.1 Type or sample test (extent of testing T)

Table 2 specifies technical requirements, environmental tests and suitability indices for extent of testing T.

Table 3 shows a summary of the tests given in Table 2, as specified in ISO 9022.

6.2 Series test (extent of testing S)

Series tests shall be stipulated in the relevant specification.

6.3 Special requirements

Further technical requirements to be met for instruments for outdoor conditions of use which are not contained in Table 2, e.g. solar radiation, may be selected from the ISO 9022 series, if required, and should be agreed upon separately between the customer and manufacturer.

7 Procedure

Tests shall be performed as specified in ISO 9022. The tests may be performed in any order, if not specified otherwise.

Table 2 — Technical requirements, environmental tests and suitability indices for extent of testing T

Serial No.	ISO 9022		Instrument type		Instruments not weather-protected			Instruments weather-protected			Instruments for use in difficult conditions, weather-protected			Instruments in rooms without air-conditioning			Instruments for measuring rooms		
	Part	Conditioning method	Type number		01			02			03			04			05		
			State of operation		0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
1	2	10 Cold	Technical requirement	Temperature °C	– 40	-	– 20	– 40	-	– 15	– 40	-	0 [a]	– 40	-	-	– 40	-	-
			Degree of severity		08	-	04	08	-	03	08	-	01	08	-	-	08	-	-
			Suitability index for standard climates	1	E	-	E	E	-	E	E	-	E	E	-	-	E	-	-
				2	A	-	B	A	-	C	A	-	C	A	-	-	A	-	-
				3	A	-	A	A	-	B	A	-	B	A	-	-	A	-	-
				4	E	-	E	E	-	E	E	-	E	E	-	-	E	-	-
				5	A	-	A	A	-	A	A	-	A	A	-	-	A	-	-
				6	A	-	A	A	-	B	A	-	B	A	-	-	A	-	-
2	2	11 Dry heat	Technical requirement	Temperature °C	70	-	55	70	-	55 [a]	70	-	40 [a]	70	-	10 to 40 [a]	70	-	b
			Degree of severity		05	-	03	05	-	03	05	-	02	05	-	01 to 02	05	-	-
			Suitability index for standard climates	1	A	-	A	A	-	A	A	-	A	A	-	A	A	-	-
				2	A	-	A	A	-	A	A	-	C	A	-	D	A	-	-
				3	A	-	A	A	-	A	A	-	A	A	-	A	A	-	-
				4	A	-	A	A	-	A	A	-	C	A	-	D	A	-	-
				5	A	-	A	A	-	A	A	-	A	A	-	A	A	-	-
				6	A	-	A	A	-	A	A	-	B	A	-	C	A	-	-
3	2	12 Damp heat	Technical Requirements	Temperature °C	-	-	40	-	-	40	-	-	40	-	-	40	-	-	-
				Rel. humidity %	-	-	92	-	-	92	-	-	92	-	-	92	-	-	-
			Degree of severity		-	-	01	-	-	01	-	-	01	-	-	01	-	-	-
			Suitability		The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														

Table 2 (*continued*)

Serial No.	ISO 9022		Instrument type			Instruments not weather-protected			Instruments weather-protected			Instruments for use in difficult conditions, weather-protected			Instruments in rooms without air-conditioning			Instruments for measuring rooms		
	Part	Conditioning method	Type number			01			02			03			04			05		
			State of operation			0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
4	2	14 Slow temperature change	Technical requirements	Temperature °C	t_2	-	40	-	-	40	-	-	40	-	-	40	-	-	-	-
					t_1	-	– 10	-	-	– 10	-	-	– 10	-	-	– 10	-	-	-	-
			Degree of severity			-	01	-	-	01	-	-	01	-	-	01	-	-	-	-
			Suitability			The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														
5	2	15 Temperatures hock	Technica requirements	Temperature °C	t_2	-	40	-	-	40	-	-	-	-	-	-	-	-	-	-
					t_1	-	– 25	-	-	– 25	-	-	-	-	-	-	-	-	-	-
			Degree of severity			-	02 [c]	-	-	02 [c]	-	-	-	-	-	-	-	-	-	-
			Suitability			The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														
6	2	16 Damp heat, cyclic	Technical requirements	Climate 1	°C/%	-	40/92	-	-	40/92	-	-	40/92	-	-	40/92	-	-	-	-
				Climate 2	°C/%	-	23/83	-	-	23/83	-	-	23/83	-	-	23/83	-	-	-	-
			Degree of severity			-	01	-	-	01	-	-	01	-	-	01 [d]	-	-	-	-
			Suitability			The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														
7	3	30 Shock	Technical requirements	Acceleration	g_n	-	30	-	-	30	-	-	30	-	-	15	-	-	15	-
				Duration	ms	-	18	-	-	18	-	-	18	-	-	11	-	-	11	-
			Degree of severity			-	04 [c]	-	-	04 [c]	-	-	04	-	-	02 [c]	-	-	02 [c]	-
			Suitability			The instrument is suitable for the technical requirement if it is operative without restriction after conditioning														
8	3	31 Bump	Technical requirements	Acceleration	g_n	25	-		25	-	-	25	-	-	10	-		10	-	-
				Duration	ms	6	-	-	6	-	-	6	-	-	6	-	-	6	-	-
			Degree of severity			05 [e]	-	-	05 [e]	-	-	05	-	-	01 [c]	-	-	01 [c]	-	-
			Suitability			The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														

