INTERNATIONAL STANDARD

ISO 10109-7

First edition 2001-07-01

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



Reference number ISO 10109-7:2001(E)

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Printed in Switzerland

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

ISO 10109-7:2001(E)

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, surfacemeasuring 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

Terms and definitions 3

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

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 produc	t standards or specifications shall primarily be taken into consideration.

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.

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 $g = 9.81 \text{ m/s}^2$.

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		ISO 9022	Instrument type	nt type		Instru weathe	Instruments not weather-protected		Inst	Instruments weather-protected	ts	Instruments for use in difficult conditions, weather-protected	Instruments for use in difficult conditions,	for ult	Inst roo	Instruments in rooms without iir-conditioning	Instruments in rooms without air-conditioning	Inst m	Instruments for measuring rooms	nts for ing
<u>:</u>	Part	g	Type number				10			02			03			04			02	
		method	State of operation			0	1	2	0	1	2	0	-	2	0	1	2	0	1	2
			Technical requirement	Temperature	၁့	- 40	•	- 20	- 40		- 15	- 40		0 a	- 40		-	- 40	,	,
_	2	10	Degree of severity			08	-	04	80	-	03	80	-	10	80	-	-	80	-	•
_		Cold		1		Е	-	Е	Е	-	Е	Е	-	Е	Е	-	-	Ш	•	•
				2		Α	-	В	Α	-	С	Α		C	A	-	-	Α	•	•
			Suitability index for	3		٨	-	Α	Α	-	В	А	-	В	A	-	-	Α	•	•
			standard climates	4		Е	-	Е	Ш	-	В	Е		Е	В	-	-	Е	ı	ı
				5		4		A	A	-	⋖	Α	-	4	A		-	٨		•
				9		4		A	A	-	В	Α	-	В	A		-	٨		•
			Technical requirement	Temperature	၁့	20		22	20		55 a	02		40 a	02	,	10 to 40 a	20	ı	q
7	7	l l	Degree of severity			05	-	03	90	-	03	90		02	90	-	01 to 02	05	ı	ı
_		Dry heat		1		٧	-	А	A	-	4	А		A	Α		А	Α	•	•
				2		A	-	А	А	-	٨	А	-	C	Α		D	А	•	•
			Suitability index for	3		٨	-	Α	Α	-	4	А		A	A	-	А	Α	•	•
			standard climates	4		A	-	А	А	-	٨	А	-	C	Α		D	А	•	•
				5		٨	-	Α	Α	-	4	А		A	A	-	А	Α	•	•
				9		A	-	А	А	-	٨	А	-	В	Α		С	А	•	•
			Technical	Temperature	၁့	-	-	40	-	-	40	-	-	40	-		40	•	•	•
က	2	12	Requirements	Rel. humidity	%	-	-	92	-	-	92	-		92		-	92	•	•	•
		Damp heat	Degree of severity			-	-	01	ı	ı	01	-		10	ı	-	01	1	ı	ı
			Suitability		<u> </u>	The ins	trument	is suita	ble for 1	the tech	nnical re	quireme	ant if it i	s opera	ıtive wit	thout r	The instrument is suitable for the technical requirement if it is operative without restriction after conditioning	after c	onditic	oning.

Table 2 (continued)

