International Standard

ISO 12870

Fifth edition
2024-11

Ophthalmic optics — Spectacle frames — Requirements and test methods

Optique ophtalmique — Montures de lunettes — Exigences et méthodes d'essai

Reference number
ISO 12870:2024(en)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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).

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 voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 7, *Ophthalmic optics and instruments*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 170, *Ophthalmic optics,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fifth edition cancels and replaces the fourth edition (ISO 12870:2016), which has been technically revised.

The main changes are as follows:

— rimmed clip-ons, prescription inserts, and frames made by additive manufacture are now included in the scope;

— additional terms and definitions;

— clarification of the tests to be applied for the biological properties of custom-made frames in Table 1 (in 4.1);

— some re-arrangement of and additional text in 4.2;

— simplification of the text in 4.2 to make it more general, and addition of a note on magnets;

— additional wording has been added to 4.12.3 and 8.5 to emphasize that the apparatus prevents rotational movements of the "fixed" side;

— minor changes to 4.2, 6.1, 8.5.2.3, 8.6, 8.7 (with a new Annex E), Clause 9 and 10.3;

— 4.5 and 4.9 have been made optional, while the original 10.5 and 10.6 are now in a Note to 4.2;

— 10.1 refers to an informative Annex F on frame handling information.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ophthalmic optics — Spectacle frames — Requirements and test methods

1 Scope

This document specifies fundamental requirements and their test methods for unglazed spectacle frames designed for use with prescription lenses. It is applicable to spectacle frames at the point of sale by the manufacturer or supplier to the retailer.

This document is applicable to:

— all mass-produced spectacle frame types, including rimless mounts, semi-rimless mounts and folding spectacle frames;

— spectacle frames made with additive manufacturing, for example, 3D printing;

— spectacle frames made from natural organic materials;

— the frame or mount of clip-ons designed specifically for attachment to particular models of spectacle frame, but not to their lenses or filters to which ISO 16034 or ISO 12312-1 apply;

— prescription inserts designed for attachment to particular models of, for example, eye protector, sunglass or diving mask.

Parts of this document are applicable to custom-made frames – see 3.1.3 and Table 1.

NOTE See Annex A for recommendations on the design of spectacle frames and terms to be used when describing metal frames.

This document is not applicable to spectacle frames used in eye protection, where ISO 16321-1 applies, or to sunglasses with afocal filters, where ISO 12312-1 applies.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

ISO 7998, *Ophthalmic optics — Spectacle frames — Lists of equivalent terms and vocabulary*

ISO 8624, *Ophthalmic optics — Spectacle frames — Measuring system and vocabulary*

ISO 11380, *Optics and optical instruments — Ophthalmic optics — Formers*

ISO 11381, *Ophthalmic optics — Spectacle frames — Screw threads*

EN 16128, *Ophthalmic optics — Reference method for the testing of spectacle frames and sunglasses for Nickel release*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7998 and ISO 8624 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms

3.1.1
spectacle frame model
spectacle frame produced to a common design, using the same materials (but not necessarily the same pigmentation) and surface treatment

3.1.2
mass-produced frame
frame that is based on standardized dimensions/designs and is typically produced in a continuous production run or homogenous batch

Note 1 to entry: A homogeneous batch will be made to the same specifications using the same machine/ equipment set-up.

Note 2 to entry: A mass-produced frame is not designed for a particular individual, but may have to be adapted to fit the wearer's facial features during dispensing, and will be adapted by fitting it with spectacle lenses.

[SOURCE: Adapted from IMDRF N49:2018, 4.7 and 4.8]

3.1.3
custom-made frame
frame made to a written request from a person authorized by national law for the sole use of a particular individual to address the specific anatomo-physiological features, pathological condition or frame colour or design request of the individual for whom it is intended

Note 1 to entry: Frames that are patient-matched, adaptable or mass-produced shall not be considered to be custom-made.

Note 2 to entry: A custom-made frame is intended for a case where an individual's specific needs cannot be met, or cannot be met at the appropriate level of performance, by an alternative device available on the market.

[SOURCE: IMDRF N49:2018, 4.2, definition abbreviated to fit ISO Rules.]

3.1.4
principal component
<of a frame> rims, bridge, lugs and sides

Note 1 to entry: For a frame of which the front is made of plastic materials, the rims, bridge and lugs can be machined from or moulded in a single piece of material.

Note 2 to entry: Other components of a frame, which might be called non-principal components, include joints, sprung joints, screws, closing blocks, solders, washers, bushings, nuts of screw assemblies, dowel pins, metal cores for plastics sides, plastics nose pads, plastics hoods, plastics end covers, plastics inner winding and cores of curl sides.

3.1.5
trained observer
person trained in the testing of frames who has a binocular decimal visual acuity of at least 1,0 (6/6 or 20/20) and wearing the appropriate refractive correction, if necessary, for the observation distance of the test

[SOURCE: ISO 4007:2018, 3.11.1, modified by replacing "with" by "who has" and "eye and face protectors" with "frames.]

3.1.6
test lens
lens as described in 6.1 to be mounted into the frame for testing the frame's requirements

3.2 Types of frame

3.2.1
plastics frame
frame of which the *principal components* (3.1.4) of the front are made of a plastics material

3.2.2
frame made of natural organic materials
frame of which the *principal components* (3.1.4) of the frame are made of *natural organic materials* (3.3.1)

Note 1 to entry: For the purposes of terminology, a frame from natural organic materials has the same construction as a plastics frame, the material having some properties similar to those of a plastic material.

3.2.3
metal frame
frame of which the *principal components* (3.1.4) of the frame are made of metal

3.2.4
folding frame
frame hinged at the bridge, and possibly in the sides, so as to fold into a small space

3.2.5
combination frame
frame of which the front and/or sides are made of at least two different categories of material

Note 1 to entry: The non-principal components (see 3.1.4, Note2 to entry) are excluded from consideration in this definition.

Note 2 to entry: Categories of material include, but are not limited to, metal, plastic and natural organic materials.

Note 3 to entry: This includes the original meaning of the term when the combination depended only on the construction of the front.

3.2.6
mount for rimless and semi-rimless spectacles
mount of which the front is made of metal or of a plastic material or a *natural organic material* (3.3.1) having similar properties, or a combination of both, and in which the lenses are not or only partially surrounded by a protecting rim

3.2.7
mixed frame
frame in which the components liable to come into close and prolonged contact with the skin are made of at least two different categories of material

Note 1 to entry: All components are included, both *principal components* (3.1.4) and non-principal components (see 3.1.4, Note2 to entry).

Note 2 to entry: Categories of material include, but are not limited to, metal, plastic and natural organic materials.

Note 3 to entry: This definition is used only for descriptions for testing purposes, not for frame categorization when marketing or in catalogues.

3.2.8
clip-on
pair of lenses/filters or a one-piece lens or filter designed to clip on over the front of or behind a pair of spectacles

Note 1 to entry: For the purposes of this document, the term is restricted to designs with a rim that fits on the front.

[SOURCE: ISO 4007:2018, 3.5.1.14, modified by the addition of the note 1 to entry.]

3.2.9
prescription insert
device for carrying prescription lenses that is intended to be attached on the inside of the protector between the eyes of the wearer and the protective lens

Note 1 to entry: Prescription inserts can be used with eye and face protectors for occupational use, sunglasses, diving goggles, augmented reality devices, etc.

[SOURCE: ISO 4007:2018, 3.5.1.15, modified by the addition of the note to entry.]

3.3 Term describing frame materials

3.3.1
natural organic material
material that has not been synthesized from other raw organic materials and, when processed, remains essentially in its original state

Note 1 to entry: Processing in this case is defined as cutting, shaping, laminating, bonding, bending, polishing and heating.

EXAMPLE Natural horn, bamboo and wood.

3.3.2
rolled-gold covering
covering achieved using a method by which a layer of gold alloy is bonded to a sheet or bar of base metal, the whole then being subjected to reduction by rolling

Note 1 to entry: The proportion of gold is designated by its nominal thickness, in micrometres, and by the fineness of the gold alloy covering the base metal, for example, 40 µm nominal thickness of 500 fineness gold alloy. In accordance with ISO 3160-1, the range of nominal thicknesses, in micrometres, are 5 µm, 10 µm, 20 µm, 40 µm and 80 µm, with a tolerance of −20 %, and the fineness is defined as the proportion of pure gold contained in the gold alloy, normally expressed in thousandths (41,67 thousandths = 1 carat).

