



WORK WATCHING YOUR EYES

Protective glasses against solar radiation

Exposure to solar radiation

Even though Directive 2006/25/EC¹ occupational exposure to artificial optical radiation excludes solar radiation from its scope, Directive 89/391/EEC², **establishes that the employer shall have a duty to ensure the safety and health of workers in every aspect related to the work, which includes, among others, the risks derived from solar radiation.** Farmers, construction and maritime workers, gardeners and lifeguards are some of the most exposed professions to these radiations.

An action plan should be implemented in the workplace, to be applied in the event of a potential risk due to exposure to solar radiation. This plan may require, among many other measures, the use of specific Personal Protective Equipment (PPE), such as protective glasses against solar radiation.

Filters against solar radiation

Protective glasses against solar radiation (hereinafter referred to as sunglasses) are equipped with oculars with filtering action against this radiation. **The main purpose of filtering oculars against solar radiation (hereinafter referred to as sunglass filters) is to protect the human eye from the harmful effects of excessive solar radiation** which can lead to pathologies such as photokeratitis, photoconjunctivitis, cataracts or photoreinitis. Furthermore, the use of sunglass filters, from an ergonomic point of view, increases the comfort and visual perception of the user.

The selection of the sunglass filter depends on the ambient light level and individual sensitivity to glare, in order to ensure fatigue-free vision even in the case of prolonged use.

Sunglasses for general use



This equipment usually meets the requirements of EN ISO 12312-1³ which specifies the mechanical, optical, etc. properties of sunglasses intended for

general use, which only provide protection against solar radiation.

This standard classifies sunglass filters according to their visible transmission factor in categories ranging from 0 to 4.

Sunglasses for occupational use

This equipment is usually certified according to EN 166³, which states that sunglass filters shall be marked with the scale number. This represents the transmission properties of the sunglass filter by means of a combination of two numbers. The former refers to the type of radiation against which the filter protects (code number) and the latter indicates the degree of protection provided by the ocular. (The higher degree of protection, the higher the absorption of incident radiation and, in general, the lower the transmission in the visible spectral range).

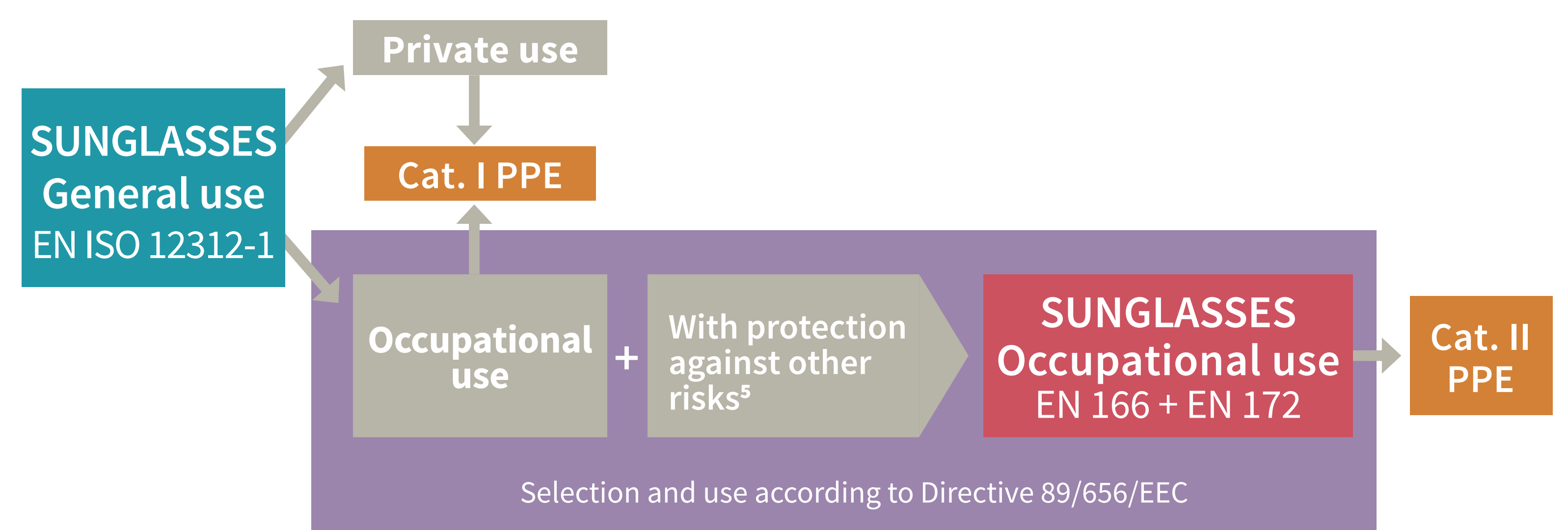
Scale number = code number + scale number

5 or 6 – 1,1 to 4,1
→ Scale number
→ With infrared specification
→ Without infrared specification

EN 172 defines, in a complementary and specific way, the scale numbers and transmission coefficient requirements corresponding to sunglass filters for occupational use. The rest of the requirements for this type of filters are included in EN 166. Sunglasses meeting this standard provide protection not only against solar radiation, but also against several risks such as impacts, splashes, etc.

Both sunglasses for general use and sunglasses for occupational use fall within the scope of Regulation (EU) 2016/425⁴, which lays down the requirements for PPE placing on the market and free movement. This can also be seen in Annex I of Regulation, where both types are considered PPE.

Like any other PPE, sunglasses shall bear the CE marking, which indicates compliance with the essential health and safety requirements set out in the Regulation.



