

Australian Standard 2211—1978

LASER SAFETY

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STANDARDS ASSOCIATION OF AUSTRALIA

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THE FOLLOWING SCIENTIFIC, INDUSTRIAL AND GOVERNMENTAL ORGANIZATIONS and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Atomic Energy Commission
Australian College of Ophthalmologists
Confederation of Australian Industry
Department of Defence
Departments of Health
Department of Labour Relations
Department of Productivity
Departments of Labour and Industry
Health Commission of N.S.W.
Melbourne and Metropolitan Board of Works
Metropolitan Water Sewerage and Drainage Board, Sydney
Safety Institute of Australia

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To keep abreast of progress in industry, Australian standards are regularly reviewed. Suggestions for improvements to published standards, addressed to the head office of the Association, are welcomed.

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AUSTRALIAN STANDARD

**CODE OF PRACTICE FOR
LASER SAFETY**

AS 2211-1978

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PREFACE

This standard was prepared by the Association's Committee on Personal Protection Against Laser Radiation, under the authority 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.

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.

During preparation of this standard, consideration was given to the work currently being undertaken within IEC†/TC 76 and ANSI‡. The classification requirements are identical with those of the IEC whilst the remaining requirements of the standard are in general agreement with those being developed by IEC.

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

* ISO = International Organization for Standardization.

† IEC = International Electrotechnical Commission.

‡ ANSI = American National Standards Institute.

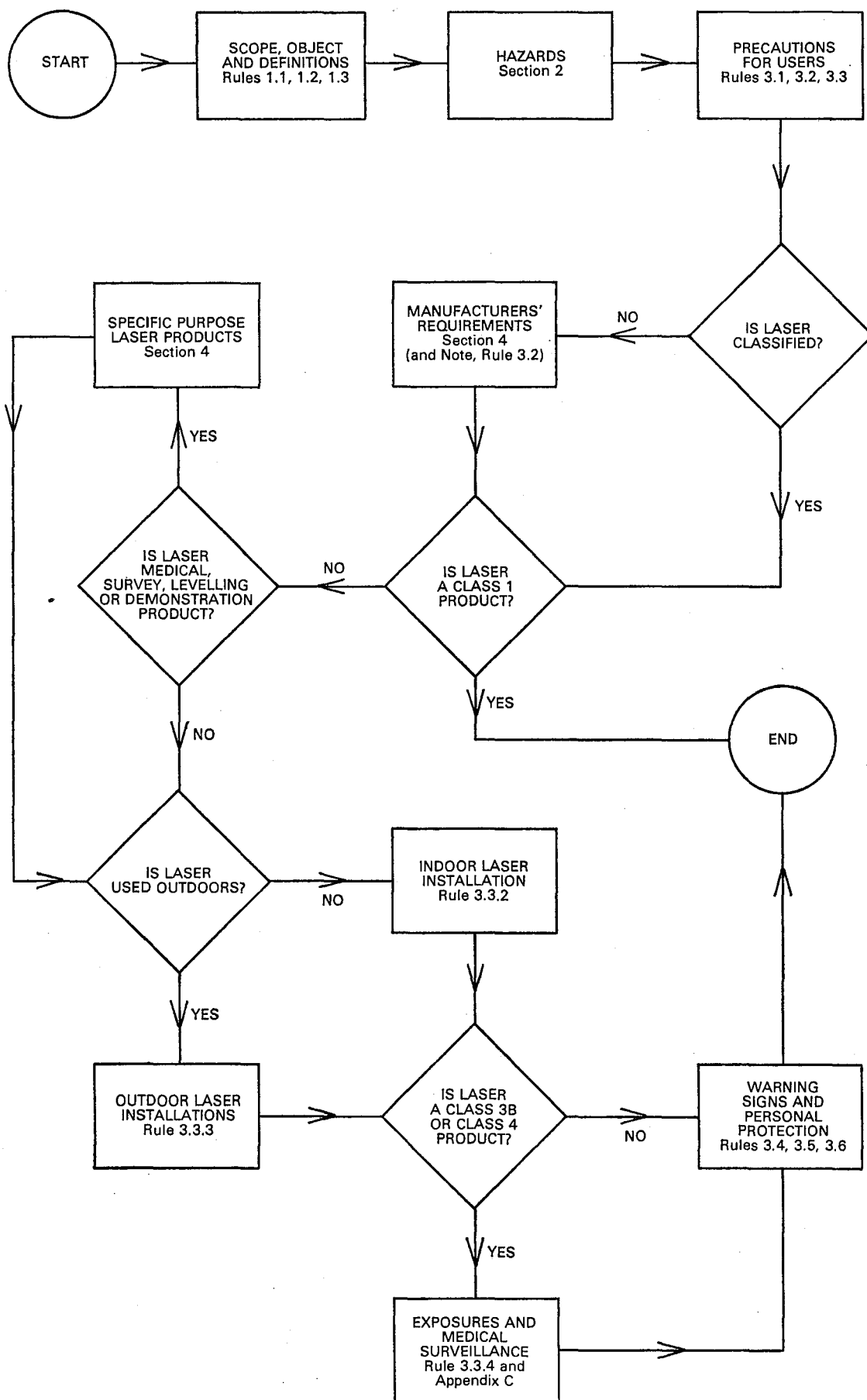
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USER'S GUIDE



STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
CODE OF PRACTICE
FOR
LASER SAFETY

SECTION 1. SCOPE AND DEFINITIONS

1.1 SCOPE. This code 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 code 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 code, since the final product will itself be subject to this code (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 code 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 code, 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.