Note 2 to entry: To clarify that the frame is made from rolled-gold material, the initials L or RG can also be marked on the frame.

[SOURCE: ISO 3160-1:1998, 3.1, modified by the addition of the notes which have been developed from the standard, including ISO 3160-1:1998, 3.5.]

3.3.3
rolled-gold spectacle frame
frame of which each of the metal *principal components* (3.1.4) is made of a material with a rolled-gold covering

3.3.4
titanium frame
frame of which each of the metal *principal components* (3.1.4) is made of an alloy containing at least 70 % titanium by mass and has a non-nickel containing coating

3.3.5
pure titanium frame
frame of which each of the metal *principal components* (3.1.4) is made of an alloy containing at least 90 % titanium by mass and has a non-nickel containing coating

3.3.6
memory-metal frame
frame of which some of the metal *principal components* (3.1.4) are made of an alloy with specific flexibility characteristics

Note 1 to entry: The rims might be made of monel or similar material, or a titanium alloy.

Note 2 to entry: Some memory-metal alloys contain at least 40 % titanium (mass fraction).

3.3.7
titanium niobium frame
Ti-Nb frame
frame of which some of the metal *principal components* (3.1.4) are made of an alloy containing at least 50 % and less than 70 % titanium by mass and contains the element niobium

Note 1 to entry: Niobium and other elements are included in order to decrease Young's modulus to 80 GPa or less for specific flexibility characteristics. The alloy and its surface coating do not contain the element nickel.

Note 2 to entry: The rims are probably made of titanium, usually β-titanium. β-titanium material is a titanium alloy containing at least 70 % titanium by mass with specific characteristics.

4 Requirements

4.1 General

The requirements applicable to different types of spectacle frames are given in Table 1. All spectacle frame types covered by this document shall comply with the requirements identified as "general" (g). Requirements marked "O" are optional, but can be required by legislation in some countries.

In some regions, local legislation requires a spectacle frame model to comply with regulatory requirements throughout the duration of its supply to the market. When conformity with this document is claimed, the manufacturer or its representative has the responsibility, by any chosen means, to ensure that the compliance of the spectacle frame model continues throughout its duration of supply, and not only at its first launch on the market.

Table 1 — Requirements applicable to different types of spectacle frame

Production method	Frame type	Subclause/Clause[a]												
		4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	4.13	4.14	9
Mass-produced frame[b]	Mounts for rimless and semi-rimless spectacles	g	g	g	O	g	O	g[c]	O	g	g	g	g	O	g
	Rimmed clip-ons, prescription inserts	g	g	g	O	g	g	g	N	N	g	N	g	O	O
	All other frame types[d]	g	g	g	O	g	g	g	O	g	g	g	g	O	g
Custom-made frame[b]	Mounts for rimless and semi-rimless spectacles	g	g	g	O	g	O	N	O	N	N	N	g	O	O
	Rimmed clip-ons, prescription inserts	g	g	g	O	g	g	O	N	N	N	N	g	O	O
	All other frame types[d]	g	g	g	O	g	g	O	O	N	N	O[e]	g	O	O

Key	
g	Frame type shall meet the requirements of this subclause in order to conform with this document.
O	Conformity with this subclause is optional.
N	Not applicable

4.2	Construction	4.9	Tolerance on screw threads
4.3	Risk analysis	4.10	Dimensional stability at elevated temperature
4.4	Biological compatibility	4.11	Resistance to perspiration
4.5	Nickel release	4.12	Mechanical stability
4.6	Clinical evaluation	4.13	Resistance to ignition
4.7	Measurement system	4.14	Resistance to optical radiation
4.8	Dimensional tolerances on nominal size	Clause 9	Marking

[a] Under European legislation, 4.2, 4.3, 4.4, 4.5, 4.6, 4.9, 4.10, 4.11, 4.12, 4.13 and Clause 9 cover some essential requirements.

[b] The manufacturer shall inform the test laboratory of the production method.

[c] Horizontal boxed lens size is optional for rimless mounts.

[d] "All other frame types" include plastics, metal, combination frames and frames made of natural organic materials, including folding frames, that have a rim that completely surrounds the lens periphery.

[e] Only 4.12.1 and 4.12.2 can be applied.

4.2 Construction

The solutions adopted by the manufacturer for the design and construction of spectacle frames shall conform to safety principles, taking account of the generally acknowledged state of the art.

When tested under the inspection conditions given in 7.2, areas of the spectacle frame that might, during intended use, come into contact with the wearer shall be smooth and without sharp protrusions.

NOTE 1 If a frame incorporates magnets, e.g., for attachment of clip-ons or prescription inserts, then the risk management process must ensure that there will not be any interference with other medical devices, e.g. hearing aids, and shall not compromise health, e.g., the possibility of being swallowed. The risk of swallowing magnets by children can be tested, e.g. EN 71-1.

NOTE 2 Legislation in some countries can require that, e.g., for frames fitted with headbands that help retain the spectacles in the correct position in front of the eyes, the headband shall not be capable of causing a strangulation hazard. See, for example EN 71-1 and EN 14682.

4.3 Risk management

Spectacle frames should be designed, manufactured and packaged so that, when used under normal conditions of use, they shall be safe.

ISO 14971 gives guidance on risk management.

NOTE In some countries, additional regulations can be relevant, e.g. CPSIA (Consumer Product Safety Improvement Act), or for wearers aged 36 months or less, e.g., Directive 2009/48/EC of the European Parliament and of the Council of 18 June 2009 on the safety of toys.

4.4 Biological compatibility

When considering the biological properties of frame materials, manufacturers should avoid using substances that are known to be allergenic, carcinogenic, mutagenic or toxic to reproduction. Attention should be paid to any regulatory limits.

For mixed-frames, where more than one material is liable to come into close and prolonged contact with the skin, the manufacturer will have to consider the biological properties of each material.

NOTE 1 In some countries, restrictions on specific materials or their chemical constituents are mandatory, e.g. European REACH, Californian Proposition 65.

NOTE 2 For manufacturer's convenience, Annex B gives a list of chemicals that could give rise to concern. This list is only an indication, is not comprehensive, is subject to change and does not give threshold limits. Manufacturers should check their local regulations regularly.

NOTE 3 The following list, which is given for information, provides examples of documents that can be examined when checking the innocuousness of materials:

— specification of the materials used;

— safety data sheets relating to the materials;

— information relating to the suitability of the materials for use in medical devices or other relevant applications;

— information relating to investigations into the allergenic, carcinogenic, toxicological or mutagenic properties of the materials, or their toxicity with regard to reproduction;

— information relating to ecotoxicological and other environmental investigations on the materials.

NOTE 4 Reactions can be generated by excessive pressure, for example, due to a poor fit on the face, chemical irritation or allergy. Rare or idiosyncratic reactions can occur to any material and indicate the need for the individual to avoid frames made from that particular material.

NOTE 5 Testing according to ISO 10993 gives useful information on biocompatibility.

4.5 Nickel release (optional)

Those parts of metal frames and those metal parts of combination frames that come into direct and prolonged contact with the skin of the wearer shall not have a nickel release greater than 0,5 µg cm^{-2} $week^{-1}$ (expressed as 0,5 µg/cm^2/week in the EU's REACH regulation) when tested in accordance with EN 16128.

The parts to be tested are specified in EN 16128 and shall include the following:

— the front (rims, bridge and, if applicable, brace bar and any nasal bearing surfaces including metal nose pads), excluding pad arms and lugs;

— the sides including metal collets, but excluding the joints and areas intended to be protected by plastic end covers (tips);

— metal decorative trims, if fitted on the inside of plastic sides and plastic end covers.

NOTE 1 Annex C provides brief information about European requirements and legislation.

NOTE 2 If only indicative information on the extent of nickel release is required, such information can be obtained by performing one of the tests specified in CEN/TR 12471. See NOTE 2 of Annex C.

4.6 Clinical evaluation

If a spectacle frame is manufactured using materials (e.g., plastics, alloys, coatings or pigments) not previously used in spectacle frame manufacture, the clinical evaluation shall be made according to the appropriate International Standard(s), either using the spectacle frame itself or using studies where the identical material is used in other medical devices.

