Technical Report

ISO/TR 22572

Ophthalmic optics — Spectacle lenses — Measurement of refractive index

Optique ophtalmique — Verres de lunettes — Mesurage de l'indice de réfraction

Sample Document
get full document from standards.iteh.ai

First edition
2026-11

Reference number
ISO/TR 22572:2026(en)

© ISO 2026

Sample Document

get full document from standards.iteh.ai



COPYRIGHT PROTECTED DOCUMENT

© ISO 2026

All rights reserved.

This ISO publication is protected by copyright and is owned by ISO and/or its licensors.

The content of this ISO publication is provided under licence, not sold. Use is subject to the applicable licence terms issued by ISO, an ISO member body, or an authorized third-party distributor.

Except as required for implementation or expressly permitted by a separate licence, no part of this ISO publication may be reproduced, distributed, modified, used, or made available in any form or by any means - electronic or mechanical, including photocopying, scanning, recording, or posting on internal or external digital platforms.

Any use beyond the scope of the granted rights is prohibited and may result in legal action.

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

Published in Switzerland

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Laboratory temperature **2**
5 Traditional destructive methods **2**
5.1 Minimum deviation method 2
5.2 V-block method 2
5.3 Abbe refractometer 3
5.4 Practical results 4
6 "Classical" non-destructive methods **5**
6.1 Sagittal depth gauge and radius of curvature methods 5
6.1.1 Accurate theory and considerations 5
6.1.2 Approximate or simplified theory and considerations 6
6.2 Immersion methods 7
6.2.1 Theory 7
6.2.2 Measurement apparatus – Go-Meisan method 8
6.2.3 Another immersion method 8
7 "New" non-destructive methods **12**
7.1 Low-coherence interferometry 12
7.2 Measuring apparatus 13
8 Prism coupled refractometer **14**
8.1 Theory 14
Annex A (informative) **Comparison of the different destructive methods** **16**
Annex B (informative) **Expected uncertainty when used with spectacle lens samples** **17**
Annex C (informative) **Group refractive index and phase refractive index** **22**
Annex D (informative) **Discussion – surface power method** **24**
Annex E (informative) **Details of refractive index matching liquids** **26**
Bibliography **27**

Sample Document
get full document from standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 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*.

Sample Document
get full document from standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

Introduction

This document results from work in ISO/TC 172/SC 7/WG 3 to identify methods that could determine the refractive index of spectacle lenses with the aim of being able to differentiate between the refractive index of finished spectacle lenses. This would enable trading standards authorities to verify manufacturers' claims on their products.

Three methods of measurement of the refractive index of optical materials have been standardized, the minimum deviation method in ISO 21395-1, the V-block refractometer method in ISO 21395-2, as well as the Abbe refractometer method. These methods use specialised instruments and require either a prism to be cut out of the plane of the lens and the cut edges polished or a zone on the front surface to be surfaced flat and polished. Hence, although they can be used to measure the properties of stock spectacle lenses, they cannot be applied to a wearer’s spectacle lenses since they are ruined. For optimum results, two of the methods require specialised contacting liquids of similar index to that of the lens under test. Care is needed with the contacting liquid if it presents an environmental and health hazard during handling, storage, and disposal – see the warning in ISO 489.

In general, there is no restriction on the value of the refractive index of finished spectacle lenses, but it can be necessary to determine the refractive index of finished spectacle lenses and whether the index is what the manufacturer claims it to be. Both the industry and spectacle wearers prefer a non-destructive method to be used to check the lenses, since these methods do not harm the products. For example, the methods that combine vertex power measurements and either the sagittal depth gauge and radius of curvature or the immersion methods have no specific instruments for determining the refractive index. In addition, there are some recent devices in the market that provide refractive index measurement for finished spectacle lenses, such as critical angle and interferometric based measurements.

This document is intended to aid in measuring the refractive index of spectacle lenses and improve the communications between spectacle manufacturers and customers. For the purposes of spectacle lenses, an accuracy of 0,01 is expected as the minimum requirement.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
ISO/TR 22572:2026
get full document from standards.iteh.ai

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

Sample Document

get full document from standards.iteh.ai

Ophthalmic optics — Spectacle lenses — Measurement of refractive index

1 Scope

This document describes the possible methods of determining the refractive index of spectacle lenses, whether in uncut, cut or final mounted form.

