STRATEGIC BUSINESS PLAN (SBP)

IEC/TC or SC	Secretariat	Date
76	USA	August 2013

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Title of TC
OPTICAL RADIATION SAFETY AND LASER EQUIPMENT

A Background

First Meeting: June 1974

Scope:

To prepare international standards for equipment (including systems) incorporating lasers (and light emitting diodes) or intended only for use with lasers, including those factors introduced by the use of lasers which are needed to characterize equipment and/or which are essential to safe use. The scope includes the preparation of standards applying limits as determined by organizations such as ICNIRP and CIE, to human exposure to optical radiation (100 nm to 1 mm) from artificial sources..

Responsibilities: Safety Group Function for "Aspects pertaining to human safety relating to the use of lasers"

B Business Environment

B.1 General

Historically, TC 76 has been working in the domain of laser, LED and other optical radiation safety of equipment and is recognized as the leading body on laser standardization in this technical area. It also provides guidance to other TCs preparing vertical standards for products containing optical radiation sources. With the growth in interest shown by individual nations and nations with unified interest like the European Community, the need for standardization has accelerated. This is especially true in the field of lasers, and as a consequence a number of standardization bodies are now involved. This calls for a continued revision of our activities, which includes coordination and close cooperation with a number of other committees, as well as unification of work at various levels within the standardization organizations. It is anticipated that laser technology will continue its rapid growth as a number of application fields are growing in society. Areas where laser radiation sources will play a major role are the following: surgical and medical therapeutic and diagnostic means, including cosmetic uses; materials processing in industry; optical communications, general and local networks; office machines; measurement systems for use in a variety of environments; laser light shows and displays and full colour TV LED and laser displays; and consumer equipment such as CD/DVD players/recorders and home improvement aids.

These trends imply a growth of widely different laser devices ranging from high power lasers for industrial, medical, and research applications to low power laser components for information technology type applications. Particularly noticeable is the increase in numbers of semiconductor lasers, which constitute inexpensive components for a wide variety of applications such as sensors, measuring devices, and optical transmitters. The laser radiation used in these applications is in many cases transmitted through optical fibres. In addition to these mostly low power semiconductor laser applications, there is an increasing practice to transmit high power laser radiation through optical fibres. Such is the case with regard to the use of Nd:YAG lasers in medical and cosmetic applications as well as in materials processing. In the latter field the availability of high power multi kW diodes and arrays, and the increased use of robots present particular safety problems. Additionally there is an increased use in the transmission of IR radiation in "free space." Such is the case in communications between computers, modems, etc., both within the same room as well as inter-building transmissions. There is also an increasing use of military laser devices and systems, e.g. for targeting, reconnaissance, and optical radiation weapons. The increase in terrorism can lead to the use of additional laser devices. Some possibilities are intercepting missiles and enhanced security detection systems. A very recent safety concern has arisen with the general public's (especially children's) ability to obtain laser pens/pointers. The use of lasers in the chemical processing industry is another growth candidate. Laser

technology is continuing to develop with traditional large and energy inefficient laser equipment being replaced with physically smaller devices delivering high laser powers, usually at lower cost. This is providing opportunities for lasers to be used in a wide range of new applications and also for laser technology to transfer from the workplace to the home.

Non-laser optical sources and their applications are also developing at a rapid pace. These include the use of LED arrays to replace incandescent and fluorescent lighting, and the use of multi-coloured LEDs in public displays, such as sports scoreboards. Application of incoherent intense pulsed light sources (IPLS) on humans is increasing, causing hazards which are similar to those of the laser. Other non-laser optical sources continue to develop and employers are increasingly required to assess the risk to their workers and others. By providing standards and guidance for manufacturers of these devices it will reduce the need for practical assessments to be carried out by users. The standards developed by TC 76 not only respond to workplace needs, but also to the safety of the general public as innovative sources of light and other optical radiation proliferate.