4.7 Measurement system

The stated nominal dimensions of the spectacle frame shall be in accordance with the measuring system specified in ISO 8624.

4.8 Dimensional tolerances on nominal size

When measured with a linear measuring device with an uncertainty no greater than ±0,1 mm, the following tolerances shall apply to the marked dimensions of the unglazed spectacle frame using the boxed lens measurement method described in ISO 8624:

a) horizontal boxed lens size: ±0,5 mm;

b) distance between lenses: ±0,5 mm;

c) overall length of side: ±2,0 mm.

To improve the accuracy of measurement of overall length of side, it is recommended that the drop be physically straightened. Sinuosity in the intended vertical plane, or pronounced curvature in the intended horizontal plane in the part of the side before the earbend, should be ignored. The overall length of side should be taken as the length of the straight line between the axis of the joint (hinge) or dowel screw's axis and the end of the side. See ISO 8624:2020, Figure 2, for an illustration of overall length of side.

Gentle bowing of the side to go around the width of the head should be straightened. For sides without a hinged joint, the side should be held open at $(90^{0}_{-5})°$ to the front or to that part of the side that is attached to the front, and the length measurement is from the end of the side to the back surface of the lug less 10 mm – see Figure 1 for an illustration of overall length of side.

Dimensions in millimetres

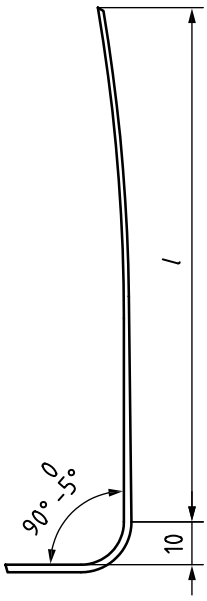


Figure 1 — Measurement of overall length of side for sides without a joint

To simplify the edging of lenses for any single frame model, tighter tolerances in the lens aperture size from one frame to another of the same nominal size may be a matter of agreement between supplier and purchaser.

4.9 Tolerance on screw threads (optional)

It is recommended that the screw threads used in spectacle frame manufacture are chosen from those in ISO 11381, but this should not restrict future frame development.

The tolerances on the screw threads used in the spectacle frame should conform to ISO 11381.

4.10 Dimensional stability at elevated temperature

When the spectacle frame with test lenses fitted is tested in accordance with 8.2, the distance between the tips of the sides shall not alter by more than +6 mm or −12 mm. For small spectacle frames where the tip of the side is less than 100 mm from the back plane of the front, these tolerances are reduced to +5 mm or −10 mm.

4.11 Resistance to perspiration

When the spectacle frame is tested in accordance with 8.3, there shall be

a) no spotting or obvious alteration in colour (except for loss of gloss to the surface) anywhere on the frame, excluding joints and screws, after testing for 8 h, and

b) no corrosion, surface degradation (e.g., roughness, orange peel appearance) or separation of any coating layer on the parts liable to come into prolonged contact with the skin during wear, i.e. the insides of the sides, bottom and lower parts of the rim and the inside of the bridge, after testing for a total of 24 h.

The labelling of manufacturer/brand, model and size should still be legible after testing for 8 h.

Such defects shall be visible to a trained observer under the inspection conditions described in 7.2.

If the spectacle frame is made from natural organic materials and the manufacturer recommends use of a product such as a cream or wax for its maintenance, then, before testing, the frame(s) shall be prepared with this product in accordance with the manufacturer's instructions. At the end of the test, if the frame fails to meet this requirement when checked for colour change or surface degradation, use the product and

wait for one day before checking again for colour change or surface degradation. If the frame has recovered its original colour and surface finish, the spectacle frame is considered to have passed the test; if the frame remains discoloured, the frame is considered to have failed the test.

If the spectacle frame is fitted with readily interchangeable soft nosepads or endcovers (side tips), and at the end of the 24 h test the frame would have passed the test but these components have changed appearance but without surface degradation, then the spectacle frame is considered to have passed the test.

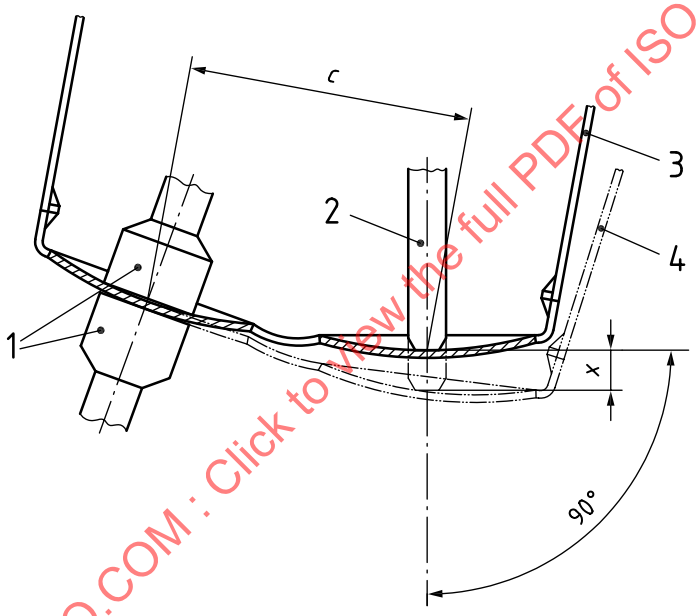
4.12 Mechanical stability

4.12.1 Bridge deformation

When tested in accordance with 8.4, the spectacle frame with the test lenses fitted shall not

a) fracture or crack at any point, or

b) be permanently deformed from its original configuration by more than 2 % of the distance, *c*, between the boxed centres (see ISO 8624) of the spectacle frame, i.e. the residual deformation, *x*, shall not exceed 0,02*c* (see Figure 2).



Key

1 annular clamp
2 pressure peg
3 original position
4 position of residual deformation
c boxed centre distance
x residual deformation

Figure 2 — Permanent deformation of bridge

4.12.2 Lens retention characteristics

The spectacle frame shall be considered to demonstrate acceptable lens retention characteristics if, when tested in accordance with 8.4, neither test lens is dislodged wholly or partially from its original location in the groove or mount.

4.12.3 Endurance

This test aims to simulate the strains on the frame, particularly the joints, when putting the spectacles on or off. The end of one side is rotated through a circle of diameter 60 mm. The end of the other side is clamped to a universal joint, the other end of which is fixed, thus allowing vertical and horizontal angular but not twisting rotational movements. The bridge is supported, but not clamped, by an artificial nose to restrict movement of the frame.

When tested in accordance with 8.5, the spectacle frame with the test lenses fitted shall not

a) fracture at any point,

b) be permanently deformed from its original position by more than 5 mm after 500 cycles,

c) require more than light finger pressure to open and close the sides (except for frames fitted with sprung joints), or

d) have a side that closes under its own weight at any point in the opening/closing cycle (for frames not fitted with sprung joints), or for sides fitted with sprung joints, the side shall still support its weight in the open position (i.e. opened to the fullest natural extent without activating the spring mechanism).

4.13 Resistance to ignition

When the spectacle frame is tested in accordance with 8.6, there shall be no continued combustion after withdrawal of the test rod.

4.14 Resistance to optical radiation (optional)

When tested in accordance with 8.7, there shall be no

a) colour change greater than grade 3 on the grey scale in ISO 105-A02, or

b) loss of lustre on bright surfaces,

when compared with an untested sample under the inspection conditions described in 7.2.

5 Selection of test samples

5.1 General

The minimum level of conformity testing requires that two test specimens of each spectacle frame model shall be selected at random. These specimens shall be selected by the manufacturer or its representative, and shall be identified as test sample 1 and test sample 2. They shall be conditioned as described in Clause 6 before testing as described in Clauses 7 and 8.

5.2 Testing for nickel release

For metal, combination and mixed frames that are subject to 4.5, two additional test samples shall be selected at random and shall be conditioned and tested as specified in EN 16128.

5.3 Change in spectacle frame model

If a range of spectacle frame models is made from the same material(s), following the same manufacturing procedures, including surface treatments, it is acceptable to perform, from Table 2, test sequences 4 (see 8.3), 8 (see 8.6) and, if required, 9 (see 8.7), on only one of the frame models.

6 Preparation and conditioning of test samples

6.1 Test lenses

Prior to testing for the requirements described in 4.10 to 4.14, test samples 1 and 2 shall be fitted with a pair of suitable test lenses.

