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LASER SAFETY

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STANDARDS ASSOCIATION OF AUSTRALIA
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Australian Atomic Energy Commission

Confederation of Australian Industry

Department of Defence

Departments of Health

Department of Productivity

Department of Industrial Relations, N.S.W.

Department of Labour and Industry, Vic.

Department of Labour Relations, Qld.

Health Commission of New South Wales

Health Commission of Victoria

Melbourne and Metropolitan Board of Works

Metropolitan Water Sewerage and Drainage Board, Sydney

Royal Australian College of Ophthalmologists

Safety Institute of Australia

This standard, prepared by Committee SF/19, Personal Protection Against Laser Radiation, was approved on behalf of the Council of the Standards Association of Australia on 2 March 1981, and was published on 1 May 1981.

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AUSTRALIAN STANDARD

LASER SAFETY

AS 2211—1981

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PREFACE

This edition of the standard was prepared by the Association's Committee on Personal Protection Against Laser Radiation, under the supervision of the Safety Standards Board.

The standard includes requirements for users and for manufacturers of laser products, and details procedures and requirements designed to protect persons from laser radiation by —

(a) indication of safe working levels of optical radiation; and

(b) classification of lasers and laser products according to their degree of hazard.

The requirements of the standard are intended to—

(i) ensure adequate warning of hazards from laser products by means of signs, labels and instructions;

(ii) reduce the possibility of injury by the minimizing of unnecessary accessible radiation;

(iii) give improved control of the radiation through the incorporation of protective features; and

(iv) provide safe usage of laser products by the specifying of operator control measures.

The system of classification provides five main classes of laser products and laser installations and is based on the maximum accessible emission limits (AEL) of the laser product and on the hazard potential related to the maximum permissible exposure level (MPE). The MPE level represents the maximum level to which the eye or skin can be exposed without consequential injury and is related to the wavelength of the radiation, the pulse duration or exposure time, the tissue at risk and, for visible and near visible radiation, the size of the retinal image.

This edition of the standard includes technical and editorial amendments which were identified as necessary during the application of the 1978 edition. These include the following:

- Clarification of limits in Table 4.2, particularly the alternative limits applicable to Class 1 lasers.
- Deletion of Class 2 limit for demonstration laser products, provided that precautions are taken (e.g. physical barriers) to ensure that any accessible radiation is limited to the MPE.
- Corrected graphical presentation of MPE for viewing (Figs A2 and A3).
- A new Appendix listing those deviations from the standard necessary for its application by the Department of Defence.

Some other editorial updating has been carried out.

It is anticipated that requirements for eye protectors, currently being developed by ISO*/TC 94, will eventually be included either in this standard or in another standard related to AS 1337, Industrial Eye Protectors.

To assist in the ready identification and understanding of the requirements appropriate to a particular class and/or application of lasers, a schematic user's guide is shown on the opposite page.

Attention is also drawn to the supplementary standard AS 2397, Guide to the Safe Use of Lasers in the Construction Industry, which was prepared as a concise reference appropriate for the use of those visible light lasers used for alignment, levelling, control and survey tasks in the construction industry. It should be noted that while AS 2211 is applicable to all lasers, AS 2397 specifies additional or more stringent requirements considered necessary for those lasers used in the construction industry.

During preparation of this standard, consideration was given to the work currently being undertaken within IEC†/TC 76 and ANSI‡. The classification and safety requirements are generally compatible with those developed by ANSI and under consideration by IEC. However, proposals recently introduced in IEC/TC 76 for extension of limits for Class 3A lasers are not acceptable to the Australian National Committee, which is currently arguing these matters in the IEC Committee.

This standard may require reference to AS 1894, Code of Practice for the Safe Handling of Cryogenic Fluids.

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* ISO = International Organization for Standardization.

† IEC = International Electrotechnical Commission.

‡ ANSI = American National Standards Institute.

