Appendix 14. Definitions of technical laser terms

A14.1 Accessible Emission Limit (AEL)
The radiation level produced in regions accessible to the user, which must not be exceeded for a given class of laser. It is generally expressed as the total power or pulse energy output of the laser.

A14.2 Beam divergence
The measure of increasing beam diameter, expressed as a linear angle, with distance of propagation. For beams with non-circular symmetry, beam divergence values in orthogonal planes may be specified.

A14.3 Class 1 Laser products
Laser products that are normally safe under reasonably foreseeable conditions or use, either because the output of the laser source is sufficiently low, or by virtue of their engineering design e.g. total enclosure of the laser output.

A14.4 Class 1M laser products
Laser products that exceed the permitted accessible emission limits for Class 1 but which are safe for viewing with the unaided eye. Typically the output laser beam is reasonably collimated and has a large diameter, such that harmful exposure can occur under viewing with a telescope or binoculars.

A14.5 Class 2 laser products
Laser products emitting low levels of visible radiation (i.e. in the wavelength range 0.4 to 0.7 μm) that are safe by virtue of the natural aversion response to bright light.

A14.6 Class 2M laser products
Laser products emitting levels of visible radiation (i.e. in the wavelength range 0.4 to 0.7 μm) that exceed the permitted accessible emission limits for Class 2 but which are safe for viewing with the unaided eye by virtue of the natural aversion response to bright light. Typically the output laser beam is reasonably collimated and has a large diameter, such that harmful exposure can occur under viewing with a telescope or binoculars

A14.7 Class 3B laser products
Medium power laser products for which direct ocular exposure is unsafe, but under certain conditions they may be safely viewed via a diffuse reflector. In general these safe conditions are:
i) a minimum viewing distance of 130 mm and
ii) a maximum viewing time of 10 seconds
These lasers may present a skin hazard.

A14.8 Class 3R laser products
Laser products for which intra-beam viewing is potentially hazardous but the risk is low. For visible radiation (i.e. in the wavelength range 0.4 to 0.7 μm) the level of accessible emission can exceed the AEL for Class 2 by up

to five times; for other wavelengths the level of accessible emission can exceed the AEL for Class 1 by up to five times.

A14.9 Class 4 laser products
High-power laser products. In addition to the hazard from intra-beam viewing or specular reflections, they are capable of producing hazardous diffuse reflections, may cause skin injuries and could also present a fire hazard. Their use requires extreme caution.

A14.10 Continuous Wave (CW)
The description used for a laser which produces a constant, as opposed to a pulsed laser output.

A14.11 Designated Laser Area (DLA)
A room or other enclosed working area designed to contain lasers, such that there is no laser radiation hazard beyond the defined boundary of the area.

A14.12 Diffuse reflection
The scattering of laser radiation from a rough surface.

A14.13 Extended Nominal Ocular Hazard Distance (ENOHD)
The shortest distance (generally measured from the position of the laser source) at and beyond which a laser beam is safe for aided viewing.

A14.14 Hazard level
The classification of fibre optic output at locations where interruption of the fibre might reasonably be foreseen, as described in BS EN 60825-2 ‘Safety of laser products: Part 2- Safety of optical fibre communication systems’. Hazard levels use the same nomenclature and warnings as is used for laser classes.

A14.15 Human access
Capability for part of the human body to meet hazardous laser radiation.

A14.16 Intrinsically safe
Safe by virtue of its intrinsically low emission of laser radiation. This contrasts with the emission from a Class 1 Embedded Laser Product which is safe by engineering design.

A14.17 Intra-beam viewing
The exposure of the eye to all or part of a laser beam, either directly or after specular reflection.

A14.18 Irradiance
The radiant power incident on an element of a surface divided by the area of that element (Wcm^{-2}). For normal incidence irradiation, this term is equal to the beam intensity at the surface.

A14.19 Laser
(As defined in EN 60825-1) a device that can be made to produce or

amplify electromagnetic radiation in the wavelength range from 180 nm to 1 mm primarily by the process of stimulated emission. MPE values do not exist for wavelengths outside this.

A14.20 Laser Hazard Zone
The region around the laser and laser beam path within which, under all reasonably foreseeable conditions, a hazardous level of laser radiation may be present.

A14.21 Laser product
Any product or assembly of components that constitutes, incorporates or is intended to incorporate a laser or laser system.

A14.22 Laser system
A laser in combination with an appropriate laser energy source with or without additional incorporated components.

A14.23 Maximum Permissible Exposure (MPE)
That level of laser radiation to which, in normal circumstances, persons may be exposed without suffering adverse effects. MPE values for eyes and skin exposures represent the maximum levels to which the eye or skin can be exposed without consequential injury. They vary with the wavelength of the radiation, the pulse duration or exposure time, the tissue at risk and, for visible and near-infrared radiation, the size of retinal image.

A14.24 Maintenance
Adjustments or procedures specified in the user information provided by the manufacturer/supplier with the laser product, which are performed by the user for the purposes of assuring the intended performance of the product. It may require access within the laser enclosure and may expose the laser worker to additional hazards.

A14.25 Nominal Ocular Hazard Distance (NOHD)
The shortest distance (generally measured from the position of the laser source) at and beyond which a laser beam is safe for unaided viewing.

A14.26 Personal Protective Equipment (PPE)
Protection that is worn or carried. This includes laser safety eyewear and protective clothing, such as gloves. Viewing windows and screens are not PPE.

A14.27 Protective housing
Those portions of a laser product (including a product incorporating an embedded laser) that are designed to prevent human access to laser radiation in excess of the AEL prescribed for the product. (The laser product manufacturer generally installs the protective housing.)

A14.28 Pulsed laser
(As defined in EN 60825-1) a laser that delivers its radiation output in the form of pulses with duration less than 0.25s, either singly or a train of pulses.

A14.29 Pulse Repetition Frequency (PRF)
The number of pulses per second emitted by a pulsed laser.

A14.30 Radiance
The radiant power per unit area of a radiating surface per unit solid angle of emission ($Wsr^{-1}cm^{-2}$).

A14.31 Radiant exposure
The radiant energy incident on an element of a surface divided by the area of that element (Jcm^{-2}).

A14.32 Specular reflection
Reflection from a shiny surface, such as a mirror.

A14.33 Standing Orders (SO)
A set of formal written instructions that address all hazards and procedures for a specified location or piece of laser equipment.