The test lenses should be supplied or specified by the manufacturer/importer/authorized representative. If test lenses are not supplied or specified, then the testing laboratory shall contact the frame manufacturer for a recommendation for the lens's material, power, thickness, curvature and, as appropriate, bevel angle or edge profile.

In the absence of supply or specifications from the manufacturer or an inability to contact the manufacturer, test lenses are recommended to be of suitable material for the type of frame and have a vertex power of (0,00 ± 0,25) D, a centre thickness of (2,00 ± 0,2) mm and a curvature appropriate for the frame.

For all test samples, these test lenses shall be edged either in accordance with the manufacturer's electronic instructions or with a digitally controlled edging machine that uses the tracing made of the individual test sample or, where appropriate, using a mechanical former in accordance with ISO 11380.

NOTE These test lenses can also be used for any test samples required for nickel release testing.

6.2 Sample conditioning and test conditions

Immediately before starting the series of tests, the test samples shall be conditioned for at least 4 h at an ambient temperature of (23 ± 5) °C, in the condition as received from the manufacturer or supplier, without prior realignment, adjustment or lubrication.

Carry out the testing in an atmosphere maintained within the same temperature range.

7 Testing, inspection and conformity

7.1 Testing

The testing shall be carried out with the conditioned test samples (see 6.2) in the sequence specified in Table 2 at an ambient temperature of (23 ± 5) °C.

Table 2 — Sequence of testing

Identification of test	Requirement subclause	Test method subclause	Sequence	Sample 1	Sample 2	Nickel release samples
Construction	4.2	4.2	1	*		
Dimensional tolerance	4.7, 4.8	4.8	2	*		
Dimensional stability	4.10	8.2	3	*		
Resistance to perspiration	4.11	8.3	4	*		
Bridge deformation	4.12.1	8.4	5		*	
Lens retention	4.12.2	8.4	6		*	
Endurance	4.12.3	8.5	7		*	

* Indicates that the test shall be applied.

[a] This test is optional.

[b] This test is a legal requirement in some countries.

Table 2 *(continued)*

Identification of test	Requirement subclause	Test method subclause	Sequence	Sample 1	Sample 2	Nickel release samples
Resistance to ignition	4.13	8.6	8	*		
Resistance to optical radiation	4.14	8.7	9		*a	
Nickel release	4.5	EN 12472 and EN 16128	10			*b

* Indicates that the test shall be applied.

a This test is optional.

b This test is a legal requirement in some countries.

7.2 Inspection and examination

Where visual inspection is required, the inspection and examination of test samples shall be carried out, without magnification, by a trained observer.

During the examination, expose the test specimen and, if specified, the reference specimen to an illuminance of 1 000 lx to 2 000 lx and carry out the inspection against a matt black background.

7.3 Conformity

If all test samples of the spectacle frame model pass the tests specified in Table 1 and in the sequence listed in Table 2, the product shall be deemed to comply with this document (see Figure 3).

If either sample 1 or sample 2 fails any one of the tests in the complete test sequence, an additional sample shall be used to repeat the test that was failed. If this additional sample passes the previously failed test and subsequent tests specified in Table 1 and listed in Table 2, the product shall be deemed to comply with this document. If one or more tests in the sequence result in failure, the product shall be deemed not to comply with this document.

If two or more of the tests carried out on the first set of test samples result in failure, no additional samples shall be tested and the product shall be deemed not to comply with this document.

In the case of non-conformity, this clause does not preclude resubmitting the frame for testing after improvements have been made to its design or manufacture.

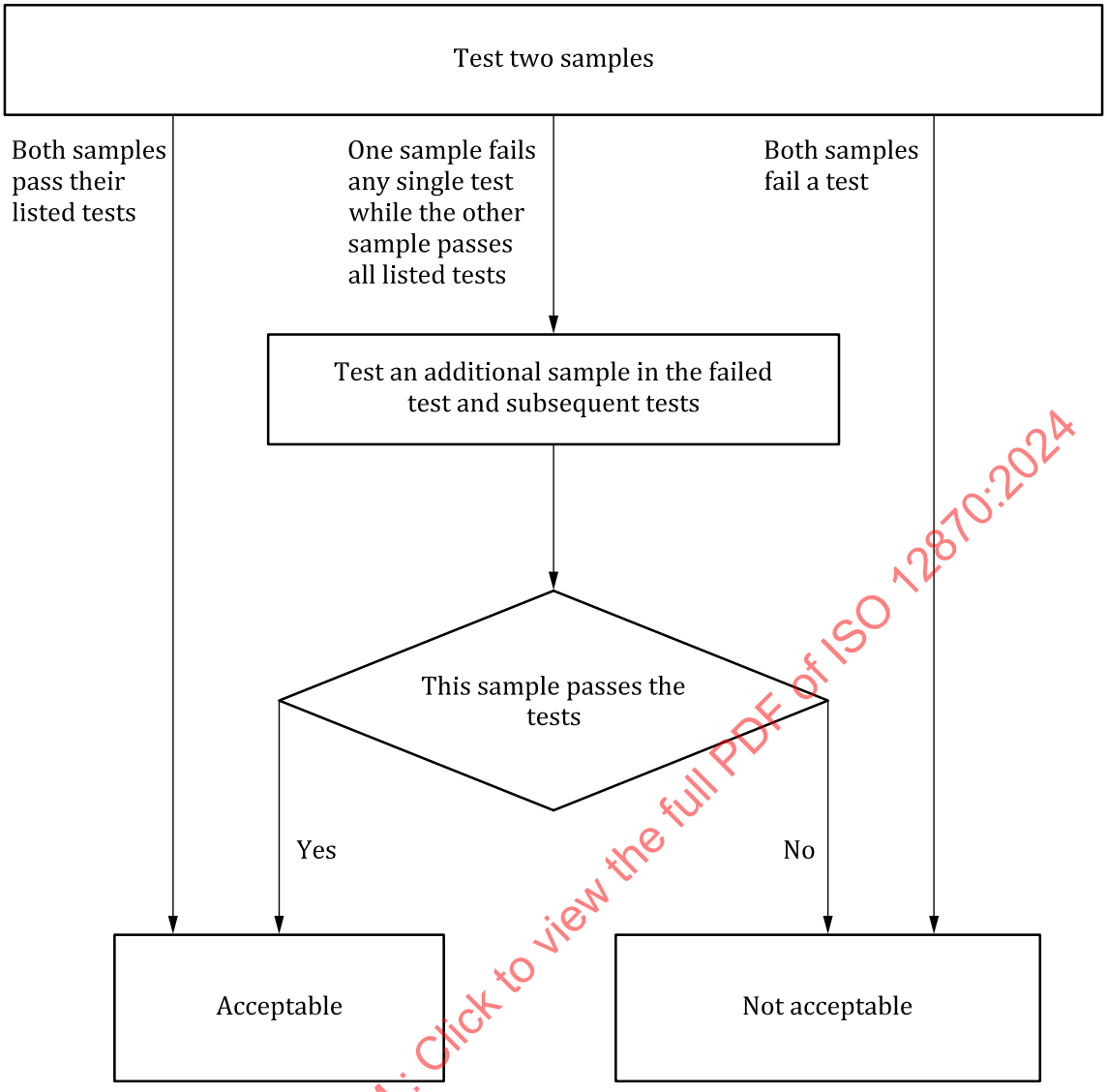


Figure 3 — Flow chart for conformity, excluding testing for nickel release

8 Test methods

8.1 General

The test methods described are reference test methods. Variations or alternatives may be used provided their results can be shown to be equivalent to those of the relevant reference method. In case of dispute, the result obtained with the reference method shall have precedence.

8.2 Test for dimensional stability

8.2.1 Apparatus

8.2.1.1 **Oven**, capable of producing the test temperature of (55 ± 5) °C.

8.2.1.2 **Flat plate**, of glass or metal, mounted in the oven (8.2.1.1) either on, or parallel to, the base of the chamber.

8.2.1.3 Linear measuring device, having an uncertainty no greater than ±0,5 mm.

8.2.2 Procedure

8.2.2.1 At an ambient temperature of (23 ± 5) °C, take test sample 1, with test lenses fitted and with the sides open to the fullest extent (for frames with sprung joints, opened to the fullest natural extent without activating the spring mechanism), and measure the distance between the side tips using the measuring device (8.2.1.3). Record this measurement as the pre-heating value, l_0.

