Summary guide on quality standards for spectacles

World Health Organization

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Contents

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Assessment and management of conflict of interest from external reviewers

External reviewers completed a declaration of interest form disclosing potential conflicts of interest that might affect, or might reasonably be perceived to affect, their objectivity and independence in relation to the subject matter of the meeting / guidance. WHO reviewed each of the declarations and concluded that none could give rise to a potential or reasonably perceived conflict of interest related to the subjects discussed at the meeting or covered by the guidance.

Glossary of terms

Axis	The angle (in degrees) of the cylindrical power of the lens
Back vertex distance (BVD)	The distance (in mm) between the front surface of the eye and the back surface of the lens when the user is wearing the spectacles
Columbia resin #39 (CR-39)	A material used to make spectacle lenses
Cylindrical power	The power of the lens in a specific meridian
Dioptres (D)	Unit of measurement for refractive power
Diplopia	Double vision
Focimeter	Machine used to measure the refractive power of a lens
High index plastic	A material used to make spectacle lenses
Hyperopia	Long-sightedness
Myopia	Short-sightedness
Polycarbonate	A material used to make spectacle lenses
Presbyopia	The gradual loss of the ability to focus on near objects, generally occurring from the age of 40 years onwards
Prism	Type of prescription used to correct diplopia
Pupil heights	The distance between the bottom of the frame and the centre of the user's pupil when the user is wearing the spectacles
Pupillary distance	The distance (in mm) between the centre of a user's pupils
Spherical power	The power of the lens that is equal in all meridians
Ultraviolet (UV)	A wavelength on the electromagnetic spectrum. Exposure to ultraviolet can increase the risk of multiple eye conditions.
Varifocals	Varifocal lenses are multifocal lenses that provide seamless vision correction at different working distances, from near distance to far distance.

Introduction

In May 2024, the World Health Organization (WHO) launched SPECS 2030 *(1)*, a global initiative to support Member States in achieving the global target, endorsed at the Seventy-fourth World Health Assembly, of a 40-percentage point increase in effective coverage of refractive error by 2030 *(2, 3)*. Uncorrected refractive error is the leading cause of vision impairment in child and adult populations. It is estimated that at least 826 million people worldwide have distance- or near-vision impairment due to lack of access to refractive error services and spectacles *(3, 4)*. This figure is expected to rise during the next decade. Due to the world's ageing population, a higher prevalence of presbyopia is predicted; furthermore, multiple studies show an increase in the number of young people developing myopia *(4)*. Ensuring the quality of spectacles is a key priority of SPECS 2030.

People living in low- and middle-income settings face multiple challenges when accessing good quality spectacles, including geographical, social and financial barriers. The International Organization for Standardization (ISO), the worldwide federation of national standards bodies, has developed specific requirements and management guidelines to ensure that products and services meet rigorous criteria for quality, safety, and effectiveness *(5)*. Every pair of optical frames, ophthalmic lenses, and sunglasses must attain the ISO requirement and test methods to meet the necessary standards for quality (see Annex 1 for important ISO standards and the Glossary of terms for definitions). By adhering to these standards, eyewear manufacturers ensure that their products are not only effective but also comply with global regulations. Moreover, consumers can trust that qualified eyewear meets the highest standards for quality and safety. This standardization process is crucial to maintaining consistent high quality across the global eyewear market and protecting consumer health and vision.

This guide summarizes the existing quality standards for spectacles and their components based on ISO standards for ophthalmic optics. The standards aim to support service providers, including ministries of health, in ensuring that optical products meet quality and safety requirements, providing effective and reliable lenses for users.

Approach to developing the guide

This guide on quality standards for spectacles reflects content from the WHO Package of eye care interventions *(6)*, which was prepared with technical support from 360 experts across all WHO regions. The guide also draws upon information given in the paper: "Identification and critical appraisal of evidence for interventions for refractive error" *(7)*, used in the development of the Package of eye care interventions.

To complement the available information, a scoping review and assessment of guidance and guidelines were conducted, as was a search strategy of the grey literature and webpages of relevant and internationally recognized institutions and authorities (such as the ISO) *(5)*, involved in the development of policies and standards for spectacles.

The criteria for information to be considered in the guide included: i) international policy documents that define best practices for prescribing and dispensing spectacles and spectacle components; and ii) reports of international organizations that provide quality standards for spectacles and their components, published within 25 years of the search date. The identified information focuses on spectacles and their components (such as ophthalmic lenses and frames), and ready-made spectacles. Irrelevant titles were excluded; for each included title, key characteristics were extracted, and a summary obtained.

Evidence from the Package of eye care interventions, and summaries from the scoping review, were combined and consolidated into a draft that was shared with relevant WHO programmes. Technical contributions from the WHO programmes, Access to Assistive Technology and Medical Devices, and In Vitro Diagnostics, were incorporated.

Following finalization, international recognized experts reviewed the document and provided feedback and contributions.