Table 2 (*continued*)

Serial No.	ISO 9022		Instrument type		Instruments not weather-protected			Instruments weather-protected			Instruments for use in difficult conditions, weather-protected			Instruments in rooms without air-conditioning			Instruments for measuring rooms		
	Part	Conditioning method	Type number		01			02			03			04			05		
			State of operation		0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
9	3	36 Sinusoidal vibration	Technical requirements	Acceleration g_n	0,5	-	-	0,5	-	-	2	-	-	0,5	-	-	0,5	-	-
				Frequency range Hz	10 to 500	-	-	10 to 500	-	-	10 to 500	-	-	10 to 500	-	-	10 to 500	-	-
			Degree of severity		01	-	-	01	-	-	04	-	-	01	-	-	01	-	-
			Suitability		The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														
10	3	37 Random vibration (wide band), digitally controlled	Technical requirements	Rms (g multiples)	-	1,6	-	-	1,6	-	-	-	1,4	-	-	-	-	-	
				Frequency range Hz	-	20 to 500	-	-	20 to 500	-	-	-	20 to 2000	-	-	-	-	-	-
			Degree of severity		-	11	-	-	11 [f]	-	-	-	21 [f]	-	-	-	-	-	-
			Suitability		The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														
11	20	41 Sulphur dioxide (SO_2) in humid atmosphere	Technical requirements		Ability to be operated for $\geqslant$ 5 years if stipulated instructions regarding care and maintenance are complied with.														
			Degree of severity		-	01	-	-	04	-	-	04	-	-	04	-	-	01	-
			Suitability		The instrument is suitable for the technical requirement if the representative sample [h] or component [h] has met the requirements of the test.														
12	7	74 Driving rain	Technical requirements	Wind velocity m/s	-	18	-	-	[g]	-	-	[g]	-	-	-	-	-	-	-
				Rain rate mm/min	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
			Degree of severity		-	02	-	-	-	-	-	-	-	-	-	-	-	-	-
			Suitability		The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.														

Table 2 (*continued*)

Serial No.	ISO 9022		Instrument type	Instruments not weather-protected			Instruments weather-protected			Instruments for use in difficult conditions, weather-protected			Instruments in rooms without air-conditioning			Instruments for measuring rooms		
	Part	Conditioning method	Type number	01			02			03			04			05		
			State of operation	0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
13	12	86 Basic cosmetic substances and artificial hand sweat	Technical requirements	Ability to be operated for ⩾ 5 years if stipulated instructions regarding care and maintenance are complied with.														
			Degree of severity	-	01	-	-	01	-	-	01	-	-	01	-	-	01	-
			Suitability	The instrument is suitable for the technical requirement if the representative sample or component has met the requirements of the test.														
14	12	87 Laboratory agents	Technical requirements	Ability to be operated for ⩾ 5 years if stipulated instructions regarding care and maintenance are complied with.														
			Degree of severity	-	02	-	-	02	-	-	02	-	-	02	-	-	02	-
			Suitability	The instrument is suitable for the technical requirement if the representative sample or component has met the requirements of the test.														
15	12	88 Production plant resources	Technical requirements	Ability to be operated for ⩾ 5 years if stipulated instructions regarding care and maintenance are complied with.														
			Degree of severity	-	02	-	-	02	-	-	02	-	-	02	-	-	-	
			Suitability	The instrument is suitable for the technical requirement if the representative sample or component [d] has met the requirements of the test.														

a Existing product standards or specifications shall primarily be taken into consideration.

b Technical requirement according to the relevant specification.

c Mobile, hand-held units only.

d Number of cycles: 2.

e In mobile use, built in a test car only state of operation 1.

f Only apply degree of severity if no other requirements exist which are found by spectrum analysis at the place of use.

g Spray water test in accordance with relevant specification.

h See ISO 9022-1.

Table 3 — Test summary

Environmental requirement ISO 10109-06-01-T	Environmental requirement ISO 10109-06-02-T	Environmental requirement ISO 10109-06-03-T	Environmental requirement ISO 10109-06-04-T	Environmental requirement ISO 10109-06-05-T	Part of ISO 9022
10-08-0	10-08-0	10-08-0	10-08-0	10-08-0	2
10-04-2	10-03-2	10-01-2	11-05-0	11-05-0	
11-05-0	11-05-0	11-05-0	11-01/02-2		
11-03-2	11-03-2	11-02-2	12-01-2		
12-01-2	12-01-2	12-01-2	14-01-1		
14-01-1	14-01-1	14-01-1	16-01-1		
15-02-1	15-02-1	16-01-1			
16-01-1	16-01-1				
30-04-1	30-04-1	30-04-1	30-02-1	30-02-1	3
31-05-0	30-05-0	31-05-0	31-01-0	31-01-0	
36-01-0	36-01-0	36-04-0	36-01-0	36-01-0	
37-11-1	37-11-1	37-21-2			
41-01-1	41-04-1	41-04-1	41-04-1	41-01-1	20
74-02-1					7
86-01-1	86-01-1	86-01-1	86-01-1	86-01-1	12
87-02-1	87-02-1	87-02-1	87-02-1	87-02-1	
88-02-1	88-02-1	88-02-1	88-02-1		

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