INTERNATIONAL STANDARD

ISO 9022-3

Redline version compares Third edition to Second edition

Optics and photonics — Environmental test methods —

Part 3: Mechanical stress

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

Partie 3: Contraintes mécaniques

Reference number
ISO 9022-3:redline:2015(E)

IMPORTANT — PLEASE NOTE

This is a mark-up copy and uses the following colour coding:

Text example 1	— indicates added text (in green)
~~Text example 2~~	— indicates removed text (in red)
	— indicates added graphic figure
	— indicates removed graphic figure
1.x ...	— Heading numbers containg modifications are highlighted in yellow in the Table of Contents

DISCLAIMER

This Redline version provides you with a quick and easy way to compare the main changes between this edition of the standard and its previous edition. It doesn't capture all single changes such as punctuation but highlights the modifications providing customers with the most valuable information. Therefore it is important to note that this Redline version is not the official ISO standard and that the users must consult with the clean version of the standard, which is the official standard, for implementation purposes.

Contents

Page

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).

~~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 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

~~International Standard~~The committee ~~ISO 9022-3 was prepared by Technical Committee~~responsible for this document is ISO/TC 172, *Optics and* ~~optical instruments~~photonics, Subcommittee SC 1, *Fundamental standards*.

This ~~second~~third edition cancels and replaces the ~~first~~second edition (ISO 9022-3:~~1994~~1998), ~~which has been technically revised~~of which it constitutes a minor revision.

ISO 9022 consists of the following parts, under the general title *Optics and* ~~optical instruments~~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* ~~5: Combined cold, low air pressure~~6: Dust

~~— *Part 6: Dust*~~

— *Part 7:* ~~Drip,~~Resistance to drip or *rain*

— *Part 8: High* internal *pressure, low* internal *pressure, immersion*

— *Part 9: Solar radiation* and weathering

~~— *Part 10: Combined sinusoidal vibration and dry heat or cold*~~

— *Part 11: Mould growth*

— *Part 12: Contamination*

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

— *Part 14: Dew, hoarfrost, ice*

— *Part 15: Combined digitally controlled broad-band random vibration and dry heat or cold*

— *Part 16: Combined bounce or steady-state acceleration and 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*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*

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.

~~It should be noted that, as~~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~~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 ~~may~~can arise where application of both ISO 9022 and other appropriate International Standards will be necessary.

Optics and photonics — Environmental test methods —

Part 3: Mechanical stress

1 Scope

This part of ISO 9022 specifies ~~methods for the testing~~the methods relating to the environmental tests of optical instruments ~~and instruments containing optical components~~including additional assemblies from other fields (e.g. mechanical, chemical, and electronic devices), under equivalent conditions, for their ability to resist the influence of mechanical stress.

The purpose of the testing is to investigate to what extent the optical, ~~thermal~~climatic, mechanical, chemical, and electrical (including electrostatic) performance characteristics of the specimen are affected by mechanical stress.

2 Normative references

The following ~~standards contain provisions which, through reference in this text, constitute provisions of this part of~~documents, in whole or in part, are normatively referenced in this document ~~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~~and are indispensable for its application. For dated references, ~~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~~only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60068-2-6:~~1995~~2007, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*~~.~~

IEC 60068-2-7~~:1983~~, *Environmental testing — Part 2-7: Tests — Test Ga and guidance: Acceleration, steady state*~~.~~

IEC 60068-2-27~~:1987~~, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*~~.~~

~~IEC 60068-2-29:1987, *Environmental testing — Part 2: Tests — Test Eb and guidance: Bump.*~~

IEC 60068-2-31~~:1969~~, *Environmental testing — Part 2-31: Tests — Test Ec: ~~Drop and topple~~Rough handling shocks, primarily for equipment~~-~~ type specimens*~~.~~

~~IEC 60068-2-32:1975, *Environmental testing — Part 2: Tests — Test Ed: Free fall.*~~

IEC 60068-2-47~~:1982~~, *Environmental testing — Part 2-47: Tests — Mounting of ~~components, equipment and other articles for dynamic tests including shock (Ea), bump (Eb), vibration (Fc and Fd) and steady-state acceleration (Ga) and guidance.~~specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-55~~:1987~~, *Environmental testing — Part 2-55: Tests — Test Ee and guidance: ~~Bounce.~~Loose cargo testing including bouce*

IEC 60068-2-64~~:1993~~, *Environmental testing — Part 2-64: Test methods — Test Fh: ~~vibration, broad-band random (digital control) and guidance.~~Vibration, broadband random and guidance*

3 General information and test conditions

The test shall be carried out at ambient atmospheric conditions and in accordance with ISO 9022-1 and with the International Standards listed in Table 1. The specimens shall be mounted on the test apparatus (shock machine, acceleration facility, or electrodynamic shaker) in accordance with IEC 60068-2-47.