1.

How to use this summary guide

Previous cataract patient, Mohammed Sonu, inside his home with his son and daughters.

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1.1 Scope

This guide aids countries in making informed decisions when procuring spectacles and spectacle components. It simplifies global standards, and provides practical guidance on good practices, clinical competencies for prescribing spectacles, and the role of optical dispensing in integrated eye care. The guide also includes minimum quality standards for lenses, frames, and ready-made spectacles, ensuring safe and effective use to meet population needs. For ease of use, quick reference tables giving the minimum standards for quality are provided in Annex 2.

1.2 Target audience

This guide is targeted at anyone involved in refractive error planning or spectacles procurement and related services. It may also be informative for product manufacturers, service providers, users and user organizations.

The primary audience is ministries of health, and other government ministries involved in planning the delivery of eye care services, specifically services addressing refractive error. Other potential end-users include: i) government service providers that plan and implement the dispensing of spectacles in their service programmes; and/or ii) organizations including development agencies and professional associations that can use the guide to ensure a minimum standard of quality for spectacles dispensed in their eye care programmes.

1.3 Ensuring successful service provision

The refractive prescription is arguably the most important aspect in the process of providing spectacles because of its impact on a user's vision. Quality checks should confirm that the power of the lenses matches the prescription, within a certain tolerance. These checks need to be carried out only when dispensing lenses that have been custom-made for a user (see Annex 3); they are not required for near-vision ready-made spectacles (same as near-vision ready-to-wear spectacles), ready-to-clip spectacles or non-prescription spectacles (for example, non-prescription sunglasses or non-prescription safety spectacles).

In the provision of eye care services, the roles and responsibilities of eye care personnel vary and should align with the competencies and scope of practice as outlined in the WHO *Eye care competency framework (8)*. (Note: For competencies specific to refractive error, please refer to the recently published *Competency-based refractive error teams*.)

1.4 Considerations on environmental impact

As the eyewear industry evolves, it is crucial to address environmental sustainability in the production and dispensing of spectacles. This includes:

- **Reducing waste:** Implementing strategies to minimize waste during the manufacturing process, such as using recycled materials like repurposed plastics or bio-based acetate, can significantly decrease the environmental impact of eyewear production while promoting sustainability.
- **Eco-friendly packaging:** Utilizing sustainable packaging materials and practices can further reduce the carbon footprint associated with eyewear distribution.
- **Promoting recycling:** Encouraging the appropriate recycling of old spectacles is essential. Supporting local recycling initiatives and educating consumers about how to dispose of their eyewear responsibly can help minimize landfill waste and promote a circular economy in the eyewear industry.

Incorporating these sustainable practices is not only beneficial for the environment, but also ensures that the quality standards for spectacles are upheld, providing consumers with high-quality, eco-friendly eyewear options.

2.

Minimum quality standards for spectacles

Child walking home with his mother wearing his new glasses after leaving the school

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2.1 Ophthalmic lenses

2.1.1 Relevant ISO standards for lenses

ISO 21987: Ophthalmic optics – Mounted spectacle lenses.
ISO 8980-1: Ophthalmic optics – Uncut finished spectacle lenses. Part 1: Specifications for single-vision and multifocal lenses.
ISO 8980-2: Ophthalmic optics – Uncut finished spectacle lenses. Part 2: Specifications for power-variation lenses.
ISO 8980-3: Ophthalmic optics – Uncut finished spectacle lenses. Part 3: Transmittance specifications and test methods.
ISO 8980-3: Ophthalmic optics – Uncut finished spectacle lenses. Part 3: Transmittance specifications and test methods (Amendment 1).
ISO 8980-4: Ophthalmic optics – Uncut finished spectacle lenses. Part 4: Specifications and test methods for anti-reflective coatings.
ISO 8980-5: Ophthalmic optics – Uncut finished spectacle lenses. Part 5: Minimum requirements for spectacle lens surfaces claimed to be abrasion-resistant.
ISO 14889: Ophthalmic optics – Spectacle lenses. Fundamental requirements for uncut finished lenses.
ISO 14889: Ophthalmic optics – Spectacle lenses. Fundamental requirements for uncut finished lenses (Amendment 1).
ISO/FDIS 14889. Ophthalmic optics – Spectacle lenses. Fundamental requirements for uncut finished lenses
ISO 13666: Ophthalmic optics – Spectacle lenses. Vocabulary.

2.1.2 Description and intended use

Lenses in spectacles are transparent optical components, typically made from plastic. They are designed to correct or enhance vision for individuals with conditions such as myopia (short-sightedness), hyperopia (long-sightedness), presbyopia, astigmatism, or diplopia (double vision). As with sunglasses or safety spectacles, lenses can also provide protection, while still meeting necessary quality standards for effective vision support. As the corrective function affects the daily lives of wearers, precise lens manufacturing and mounting are important requirements to provide good quality spectacles to the end user. Protective or safety spectacles are regulated separately.