It lists several destructive and non-destructive test methods having different accuracies.

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 9802, *Raw optical glass — Vocabulary*

ISO 13666, *Ophthalmic optics — Spectacle lenses — Vocabulary*

ISO 80000-1, *Quantities and units — Part 1: General*

ISO 80000-3, *Quantities and units — Part 3: Space and time*

Sample Document

3 Terms and definitions

get full document from standards.iteh.ai

For the purposes of this document, the terms and definitions given in ISO 9802, ISO 13666, ISO 80000-1, ISO 80000-3 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
V-block prism
prism with a 90° channel manufactured from optical glass with a known refractive index

[SOURCE: ISO 21395-2:2022, 3.1, modified — The words “with a 90° channel” were added.]

3.2
refractive index matching liquid
transparent liquid having the refractive index close to that of the specimen

[SOURCE: ISO 21395-2:2022, 3.2]

3.3
contacting liquid
transparent liquid having the refractive index higher than the specimen

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

4 Laboratory temperature

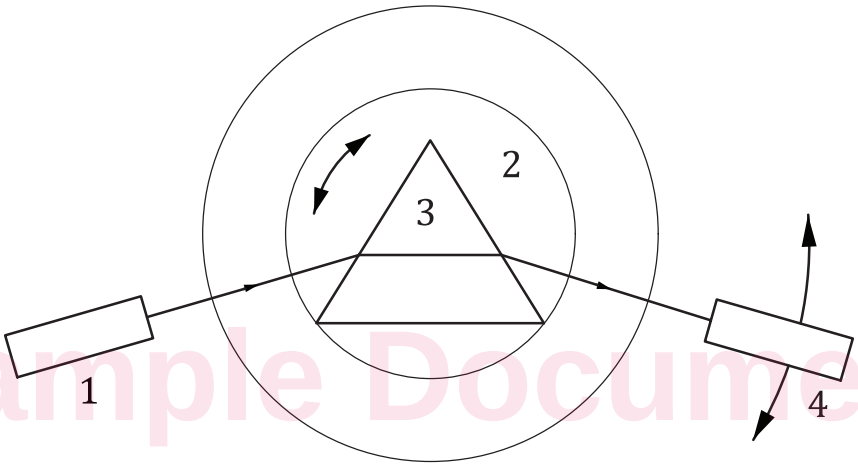
For the precision required for this purpose, measurement can be at ambient laboratory temperature, which is usually either (23 ± 5) °C or (27 ± 5) °C in accordance with national practice.

NOTE The temperature of 23 °C is normally the standard laboratory temperature in temperate areas while 27 °C is the standard laboratory temperature in tropical and subtropical areas.

5 Traditional destructive methods

5.1 Minimum deviation method

This method uses a goniometer or spectrometer and requires a prism with a (55 ± 10)° apical angle to be cut out of the plane of the lens, and the surfaces of the two cut edges polished – see Figure 1. For a comparison of the different destructive methods see Annex A.



Sample Document
get full document from standards.iteh.ai

Key

1 laser or light source, slit and collimator
2 turntable, with angular scale
3 prism cut from spectacle lens
4 detector or viewing telescope

Figure 1 — Schematic diagram of the minimum deviation method

The apical angle of the prism is measured by reflecting light from the collimator part of the instrument from the two adjacent surfaces and viewing the reflected beam in the telescope. The relative positions of the collimator, telescope and orientation of the prism are then adjusted to allow light from the collimator to pass through the prism and be viewed in the telescope. The angle of incidence on the first face of the prism is then adjusted to find the minimum angle of deviation. At this angle, the ray path through the prism is symmetrical, so that the final angle of refraction equals the angle of incidence. The refractive index is calculated using Snell's law and the geometry of the apical angle and angle of incidence. Detailed instructions for applying this method are specified in ISO 21395-1.