Part Conditioning									Ì			ŀ									
Part Conditioning State of operation 2	erial	180) 9022	Instrum	ent type		Instru weath	uments er-prote		Inst weathe	rument r-prote		Instruments for use in difficult conditions, weather-protected	uments for in difficult conditions, tther-protec		Instr rooms con	Instruments in rooms without air- conditioning	s in it air- ng	Instr	Instruments for measuring rooms	s for ooms
Slow temperature change Suitability 2 14 requirements change of severity 2 15 requirements change Suitability 2 15 requirements continuate change Suitability 2 16 requirements Climate 1 °C/% Damp heat, Degree of severity Climate 2 °C/% Damp heat, Degree of severity Climate 2 °C/% Suitability Cydic Suitability Technical Acceleration 8n requirements Duration ms Shock Degree of severity Climate 2 °C/% Suitability Climate 2 °C/% Suitability Climate 3 °C/% Technical Acceleration 8n requirements Suitability Climate 3 °C/% Technical Acceleration 8n requirements Duration ms Technical Acceleration 8n requirements Duration ms			Sonditioning	Type n	umber			01			02			03			90			90	
Slow temperature Suitability 2 15 Technical Suitability 2 15 Technical Suitability 2 16 Technical Suitability 2 16 Technical Suitability 2 16 Technical Suitability 2 2 16 Technical Suitability 3 30 Technical Suitability 5 Shock Degree of severity 7 Technical Acceleration Sn Technical Suitability 8 Shock Degree of severity 8 Suitability 7 Technical Acceleration Sn Technical Suitability 8 Technical Suitability 8 Technical Acceleration Sn Technical Snitability			method	State of operation			0	-	2	0	-	2	0	_	2	0	1	2	0	1	2
Slow temperature change Suitability 2 15 Technica Suitability 2 16 Technical Climate 1 °C/% Damp heat, Degree of severity Cyclic Suitability 3 30 Technical Duration ms Shock Degree of severity Technical Acceleration 8n Technical Suitability Technical Acceleration 8n Technical Suitability Suitability Technical Acceleration 8n Technical Suitability Technical Duration ms Suitability Technical Acceleration 8n Technical Technical Burration 8n Technical 8n Techni				Technical	Temperature	<i>t</i> 2	-	40		-	40		-	40			40	-	-		•
Slow temperature change Suitability 2 15 Technica Tequirements Climate 1 °C/% Suitability 2 16 Technical Climate 1 °C/% Suitability Cyclic Suitability 3 30 Technical Climate 2 °C/% Suitability Technical Climate 2 °C/% Suitability Technical Acceleration 8n requirements Duration ms Shock Degree of severity Suitability Technical Acceleration 8n requirements Duration 8n requirements		7	4	requirements	٥.	<i>t</i> ₁		- 10		-	- 10		•	- 10	-	ı	- 10	-	-	-	-
change change change a requirements change requirements change requirements containing cyclic Suitability cy			Slow	Degree of severity				10			01		-	01	-	-	01	-	-	-	•
Technica Temperature 12 Technica Temperature 12 Temperatures Degree of severity Climate 1 °C/% 14			remperature change	Suitability		-	The ins	trument	is suitał	ole for th	he techi	nical re	quireme	nt if it is	operat	ive with	out rest	triction ;	after co	ndition	ing.
Temperatures Degree of severity Damp heat, cyclic Suitability Duration Suitability				Technica	Temperature	<i>t</i> 2	-	40		-	40		-		-		-	-	-		•
Temperatures Degree of severity Suitability Technical Climate 1 °C/% Technical Climate 2 °C/% Suitability Acceleration 8n Technical Degree of severity Technical Acceleration 8n Shock Degree of severity Suitability Technical Acceleration 8n		7	15	requirements	٥.	1,1	-			-				1		-	-	-		-	-
Damp heat, Cyclic Suitability Damp heat, Cyclic Suitability Suitability Shock Degree of severity Shock Degree of severity Shock Degree of severity Suitability Suitability Technical Shock Degree of severity Suitability Technical Acceleration 8n Technical Acceleration 8n Technical Acceleration 8n Technical Duration ms		ř		Degree of severity				02 c		-	02 c		-	-			-	-		-	-
Technical Climate 1 °C/%			hock	Suitability			The ins	trument	is suital	ole for th	he techi	nical re	quireme	∩t if it is	operat	ive with	out rest	triction ;	after co	ndition	ing.
Damp heat, Degree of severity cyclic Suitability 3 30				Technical	Climate 1	%/ > °		40/92			40/92		- 4	40/92		-	40/92	-		-	
Shock Degree of severity Shock Degree of severity Shock Degree of severity Suitability Suitability Technical Suitability Technical Technical Acceleration Accele		7	16	requirements	Climate 2	%/ > °		23/83			23/83		-	23/83	-	-	23/83	-	-	-	•
Shock Degree of severity Suitability Technical Shock Degree of severity Suitability Technical Technical Technical Acceleration 8n Technical Acceleration 8n Technical Acceleration 8n				Degree of severity			ı	10	1		10			01			01 d		1		
Shock Degree of severity Suitability Technical Acceleration 8n Buration ms Shock Degree of severity Suitability Technical Technical Acceleration 8n requirements			cyclic	Suitability		-	The ins	trument	is suitał	ole for th	he techi	nical re	quireme	∩t if it is	operat	ive with	nout rest	triction	after co	ndition	ing.
Shock Degree of severity Suitability Technical Acceleration 8n requirements				Technical	Acceleration	8n		30		,	30		1	30	-	1	15	-	-	15	•
Shock Degree of severity Suitability Technical Acceleration 8n requirements		ဗ	30	requirements	Duration	ms		18		-	18		-	18			11	-		11	-
Suitability Technical Acceleration 8n requirements			Shock	Degree of severity				04 c			04 c			04		,	02 c			02 c	•
Technical Acceleration $g_{\rm n}$ 25 - 25 - 35 - 34 requirements Duration ms 6 - 6 - 6 - 6				Suitability		<u> </u>	The ins	trument	is suitał	ole for th	he techi	nical re	quireme	∩t if it is	operat	ive with	out rest	triction ;	after co	ndition	ing
3 34 requirements Duration ms R R .				Technical	Acceleration	8n	25			25			25			10	-		10		٠
	∞	က	31	requirements	Duration	ms	9			9	-	-	9	-	-	9	-	-	9	-	•
Bump Degree of severity 05 e - 05 e - 05 e			Bump	Degree of severity			e 20		1	e 20	1	,	90	1	1	01 c			01 c	1	1
Suitability The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.		\dashv		Suitability			The ins	trument	is suital	ole for tl	he techi	nical re	quireme	nt if it is	operat	ive with	nout resi	triction	after co	ndition	ing.