All lenses should meet the ISO quality standards before being supplied or dispensed to a user. This includes lenses for sunglasses or safety spectacles.

2.1.3 General features of lenses

Fitting, combining lens and frame	Spectacles and their lenses need to be designed to minimize risk to the user, both when the spectacles are in use and when they are not.
	Lenses should be secured in the frame so that they do not rotate, loosen or drop out when in use.
Performance	The goal of using spectacles is to achieve clear vision. The lenses must correct vision as intended.
	The temperature tolerance required to test methods for mounted spectacle lenses relative to the prescription should be measured (and applied) at a temperature of 23 °C ± 5 °C.
	Neither of the lenses should exhibit any defect either internally or on the surfaces that may impair vision. Small, isolated material and/or surface defects, that are unlikely to impair vision, may be acceptable.
	Lenses should not be made from materials known to be physiologically incompatible, or known to create allergic or toxic reactions, to the wearer. Lenses should be non-toxic and non-allergenic. It is recommended that lenses should be made of plastic/ polycarbonate materials. Mineral lenses have a lower risk for allergic or toxic reactions.
	Lenses should be tested to ensure they are ignition resistant.
	Coatings can be applied to lenses to add or enhance certain characteristics. As lens coatings are applied during the manufacturing process, coatings should be discussed with users prior to ordering the spectacles.
Mechanical strength	The mechanical strength of the lens material must be tested by the manufacturer before being supplied. Testing is essential for new products and/or materials: this helps to ensure the durability of the spectacles.
Transmittance	The transparency of the lens (i.e. the amount of light that can pass through the lens) should be sufficient for the spectacles to be suitable for daylight use, driving in twilight or at night. Several combinations of material, coating, and colour/filter are unsuitable for use when driving. This must be declared by the manufacturer.

2.1.4 Types of lenses

Single vision lenses	Single vision lenses are designed to correct vision for a specific distance and are suitable for individuals with refractive errors such as myopia (short-sightedness), hyperopia (long-sightedness), or astigmatism who do not have presbyopia. For presbyopic individuals, single vision lenses can be prescribed for near vision tasks, such as reading; however they will not provide clear distance vision. Conversely, single vision lenses can also be used to correct distance vision, but they will not address near vision difficulties associated with presbyopia. As a result, presbyopic individuals may need to switch between different pairs of spectacles for near vision and distance vision tasks.
Multifocal (variable power) lenses	Multifocal (variable power) lenses have two or more separate areas of power within the same lens allowing people with presbyopia to be able to see at different distances. The different gradated segments of the lens allow the user to see through the various prescriptions. Different types of multifocal lenses include: – Bifocals have a distance vision prescription at the top of the lens and a near vision prescription in a small segment at the bottom of the lens. – Trifocals have a distance prescription at the top of the lens, a small segment for the intermediate prescription (usually used for viewing a computer screen) and an even smaller segment for the near vision prescription. – Multifocals (variable power) have distance, intermediate and near vision prescriptions gradating down through the lens. These different prescriptions within the lens are not possible to see. – In some high-resource settings, multifocal (variable power) lenses have different regulations than other prescription lenses.

2.1.5 Materials for lenses

Columbia resin #39 (CR-39)	**Advantages**
	– Low cost – Good for prescriptions of up to +4 or –4 dioptres
	Disadvantages
	– Less suitable for high prescriptions as the material can cause lenses to be very thick – Blocks ultraviolet (UV) rays only up to 360 nanometres (nm) (i.e. the material offers about 50% protection from UV rays)
Polycarbonate	**Advantages**
	– Able to withstand very high impact making it ideal for children's and sports spectacles – Good for prescriptions of over +4 or –4 dioptres – Blocks UV rays of up to 400 nm offering 100% UV protection
	Disadvantages
	– Slightly more high price than CR-39 – Less optical quality: low Abbe number that induces chromatic aberration – Poor abrasion resistance

High Index Plastic	**Advantages**
	– Good for higher prescriptions (e.g. over +7 or –7 dioptres); the weight of this material is lighter than other materials, making spectacles with higher prescriptions (and thicker lenses) more comfortable to wear – Offers enhanced aesthetics that can lead to improved compliance in the use of spectacles – Blocks UV rays of up to 400 nm, offering 100% UV protection
	Disadvantages
	– More high price than CR-39
Glass/Mineral	**Advantages**
	– Scratch resistant – Thinner than plastic lenses
	Disadvantages
	– Should never be used for children's spectacles due to the risk of injury if shattered – Difficult to apply a tint to the lens – Heavier in weight than plastic lenses

2.1.6 Coatings for lenses

Ultraviolet (UV) coatings	UV filters can be applied to the lenses to block or absorb UV light. The coating does not filter visible light meaning that this coating can also be applied to lenses which are not to be used as sunglasses. Reducing UV exposure to the eyes helps to reduce the risk of many eye conditions including cataracts, macular degeneration, pinguecula and pterygium *(9-11)*.
Scratch resistant coatings	Layers applied to the lenses to protect the lenses against mechanical friction. These lens coatings help spectacles last longer and are particularly suitable for use in children's spectacles.
Anti-reflective coatings	Layers applied to the lens to reduce the reflection off the lens surface. These coatings are particularly effective for users who drive vehicles as they reduce the effect of glare from car headlights. Anti-reflective coatings also help to reduce eye strain, which can be especially beneficial for people whose screen usage is substantial and lengthy. Aesthetically these coatings are more attractive.

