

Australian Standard®

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**Laser safety**

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This Australian Standard was prepared by Committee SF/19, Personal Protection Against Laser Radiation. It was approved on behalf of the Council of Standards Australia on 12 June 1991 and published on 16 September 1991.

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The following interests are represented on Committee SF/19:

Australian Dental Association  
Australian Laser Institute  
Australian Nuclear Science & Technology Organisation  
Australian Radiation Laboratory  
Australian Small Business Association  
Confederation of Australian Industry  
Department of Defence (Commonwealth)  
Department of Health, New South Wales  
Department of Health, Queensland  
Department of Industrial Affairs, Queensland  
Department of Industrial Relations & Employment, New South Wales  
Department of Labour, Victoria  
Health Department, Victoria  
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*This Standard was issued in draft form for comment as DR 89051.*

# Australian Standard<sup>®</sup>

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## Laser safety

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First published as AS 2211—1978.  
Second edition 1981  
Third edition 1991.

## PREFACE

This Standard was prepared by the Standards Australia Committee on Personal Protection Against Laser Radiation, to supersede AS 2211—1981, *Code of practice for laser safety*.

This edition of the Standard has been substantially rearranged to align closely, in technical content and format, with IEC Publication 825, *Radiation safety of laser products, equipment classification, requirements and user's guide*, as amended by the six months' rule document 76(Central Office)15. This alignment has been possible because—

- (a) the amendments in 76(Central Office)15 and the subsequent further decisions taken by IEC TC 76 satisfy many of the Australian objections to IEC Publication 825—1984, and
- (b) the Committee believes that alignment with the International Standard will more readily facilitate comparison of the respective requirements for testing and approvals purposes, as well as import and export activities.

This edition also provides for low powered lasers used for survey and alignment tasks in the building and construction industry to be classified as 3B (Restricted) lasers. Although IEC 825 as amended by 76(Central Office)15 does not clearly identify such a classification, it provides identical technical requirements for the manufacture and testing of such lasers, which are identified as limited power (<5 mW) 3B lasers operating in the visible wavelength range. Of particular concern during preparation of this Standard was the different approach taken by US authorities who, by removing the irradiance limit on these lasers, simply allowed them to be covered in the US Federal Regulations by the 3A classification. In determining to follow the IEC approach (in line with Standards Australia policy) the Committee expressed regret that it had not been possible to encourage a truly world-wide adoption of common classification criteria for these lasers.

Other significant technical amendments and format changes incorporated in this edition, including those resulting from the above alignment, include the following:

- (i) The textual order of the Standard has been changed to align with IEC 825.
- (ii) Text, tables and graphs are presented in the IEC format.
- (iii) Extension of the radiant power limits, for wavelengths other than the visible range, for Class 3A lasers. However, the imposition of irradiance limits for this wavelength range ensures that Maximum Permissible Exposures (MPEs) are not exceeded.
- (iv) The limiting aperture for Accessible Emission Limits (AELs) from 1400 nm to 10<sup>5</sup> nm and exposure times greater than 0.25 s has been changed to 3 mm and the AELs have been modified accordingly.
- (v) Revised medical surveillance specifications.
- (vi) Extended examples of calculations.

Attention is also drawn to the supplementary Standard AS 2397—1980, *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 although 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. It should also be noted that AS 2397 is currently under revision.

Attention is also drawn to specialist software, available through Standards Australia, which assists to readily identify relevant limits and to undertake calculations of the sort listed in Appendix A.

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## CONTENTS

	<i>Page</i>
FOREWORD .....	4
SECTION 1 GENERAL	
1 SCOPE .....	5
2 OBJECT AND REFERENCED DOCUMENTS .....	5
3 DEFINITIONS .....	5
SECTION 2 MANUFACTURING REQUIREMENTS	
4 ENGINEERING SPECIFICATIONS .....	10
5 LABELLING .....	11
6 OTHER INFORMATION REQUIRED .....	13
7 ADDITIONAL REQUIREMENTS FOR SPECIFIC LASER PRODUCTS .....	13
8 TESTS .....	14
9 CLASSIFICATION .....	15
SECTION 3 USER REQUIREMENTS	
10 SAFETY PRECAUTIONS .....	22
11 HAZARDS INCIDENTAL TO LASER OPERATION .....	25
12 PROCEDURES FOR HAZARD CONTROL .....	26
13 MAXIMUM PERMISSIBLE EXPOSURES (MPEs) .....	28
APPENDICES	
A EXAMPLES OF CALCULATIONS .....	44
B MEDICAL CONSIDERATIONS .....	55
C BIBLIOGRAPHY .....	62
D SUMMARY TABLES .....	63
E EYE EXAMINATION AT COMMENCEMENT AND TERMINATION OF EMPLOYMENT OF LASER WORKERS USING CLASS 3B OR CLASS 4 LASERS .....	66
F ADVISORY AUTHORITIES .....	68

