

PROPOSED CHANGES TO THE IEC 60825-1 LASER SAFETY STANDARD

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Abstract

The IEC TC-76 committee on laser safety is currently developing a set of amendments to the IEC 60825-1 laser safety standard. This paper will briefly describe the topics that are being considered: removal of LEDs from this standard; revision of the definition of human access for better consistency with real hazards; revision of measurement criteria to increase the distance used for classification of diverging beams; simplification of measurement criteria for small sources; and application of more stringent measurement criteria for extended sources to assure that products are classified at the most hazardous position.

Other proposals include additions to the user manual, simplification of labels, revision of some engineering control measures, and revision and addition of definitions. Also, the amendment would formally remove the user requirements from the 60825-1 standard, due to the publication of updated recommendations for user safety in IEC 60825-14 last year.

After consensus is reached on the amendment within the committee, it must undergo a two-stage voting process. And thus any revisions would not likely be in effect until 2006 or 2007.

Introduction

This paper briefly describes the more significant changes that are being proposed to amend the 2001 version of the IEC 60825-1 laser safety standard [1]. They are being considered to make the document more useful and to more accurately reflect the current thinking in the laser safety community.

First – a caveat

The changes described below are proposals in an early draft as of December 2004. They will be reviewed and discussed at several meetings of the responsible IEC TC-76 working groups, and then they must be moved through a two-stage voting

process by member nations of the full TC-76 committee. Thus some of these proposals may be significantly revised (or even deleted) before the updated standard is approved and published, likely in late 2006 or 2007.

Draft Proposed Changes

Document Simplification

Two changes are proposed which would remove requirements from the IEC 60825-1 Standard

Removal of LEDs The proposal would eliminate the need to evaluate Light Emitting Diodes (or products that contain those components) to the requirements in IEC 60825-1. Inclusion of LED devices in the 60825-1 standard that had been written for lasers has caused significant problems, since most LEDs have optical characteristics that are more closely related to lamps. This step to remove them from the standard has been under consideration for many years.

In order to have information on LEDs available for use by developers of other IEC product safety standards, a working group within the IEC TC-76 committee is to develop and publish a separate report with guidelines for LED measurements based on lamp safety documents. Also, LEDs may still be considered in standards for specific applications: IEC 60825-2 for fiber optic communication systems [2] and IEC 60825-12 for free space optical communications [3].

Removal of the User Laser Safety Section The Proposal would remove these requirements (for other than MPEs) from the 60825-1 standard. This is being done since updated recommendations for user safety were published in 2004 in another IEC document [4]. The mention of “user’s guide” will then be deleted from the title of IEC 60825-1.

The requirements for Maximum Permissible Exposure (MPE) evaluations would be retained in the standard, with the needed revisions to be compatible with those for product classification.

Measurements for Classification

Changes to the measurement criteria for product classification are proposed so that they more closely match the current understanding of potential hazards.

Measurement Distance for Diverging Beams The proposal would revise the distance used under classification Condition 2 of Table 10 to a fixed value of 70 mm for most wavelengths. Currently, for laser diodes and other point sources, the specified distance is 14 mm for Classes 1, 2, 3R, and 3B. This change will allow outputs for Class 1 to be 50% of the Class 1M levels for many laser diodes and other products with diverging beams. It will also allow much higher power levels for diverging beam products in other classes.

Measurement of Point Sources The proposal would clarify for apparent sources that subtend an angle of <1.5 mrad, measurements can be made at 10 cm from fixed locations noted in the document. The locations specified in the draft include: the emitting chip of a laser diode, the tip of an optical fiber, the outer lens surface of a line generator, and the rotation axis of a scanner.

Measurement of Extended Sources Under the proposal, the measurement location for determining the class of apparent sources subtending an angle of >1.5 mrad would no longer be at a fixed distance from that source, but it must be at the Most Hazardous Position (MHP). The MHP is to be determined by an analysis that considers beam parameters as well as the accommodation of the eye. Thus, if one wishes to take advantage of the larger spot size on the retina (C6 correction factor) in order to increase the allowable emitted power level, a more complex analysis than in the current standard would be needed.