2.1.7 General user requirements

When choosing the material for the lens, it is important to consider the prescription for the spectacles and the age of the user. The choice of the material will determine the thickness and weight of the spectacles as well as lens durability.

Requirement	Lens type and material
High myopia	High index lenses, such as high index plastics, are recommended for use with spectacles for high myopia.
High hyperopia	High index lenses, such as high index plastics, are recommended for use with spectacles for high hyperopia.
Multifocal (variable power)	Multifocal lenses should match a person's occupation and needs. For tasks such as reading or computer work, specific lens designs provide better comfort and clarity of vision.
Lenses for children	Children should never be fitted with glass lenses. Polycarbonate lenses can withstand high impact making these lenses ideal for children.
Lenses for sport	Glass lenses should never be used for sports spectacles. Polycarbonate lenses can withstand high impact and are ideal for sports lenses.

2.2 Frames

2.2.1 Relevant ISO standards for frames

ISO 12870: Ophthalmic optics – Spectacle frames. Requirements 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.

2.2.2 Description and intended use

When choosing spectacle frames, most people are concerned principally with price and style. However, there are other factors to consider, such as weight, strength, flexibility, and corrosion-resistance.

Spectacle frames are made from several types of plastic and metal materials. It is important to understand the difference in the materials used as these can impact comfort, fitting, cost, and durability. Different materials will be more suited to different people, their situations and needs.

Because the frame is the part of the spectacles that has contact with the skin, it is important to determine whether the user has any allergies to the materials used in the frame selected. Although uncommon, it is possible for some people to have an allergic reaction to certain materials used in the manufacture and coating of the lenses, frames, or nose pads.

2.2.3 General features of frames

The selection of frame materials should be discussed with users based on their needs and applications of use.

Performance	Metal frames tend to be extremely strong and stand up well to wear and tear.
	Plastic frames are usually less expensive, lightweight and of varied styles. They tend to be more suitable for children (see Annex 4 for appropriate frames for children).
	Frames with adjustable nose pads provide added comfort and a customizable fit, especially for prolonged wear.

2.2.4 Types of frames

Full frame	Full frame spectacles have a frame that surrounds the entire lens rim. Full frames are suitable for children and elderly people as they tend to be more robust.
Semi-rimless frames	Semi-rimless frames have a frame that encompasses approximately half the lens. The lens is held in place within the frame by a thin wire.
Rimless	Rimless spectacles have no frame and are held in place by the arms of the spectacles being attached directly to the lenses. Rimless spectacles are less noticeable and of much lighter weight. However, they are often the most expensive and fragile of the frame styles and are therefore not advised for use with young children.

2.2.5 Materials for frames

Material	Characteristics	Suitability
Metal: Metal frames tend to be extremely strong and stand up well to wear and tear. Different metals have different characteristics making them suitable for different people.		
Titanium	Very strong, flexible, lightweight and does not corrode easily	Good choice for older children and adults. Very comfortable and durable. Is high price
Monel	Sturdy and corrosion-resistant. Often used for components that require rigidity, such as nose pads, bridges and temples	Require coating to protect the skin. May cause an allergic reaction to the skin
Beryllium	Very lightweight, strong, and flexible, making adjustment easy for the optician. Extremely corrosion-resistant	Good choice for people who spend a lot of time in or around salt water. Is less high price than titanium
Stainless steel	Lightweight and strong, but not as lightweight as titanium. Corrosion-resistant	Less high price than other metals. May cause allergic reactions to the skin due to its chromium composition
Flexon	Very flexible, returning to shape even after it is twisted or bent. Lightweight, corrosion-resistant and hypoallergenic	Great for active kids
Aluminium	Corrosion-resistant, flexible and strong	Is high price
Plastic: Plastic frames are usually less high price than metal frames; they are lightweight and come in a variety of colours and styles. Plastic frames tend to be a more suitable option for children as they are flexible and less likely to hurt the child in the event of an accident. The disadvantages of plastic frames are that they break more easily than metal frames; the colour can fade slightly with time; and their strength may decrease. Frames made from plastic can also widen over time and may need regular readjustment.		
Zyl (zylonite, or cellulose acetate)	Inexpensive and lightweight, and available in many colours	Easy to adjust for an optician
Cellulose acetate propionate	Lightweight, nylon-based plastic that is hypoallergenic	Slightly softer than other plastics used in frames