Table 2 (continued)

											Instruments for use	ents fo	or use	,					
Serial	_	ISO 9022	Instrun	Instrument type	Instr weath	Instruments not weather-protected	s not ected	Inst weath	Instruments weather-protected		in col weath	in difficult conditions, weather-protected	t s, ected	Instri rooms con	Instruments in rooms without air- conditioning	t air-	Instri measi	Instruments for measuring rooms	for
	Part	Conditioning	Type number			10			02			03			04			90	
		method	State of operation		0	1	2	0	1	2	0	1	2	0	1	2	0	1	2
			Tochologi	Acceleration g _n	0,5	-	ı	0,5	-	-	2		-	0,5			0,5	-	-
თ	ო	36 Sinusoidal	requirements	Frequency range Hz	10 to 500	1	1	10 to 500	ı		10 to 500	1	1	10 to 500	1	-	10 to 500	1	
		vibration	Degree of severity		01	-	-	10	-	-	04	-	-	01	-	-	01	-	-
			Suitability		The ins	trument	is suita	The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.	ne techr	ical red	quireme	nt if it is	operativ	re witho	ut restri	iction af	fter con	ditioning	7
				Rms (g multiples)	,	1,6	ı	ı	1,6		ı	ı	4,1	ı	,	ı	,		
10	ო	37 Random	requirements	Frequency range Hz	1	20 to 500	ı	1	20 to 500	1	ı	1	20 to 2000		1			1	
		vibration (wide band),	Degree of severity		-	11	-	•	11 f	-	-	-	21 f		-	-	-	-	-
		digitally controlled	Suitability		The ins	trument	t is suita	The instrument is suitable for the technical requirement if it is operative without restriction after conditioning.	ne techr	nical req	quireme	nt if it is	operativ	re witho	ut restri	iction af	fter cond	ditioning	J.
11	20	41	Technical requirements		Ability t	do aq o	erated f	Ability to be operated for $\geqslant 5$ years if stipulated instructions regarding care and maintenance are complied with.	ears if s	tipulate	d instru	tions re	egarding	care ar	nd main	tenano	e are co	mplied	with.
		Sulphur dioxide (SO ₂)	Degree of severity			10	ı		04		ı	04		ı	04			10	
		in humid atmosphere	Suitability		The ins the req	strument uiremen	The instrument is suitable fo the requirements of the test.	The instrument is suitable for the technical requirement if the representative sample ^h or component ^h has met the requirements of the test.	ne techr	nical rec	quireme	nt if the	represe	ntative s	sample	h or col	mponen	t ^h has	met
			Technical	Wind velocity m/s	-	18		,	g	-	-	б	-		-	-	-	-	-
12	7	74	requirements	Rain rate mm/min		2			-	-		-	-		-	-	-	-	-
		Driving rain	Degree of severity			02	'	,			-	-	-	-	-	-	-	-	-
			Suitability		The ins	trument	is suita	The instrument is suitable for the technical requirement if it is operative without restriction after conditioning	ne techr	ical rec	quireme	nt if it is	operativ	e witho	ut restri	iction af	fter cond	ditioning	- -