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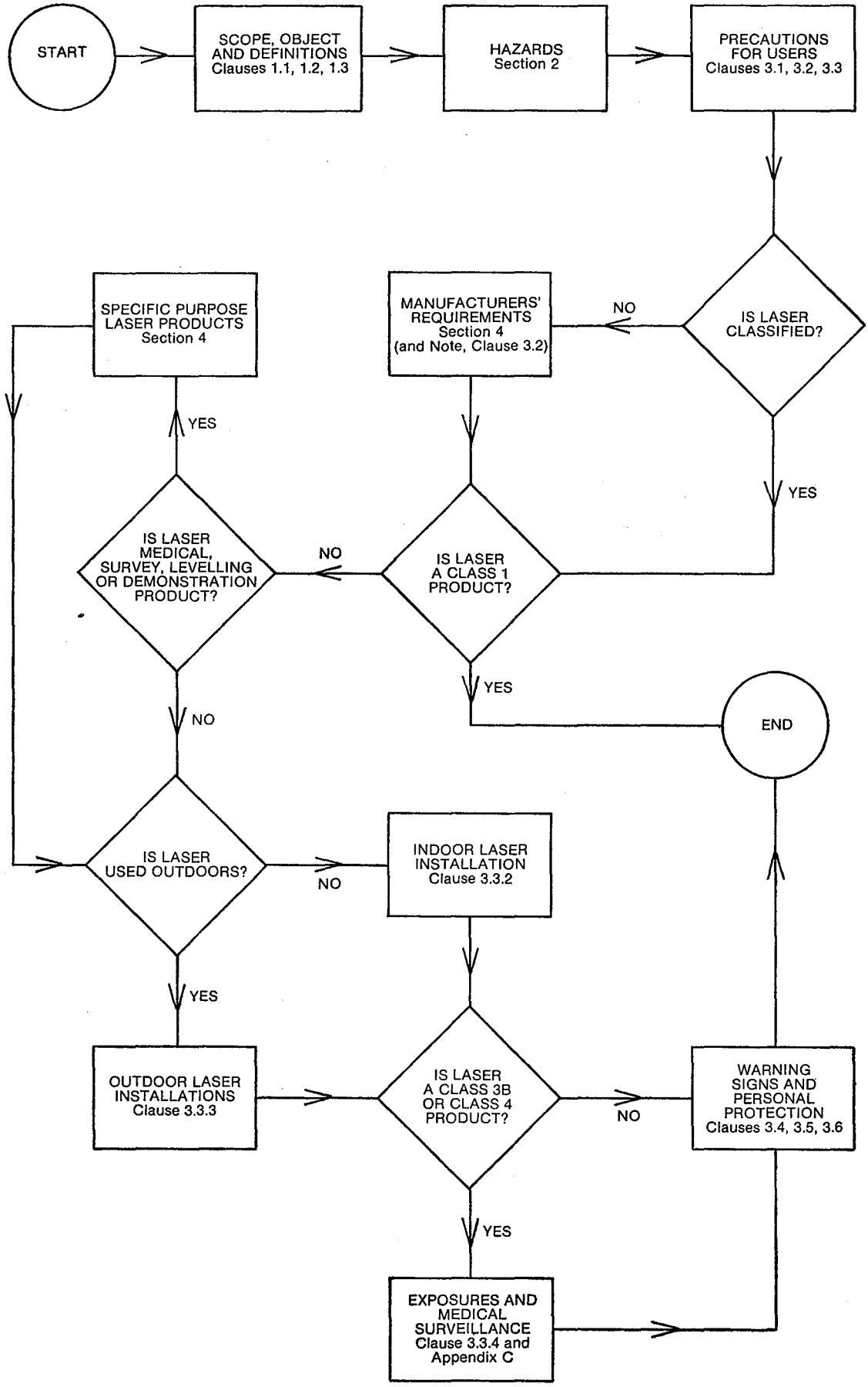
USER'S GUIDE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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
LASER SAFETY

SECTION 1. SCOPE AND DEFINITIONS

1.1 SCOPE. This standard details procedures to protect persons from laser radiation in the wavelength range 100 nm to 1 mm by—

(a) indication of safe working levels of optical radiation; and

(b) classification of lasers and laser products according to their degree of hazard.

The standard also sets out the requirements of both the user and the manufacturer in the establishing of procedures and the supplying of information so that proper precautions can be adopted.

Laser products intended for sale to other manufacturers for use as components of any equipment for subsequent sale are not covered by this standard, since the final product will itself be subject to this standard (see Note).

NOTE: A laser product may consist of a single laser with or without a power supply or may incorporate one or more lasers in a complex optical electrical or mechanical system. Typically, laser products are used for demonstration of physical and optical properties and transfer of energy to material, cutting and drilling, metrology, and the reading, storage, transmission and display of information, etc. Such systems have found use in industry, construction, surveying, business, entertainment, research, education and medicine.

1.2 OBJECT. This standard is intended to ensure adequate warning to individuals, by means of signs, labels and instructions, of hazards associated with accessible radiation from laser products. It is also intended to—

(a) reduce the possibility of injury by minimizing unnecessary accessible radiation;

(b) give improved control of the radiation through protective features; and

(c) provide safe usage of laser products by specifying operator control measures.

A system of classification provides five main classes of laser products and laser installations based on the maximum accessible emission limits (AEL) of the laser product and on the hazard potential related to the maximum permissible exposure level (MPE). The MPE level represents the maximum level to which the eye or skin can be exposed without consequential injury and is related to the wavelength of the radiation, the pulse duration or exposure time, the tissue at risk and, for visible and near visible radiation, the size of the retinal image.

It is the responsibility of the manufacturer or his agent to provide the correct classification of a laser product or installation on the basis of the AEL (see Section 4).

The MPE levels are specified in Appendix A and Section 3 lists the precautions necessary to ensure that personnel are not exposed to radiation in excess of such levels.

1.3 DEFINITIONS. For the purpose of this standard, the following definitions apply:

1.3.1 Accessible emission level — the magnitude of emission from a laser product of laser radiation of a wavelength and emission duration to which human access is possible.

1.3.2 Accessible emission limit (AEL) — the maximum accessible emission level permitted within a particular class.

1.3.3 Apparent visual angle — the angle subtended by the source as calculated from the source size and distance from the eye. It is not the beam divergence of the source.

1.3.4 Attenuation — the decrease in the radiant flux as it passes through an absorbing or scattering medium.

1.3.5 Beam — a collection of rays which may be parallel, divergent or convergent.

1.3.6 Beam diameter (a) — the distance between diametrically opposed points in that cross-section of a beam where the power per unit area is $1/e$ times that of the peak power per unit area.

1.3.7 Beam divergence (ϕ) — the full angle of the beam spread between diametrically opposed $1/e$ irradiance points. (Unit: rad.)

1.3.8 Beam expander — a combination of optical elements which will increase the diameter of a laser beam.

1.3.9 Class 1 laser product — a laser product which does not permit human access to laser radiation in excess of the accessible emission limits shown in Table 4.2.

1.3.10 Class 2 laser product —a laser product which permits human access to laser radiation in excess of the accessible emission limits shown at Table 4.2, but not in excess of those shown in Table 4.3.

1.3.11 Class 3A laser product — a laser product which permits human access to visible laser radiation in excess of the accessible emission limits shown in Table 4.3, but not in excess of those shown in Table 4.4.

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