Material	Characteristics	Suitability
Blended nylon	Strong and lightweight. Easily moulded, so often found in wraparound frame styles	A popular choice for sports or safety frames
Optyl	A brand of epoxy resin	When heated, optyl becomes very malleable, making it easy for the optician to mould the frame to the shape of the face

2.2.6 General user requirements

Requirement	Frame
High myopia	Frames that require a smaller lens size are recommended for high myopia. With myopic spectacles, the thickest part of the lens is at the edge. Therefore the smaller the lens size, the more of the thick edges of the lens can be removed during glazing and so the thinner the lens will be. This makes the spectacles lighter in weight and more comfortable to wear. Full frames help to disguise the thick edges of the lenses thus making the spectacles more aesthetically pleasing.
High hyperopia	For high hyperopia, a smaller-sized frame helps to reduce the weight of the lenses making the spectacles more comfortable for the wearer.
Multifocal spectacles	Multifocal spectacles benefit from having larger-sized lenses as at least two different prescriptions will need to fit within one lens. The larger the size of spectacle frame, the more easily the different prescriptions can be incorporated into the lens.
Spectacles for children	Full frames tend to be more robust than other frames and are recommended for use with children. Plastic frames tend to be lighter and more flexible, and therefore less likely to hurt the child in the event of an accident. For infants and toddlers, consider gently fastening spectacles around the head with a strap to prevent them from falling off or sliding down.
Spectacles for sport	Full frames are more robust than other frames and are advisable for use with sports spectacles. Straps secured around the head are also useful to enhance comfort and stability.

2.3 Ready-made spectacles

2.3.1 Relevant ISO standards for ready-made spectacles

ISO 16034: Ophthalmic optics – specifications for single-vision ready-to-wear near-vision spectacles.
ISO 16034: Ophthalmic optics – specifications for single-vision ready-to-wear near-vision spectacles (Technical Corrigendum 1).

2.3.2 Description and intended use

Part of integrated people-centred eye care is to support services to make eye care more accessible and convenient for users *(12)*. It is recommended that community and primary levels of care dispense ready-made spectacles for presbyopia, following a vision and eye screening where needed *(13)*. Ready-made spectacles for distance vision allow clinicians to provide users with immediate access to spectacles that are customized to their prescription, meaning that users no longer need to make a return journey for spectacle collection. Near-vision ready-made spectacles can be used to treat users with presbyopia. These spectacles can be purchased without a prescription; however it is strongly recommended that users wearing near-vision ready-made spectacles continue to attend regular sight tests.

2.3.3 Types of ready-made spectacles

Ready-made spectacles for distance	Ready-made spectacle kits come with a variety of spectacles frames designed to fit a selection of precut single vision prescription lenses. The frames are designed in a range of colours to suit both males and females. Fitting for both adults and children is made easier by the bridge and the arms of the spectacles being adjustable, with no additional equipment necessary, helping to ensure a comfortable fit. Different prescriptions can be fitted for each eye. Lenses range between ±4.00 D meaning they can be used to provide single vision distance spectacles for people who have myopia (short-sightedness) or hyperopia (long-sightedness). Ready-made spectacles for distance are advised only to be fitted to users who meet all the following criteria, according to the prescription: – The spherical equivalent improves the visual acuity equal to, or not more than, 1 line of visual acuity less than a full correction in the better eye. – The difference between the spherical equivalent in each eye is not more than 0.50 D. – There is no astigmatism, or astigmatism of less than 1.00 D in one or both eyes. – The spherical equivalent required in each eye is less than or equal to +4.00 D or –4.00 D. – The prescribed prism is less than or equal to 0.50 D. Users who do not fit any of the above criteria should be fitted with made-to-order spectacles which have been cut specifically to their prescription.

Near-vision ready-made spectacles	Near-vision ready-made spectacles can be used to treat users with presbyopia. Although these spectacles can be purchased without a prescription, it is strongly recommended that users wearing near-vision ready-made spectacles continue to attend regular sight tests with eye care personnel, and also to receive distance vision correction if needed. These spectacles are intended for near vision and reading use only; they incorporate a pair of single-vision lenses of equal positive spherical power. The quality standards described above also apply to these types of spectacles. The spectacle lenses should be secure so that they are not able to rotate within the frame or drop out. The optical power range lenses for single-vision near-vision ready-made spectacles are required to have equal nominal power within the range of +0.75 to +3.50 D in intervals of 0.25 D. The spectacles should be marked with the spherical power as this allows users and clinicians to easily determine the strength of the lenses without the use of a focimeter. They should also be marked with the name or trademark of the manufacturer or distributor. The supplier should also provide information on *(14)*: frame dimensions, including eye size (lens width), bridge width, temple (arm) length and lens height; – optical centration distance; – overall weight; – lens type and material; – lens coating; and – frame material and colour.