Requirements for protection against solar radiation

| EN ISO 12312-1 | | | Range of luminous transmittance (C _v) % | | EN 172 | | |
|-----------------|---|--|---|------|-------------|--|--------------|
| Filter category | Usage/Symbol | Designation | | | Designation | Usage/Symbol | Scale number |
| | | | 380nm to 780 | | | | |
| | | | from | to | | | |
| 0 | Very limited reduction of sunglare | Light tint sunglasses | 100,0 | 80,0 | - | Only applies to certain photochromic filters in the clear state and for the highest transmission range in the visible. | 5 o 6 – 1,1 |
| 1 | Limited protection from sunglare | | 80,0 | 58,1 | Very clear | As a very clear filter | 5 o 6 – 1,4 |
| | | | 58,1 | 43,2 | Clear | As a clear filter | 5 o 6 – 1,7 |
| 2 | Good protection against sunglare | General purpose sunglasses | 43,2 | 29,1 | Medium | As universal filter recommended for most situations | 5 o 6 – 2 |
| | | | 29,1 | 17,8 | Dark | Generally used in Central Europe | 5 o 6 – 2,5 |
| 3 | High protection against sunglare | | 17,8 | 8,0 | Very dark | In tropical or subtropical regions, for direct observation of the sky, in high mountains, for snowy surfaces, expanses of shining water or sand, chalk or slate quarries. Not recommended for road driving | 5 o 6 – 3,1 |
| 4 | Very high protection against extreme sunglare, at sea, over snowfields, on high mountain, or in desert. Not suitable for driving and road use⁶ | Special purpose sunglasses, very high sunglare reduction | 8,0 | 3,0 | Very dark | For very intense radiation Not suitable for driving and road use | 5 o 6 – 4,1 |

Sunglass filters shall ensure, in addition to a certain absorption of visible radiation (VIS), protection of the eye in the ultraviolet (UV) spectral region and, in some cases, in the infrared (IR) spectral region. In this regard, there are no significant differences in the specifications and requirements between sunglasses for occupational use and sunglasses for general use, and it is possible to establish a certain correlation between them.

Sunglasses suitable for driving shall allow the detection of signal lights (improved colour recognition). It should also be considered that in poor light, sunglass filters designed for bright daylight reduce visual perception. The lower the transmission value in the visible, the more vision is impaired. In order to limit this effect, additional light transmission requirements are set for sunglass filters for driving in twilight or at night.

Possible applications



Special filters

These filters have additional properties that can facilitate vision and hence increase the well-being of the user.

Photochromic filters

These filters change their visible transmission factor reversibly under the influence of solar radiation intensity, temperature and other parameters. This change is not instantaneous, but varies according to temperature and material.



If they are used while driving, it should be noted that the windscreen would filter the sun's UV radiation and prevent the obscuration of most sunglasses of this type.

Polarizing filters

Sunlight is not polarised. It means that, when reflected from some shiny horizontal surfaces (water, snow, road, slate quarries, etc.), it is polarised on a single plane, generally horizontal. The use of polarised filters allows this stray polarised light (reflections) to be eliminated, avoiding glare.

The screens of most electronic devices (tablets, smartphones, etc.) incorporate polarised screens whose vision is hindered if the user wears glasses with polarised filters.

Gradient-tinted filters

In these filters, the tint gradually lightens, with the upper part being darker and the lower part lighter.

They are best suited for indoor and low-sunlight conditions. However, it should be noted that reflections from bright horizontal surfaces are more likely to penetrate through the lower, lighter part of the lens.

Aspects to be considered

• All sunglasses shall be accompanied by the following information:

- CE marking visible, legible and indelible.
- Identification of the model.
- Identification of the manufacturer.
- Reference to the standard to which the equipment has been certified.

– Scale number of the filter or, where appropriate, filter category.

– Restrictions on use.

- Particular attention should be paid to the limitations of use of the sunglasses according to their scale number or category.
- The colour of the filter is not decisive for the selection; the darkest is not always the most protective. The transmission of solar radiation in the VIS depends on the colour, but it is the material that determines the spectral transmission coefficient in the UV.

• Filter shape and size are often matters of fashion. However, in some circumstances it is appropriate to choose wraparound or with side shield sunglasses.

• In certain cases, such as prolonged exposure to the sun in desert environments, sunglasses with a specific IR protection requirement.

• In conditions of extreme illuminance, especially in snowy areas, the risk of exposure to the solar blue-light should be considered. It should be emphasised that direct viewing of the sun is dangerous due to its high blue light content (specifications for filters for direct observation of the sun are in EN ISO 12312-2).

References

EN 166:2001 Personal eye-protection – Specifications
EN 172:1994 Personal eye protection - Sunglare filters for industrial use
EN ISO 12312-1:2022 Eye and face protection - Sunglasses and related eyewear - Part 1: Sunglasses for general use.

(1) Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation).

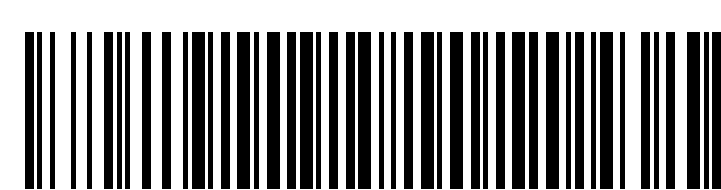
(2) Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work.

(3) Not applicable to eyewear for protection from artificial radiation, eye protectors for specific sports or equipment intended for direct observation of the sun.

(4) Directive 2006/25/EC of the European Parliament and of the Council of 5 April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC).

(5) E.g. protection against impacts, etc.

(6) Could be used in extremely high luminance conditions, such as desert and snowfields under full sunlight.



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