



Safety and protective eyewear

A reference guide for ABDO members



Industrial prescription safety eyewear

Legal requirements

On 1 January 1993, in line with a European directive, the Government of the UK introduced new legislation on health and safety at work. These effectively replaced the old UK legislation of 10 April 1947.

Six areas were considered within the legislation, one of which was personal protective equipment (PPE). The regulations were published under the Health and Safety at Work Act 1974 as Personal Protective Equipment (European Community EC Directive) Regulations 1992 SI 1992/3139.

Eye Protection was included in these regulations.

The 1993 regulations apply to all workers in the UK, with the exception for crews of sea-going ships (there is also some debate about the protection afforded to military personnel).

As a result of the publication of these rules all previous legislation was completely revoked. The regulations relating to eye protection are now taken as European Normals i.e. EN standards.

These are:

- **EN 165 Personal eye protection: Vocabulary**
- **EN 166 Personal eye protection: Specifications**
- **EN 167 Personal eye protection: Optical test methods**
- **EN 168 Personal eye protection: Non optical test methods**
- **EN 169 Personal eye protection: Filters for welding and related techniques: Transmittance requirements and recommended use**
- **EN 170 Personal eye protection: Ultraviolet filters: Transmittance requirements and recommended use**
- **EN 171 Personal eye protection: Infrared filters: Transmittance requirements and recommended use**
- **EN172 Sunglare eye protectors for industrial use**
- **EN 207 Filters and eye protectors against laser radiation**
- **EN 208 Eye protectors for adjustment work on lasers and laser systems**
- **EN 379 Welding filters with transmittance variable by time and zone**

Types of safety eyewear

Glasses, goggles and shields

As previously stated, all safety eyewear in the UK must conform to the European standard EN166-2002, which has several differing levels of impact resistance, indicated by symbols.

The range of symbols used in lens type marking are:

Symbol	Property
S	Increased robustness
F	Low energy impact
B	Medium energy impact
A	High energy impact
9	Non-adherence of molten metal and resistance to penetration of hot solids
K	Resistance to damage by fine particles
N	Non-fogging properties

Note: When medium energy impact resistance, denoted as EN166 B, is required or, there is a requirement for protection against electrical arcs, welding materials and corrosive materials, prescription glasses should not be supplied and goggles, or visors, should be considered, which must carry the appropriate EN specifications.

Grade B test: 6mm, 0.86g steel ball travelling at 120 metres per second

When high energy impact resistance (EN 166 A) is required visors or face shields must be supplied.

Grade A test: 6mm, 0.86g steel ball travelling at 190 metres per second

Low energy impact grade (EN 166 F) is the highest level of impact offered by safety spectacles/glasses.

Grade F test: 6mm, 0.86g steel ball travelling at 45 metres per second - (Polycarbonate)

CR39 (with increased thickness) and toughened glass (usually thermally toughened in the UK) are materials offering increased robustness (EN 166 S). **The mechanical Grade S test standard is a 43g, 22mm steel ball dropped onto the lens at a speed of 5.1 metres per second. This is derived from the practical test, which is to drop the ball (as stipulated) from a height of 1.3 metres.**

Industrial prescription safety eyewear

Markings required on the lenses of supplied safety spectacles

N..... Manufacturers' mark

1 Optical Class

S or F Impact Grade

There will probably also be a Kite Mark, which is not a regulatory requirement, but more of a manufacturer's stamp of quality.

The Kite Mark: is considered the world's premier symbol of trust, integrity and quality. It indicates that manufacturers carrying the mark have satisfied the most rigorous quality process. The scheme is developed by using BS, EN, ISO or Trade Association specification.

Lens

Manufacturers' mark, so that source is traceable in the event of problems (plus kite mark) 1 – F or 1-S.

In a number of working environments it may well be possible to only provide appropriate over goggles, or side shields, to spectacle wearers, but such steps should only be regarded as temporary measures. It should be noted that these measures are not suitable for prolonged or regular use.

Frames

These may be manufactured in metal (often nickel alloys – plated) and plastic (commonly cellulose acetate, polymamide or polycarbonate).

Functionality and use dictates their design, but a range of colours and styles are readily available from the appropriate suppliers.

Frames must also carry the appropriate markings which will be:

Marks: Manufacturer's mark, again offering traceability (plus kite mark, not a requirement).