8.2.2.2 Before commencing the test, stabilize the oven (8.2.1.1) at the test temperature of (55 ± 5) °C.

Place the test sample on the plate (8.2.1.2), with the sides still open to the fullest extent, and with the top edge of the front and the top edge of the sides resting on the plate surface. Place the sample on the plate in the oven, and ensure that the sample does not touch other samples or the oven wall.

8.2.2.3 When the test sample has reached the test temperature after approximately 15 min at the appropriate setting, leave it undisturbed at the test temperature for a further 2 h $^{+5\ \text{min}}_{0\ \text{min}}$.

After this period, remove the test sample, still on the plate, from the oven. Allow to cool for a period of at least 2 h at (23 ± 5) °C and repeat the measurement of the distance between the side tips as described in 8.2.2.1. Record this measurement as the post-heating value, l_1, and calculate the difference, $l_1 - l_0$. Compare the result against the requirement in 4.10.

8.3 Test for resistance to perspiration

8.3.1 Apparatus and reagents

8.3.1.1 Oven, capable of producing the test temperature of (55 ± 5) °C.

8.3.1.2 Container, of glass or inert plastic, measuring at least 200 mm across and 90 mm high, capable of being closed.

8.3.1.3 Volumetric flask, 1 l, gauged to class A of ISO 1042.

8.3.1.4 Water, conforming to grade 3 of ISO 3696.

8.3.1.5 Artificial sweat solution, comprised of the following:

a) lactic acid, >85 % mass fraction purity;

b) sodium chloride (of recognised pro analysis, p.a., grade or better);

c) water, conforming to grade 3 of ISO 3696.

Using suitable containers, weigh (50 ± 0,1) g of lactic acid and (100 ± 0,1) g of sodium chloride and dissolve in 900 ml of water. Using the flask (8.3.1.3), make up to 1 l with water.

8.3.1.6 Frame supports, of glass or inert plastic, fitted in the container so that the sample(s) are held at no less than the specified distance above the artificial sweat solution (see 8.3.2.1 and Figure D.1). The supports can be designed so as to hold several samples stacked one above another, or side by side, or both, but without being in contact with each other.

8.3.2 Procedure

8.3.2.1 Cover the base of the container (8.3.1.2) with the artificial sweat solution (8.3.1.5) to a minimum depth of 10 mm so that the lowest part of the (lowest, if stacked) frame shall be not less than 12 mm above the solution.

Place test sample 1, fitted with the test lenses, on the supports (8.3.1.6), with the sides open to the fullest extent (for frames with sprung hinges, opened to the fullest natural extent without activating the spring mechanism), and with the bottom edges of the sides resting on the supports (see Figure D.1). Ensure that the spectacle frame does not touch other samples or the container walls.

Close the container, place it in the oven (8.3.1.1) and maintain at (55 ± 5) °C.

8.3.2.2 After (8 ± 0,5) h, remove each sample and immediately wash with water (8.3.1.4). Dry without rubbing, using a soft cloth.

8.3.2.3 Within 30 min, examine each test sample under the inspection conditions described in 7.2. By comparison with an identical untested spectacle frame, check for and record any spots or change in colour – see the requirements in 4.11.

8.3.2.4 Replace the test sample(s) on the support(s), close the container and maintain the test temperature of (55 ± 5) °C for a further (16 ± 0,5) h. After completion of this second period, remove, clean and dry the samples as described in 8.3.2.2.

8.3.2.5 Within 30 min, examine those areas of each sample that are liable to come into prolonged contact with the skin of the wearer under the inspection conditions described in 7.2. By comparison with an identical untested spectacle frame, check for and record any corrosion, surface degradation or separation of any coating layer – see the requirements in 4.11.

8.4 Bridge deformation and lens retention

8.4.1 Apparatus

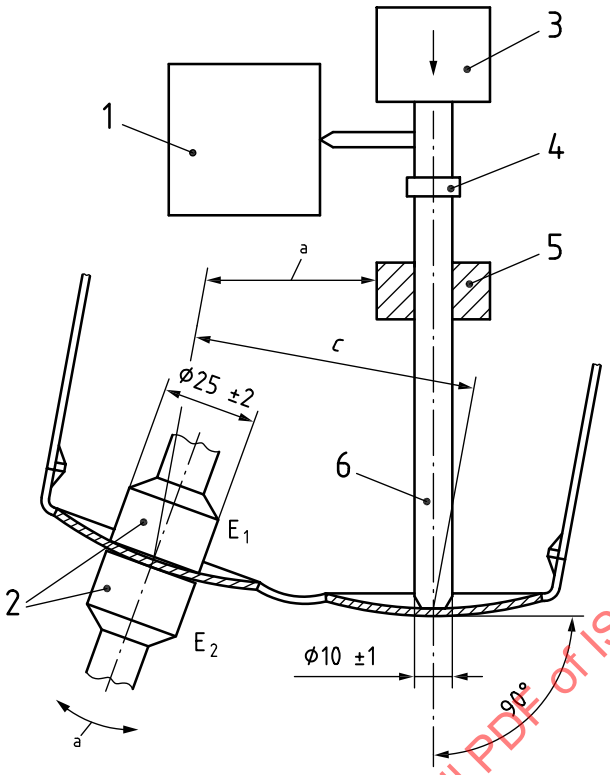
8.4.1.1 Overall scheme, the test apparatus consists of an annular clamp, a downward-operating pressure peg and a measuring device. See Figure 4.

8.4.1.2 Annular clamp, (see Figure 4, key item 2) shall be capable of holding the test sample without twist or slip and have a diameter of (25 ± 2) mm, with two contact surfaces, E_1 and E_2, made of a firm elastic material (e.g., polyamide). The clamping surfaces shall be capable of being separated by at least 10 mm on either side of a horizontal line going through the apparatus. To accommodate frames with a significant face form angle, the annular clamp shall also be capable of rotating about a horizontal axis so that the axis of the pressure peg (8.4.1.3) remains vertical and perpendicular to the plane of the unclamped lens at its boxed centre.

8.4.1.3 Pressure peg, (see Figure 4, key item 5), which operates vertically downwards, shall have a diameter of (10 ± 1) mm with a nominally hemispherical contact surface. The pressure peg shall be capable of travelling from at least 10 mm above the horizontal line to not more than 8 mm below. The horizontal distance between the annular clamp and pressure peg is adjustable. The pressure peg slides in a guiding sleeve (see Figure 4, key item 5) that maintains its vertical orientation and lateral position.

8.4.1.4 Measuring device, to measure the linear displacement of the pressure peg, with an uncertainty no greater than ±0,1 mm.

Dimensions in millimetres



Key

1	measuring device
2	annular clamp
3	direction and point of application of force (maximum 5 N)
4	displacement limiting ring (optional)
5	guiding sleeve
6	pressure peg
c	boxed centre distance (adjustable)
E_1, E_2	contact surfaces
a	Adjustable.

Figure 4 — Example of equipment for the bridge deformation test

8.4.2 Procedure

8.4.2.1 Mount test sample 2 on the device with the sides of the sample extended and with the front of the sample facing downwards. Clamp the sample within 2 mm of the boxed centre of one test lens (see Figure 4).

If the sides are in the way of mounting the frame, e.g., jointless sides, then it is permissible to remove them, but if so, the endurance test (8.5) shall be performed first. Since the endurance test may be a more severe test of the frame's mechanical strength, the preferred option is to subject the sample to the bridge deformation and lens retention test before the endurance test.

Lower the pressure peg so that it rests on the back surface of the unclamped lens within 2 mm of its boxed centre, ensuring that there is no movement of the lens. Record the reading on the linear measuring device (8.4.1.4) as the starting position.

Move the pressure peg slowly and smoothly downwards, increasing the force until the first of the following criteria is reached:

a) a maximum force of 5 N;

b) a displacement of the pressure peg from the starting position equal to (10 ± 1) % of the boxed centre distance, *c* (see ISO 8624). An optional displacement limiting ring (see Figure 4, key item 4) can be used to limit the movement of the pressure peg.

8.4.2.2 If the maximum force of 5 N is insufficient to displace the pressure peg over the distance specified in 8.4.2.1 b), record the displacement and continue the test.