“g_n” is the standard acceleration due to the earth’s gravity, which itself varies with altitude and geographical latitude.

NOTE For the purposes of this part of ISO 9022, the value of g_n is rounded up to the nearest whole number, that which is 10 m/s².

Table 1 — Conditioning methods and applicable International Standards for testing

Subclause	Conditioning methods	International Standard
4.1	30: Shock	IEC 60068-2-27
4.2	31: Bump	IEC 60068-2-29
4.3	32: Drop and topple	IEC 60068-2-31
4.4	33: Free fall	IEC 60068-2-32
4.5	34: Bounce	IEC 60068-2-55
4.6	35: Steady-state acceleration	IEC 60068-2-7
4.7	36: Sinusoidal vibration	IEC 60068-2-6
4.8	37: Random vibration (wide-band), digital control	IEC 60068-2-64

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4.6	35: Steady-state acceleration	IEC 60068-2-7
4.7	36: Sinusoidal vibration	IEC 60068-2-6
4.8	37: Random vibration (wide-band), digital control	IEC 60068-2-64

4 Conditioning

4.1 Conditioning method 30: Shock

See Table 2.

When testing optical instruments, a half-sine shock pulse shall be applied. The specimen shall be subjected to three shocks in each direction along each axis.

Table 2 — Degrees of severity for conditioning method 30: Shock

Degree of severity	01	**02**	**03**	04	**05**	06	07	08[1)]

1) Applicable to testing of components and assemblies. Complete optical instruments should be subjected to 500 *g* acceleration and shocks of 0,5 ms duration.

Acceleration amplitude	m ·s−2		100	150	300	300	500	500	1 000	5 000
	g_n multiples		10	15	30	30	50	50	100	500
Duration of nominal shock		ms	6	11	6	18	3	11	6	1
State of operation			0 or 1 or 2							

NOTE Degrees of severity in boldface shall be given preference.

1) Applicable to testing of components and assemblies. Complete optical instruments should be subjected to 500 *g* acceleration and shocks of 0,5 ms duration.

Table 2 — Degrees of severity for conditioning method 30: Shock

Degree of severity		01	02	03	04	05	06	07	08[a]
Acceleration amplitude	m s-2	100	150	300	300	500	500	1 000	5 000
	g_n multiples	10	15	30	30	50	50	100	500
Duration of nominal shock	ms	6	11	6	18	3	11	6	1
State of operation		0 or 1 or 2							

NOTE Degrees of severity 02, 03 and 05 are to be given preference.

[a] Applicable to testing of components and assemblies. Complete optical instruments should be subjected to 500 g_n acceleration and shocks of 0,5 ms duration.

4.2 Conditioning method 31: Bump

See Table 3.

~~Table 3 — Degrees of severity for conditioning method 31: Bump~~

Degree of severity			01	02	03	04	05	06	07	08
Acceleration amplitude	m ·s−2		100	100	100	100	250	250	400	400
	g_n multiples		10	10	10	10	25	25	40	40
Duration of nominal shock		ms	6	6	16	16	6	6	6	6
Number of shocks in each direction along each axis ± 10			1 000	4 000	1 000	4 000	1 000	4 000	1 000	4 000
State of operation			0 or 1 or 2							

Table 3 — Degrees of severity for conditioning method 31: Bump

Degree of severity		01	02	03	04	05	06	07	08
Acceleration amplitude	m s-2	100	100	100	100	250	250	400	400
	g_n multiples	10	10	10	10	25	25	40	40
Duration of nominal shock	ms	6	6	16	16	6	6	6	6
Number of shocks in each direction along each axis ±10		1 000	4 000	1 000	4 000	1 000	4 000	1 000	4 000
State of operation		0 or 1 or 2							