EN 166 Relevant Standard

F if the frame claims to meet low energy impact (no markings are required for Grade S increased robustness)

CE mark

Technical information

BS EN 166	Protector Type				
	Frames	Lenses	Spectacles	Goggles	Faceshields
Manufacturer's mark	R	R	•	•	•
Optical class					
Refractive power +/-0.06	-	1	•	•	•
Refractive power +/-0.12	-	2	•	•	•
Refractive power +0.12	-	3	•	•	
Refractive power - 0.25	-	3	•	•	
Mechanical strength					
Increased robustness	-	S	•	•	•
Low energy impact	-F	F	•	•	•
Medium energy impact	-B	B		•	•
High energy impact	-A	A			•
Field of view					
Liquid droplets/Splashes	3	-		•	•
Large dust particles	4	-		•	
Gas/Fine dust particles	5	-		•	
Short circuit electric arc	8	-			•
Molten metal/Hot solids	9	9		•	•
Resistance to fogging	-	N	•	•	•
Resistance to surface damage (damage by fine particles)	-	K	•	•	•

Industrial prescription safety eyewear

Assessment of required safety eyewear

Health and Safety at Work Regulations require the employer to identify and evaluate workplace risk. This is commonly undertaken by the company safety officer. The reason for this is that in order to do a comprehensive assessment, someone with access to, and familiarity with, the working environment is essential. This effectively means that a practice based optician is not the appropriate person to assess such risk, though they may well dispense the required safety spectacles.

The net result of this is that the patient will come into the practice with a "Company" order form. This will stipulate the type of lens and lens material required.

Note: If this is not stipulated contact the company health and safety officer before proceeding. The frame may also be specified though, frequently, a choice is offered to the patient from a stipulated range.

On occasions, however, a self-employed tradesman may come into the practice requiring safety spectacles. In this instance the optician should perform a detailed assessment of the patient's requirements and the type of hazards

that are associated with their day to day work. If it is feasible contact a local company involved in the same, or very similar, work type. Alternatively the optician should contact a supplier involved in the supply of safety eyewear to seek their advice. However when the optician proceeds, he/she should keep detailed case records of the reasons for their choice of lenses and frames supplied.

Once an order has been established the safety spectacles must be ordered from a recognised safety eyewear manufacturer. This will ensure that the necessary standards are met and that a proper safety certificate is issued at the time of completion.

The norm when "Company" safety spectacles are being supplied is that the optician will receive a fee for the dispensing service. There are no specific amounts established for the dispensing service so this should be agreed with the supplier before proceeding.

Care of safety glasses

Not all responsibility lies with the employer. The wearer has obligations to wear the safety spectacles when required and in the manner that they were issued for. The wearer, or another party, must not interfere with, abuse, or alter the safety spectacle in any way.

Advice on the proper care of the lens should be given (how to clean and the benefits of putting into the case provided when not in use). **Remember the hazards of cleaning polycarbonate lenses with acetone or methyl chloride!**

Avoid extreme heat (unless specifically designed for such use) and humidity.

It is very important that the optician is aware of the very limited actions that they can perform with regard to safety spectacles; effectively this is limited to adjustment only. The optician must never undertake any repair – even replacing a screw. Such action would invalidate the protection guarantee. All repairs must be returned to the original supplier who will, when completed, issue a new guarantee certificate.



Sunglass protection

Sunglass tints simplistically will cut down light transmission, and should offer 100% protection from UV radiation (specifically UVA – possible cataract formation, retinal damage with long term exposure. UVB potentially the most hazardous, can damage the retina and the conjunctiva, the worst scenario being blindness. The eye itself counteracts UVC). In hot conditions/climates Infrared is a serious threat – cataracts etc.

Standard BSEN 1836 – Sunglasses and glare Filters for general use (Plano Powers)

BSEN 1836 is for sunglasses with plano prescription for general use – including driving. This standard does not cover prescription or industrial sunglare filters.

Labelling and information should include:

1. Identification of manufacturer.
2. Filter category number (see below)
3. Number and year of standard (i.e. BSEN1836-1997)
4. With category 4 filters a warning “not suitable for driving or road use (symbol: a car with a line through it).
5. Additional information drawn up and kept by the manufacturer.
 - a) manufacturer’s name and address
 - b) type of filter
 - c) instructions for cleaning and use

- d) explanation of markings
- e) optical class
- f) plano sunglasses must be CE marked against the P.P.E. Directive

Filter categories and descriptions

See table on opposite page

Note: Sunglare filters with an LTF of less than 80% are not suitable for use in twilight or night driving and road use. The advice should be for no tinting to the lens, but an MAR coat should be a must. (Perhaps a gold reflex, an arguable aid to contrast). In passing, there is an argument for recommending a blue reflex for any one spending a lot of time under fluorescent lighting - increased UV.