Maintain the force or displacement, whichever was achieved first, for 5 s, then remove the force and lift the pressure peg away from the lens. After a relaxation period of 20 s, slowly and smoothly lower the pressure peg until it just rests again on the lens. Record this as the final position of the pressure peg.

8.4.2.3 Calculate the distance, *x*, between the starting position and final position of the pressure peg (see Figure 2) and calculate the percentage deformation, *f*, using formula (1). Check that the spectacle frame shows no fracture.

$$f = \frac{x}{c} \times 100 \quad (1)$$

where

f is the percentage deformation;

x is the distance between the starting and final positions of the pressure peg (see Figure 2);

c is the boxed centre distance.

Compare the distance *x* with the requirement in 4.12.1.

8.4.2.4 Using the inspection conditions described in 7.2, check that neither test lens has been wholly or partially dislodged from its original location in the groove or mount, see 4.12.3.

8.5 Endurance test

8.5.1 Apparatus

8.5.1.1 Overall scheme. The test apparatus consists of two clamping devices mounted on universal joints which are used to move the sides relative to each other, a bridge support and a revolution counter.

The positions of the clamps and bridge support, relative to each other, shall be adjustable by at least 40 mm horizontally and vertically.

The apparatus shall be capable of continuously and smoothly imparting a cyclical motion to one of the universal joints:

— down (30 ± 0,5) mm;

— out (60 ± 1,0) mm;

— up (30 ± 0,5) mm;

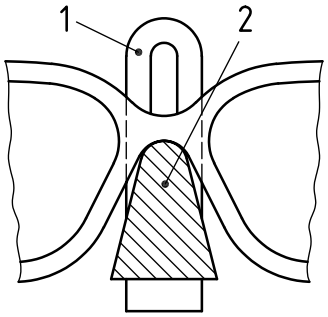
at a rate of 40 cycles/min, with the other clamped side remaining fixed, except for the flexure of the universal joint.

For testing in frame development, manufacturers may modify the test equipment so that either the right or the left side is subject to the cyclical motion, the other remaining fixed.

8.5.1.2 Clamping devices, mounted on universal joints, are used to restrain the sides (see Figures D.2 and D.3). The universal joints shall not restrict the angular movement of the sides. The clamping point, specified as the edge of the clamp nearest the axis of the joint (hinge) or dowel screw's axis, shall be (55 ± 1) mm from the centre of the pivot of the universal joint.

8.5.1.3 Bridge support, formed from a horizontal bar of triangular cross-section, enclosing an angle of (30 ± 2)° and having a thickness at the top of (12 ± 1) mm with the upper edge approximately radiused (see Figure 5, key item 2).

8.5.1.4 Revolution counter, used to count the number of cycles imparted to one of the spectacle sides.



Key

1 vertical support with slot to facilitate height adjustment

2 horizontal bar, located through a slot in the vertical support

Note see the text of 8.5.1.3 for dimensions

Figure 5 — Detail of adjustable bridge support for endurance test rig

8.5.2 Procedure

8.5.2.1 Before mounting test sample 2 on the test apparatus, establish the clamping and measuring points.

Except for curl sides, ensure that the sides are clamped at a distance from the axis of the joint (hinge) or dowel screw's axis equivalent to (70 % of the overall side length) ±1 mm. Each measuring point shall be (15 ± 1) mm nearer to the axis of the joint (hinge) or dowel screw's axis than the clamping point.

For curl sides, ensure that the clamping points are (3 ± 1) mm nearer to the axis of the joint (hinge) or dowel screw's axis than the junction between the curl and the rigid side. Each measuring point shall be (10 ± 1) mm nearer to the axis of the joint (hinge) or dowel screw's axis than the clamping point.

For sides without a joint, the reference point for measurement shall be taken as (10 ± 1) mm from the back surface of the lug, see Figure 1.

8.5.2.2 Before testing, open the sides of the spectacle frame to the fullest extent, without tension, and measure the distance between the sides at the pre-determined measuring points. Record this distance, d_1.

Mount the spectacle frame on the test device and ensure the following:

a) that the rotating clamp (see Figure D.2, key item 5) is on the same plane as the fixed clamp (see Figure D.2, key item 4) and that it is positioned at the nearest point of its rotation towards the fixed clamp;

b) that the bridge of the spectacle frame is freely supported on the bridge support (see Figure D.2, key item 6, see also Figure 5);

c) that the horizontal relationship between the fixed clamp (see Figure D.2, key item 4), the bridge support (see Figure D.2, key item 6), and the rotating clamp (see Figure D.2, key item 5) are such that

the spectacle frame can be mounted with sides fully open, but not under tension, and with the bridge support midway between the clamps;

d) that the height of the bridge support is adjusted so as to ensure that the sides are in line with the axis of the clamps and parallel to the base of the device;

e) that the sides are clamped within 1 mm of the calculated clamping point;

f) that the lockscrew (see Figure D.3, key item 6) is loosened to allow the fixed clamp to align with the inward angle of drop of the side, and then re-tightened so that no rotation around the axis of the lockscrew occurs;

g) that the revolution counter is set to zero.

8.5.2.3 With the test sample, fitted with the test lenses, in position, set the apparatus in motion, subjecting the sample to the cyclical rotating movement described in 8.5.1 to up to 5 cycles of the rotating movement. If the bridge of the spectacle frame lifts completely off the bridge support, add an elastic retaining band to prevent this but allowing the frame to move almost to the top of the support. Then continue the test to a total of $(500\ ^{+1}_{0})$ cycles.

After the $(500\ ^{+1}_{0})$ cycles have been completed, stop the motion and remove the sample from the apparatus. Measure the distance between the sides at the measuring point and record the distance, d_2, in millimetres. Check that the difference between d_1 and d_2 does not exceed 5 mm.

Under the inspection conditions described in 7.2, inspect the spectacle frame for fractures, cracks or change in side movement (see 4.12.3).

8.6 Test for resistance to ignition

8.6.1 Apparatus

8.6.1.1 Steel rod, (300 ± 3) mm long and (6,0 ± 0,5) mm in diameter, with end faces that are flat and perpendicular to its longitudinal axis.

8.6.1.2 Heat source.

8.6.1.3 Thermocouple and temperature-indicating devices.

8.6.1.4 Timer, capable of measuring an elapsed time of 10,0 s with a resolution of ±0,1 s.

8.6.2 Procedure

8.6.2.1 All batteries and electronic parts, if applicable, likely to explode should not be subjected to testing.

Heat one end of the steel rod (8.6.1.1) over a length of at least 50 mm to a temperature of (650 ± 20) °C.

For routine testing, the steel rod may initially be heated in an oven/furnace to a greater temperature, e.g., around 900 °C. After removal, the temperature of the steel rod should be measured by means of the thermocouple (8.6.1.3) attached at a distance of (20 ± 1) mm from the heated end of the steel rod which is allowed to cool to the required temperature to simulate a test. Then reheat the steel rod, again to a greater temperature, for a known time, remove the steel rod and repeat the cooling measurement. The time taken after removal of the steel rod from the oven for its temperature to fall to the required value should be recorded. Using these heating and cooling times avoids systematic measurement of the steel rod temperature during each contact with the test sample because the heating and cooling curve (temperature versus time) of the heated end of the rod is known.

Press the heated face of the steel rod (long axis vertical with the heated end downwards) against the surface of test sample 1 (the contact force being equal to the weight of the steel rod) for a period of (5,0 ± 0,5) s, then remove the rod.

Carry out the test on all externally exposed materials of the frame.

8.6.2.2 Carry out a visual inspection during the test to establish whether the test sample ignites during the test or continues to glow after removal of the rod (see 4.13).

8.7 Test for resistance to optical radiation

8.7.1 Apparatus

8.7.1.1 Fused-silica envelope, ozone-free, high-pressure xenon lamp, either

a) specific xenon radiation apparatus (reference test method)

— the power of the lamp shall be (450 ± 50) W;

— the spectral transmittance of the lamp envelope shall be at least 30 % at 200 nm;

— new lamps shall be burned in for at least 150 h before use;

— the lamp shall not be used after 2 000 h of operation.

NOTE A suitable lamps is UXL 451-O 450 W (ozone free).[1)]

b) Xenon radiation apparatus using other power high-pressure xenon lamps (alternative method)

— new lamps shall be burnt in for at least 150 h before use;

— the lamp shall not be used after 2 000 h of operation.