Beams Containing Both Visible and IR Energy The current standard does not clearly indicate what time period would apply for classifying IR energy under Classes 2, 2M, and 3R for such mixed-wavelength products. The proposal clarifies that if a product emits a beam with both visible and IR energy, these class limits can be evaluated at 0.25 s even for the IR wavelengths.

Outputs with Varying Pulse Widths or Durations For products that emit a pulsed or scanning beam in which the measured pulses do not have constant parameters, the revision proposed for the repetitive pulse requirement specifies that the pulse trains be evaluated using the Total On-Time Pulse (TOTP) approach. That is, the total on-time is calculated and

the output is compared to the class limit for that duration.

Definitions

Requirements for Classification Under the proposal, classification must consider any procedure that the operator can perform without the use of tools or without defeating of an interlock, even if that procedure is specifically prohibited in the manual. If approved, this requirement could impact classification of many products, (e.g. instruments with microscopes that have exchangeable objectives or instruments that have fibre optic connectors).

Human Access Definition The proposal would allow larger cracks in the housing for laser energy inside that is below Class 3B. This will facilitate the use of vents and permit small openings for housings in which there is no hazard to the skin and no exposure of an eye. Another change would require that energy inside a walk-in enclosure be considered accessible if it is not blocked by automatic detection system.

Engineering Controls

Additional control features on products would be required under some of the amendment proposals.

Walk-in Work Stations For products of such a size that entry by persons into the housing is intended or reasonably foreseeable, the proposal would require a detection system to ensure that emission above the class of the product is not possible when a person is inside. Thus, if this change is approved, one could not have a Class 1 product with a low power alignment laser accessible inside. The wording in the draft will likely require revision, since it is difficult to envision how service could be performed on a Class 1 product with a walk-in enclosure.

Override of Interlocks The proposal would specify that a product must require a removable key or password in order to defeat housing interlocks. If approved, this would necessitate redesign of a large number of laser products that are currently being sold.

Manual Reset Feature The proposal would specify that Class 4 products require a manual intervention in order to allow the resumption of laser emission after the remote interlock connector is actuated. This feature has been required by the U.S. CDRH regulations for many years, so its inclusion in the IEC standard is not expected to have a major impact on manufacturers.

Other Changes

Other changes considered for the draft include: alternate wording options for some labels and warnings; additional warnings in manuals; relaxed requirements on scanning safeguards where an exposure is unlikely; clarification of the need for single fault evaluation of housings for Class 4 energy inside; added criteria for Class 1M and 2M beams that could create a skin hazard; deletion of the need for measurements per Condition 2 at wavelengths longer than 1400 nm; and clarification of other requirements.

References

- [1] IEC 60825-1/A2:2001, Safety of Laser Products - Part 1: Equipment classification, requirements, and user's guide, International Electrotechnical Commission, Geneva, Amendment 2, 2001
- [2] IEC 60825-2, Ed.3, Safety of Laser Products - Part 2: Safety of Optical Fibre Communication Systems (OFCS), International Electrotechnical Commission, Geneva, Edition 3, June 2004.
- [3] IEC 60825-12, Safety of Laser Products - Part 12: Safety of Free Space Optical Communication Systems Used for the Transmission of Information, International Electrotechnical Commission, Geneva, February 2004.
- [4] IEC TR60825-14, Safety of Laser Products - Part 14: A User's Guide, International Electrotechnical Commission, Geneva, February 2004.

Meet the Author

Robert Weiner is president of Weiner Associates, a consulting firm that specializes in laser safety regulations. Since 1976 he has assisted more than 650 companies with the CDRH, ANSI, states', and IEC/EN laser safety requirements. He is the assistant chief US delegate to the IEC TC-76 committee on laser safety and an active member of the working groups that amend the 60825-1 document, and he serves on the ANSI Z136 and the LIA Laser Safety Committees. He earned BSME, MSEE, and MBA degrees, and he is a registered Professional Engineer and a Senior Member of the LIA.