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Special considerations: Class 3R

In the second edition of the international laser safety standard IEC 60825-1, which is to be published at the beginning of 2001, a new class, Class 3R, is defined. Class 3R characterizes products for which the hazard lies between the zero or very low-level hazard of Class 1 and Class 2 on the one hand and potentially highly hazardous Class 3B products on the other. The AEL of Class 3R is 5 times the AEL of Class 1 for wavelengths outside the visible and in the visible the AEL for Class 3R is 5 mW for a time base of 0.25 s, i.e. 5 times the AEL of class 2. Although exposure somewhat above the MPE for 0.25 s in the visible and above the MPE for long term exposure in the UV and the IR-B and IR-C is possible, the risk that an injury is caused by these products is still relatively small as long as they are used in a responsible manner, i.e. as long as the exposure duration is limited to accidental short time exposure and intentional viewing and long term exposure is avoided. The background for Class 3R is the safety factor of at least 10 between the MPE and the ED-50 and additionally in the UV and IR, the exposure duration will usually be less than the time base of 100 s for the IR and 30 000 s for the UV. Nonetheless the IEC committee responsible for the development of IEC 60825-1 decided that Class 3R should not be applicable for products emitting in the UV range below 302.5 nm, as in this wavelength range the safety factor for wavelengths around 270 nm is of the order of 2-3 rather than 10.

Due to the relatively low hazard level, in terms of manufacturer's requirements, Class 3R products need not incorporate key switches or remote interlock connectors, and products which emit visible wavelengths need not have an emission warning. That is, in terms of manufacturer's requirements, visible Class 3R products are treated practically as Class 2 products, however in contrast to Class 2 and Class 1 laser products, Class 3R products needs to carry an aperture label.

Typical products which are Class 3R in the visible wavelength range are alignment lasers such as HeNe lasers and laser diodes, which are used widely in industry, science and medicine. As such these types of lasers with output powers of typically about 3 mW are used in large numbers worldwide and so far, to the knowledge of the author, no eye injuries were reported for these kind of laser and uses. The only records of eye injuries which involved these kind of laser products relate to the use of such laser outside professional use by untrained people where long term deliberate viewing of several seconds was involved, such as school kids performing experiments related to pupil constriction with a laser pointer and a man mounting a laser diode aiming device for his gun the wrong way around.

A comparison of the new Class 3R with the manufacturer's and user requirements of the previous edition of the standard shows that in practice an equivalent Class already existed, however it did not bear a dedicated name. For visible Class 3B laser products with powers less than 5 mW, exceptions to Class 3B manufacturer's and user guidelines were defined with the expression "...except for Class 3B with not more than 5 times the AEL of Class 2 in the wavelength range from 400 nm to 700 nm". In effect this constituted already a subclass of Class 3B products and it was actually called Class 3B* by IEC committee members and other laser safety experts, there was a footnote marked with * for Class 3B in which the exceptions from the requirements for products with visible laser radiation with less than 5 mW were listed. The exceptions often led to misunderstandings and confusion on the part of users or safety and health inspectors when a

product labeled as Class 3B was encountered which was not equipped with all the usual safety features such as key-switch and emission indicator, and for which, according to the user guidelines of IEC 60825-1 (1994), no eye protection was necessary (section 10.8). In this respect, at least for radiation in the visible, the Class 3R is not a new class but rather gives the existing wordy exceptions a short name and a corresponding warning label for the product - the designation "R" is supposed to indicate "reduced requirements".

It is also interesting to note that the concept behind the new Class 3R as specified by the IEC is practically identical to Class 3A as it is specified by the US ANSI Standard Z136.1. That is, in the US standard, only the "5 times" AEL was specified as AEL for class 3A, but not the requirement not to exceed the MPE for the naked eye. In this respect the US version of Class 3A was quite different from the IEC version which lead to many laser pointers on the European market being erroneously labeled as Class 3A. It is planned that in a future edition of the US standard, Class 1M and 2M is also adopted by the US standard and that the US Class 3A will be called Class 3R in order to obtain full harmonization in terms of classification.

The risk for injury from exposure to radiation from Class 3R lasers is relatively small when they are used in a responsible way by professionals for instance in the field of industry, science and medicine. In terms of user precautions, the user should be aware of a certain limited risk and of the hazardous nature of long term exposure or intentional viewing, i.e. some level of training is prudent for the user of Class 3R laser products. Generally, care should be taken not to expose the eyes to radiation from Class 3R products. Class 3R laser products should not be used by children as toys or by persons who are not aware of the hazards of such products.