

A new edition of the UK and European laser safety standard has recently been published. This document, designated **BS EN 60825-1:2007, Edition 2 - Safety of laser products – Part 1: Equipment classification and requirements**, is the primary standard for laser safety to which many other standards and guidelines refer. It defines the basis on which all laser products are classified and specifies the manufacturing requirements that they must meet. The new edition introduces important changes as well as adopting some general improvements in presentation.

There are two key changes that affect the scope of the document. Firstly, light emitting diodes (LEDs) are no longer covered, and so the standard now only deals with the safety of lasers and of equipment incorporating lasers (it's original purpose). The safety of products incorporating LEDs will be covered by more general standards dealing with lamps and other artificial sources of optical radiation. (The primary safety standard for these kinds of optical sources will be BS EN 62471, currently in draft.) Secondly, the User Guide section which appeared in previous editions of BS EN 60825-1, (Section 3), has been completely removed from the new edition. This is because more comprehensive guidance on the safe use of lasers is now given in a separate document, PD IEC TR 60825-14, which was published in 2004. The removal of the User's Guide section means that 60825-1 has become solely a manufacturing standard, and is restricted to the classification, labelling and safety compliance of laser equipment. However, the maximum permissible exposure (MPE) limits have been retained as an Annex to 60825-1 as well as being included in 60825-14, as they provide information that can be useful to manufactures as well as to laser users.

In revising 60825-1 the opportunity has also been taken to improve its layout, making it easier to use, with the consequence that many of the sections and tables have been moved and renumbered. (For those familiar with the previous version of the standard, therefore, relevant information may not always be found in the expected place!)

Following a change introduced into the presentation of the MPE tables when 60825-14 was published in 2004, the table for the accessible emission limits (AELs) for Class 1 and Class 1M laser products has been divided into two separate tables (Tables 4 and 5, together with the use of correction factors given in Table 10). Table 4 gives the AEL values over the full range of wavelengths for point sources that is for laser sources having a value of C_6 equal to 1. This covers the majority of laser beams, and means that in these cases the MPE table is now much easier to interpret. For extended (including multiple) laser sources where C_6 can be greater than 1, a relaxation of the limits may be permissible for wavelengths within the range 400 to 1400 nm, the retinal hazard region, in order to account for the inability of such a source to be focused to a minimal spot on the retina. The added complexity in dealing with this is covered in Table 5. Should someone mistakenly refer to the simpler AEL values given in Table 4 in a situation where C_6 is actually greater than 1, this will always result in a more conservative value.

There has also been a change in the measurement geometry for Condition 2, one of the three conditions used for the classification of laser products and which is especially applicable to divergent beams. Previously, for all wavelengths, the specified condition had been a measurement aperture of 7 mm diameter located 14 mm from the position of the apparent source. This was intended to simulate the use of an eye-loupe (hand-held magnifier) having a magnification of 18 times (i.e. 250/14, where 250 mm is the standard minimum viewing distance assumed in optical engineering – but not in laser safety where a more conservative value of 100 mm is used). This viewing scenario was felt to be unduly restrictive, and in the new edition the measurement condition has been relaxed. It is now defined, over the wavelength range from 302.5 to 4000 nm, as an aperture of 7 mm diameter positioned 70 mm from the apparent source. This simulates the use of a 7 times magnifier with the added assumption that it is used under well-lit conditions, thereby resulting in a smaller pupil diameter. (The actual assumption is a 7 times magnifier used 35 mm from the source with a pupil diameter of 3.5 mm. This is exactly equivalent to a 7 mm aperture at 70 mm.)

An additional table (Table 12) has been included to indicate the reference points from which measurement distances are measured for different kinds of laser (e.g. diode laser, line laser, etc.).

New annexes have been added to clarify classification issues. Annex B includes flowcharts as a guide to the classification process and Annex C gives an explanation of each of the laser classes and a description of their potential hazards.

Another new annex, Annex E, describes the analysis of retinal laser hazards in terms of the radiance of the source. Radiance is the power emitted per unit solid angle per unit area of the source (in units of watts per square metre per steradian). This is of relevance to extended sources and, where the radiance of the source is known or can be readily determined, can provide an easier method for determining the limiting value of the AEL or MPE for wavelengths between 400 and 1400 nm, since it is directly related to the irradiance (power per unit area) produced by the source at the retina, regardless of the viewing distance. (This represents something of a return to the philosophy adopted in earlier laser safety standards, when both the MPE and the Class 1 AEL were given as dual limits, one of which was expressed in terms of the source radiance.)

Amongst other changes introduced in Edition 2 are new restrictions on the level of accessible laser radiation that is permissible with embedded laser products (usually those in Class 1 that incorporate a laser of a higher class) under conditions of user maintenance (4.2.1). A new label has been introduced to warn of potential skin hazards for certain lower-class lasers having divergent emission (5.2, 5.3), and the definition of human access (applicable to the housings for embedded laser products) has been modified (3.37).

The more logical arrangement of Edition 2 should make it a little easier for users to find their way around the standard. Only a few laser products will be affected by the changes made to the manufacturing requirements or measurement conditions, but those involved in laser classification will need to refer to the new standard (which can be obtained on-line from BSI) to ensure that they remain fully up to date with current product compliance issues.

The removal of the User's Guide from this new Edition creates a clear distinction between product safety and user safety, and underlines the necessity for all those who work with lasers to refer to the 2004 guidance document, PD IEC TR 60825-14 (Safety of laser products – Part 14: User's Guide), as their primary resource for the evaluation and control of laser hazards in the workplace.

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