8.7.1.2 Long wavelength pass (cut-on) filter, with the spectral transmittance as specified in Annex E. The cut-on wavelength λ_c = 320 nm is specified as the wavelength at which $\tau_{\lambda c}$ = 46 %. A shift of ±5 nm is permitted. The filter shall be placed between the lamp and the test sample.

8.7.1.3 Standard blue-scale radiation exposure medium, (optional), conforming to ISO 105-B02.

8.7.2 Procedure

8.7.2.1 Reference procedure: Before submitting test sample 2 to the test, cut the sample into two parts at approximately the middle of the bridge. Retain one part to serve as a control for colour comparison purposes. On the other part, separate the spectacle side from its front.

The test shall be carried out as follows:

— Stabilize the lamp current at (25,0 ± 0,2) A.

— The air temperature in the immediate area of the test sample shall be (28 ± 5) °C.

Forced ventilation is necessary to maintain the temperature within the specified range.

— Expose the front surface of the front and the outside surface of the side to radiation from the lamp as specified in 8.7.1.1 a) and filtered by the filter specified in 8.7.1.2. The angle of incidence of the radiation on the test sample's front surface shall be essentially perpendicular.

1) UXL 451-O 450 W is an example of a suitable product available commercially (from USHIO). This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of these products. Equivalent products may be used if they can be shown to lead to the same results.

— The distance from the axis of the lamp to the nearest point on the test sample shall be (300 ± 10) mm. The exposure time shall be (25,0 ± 0,2) h at a lamp power of (450 ± 50) W.

NOTE It is deemed that the required irradiation will be fulfilled, without calibration or further verification, provided that the specified apparatus and test method is applied.

8.7.2.2 Alternative procedure: Before submitting test sample 2 to the test, cut the sample into two parts at approximately the middle of the bridge. Retain one part to serve as a control for colour comparison purposes. On the other part, separate the spectacle side from its front.

The test shall be carried out as follows:

— Expose the front surface of the front and the outside surface of the side and the blue-scale radiation exposure medium (8.7.1.3) to radiation from the lamp as specified in 8.7.1.1 b) and filtered by the filter specified in 8.7.1.2 until grade 4 of the blue-scale exposure medium is bleached to stage 4,5 of the grey scale. See ISO 105-B02.

— The air temperature in the immediate area of the test sample shall be (28 ± 5) °C.

Forced ventilation is necessary to maintain the temperature within the specified range.

High-pressure xenon lamps with power other than 450 W can be used with the limitation that the irradiation time is not greater than 50 h or less than 10 h.

8.7.2.3 Switch off the radiation, remove each sample and inspect under the conditions described in 7.2, ignoring any changes adjacent to the cut surface at the bridge. Compare the exposed sample to the control sample and record as a failure if the exposed sample displays any of the changes specified in 4.14.

9 Marking

Spectacle frames shall be marked, usually on the sides, with the following minimum information:

a) identification of manufacturer or his/her agent or supplier;

b) model identification;

c) colour identification;

d) horizontal boxed lens size with box symbol ☐;

e) distance between lenses;

f) overall length of side.

NOTE 1 All dimensions used are given in ISO 8624.

NOTE 2 Marking of horizontal boxed lens size is optional for rimless mounts.

NOTE 3 National legislation in some countries can require additional information, e.g., country of origin or claims for conformity with regulations, to be marked on the frame. Legislation can also require that the labelling of frames indicates that they are medical devices. This labelling includes either a marking on the frame or on the first level of packaging.

The specified order of marking of the dimensions of the front is shown in Figure 6.

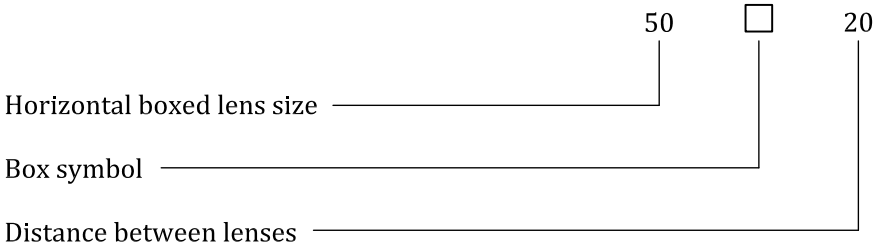


Figure 6 — Illustration of the specified order of marking of the dimensions of the front and the boxed lens symbol

10 Additional information to be supplied by the manufacturer or other person placing the product on the market

10.1 The manufacturer, or his/her agent or supplier, shall make available, with the spectacle frame, information on particular processing conditions that can be required when fitting lenses or manipulating the spectacle frame for adjustment purposes.

NOTE Information on labelling, symbols to be used, lot numbers, etc, can be found in ISO 15223-1 and ISO 20417.

Annex F, which is optional, allows manufacturers to provide information with or about their frames giving details such as the temperature for adjusting or mounting lenses, chemicals not to be used with the frame and cleaning instructions.

10.2 The following information shall be made available in catalogues:

Range available (sizes and colours) including other side lengths available.

10.3 The following information shall be made available upon request:

a) vertical boxed lens size (dimension shown in ISO 8624);

b) bridge width (dimension shown in ISO 8624);

c) bridge height (dimension shown in ISO 8624);

d) frame effective diameter (dimension shown in ISO 8624);

e) apex angle for the groove if intended for lenses having a bevel angle that differs from 120°;

f) a list of components that are available separately.

10.4 Legislation in some countries requires that the spectacle frame, or if not possible, the packaging or labelling, shall state the name and address of the manufacturer or, for spectacle frames imported into those countries where the manufacturer does not have a registered place of business, the manufacturer's authorized representative.

11 Reference to this document

If the manufacturer or supplier claims conformity with this document, reference shall be made to this document either on the packaging or in available literature. Marking ISO 12870 on the frame is optional.

Any claim for conformity with subclauses of this document that are optional for the type of frame (e.g. 4.14) shall be accompanied by a reference to this document, i.e. ISO 12870:2024, and if the requirement in 4.5 (nickel release) applies, a reference to EN 16128.

Annex A
(informative)

Recommendations for the design of spectacle frames

A.1 Design

The spectacle frame should be designed to provide secure placement and retention of the lenses in the prescribed position relative to the eyes, and should be capable of being worn without discomfort for prolonged periods. It is therefore necessary that, in addition to meeting the requirements contained in this document, the spectacle frame have the following capabilities.

A.2 Materials

As well as being sufficiently stable to meet the requirements of Clause 4, the materials used should also allow for professional adjustment at final fitting and should retain both their shape and relative position when worn. Materials should also resist degradation well enough to make the spectacle frame acceptable for use over a reasonable period.

The following information can be made available, either in documentation accompanying the frame, in catalogues or upon request:

— materials of the principal components, for example, type of plastic and whether it has a coating;

— for metal frames: a) whether it has a rolled-gold covering (see 3.3.2) or is made from a titanium material (see 3.3.4), or b) the type of base material, the type of plating and whether it has a protective and/or decorative coating.

A.3 Assembly

The method of assembly should ensure that unintentional separation of the various components from each other (e.g., separation of sides from fronts or trims from fronts) cannot occur either during fitting or in normal wear.

A.4 Range of sizes and facility for adjustment

A.4.1 Fronts

In order to provide a comfortable fit on a wide range of wearers, the spectacle frame should be available in a minimum of two lens sizes, each in a minimum of two bridge widths.

A.4.2 Sides

Apart from the general need for adjustment identified in A.2, it should be possible to vary the side length on any given front. Manufacturers should consider the overall length of side fitted in relation to the boxed lens size, face form angle and whether or not the design has a swept back lug.

Manufacturers should supply sides in a minimum of 3 lengths with a 5 mm difference between each or, for metal sides, design the part of the side under the endcover so that this can be shortened without difficulty by cutting.

A.5 Mass

It is recommended that the mass of the unglazed spectacle frame not exceed 32 g.

A.6 Contact areas

Areas intended as bearing surfaces should generally be as large as reasonably possible and in proportion to the size and weight of the frame.

In the case of pads and nasal bearing areas, it is suggested that the total area be the following:

a) at least 175 mm^2 for a spectacle frame weighing up to 25 g;

b) at least 250 mm^2 for a spectacle frame weighing over 25 g.