B.2 Market demand

Customers of standards and reports developed:

- Manufacturers of Laser and Non-Laser Optical Products
- Users of Laser and Non-Laser Optical Products
- Third Party Conformance Assessment Certifiers
- Health & Safety Organizations, including Government Agencies
- Laser and General Safety Consultants
- Other ISO/IEC Technical Committees

Representatives from these groups, which provide complete coverage of interested and affected parties, are active participants. These parties are very willing participants, except for the occasional funding problems that arise. The IEC standards are widely used at all levels, albeit somewhat modified to conform to local conditions. Recently our base standard has experienced a number of revisions. This lack of stability has limited the use of this standard to some extent. TC 76 recognizes this problem and is addressing it. Since laser and solid-state non-laser technologies are still emerging there are occasional problems with other standard organizations regarding the delineation of responsibilities. These are being handled satisfactorily through liaison. The delineation of responsibilities for specific product vertical standards are the most difficult to resolve.

B.3 Trends in technology

All these different types of laser sources and applications require a need for basic and product safety standards. This is reflected in the tasks given to the Committee with the assignment of a Safety Group Function for "Aspects pertaining to human safety relating to the use of lasers and products containing non-laser optical radiation sources." In addition to developing standards covering the basics of safety with laser equipment, TC 76 is also working on the safe use of lasers in various fields of applications, e.g., medicine and cosmetic. The Committee also deals with some aspects of radiation safety as pertaining to the public, e.g., laser light shows and displays. Of considerable importance in this regard is the potential for visual impairment of airline pilots, vehicular operators, etc. An important task is to develop and recommend measurement methods necessary for the application of the laser safety requirements for classification and consideration of permissible radiation exposures.

The need has arisen for the development of similar safety requirements for products that involve non-laser sources of radiation in the optical spectrum. The first activity in this area was to include light emitting diodes (LEDs) in the scope of TC 76. This was because some LEDs could be used interchangeably with laser diodes in some applications where the potential hazards may be equivalent for the same power and wavelength, regardless of the origin of the optical radiation. Because the treatment of LEDs as lasers resulted in exaggerated classification of their hazards, TC 76 published IEC 62471 as a joint IEC/CIE standard that more appropriately addresses LEDs in most applications. Another activity in this area is to establish a standard for intense lights used to expose humans or animals to produce a photobiological effect for medical or cosmetic purpose, and to prescribe risk-based engineering and informational controls. It was also recognised that the expertise within TC 76 may be of value to vertical committees producing standards for products containing other non-laser optical radiation sources. A technical report providing guidance has now been published as IEC 62471-2. As the world hastens to develop more electrically efficient sources of lighting, the importance of the TC 76 standards and guides grows.

B.4 Market trends

The market for products incorporating laser technology continues to grow. New application areas that are developing include the following:

1. Projectors for cinema and IT applications
   Laser projectors provide comparable performance and safety to conventional lamp illuminated projectors with much higher electrical efficiency. The laser projectors face restrictions resulting from national or local requirements that may include certification or registration of user sites and licensing/certification of operators
2. Laser excited lamps for general purpose illumination
   Demands for high efficiency lighting entails development of new technologies. Laser excited lamps offer one answer to this demand. However, the safety considerations for these types of laser products vary considerably from the types of laser products that are now used in industrial materials processing, IT and medical applications.
3. Intense Pulsed Light (IPL) and laser products treatment of the skin for medical and aesthetic purposes
   Laser products that irradiate the skin are now in commercial distribution. Many of these products cannot emit except when in contact with the intended target tissue. This necessitates the development of a new hazard classification because these products do not pose the same hazard to persons other than the person intended to be exposed. These products are being distributed for both home and clinical use.
4. High-power laser processing systems using flexible fiber-beam delivery
   High power laser processing systems using flexible fiber-beam delivery are remarkably increasing owing to the recent progress in high-power diode pumped high-brightness fiber lasers and disc lasers as well as direct diode lasers. For example, laser products with more than 10 kW average power in multimode fiber delivery and laser products with more than 1 kW average power in single-mode fiber delivery are already commercially available and industrial demands for such laser products are rapidly increasing.

