

## Appendix 9. Selection and use of laser safety eyewear

Laser protective eyewear is not a substitute for other precautions; indeed, it is only to be used if, after applying all reasonably practicable control measures, adequate protection for the eyes has not been achieved.

Laser Protective Eyewear is available from a number of laser component suppliers and can be expensive. However, it is generally a key item of safety and economies should not be made in this area; uncomfortable eyewear with a restricted field of view is unsuitable for the regular laser user.

Laser safety eyewear is marked to show the wavelength(s) for which it provides protection and the level of protection. Laser protective eyewear is given a scale number with a prefix 'L'. Adjustment eyewear is also available for visible cw laser radiation in which the filters attenuate the laser radiation to a safe level for 0.25 s exposure. In this way, visible laser beams can safely be viewed during adjustment work. The scale number for adjustment eyewear is given the prefix 'R'.

### A9.1 Mandatory requirements

The eyewear must be:

- CE marked;
- marked as providing the necessary level of protection for the assessed maximum exposure at the appropriate wavelength(s);
- held in appropriate receptacles providing clear type identification, protection from dust and scratching and separated according to type of eyewear if more than one specification is available; located near the entrance to the Designated Laser Area;
- Inspected regularly and replaced or repaired if: the filters are excessively marked or damaged or display an anomalous colouration; the mechanical integrity of the frames is suspect; or elastic tape is used and has become worn.

### A9.2 Selection of protective eyewear

When choosing appropriate eyewear each of the following must be considered:

- the wavelength or simultaneous wavelengths of potential exposure (see note 1 below);
- the reasonably foreseeable worst-case effective exposure (beam power or pulse energy, and diameter);
- the visible light transmission of the filter, and the ability to see warning lights or other indicators through the filters;
- the general design, comfort, ventilation, peripheral vision, and provision for spectacle correction (either by using goggle-style protectors which fit over normal spectacles, or protective spectacles

which incorporate the wearer's own optical correction) afforded by the eyewear; and

- the use of the eyewear, whether for occasional casual use or for working for long periods, perhaps in restricted spaces where the eyewear may be knocked.

**Note 1:** Safety eyewear based on absorbing or reflective filters cannot provide protection against potential exposure to simultaneous wavelengths spanning the visible spectrum (400 – 700 nm), whether as a spatially coherent 'white light' laser beam or several laser beams each with one or more discrete laser wavelengths, without having close to zero visible transmission.

The use of night vision eyewear may be a practical option for some but not all users and situations. Problems encountered in their use include: peripheral vision causing an increasing of the risk of trips and bumps; insufficient resolution for detailed work; and (for some people) an unwell feeling caused by the disparity between image and "reality".

**Note 2:** ISO 12609 parts 1 and 2 "Eyewear for protection against intense light sources (ILS) used on humans and animals for cosmetic and medical applications" sets out the requirements for manufacturers (Part 1) and guidance for users (Part 2). The standard is consistent with the general approach for broad band sources in HPA Guidance for Artificial Optical Radiation i.e. the tables of Exposure Limit Values (ELVs) must be used (of which there are several overlapping sets: for blue light hazards (300 – 700 nm), retinal thermal hazards (380 – 1400nm), actinic UV hazards (180 – 400 nm), and infrared hazards (780 - 3000 nm). To determine the filter requirements the user must carry out a summation (integration) of maximum foreseeable exposure divided by ELV over the full wavelength range for each of these sets. ISO 12609 part 2 recommends a minimum visible transmission of 20%. (N.B. Compared to laser safety eyewear the attenuation of the ILS eyewear is low and there is no testing for optical damage or the bleaching effects of short pulse lasers.)

### A9.3 Identifying the correct eyewear

Unless the only laser protective eyewear available in the DLA provides suitable protection for all potentially accessible beams, effective action must be taken to reduce the likelihood of incorrect selection of eyewear occurring. This could include:

- paint a distinctive mark on the eyewear, using a colour code to readily identify the eyewear and using an engineering means (e.g. a matching set of coloured lights, the light illuminated being under key control);
- make it part of the procedures for the LRO to ensure that only the eyewear appropriate to the laser(s) in use is available in the area;
- inappropriate eyewear for the work in laser progress is locked away

### A9.4 Hygiene

If the eyewear is to be worn by more than one person, then an antiseptic spray and/or medical wipes, lens cleaner and tissues should be provided in the vicinity

of where the eyewear is stored. In addition, the use of anti-fogging sprays and basic lens cleaning fluids should be considered.