Security on wearing can, in part, be provided by lateral pressure on the head. The elasticity of both front and sides should therefore be durable and contact surfaces should be as large as possible.

A.7 Sprung joints

The spring tension of sprung joints should be similar on both sides when the sides are subjected to identical deflection. The spring tensions should become active immediately at the side tip in the wearing position when the side is deflected out of its starting position.

A.8 Symmetry of spectacle frame

In a mirror-symmetric spectacle frame design, the let-back of side, the angle of side and the overall side length should be the same.

A.9 Claims for material composition

A.9.1 General

If the frame is claimed to be manufactured from rolled-gold or titanium material, then the frame should comply with the definitions in Clause 3 and the following:

A.9.2 Use of titanium in frames

When titanium is used as metal components, the following marking should be used: for example, "F-Ti" or "Front-Titanium", or "S-Ti" or "Side-Titanium". The titanium components should have a non-nickel containing coating and comply with the following:

— titanium frame;

— pure titanium frame;

— memory-metal frame;

— titanium niobium frame (Ti-Nb frame).

Annex B
(informative)

Chemicals that can be harmful to health

The following list gives only an indication of chemicals that can be harmful to health. It is not comprehensive, is subject to change and does not give threshold limits. Manufacturers should check their local regulations regularly.

Heavy metals

Alkyl-Phenols & Alkyl-Phenols Ethoxylates (APs & APEOs)

Azo Dyes

Allergenic & Carcinogenic dyes

Bisphenols

Chlorinated Paraffins

Chlorinated Phenols and Orto-Phenylphenols

Chlorinated Carriers (Chlorobenzenes and Chlorotoluenes)

Biocides & Preserving Agents

Formaldehyde

Nitrosamines

Organotin Compounds

Perfluorinated & Polyfluorinated Chemicals (PFCs)

Phthalates

Polycyclic Aromatic Hydrocarbons

Quinoline

Solvent Residuals

UV Stabilizers

Volatile Organic Compounds (VOCs) & Chlorinated Solvents (CVOCs)

Monomers

Annex C
(informative)

European requirements and legislation on nickel release

European legislation[2)] refers to the following European Standards:

— EN 1811, *Reference test method for release of nickel from all post assemblies which are inserted into pierced parts of the human body and articles intended to come into direct and prolonged contact with the skin;*

— EN 12472, *Method for the simulation of wear and corrosion for the detection of nickel release from coated items;*

— EN 16128, *Ophthalmic optics — Reference method for the testing of spectacle frames and sunglasses for nickel release.*

Of these, EN 12472 and EN 16128 are applicable to spectacle frames.

NOTE 1 EN 16128 specifies the use of the simulation of wear test in EN 12472, which is why there is no (direct) reference to EN 12472 in the body of the present document.

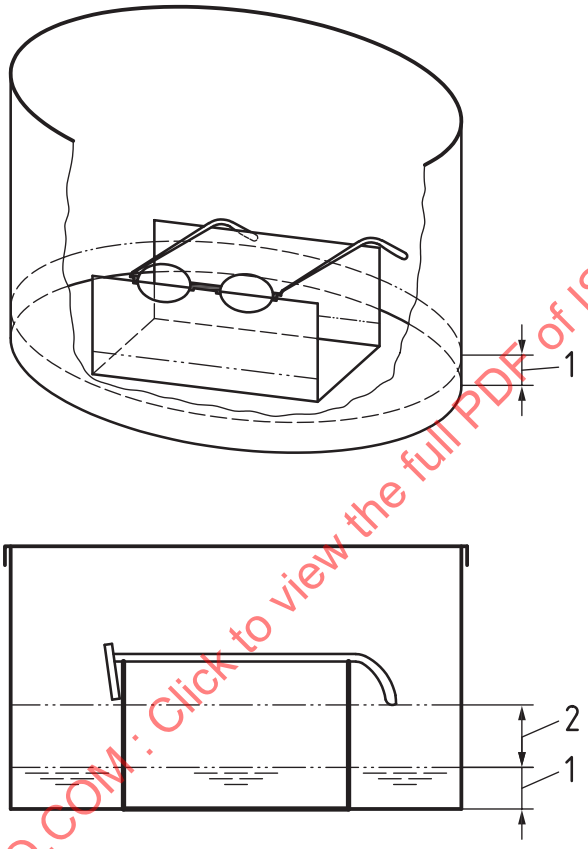
NOTE 2 For the sake of simplicity and as an indication of whether or not a sample is likely to pass the nickel release requirements, following the simulation of wear and corrosion specified in EN 12472 as specified in EN 16128, the DMG test specified in CEN/TR 12471 can be used to test the components of a spectacle frame for nickel release. The test methods are based on the formation of a coloured complex when nickel ions come into contact with a mixture of ammonia and dimethylglyoxime. There are three tests described in CEN/TR 12471, of which the laboratory test is recommended as it gives the best indication of the possible nickel release. If all the components pass without giving a pink colouration to the cotton bud, then there is a significant probability that the frame complies with the requirements of 4.5.

2) European REACH regulations state that nickel or its compounds shall not be used in articles intended to come into direct and prolonged contact with the skin if the rate of nickel release from the parts of these articles coming into direct and prolonged contact with the skin is greater than 0,5 $\mu g \cdot cm^{-2} \cdot week^{-1}$ (expressed as 0,5 $\mu g/cm^2$/week in the Regulation). For articles which have a non-nickel coating, such coating shall be sufficient to ensure that the rate of nickel release from those parts of such articles coming into direct and prolonged contact with the skin will not exceed 0,5 $\mu g\ cm^{-2}\ week^{-1}$ (expressed as 0,5 $\mu g/cm^2$/week in the Regulation) for a period of at least two years of normal use of the product[17].

Annex D
(informative)

Examples of layout of test equipment

D.1 Example of frame support for the resistance to perspiration test



Key

1 artificial sweat

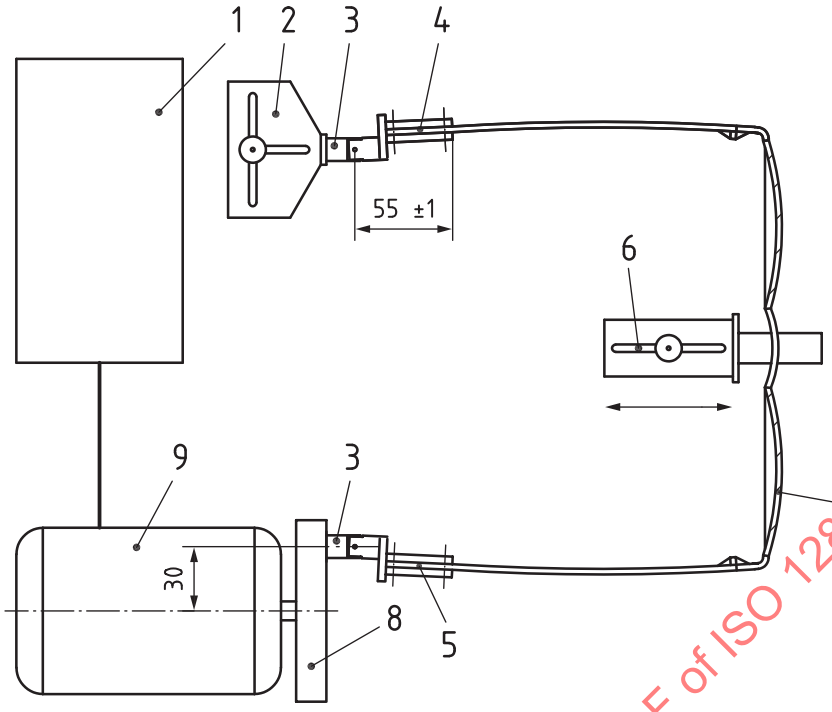
2 separation of lowest part of sample from artificial sweat (minimum 12 mm)

Figure D.1 — Diagram of a typical frame support

D.2 Examples of the equipment layout for the endurance test

NOTE For testing in frame development, manufacturers might wish to modify the test equipment so that either the right or the left side can be subject to the cyclical motion, the other remaining fixed.

Dimensions in millimetres



Key

1 control panel and counter
2 side clamp adjustment
3 universal joint
4 fixed clamp
5 rotating clamp
6 adjustable spectacle bridge support assembly
7 test sample
8 rotating disc
9 geared motor

Figure D.2 — Diagram of a typical test apparatus