## FOREWORD

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

- (a) indication of safe working levels for optical radiation; and
- (b) classification of lasers and laser products according to their degree of hazard.

The requirements of the Standard are designed 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 minimization 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 specification 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 (AELs) of the laser product and on the hazard potential related to the maximum permissible exposure (MPE) level. 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.

# STANDARDS AUSTRALIA

## Australian Standard Laser safety

### SECTION 1 GENERAL

**1 SCOPE** This Standard details requirements necessary to protect persons from radiation from laser products. For convenience, this Standard has been divided into three sections: Section 1 (General) and the appendices (of interest to all concerned); Section 2 (Manufacturing requirements); and Section 3 (Requirements for users).

The requirements for electrical safety are not covered in this Standard, such requirements being detailed in AS 3100 and IEC Publication 820.

The MPE (maximum permissible exposure) levels listed in this Standard were developed for laser radiation and do not apply to collateral radiation. These MPE levels are not applicable to patient exposure to laser radiation for the purpose of medical treatment.

#### NOTES:

- 1 A laser product may consist of a single laser, with or without a separate 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 phenomena; material processing; data reading and storage; transmission and display of information. Such systems have found use in industry, business, entertainment, research, education and medicine. However, laser products which are sold to other manufacturers for use as components of any system for subsequent sale are not subject to this Standard, since the final product will itself be subject to this Standard.
- 2 Appendices A to D have been included for the purpose of general guidance and to illustrate many typical cases. However, the appendices must not be regarded as definitive or exhaustive and reference should always be made to the appropriate clauses in Sections 1 to 3.
- 3 Collateral radiation may, if additive with the laser radiation, increase the hazard.

## 2 OBJECT AND REFERENCED DOCUMENTS

**2.1 Object** The object of this Standard is as follows:

- (a) To protect persons from laser radiation in the wavelength range 100 nm to 1 mm\* by indicating safe working levels of laser radiation and by introducing a system of classification of lasers and laser products according to their degree of hazard.
- (b) To lay down requirements for both user and manufacturer to establish procedures and supply information so that proper precautions can be adopted.
- (c) To ensure adequate warning to individuals of hazards associated with accessible radiation from laser products through signs, labels and instructions.
- (d) To reduce the possibility of injury by minimizing unnecessary accessible radiation, and to give improved control of the laser radiation through protective features and provide safe usage of laser products by specifying user control measures.

**2.2 Referenced documents** The following documents are referred to in this Standard:

AS

1337 Eye protectors for industrial applications

1894 Code of practice for the safe handling of cryogenic fluids

2397 Guide to the safe use of lasers in the construction industry

3100 Approval and test specification—General requirements for electrical equipment

IEC

820 Electrical safety of laser products

825 Radiation safety of laser products, equipment classification, requirements and user's guide

**3 DEFINITIONS** For the purposes of this Standard, the definitions listed below apply. The order of definitions has been arranged to align with IEC Publication 825, with additional definitions required by this Standard being listed last.

**3.1 Access panel**—a part of the protective housing or enclosure which provides access to laser radiation when removed or displaced.

**3.2 Accessible emission limit (AEL)**—the maximum accessible emission level permitted for a particular class of laser product.

**3.3 Administrative control**—safety measures of a non-engineering type such as key supervision, safety training of personnel, warning notices, count-down procedures, and range safety controls.

\* In this Standard, the wavelength range  $\lambda_1$  to  $\lambda_2$  means  $\lambda_1 \leq \lambda < \lambda_2$  (e.g. 100 nm to 1 mm means  $100 \text{ nm} \leq \lambda < 1 \text{ mm}$ ).