Table 2 (continued)

Serial No.		ISO 9022	Instrument type	Instru	Instruments not weather-protected	not	Inst	Instruments weather-protected		Instrun in coi weath	Instruments for use in difficult conditions, weather-protected	or use t s,	Instr rooms con	Instruments in rooms without air- conditioning	s in ıt air- ng	Instr	Instruments for measuring rooms	s for coms
	Part	ပိ	Type number		10			02			03			04			90	
		method	State of operation	0	_	2	0	-	2	0		2	0	-	2	0	1	2
13	12	98	Technical requirements	Ability to be operated for $\geqslant 5$ years if stipulated instructions regarding care and maintenance are complied with.	edo eq	rated fc)r ≥ 5 ye	ears if st	tipulated	d instruc	ctions re)gardinç	y care aı	nd main	ıtenano	e are co	mplied	with.
		Basic cosmetic	Degree of severity		10			01		-	01	-	-	01	-	-	01	-
		substances and artificial hand sweat	Suitability	The instrument is suitab requirements of the test.	rument nents of	is suital the test	ble for t t.	The instrument is suitable for the technical requirement if the representative sample or component has met the equirements of the test.	nical re	quirem	ent if the	e repres	sentative	e sampl	le or co	mpone	nt has r	net the
4	12	87	Technical requirements	Ability to be operated for $\geqslant 5$ years if stipulated instructions regarding care and maintenance are complied with.	edo eq	rated fc)r ≽ 5 ye	ears if st	tipulated	d instruc	ctions re	∍gardinç	y care aı	nd main	ıtenano	e are co	omplied	with.
		Laboratory	Degree of severity		02		-	02		-	02		-	02	-	-	02	-
		agents	Suitability	The instrument is suitab requirements of the test.	rument rents of	is suital the test	ble for t t.	The instrument is suitable for the technical requirement if the representative sample or component has met the equirements of the test.	nical re	quirem	ent if the	e repres	sentative	e sampl	le or co	mpone	nt has r	net the
15	12	88	Technical requirements	Ability to be operated for $\geqslant 5$ years if stipulated instructions regarding care and maintenance are complied with.	edo eq	rated fc	ır ≥ 5 ye	ears if st	tipulated	d instruc	ctions re	∍gardinç	y care aı	nd main	ıtenano	e are co	omplied	with.
		Production	Degree of severity	-	02	-	-	02	-	-	02	-	-	02	-	-	-	
		plant resources	Suitability	The instrument is suitable requirements of the test.	rument rents of	is suitat the test	ble for tl t.	The instrument is suitable for the technical requirement if the representative sample or component ^d has met the requirements of the test.	nical rec	quireme	nt if the	represe	entative	sample	or con	nponent	d has r	net the

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

^b Technical requirement according to the relevant specification.

Mobile, hand-held units only.

ပ

d Number of cycles: 2.

Φ

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

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

Spray water test in accordance with relevant specification.

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See ISO 9022-1.

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Table 3 — Test summary

Environmental requirement	Part of				
ISO 10109-06-01-T	ISO 10109-06-02-T	ISO 10109-06-03-T	ISO 10109-06-04-T	ISO 10109-06-05-T	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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