5.2 V-block method

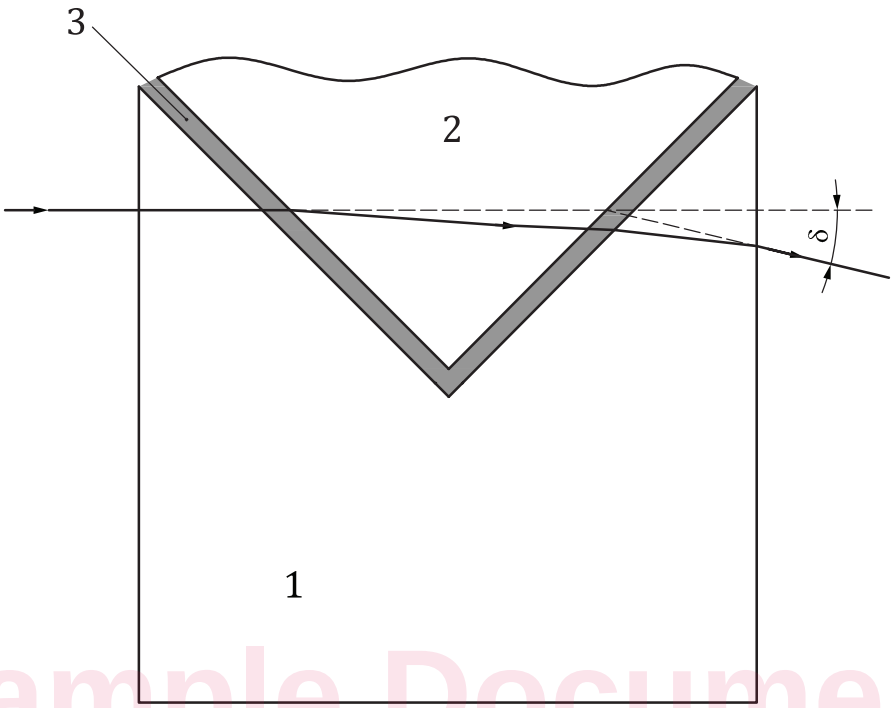
This method uses a V-block refractometer and requires a 90° prism to be cut out of the plane of the lens, and the two cut edges polished. The prism is then mounted in the V-block, which is effectively a parallel sided block of glass with a V-shaped trough into which the prism is placed – see Figure 2. Although shown in Figure 2, the refractive index matching liquid is not required if the cut edges are precisely prepared and well polished. The liquid, which has a similar refractive index to that of the lens under test, reduces the scattered light when entering and leaving the lens prism if the surfaces are not well polished, thus improving precision. The liquid can be chosen initially on the basis of the claimed refractive index and by making a first

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026

measurement and then, if necessary, using that result to make an improved choice of liquid and measuring a second time. Details of some refractive index matching liquids are given in Annex E. The prism samples used in the experiments reported in Annex B were prepared using a spectacle lens edging machine.

The final angle of refraction/deviation through the prism assembly enables the refractive index of the lens to be calculated. Detailed instructions for applying this method are specified in ISO 21395-2.



Sample Document
Get full document from standards.iteh.ai

Key

1	V-block
2	prism cut from spectacle lens
3	refractive index matching liquid

Figure 2 — Schematic diagram of the V-block refractometer

The introduction to ISO 21395-2 states:

> *"The minimum deviation method is most accurate in refractive index measurement but requires an advanced technical skill to prepare a specimen with a precise shape and to measure the refractive index."*
>
> *"In contrast the V-block refractometer method is easier and faster when preparing a specimen and requires less technical skill for measurement."*

The standard describes the potential trade-offs between the tolerance on the 90° apical angle of the prism and the refractive index difference between the refractive index matching liquid and the (lens) prism. The preferred tolerance for the apical angle of the prism is ±2' arc.

5.3 Abbe refractometer

This method uses an Abbe refractometer and requires a slab of material to be cut out of the plane of the lens with dimensions suitable to fit on the fixed prism of the instrument.

This is then surfaced flat. A contacting liquid of similar (i.e. a refractive index matching liquid) or higher refractive index than that of the lens material is used to couple the sample to the refractometer. The method is described in ISO 489 but basically relies on the measurement of the critical angle, that is with, preferably monochromatic, light from a diffuse source entering the sample and passing at grazing incidence into the instrument's prism – see Figure 3. The ray shown identifies the direction of these rays, while rays that had

© ISO 2026 – All rights reserved

ISO/TR 22572:2026 • https://standards.iteh.ai/catalog/standards/iso/62e65186-9e7c-4780-9f2b-49c5a01415a0/iso-tr-22572-2026