3.

A note on recycled spectacles

Visually impaired pupils with other kids in primary school

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Many nongovernmental organizations and other institutions continue to offer recycled spectacles for use in low- and middle-income countries. Although these donations are well-intentioned, it is not advisable for recycled spectacles to be offered to users for the following reasons:

- Recycled spectacles often do not match the precise prescription needs of recipients, potentially leading to suboptimal vision correction or even eye strain.
- Donations of recycled spectacles can potentially undermine efforts to develop sustainable local optical industries and eye care services.
- The quality and condition of recycled spectacles can vary greatly, with some potentially being damaged or worn out.
- Despite cleaning efforts, hygiene can be an issue with second-hand eyewear, especially when considering the previous close contact with face and eyes.
- Recycled spectacles may not align with local styles or cultural preferences, potentially leading to low acceptance and use.
- Using recycled spectacles is not cost–effective.
- Local facilities may be being supported in providing appropriate low-cost high-quality eye care.
- Every person has a right to clear vision, and to spectacles that are suited to their individual needs, feel comfortable and look attractive *(15)*.
- Recycled spectacles often become unusable after transportation to low- or middle-income countries, leading to their disposal and thus potential environmental issues. Instead of donating used spectacles, supporting local eye care services and proper recycling initiatives is more sustainable. Used spectacles should be recycled at dedicated facilities within the country of origin, where the materials can be correctly processed and repurposed. This approach reduces waste, minimizes environmental impact, and supports the development of sustainable waste management practices in both donor and recipient countries.

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Annex 1. Important ISO publications and other relevant documents

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Annex 2. Minimum quality standards: quick reference tables

Basic lenses quality check

Before supplying or dispensing to any user, all lenses must meet the ISO quality standards as described in this guide. The standards can be verified by the provider to determine whether a lens meets the quality required.

Fitting, combining lens and frame	Lenses should be secured in the spectacles frame so that they do not rotate or fall from the frame when in use.
Performance	Lenses should not exhibit any defect either internally or on the surfaces that may impair vision.
Transmittance	The transparency of the lenses should be sufficient to be suitable for daylight use, driving in twilight and at night.

Power of lens within tolerance

Tables A5.1–A5.4 below can be used to determine whether the power of a lens is within tolerance when compared to the user's spectacles prescription. Tolerances should be measured (and are applied) at a temperature of 23 °C, ±5 °C.

Table A5.1 Tolerances of back vertex powers for both single vision and multifocal lenses

Spherical power (dioptres)	Tolerance of the back vertex power of each principal meridian	Tolerance of absolute cylindrical power (dioptres)			
		≥0.00 and ≤0.75	≥0.75 and ≤4.00	≥4.00 and ≤6.00	>6.00
0.00–3.00	±0.12	±0.09	±0.12	±0.18	–
3.25–6.00	±0.12	±0.12	±0.12	±0.18	±0.25
6.25–9.00	±0.12	±0.12	±0.18	±0.18	±0.25
9.25–12.00	±0.18	±0.12	±0.18	±0.25	±0.25
12.25–20.00	±0.25	±0.18	±0.25	±0.25	±0.25
>20.00	±0.37	±0.25	±0.25	±0.37	±0.37

Table A5.2 Tolerances on the direction of the cylinder axis

Absolute cylindrical power (dioptres)	**<0.12**	**≥0.12 and ≤0.25**	**>0.25 and ≤0.50**	**>0.50 and ≤0.75**	**>0.75 and ≤1.50**	**>1.50**
Tolerance on the direction on the cylindrical axis (°)	No requirement	±14	±7	±5	±3	±2

Table A5.3 Tolerances for reading additions on multifocal spectacles

Value of the addition power or variation power (dioptres)	**≤4.00**	**>4.00**
Tolerance	±0.12	±0.18

Table A5.4 Tolerance of prismatic powers in horizontal and vertical meridians

Total prismatic power (prism dioptres Δ)	**Horizontal**	**Vertical**
≥0.00 to ≤2.00	±(0.25+0.1 x Smax)	±(0.25+0.1 x Smax)
>2.00 to ≤10.00	±(0.37+0.1 x Smax)	±(0.37+0.1 x Smax)
>10.00	±(0.50+0.1 x Smax)	±(0.50+0.1 x Smax)

Note: Smax is the meridian with the absolute highest power.