Driving and road use - Filters suitable for daylight are: 0, 1, 2 and 3

Filters from 1 - 4 are not suitable for night driving and road use

Filter category 4 not suitable for driving or road use per se

Though the filter categories listed in the table opposite refer to plano sunglasses the information is also very relevant to prescription sunglare wear.

Filter category	Description	Range of luminous transmittance to	
		from over	to
0	Clear or very light tint	80%	100%
1	Light tint	43%	80%
2	Medium tint	18%	43%
3	Dark tint	8%	18%
4	Very Dark tint <i>(not suitable for driving or road use in any conditions)</i>	3%	8%

Other specialist sun protection lenses

Polycarbonate

Where safety or wrap around types are required polycarbonate is commonly used (polycarbonate, in white form, eliminates 100% of UV @ 380nm).

Polarised lenses

Which are the only truly anti-glare lenses, should be recommend for use on and around water (fishing, sailing, water skiing etc). For prolonged wear, there is a very valid argument for the addition of a mirror coating, to counteract the increased UV being reflected from the water. It is also a very good driving/road use tint, especially in wet conditions on a bright/sunny day.

Snow Skiing

Commonly supplied in goggle form and where a prescription is required inserts may be used.

For general use grey tints should be suggested – grey reduces the visible light transmission, VLT, across the spectrum. Polarised lenses may also be used under these conditions. In sunny conditions darker brown tints may be used. For overcast, flat light days, in which there is an over abundance of blue light, yellow or rose tints may be used. VLT may also be further reduced by the use of mirror coatings, importantly this coating will also “reflect” the added UV radiation which is exacerbated by reflection off of the snow.

Sunglass protection

Shooting/archery

A bronze tint should be used for skeet, clay-pigeon and trap shooting. It is also the tint of choice for hunting.

For black on white target shooting yellow (sodium) tints offer good contrast. Targets may vary in colour, however. For orange targets use an orange tint. Red and pink tints are good for black and green targets and are also effective on orange targets and for hunting. They also reduce the effects of a green background, grass, trees and shrubs. The red tint can improve colour differentiation for people with a colour vision problem.

Tints should not be too dark as this will result in an enlarged pupil which can adversely affect the shooters/archers performance. Compare it to the pinhole effect.

Cricket

Tints will vary according to the light conditions, but one of the purposes of the tint will be to enhance contrast. The spectacles are mostly wrap around and will benefit from a mirror coating (cricketers spend prolonged periods in the field increasing UV exposure).

Tropical use

Not only is UV, as always, a problem but in these conditions there is the added problem of infrared (over exposure, without protection, can result in cataract). Protection from infrared is achieved by the use of ferrous oxide in the lens mix, the most common example being Rayban G15. The possible drawback of the Rayban G15 is the it is a solid tint (within the mix of the lens) presenting problems where there are differing thickness in the lens, resulting in light and dark areas. In this situation recommend a bonded/equi tint.

Photochromic lenses should be recommended for patients who are generally light sensitive, who like a flexibility in their tint, or for pathological conditions such as albinism.

Sports and home protection

Note: This is only a brief resumé on this ever expanding field.

The DIY amateur is just as vulnerable to accident as the professional, arguably more so. He/she should be encouraged to have the necessary eye protection. Just think of the hazards, flying particulars, dust, chemical compounds (ammonia, acids, superglue). Is it surprising that there are more accidents in the home than at work? The emmetrope should wear wrap around goggles (injection moulded polycarbonate). The spectacle wearer should at least have some form of over protection. For the committed DIY enthusiast spectacle wear as used for industrial eyewear should be recommended.

For "hard" ball and racket sports impact resistance is the prime concern. CR39 may be used, but to be extra safe think in terms of polycarbonate, not a wonderful material, so do not forget Trivex.

Squash has a particularly frightening hazard, just think of a squash ball, just the right size to fit into the eye orbit, literally exploding on contact.

All squash players should have eye protection. There are specifically designed goggles for squash use which

must be fitted with the most efficient impact resistant lenses.

On the subject of goggles let us not forget swimming. It reduces enjoyment if vision is poor, also the chlorine in the water, or salt in sea water, can be very uncomfortable.

Plano goggles are available, as are ready wear prescription goggles, using basic meniscus lenses, or goggles with the patient's accurate prescription incorporated. Impact resistance is a consideration, though CR39 material should be adequate.

These are areas where the optician should be actively involved. However, with responsibility comes liability, so always keep detailed practice records, even when supplying non-prescription units.



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Safetyspecs.co.uk

As standards are subject to regular updates and changes, please note the information in this brochure is only accurate at the time of going to press.

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