B.5 Ecological environment

Laser and LED products are continuing to make a considerable impact on environmental issues. The development of email and Internet communications, which are having a growing effect on commercial activities ("paperless society", "virtual conferencing", etc.) have only become possible because of the introduction of optical fibre technology using first LEDs, then lasers and developing to wave division multiplexing (WDM) and more recently dense wave division multiplexing (DWDM). New laser based technologies for IT and telecommunications purposes are expected to continue to be developed for some years. These developments have the potential to greatly reduce atmospheric pollution (reduced use of transport) and destruction of the environment (less use of paper).

Light emitting diodes are being increasingly used as light sources (traffic lights, airport beacons, indicator lamps, etc.) and it is anticipated that they will shortly replace incandescent lamps for premises. The greatly increased energy efficiency of LEDs over incandescent lights can therefore be expected to significantly reduce requirements for electric power generation.

C System approach aspects

Component committees (IEC TC 76 as customer)

- IEC TC 1: Terminology
- IEC SC 17B: Low-voltage switchgear and controlgear
- IEC SC 65A: System aspects
- IEC TC 66: Safety of measuring, control and laboratory equipment

System committees (IEC TC 76 as supplier)

- IEC TC 18: Electrical installation of ships and of mobile and fixed offshore units
- IEC TC 31: Equipment for explosive atmospheres
- IEC TC 44: Safety of machinery – Electrotechnical aspects
- IEC TC 61: Safety of household and similar electrical appliances
- IEC SC 62A: Common aspects of electrical equipment used in medical practice
- IEC TC 66: Safety of measuring, control and laboratory equipment
- IEC TC 86 and SCs: Fibre optics
- IEC TC 95: Measuring relays and protection equipment
- IEC TC 100: Audio, video and multimedia systems and equipment
- ISO/IEC JTC 1/SC 25: Interconnection of information technology equipment

D Objectives and strategies (3 to 5 years)

Keep TC 76 standards and technical reports up to date responding to developments to technologies and applications without imposing undue burdens on the manufacturers. Such burdens are potential obstacles to trade and would put laser products at competitive disadvantage compared to products using other technologies that may pose equal or greater hazards or risks.

Respond to needs for improved and new standards in a timely manner, by further reducing the cost and the time to publication.

Increase awareness of TC 76 publications.

E Action plan

Revisions of existing standards are underway and include the following:

IEC 60825-1:	Safety of laser products - Part 1: Equipment classification and requirements
IEC 60601-2-22:	Medical electrical equipment - Part 2-22: Particular requirements for basic safety and essential performance of surgical, cosmetic, therapeutic and diagnostic laser equipment
IEC 60825-12:	Safety of laser products - Part 12: Safety of free space optical communication systems used for transmission of information
IEC 60825-17:	Safety of laser products - Part 17 Ed.2: Safety aspects for use of passive optical components and optical cables in high power optical fibre communication systems
IEC/TR 60825-14:	Safety of laser products - Part 14: A user's guide

The following publications are in the process of being developed:

IEC 62471-4:	Photobiological Safety of Lamps and Lamp Systems: Measuring Methods
IEC/TR 60825-16:	Safety of intense light source equipment - Guidelines for the safe use of intense light source equipment on humans and animals
IEC/TR 62471-3:	Safety of intense pulsed light source equipment - Guidelines for the safe use of intense pulsed light source equipment on humans
ISO 11553-3:	Safety of Machinery - Laser processing machines - Part 3: Safety methods for laser processing machines and hand held laser processing devices and associated auxiliary equipment (Accuracy grades 2)

F Useful links to IEC web site

TC 76 dashboard giving access to Membership, TC/SC Officers, Scope, Liaisons, WG/MT/PT structure, Publications issued along with their Stability Dates, Work Programme and similar information for SCs, if any.

Name or signature of the secretary

William J. Ertle