Important considerations

General	When selecting the materials for the lens and the frame, it is important to consider both the prescription for the spectacles and the age of the user. Spectacles must be fitted well. Fitting is more critical when the power of lenses is high; it also impacts the use of spectacles. All products for sale should be clearly priced in the local currency. Costs should be discussed with the user before the spectacles are ordered.
Lenses and coatings	Lenses need to be designed to minimize the risk to the user, both when the spectacles are in use and when they are not. As lens coatings are applied during manufacturing, the advantages of, and need for, particular coatings should be discussed with users prior to ordering the lenses.
Frames	When selecting a frame, it is important to determine whether the user has allergies that may cause a reaction to certain materials used. Metal frames tend to be extremely strong and will withstand wear and tear. Plastic frames are usually less high price, lightweight and of varied styles. They tend to be more suitable for children. The type of material used for the frame should be discussed with the user and selected based on needs and applications of use.
Ready-made spectacles	Ready-made spectacles are designed to fit a selection of precut single vision and multifocal prescription lenses. Quality assurance of ready-made spectacles should be conducted during and after the manufacturing process. Ready-made spectacles for presbyopia can be dispensed, where needed, at community and primary care levels following vision and eye screening. Ready-made spectacles should be fitted according to prescription, and only when meeting all the following criteria: The spherical equivalent can enhance visual acuity to a level that is equal to, or no more than one line below, that of a full correction in the better eye. The difference between the spherical equivalent in each eye is not more than 0.50 dioptres (D). There is no astigmatism or astigmatism of less than 1 D in one or both eyes. The spherical equivalent required in each eye is less than or equal to +4 D or –4 D. The prescribed prism is less than or equal to 0.50 D. The horizontal limit of the prism can be set higher. Users who do not fit these criteria should be fitted with custom-made spectacles which have been cut specifically for their prescription.

Annex 3. Checklist for dispensing spectacles

Poor fitting of spectacles is one of the main causes of low rates of spectacle compliance. Not only can poor fitting make the spectacles uncomfortable to wear, it can also cause the user's vision to be blurred. Items to check and considerations for dispensing equipment and the ordering of lenses and frames are set out below.

Equipment checklist for dispensing

Equipment name	Yes	No	Condition and quality of equipment
Pupillary distance (PD) rule	☐	☐	
Focimeter	☐	☐	
Frame heater	☐	☐	
Files and locknut wrenches	☐	☐	
Range of pliers for adjustments	☐	☐	
Cleaning supplies	☐	☐	

Considerations for pre-ordering the ophthalmic lenses/frames

Check the prescription	Confirm that the user has a valid in-date spectacles prescription. *The prescription is updated periodically based on sight tests and advice of eye care professionals. A sight test is recommended to change the spectacles as soon as the user becomes aware of a drop in visual performance.*
Measure the pupillary distance (PD)	The pupillary distance (PD) is the distance between the user's eyes measured from pupil centre to pupil centre when looking at infinity. (Note: it is advisable to inform the lens manufacturer of the user's PD). *Spectacles lenses need to be aligned horizontally to prevent double vision. For single-vision distance spectacles, the PD measurement should be taken with the user focusing on a distant target (ideally 6 metres away). For spherical single-near vision spectacles, the measurement should be taken with the user focusing on a near target (ideally around 40 cm away). Multifocal measurements require PD measurements with the user focusing at a distance and near target.* Note: The difference in pupil height (see below) between the two eyes/lenses must not exceed 1 mm.

Measure vertical alignment (pupil height)	The pupil height is the distance between the bottom of the frame and the centre of the user's pupil when the user is wearing the spectacles (Note: it is advisable to inform the lens manufacturer of the pupil height). *For all lenses, particularly bifocal, trifocal and multifocal lenses, it is important that the pupils are positioned at the correct height within the lens. If the eyes sit at the incorrect height, this may cause the user to look through the wrong part of the lens.* Note: The focal centre of the lens should be within ±1 mm of the ordered pupil height.
Measure the back vertex distance (BVD)	Needs to be considered only for prescriptions with a spherical power greater than ±4 D. The BVD is the distance between the back surface of the lens and the front surface of the user's cornea. *If the user selects a frame which does not give them the same BVD as prescribed, they can still be dispensed with that frame, but the prescription incorporated into the lenses may need to be altered slightly to take this into account. The equation to recalculate the spectacle prescription can be found in Annex 5.*

Considerations to confirm the accuracy and quality of the ophthalmic lenses/frames	
Confirm lens type	Verify the lens type (e.g. single vision, bifocal, progressive) to confirm it matches the prescription. *This step ensures that the spectacles are optically correct.*
Confirm pupillary distance (PD)	Measure and verify that the PD matches the prescription or standard measurements. *Ensure that the optical centres of the lenses are correctly positioned for the user's eyes. This alignment is critical for optimal vision and comfort, especially for higher prescriptions or multifocal lenses.*
Confirm back vertex power	Using a focimeter, measure and verify that the back vertex power of the lens is within the tolerance of the user's spectacle prescription. *Make sure to include any near-vision prescription or prismatic prescriptions the lenses might have. The tolerances are different depending on the spectacle prescription (check the quick reference tables in Annex 2). If the lenses are not within tolerance, consider returning them to the manufacturer to be remade to the correct prescription.*
Check if any adjustment is needed	Confirm with the user whether their vision is satisfactory. For near-vision spectacles and varifocals, a near-vision assessment chart can be offered to help the user to check. Confirm with the user whether they feel any discomfort while wearing the spectacles. Confirm that the spectacles are not loose and therefore likely to slip down their nose. *For varifocals, follow the manufacturer's instructions making sure that the users' pupils are aligned with the appropriate lens markings.* *Adjustments should be made by a trained professional to help alleviate these problems; any multifocal lens markings should be removed prior to the user taking the spectacles home.*

Provide advice	Advice should be given in a way that the user will understand, taking into consideration local languages and any additional needs individual users may have. Clinicians should clearly explain the purpose and function of the spectacles and give advice on when to wear them. Users fitted with multifocal spectacles should be advised on how to use the various segments within the lens. Clinicians should encourage users to schedule regular eye examinations to monitor their vision and update their prescriptions as needed. Ideally, all spectacles should be dispensed with a case (for when the spectacles are not in use) and a cleaning cloth.

Annex 4. Appropriate frames for children

Young children often have flatter or less defined nose bridges and spectacle frames for children must be selected carefully. The characteristics of good frames for children are presented below.

Appropriate frames for children	
Correct frame width	A frame that is too wide will result in thicker lenses than necessary and may cause spectacles to be easily knocked off. Children are also likely to reject oversized frames.
Spring hinges	Spring hinges are less likely to break if the child is heavy-handed with the spectacles. They are also less likely to need readjusting and will absorb some of the impact if subjected to blunt force (such as during play).
A larger frontal angle	The frontal angle is formed by a line parallel to the rim of the frame where it rests on the nose and the perpendicular line dividing the nose in two. Metal nose pads allow the angle to be adjusted.
Adjustable nose pads	These can be beneficial for children's frames to ensure a proper fit on their developing nose bridge.
A larger splay	The splay angle is formed by a line parallel to the rim of the frame where it rests on the nose and the perpendicular line dividing the nose in two. Metal frames with pad arms allow some flexibility in adjusting the splay.
A flatter pantoscopic angle	The pantoscopic angle is at the vertical plane between the optical axis of a lens and the visual axis of the eye in the primary position.
A lower crest height	The crest height is the distance from the horizontal centreline to the crest of the frame.
The ability to shorten sides	The plastic covering the end of the sides can be removed, the wire cut to shorten the sides, and the plastic refitted. The angle down should not extend beyond the ear lobe.
No sharp edges	Make sure that the frames have no sharp edges which may cause injury if the frame is struck.
Compliance and comfort	Stress the importance of selecting frames that are comfortable and appealing to children to encourage consistent wear.
Safety spectacles	Safety spectacles can come as prescription or non-prescription. As well as occupational hazards, safety spectacles can also protect the eyes from injury during sports. Consider discussing these with users who take part in: – *Swimming:* waterproof goggles can help to keep the water out of the user's eyes, reducing irritation and improving vision whilst swimming. – *Cycling:* goggles can help to reduce the risk of ocular foreign bodies due to cycling. UV protection should also be considered. – *Hard ball sports:* safety spectacles can help to reduce the risk of blunt trauma caused by the ball. Lenses can be made from hard resin CR-39, polycarbonate or Trivex. – *Snow skiing:* sports sunglasses can help to protect the cornea when subjected to the larger amount of blue light reflected by snow.

Annex 5. Equation to recalculate back vertex distance

Effective power quantifies how the power of a lens changes when moved closer to or farther from the eye. The equation to recalculate the power of a lens based on a change on the back vertex distance (BVD) is as shown below:[a]

$$F_e = \frac{F_l}{1 - (\pm d \times F_l)}$$

Where:

F_e = effective power of the lens to dispense (in dioptres (D));

F_l = power of the lens prescribed (in D); and

d = change in vertex distance (in meters). The sign of d depends on the direction of movement: positive (+) when moving closer to the eye and negative (–) when moving away.

Example 1:

A user has a prescription with a –12.00 D sphere lens when refracted at 12 mm. The user selects a frame where the lens will sit at 9 mm from the apex of the user's cornea. The difference will be 3 mm closer to the eye. Therefore, the effective power of the lens to be dispensed is:

$$F_e = \frac{-12}{1 - (+0.003 \times -12)} = -11.58$$

In this case, the lens to be dispensed should have –11.50 D as this is the possible option.

Example 2:

A user has a prescription with a +12.00 D sphere lens when refracted at 12 mm. The user selects a frame where the lens will sit at 16 mm from the apex of the user's cornea. The difference will be 4 mm farther from the eye. Therefore, the effective power of the lens to be dispensed is:

$$F_e = \frac{-12}{1 - (-0.004 \times +12)} = +11.45$$

In this case, the lens to be dispensed should have +11.50 D, as this is the possible option.

[a] Fannin TE, Grosvenor T. Clinical optics (Chapter Three – Power specification and measurement). Butterworth-Heinemann; 2013:61–92.

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