

Australian/New Zealand Standard™

Safety of laser products

Part 1: Equipment classification and requirements



AS/NZS IEC 60825.1:2014

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee SF-019, Personal Protection Against Laser Radiation. It was approved on behalf of the Council of Standards Australia on 2 October 2014 and on behalf of the Council of Standards New Zealand on 3 October 2014.
This Standard was published on 12 November 2014.

The following are represented on Committee SF-019:

Australasian Faculty of Occupational and Environmental Medicine
Australian Dental Association
Australian Radiation Protection and Nuclear Safety Agency
Defence Materiel Organisation
Department of Defence, Australia
Electronics Industry Association
Institute of Environmental Science and Research
NSW Business Chamber
Royal Australian and New Zealand College of Ophthalmologists
Telecom New Zealand
Telstra Corporation

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS IEC 60825.1:2014.

Australian/New Zealand Standard™

Safety of laser products

Part 1: Equipment classification and requirements

Originated in Australia as AS 2211—1978.
Previous edition AS/NZS IEC 60825.1:2011.
Second edition 2014.

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN 978 1 74342 875 7

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee SF-019, Personal Protection Against Laser Radiation, to supersede AS/NZS IEC 60825.1:2011.

It is important to note that the designation of this Standard has changed; prior to 2011, this Standard was designated AS/NZS 2211.1:2004, *Safety of laser products, Part 1: Equipment classification, requirements and user's guide* (IEC 60825-1:2001, MOD).

Standards in the IEC 60825 series may have been adopted as either AS/NZS IEC 60825 series standards (e.g. IEC/TR 60825-14 has been adopted as AS/NZS IEC 60825.14), or AS/NZS 2211 series standards (e.g. IEC 60825-4 has been adopted as AS/NZS 2211.4).

The objectives of this Standard are as follows:

- (a) To protect people from laser radiation in the wavelength range 180 nm to 1 mm by introducing a system of classification of lasers and laser products according to their degree of optical radiation hazard.
- (b) To specify requirements for the manufacturer to supply information so that proper precautions can be adopted.
- (c) To ensure adequate warnings are provided to individuals of hazards associated with accessible radiation from laser products through the use of labels and instructions.
- (d) To reduce the possibility of injury by minimizing unnecessary accessible radiation and to give improved control of the laser radiation hazards through protective features.

This Standard is identical with, and has been reproduced from, IEC 60825-1, Ed. 3.0 (2014), *Safety of laser products, Part 1: Equipment classification and requirements*.

This Standard adopts the 2013 maximum permissible exposure (MPE) limits published by the International Commission on Non-Ionizing Radiation Protection. The MPE limits in Annex A of this Standard are more recent than the MPE limits in other earlier standards in this series, and may be used in preference.

As this Standard is reproduced from an International Standard, the following applies:

- (i) In the source text 'this part of IEC 60825' should read 'this Australian/New Zealand Standard.'
- (ii) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian/New Zealand Standards, as follows:

<i>Reference to International Standard</i>	<i>Australian/New Zealand Standard</i>
IEC	AS/NZS IEC
62471 Photobiological safety of lamps and lamp systems (all parts)	62471 Photobiological safety of lamps and lamp systems (series)

Only normative references that have been adopted as Australian or Australian/New Zealand Standard have been listed.

The term 'informative' has been used in this Standard to define the application of the annex to which it applies. An 'informative' annex is only for information and guidance.

CONTENTS

	<i>Page</i>
1 Scope and object.....	8
2 Normative references	10
3 Terms and definitions	10
4 Classification principles	24
4.1 General.....	24
4.2 Classification responsibilities	24
4.3 Classification rules.....	24
4.4 Laser products designed to function as conventional lamps	29
5 Determination of the accessible emission level and product classification.....	29
5.1 Tests	29
5.2 Measurement of laser radiation	30
5.3 Determination of the class of the laser product.....	31
5.4 Measurement geometry.....	40
5.4.1 General	40
5.4.2 Default (simplified) evaluation.....	41
5.4.3 Evaluation condition for extended sources	42
6 Engineering specifications	44
6.1 General remarks and modifications	44
6.2 Protective housing	44
6.2.1 General	44
6.2.2 Service	45
6.2.3 Removable laser system.....	45
6.3 Access panels and safety interlocks.....	45
6.4 Remote interlock connector.....	46
6.5 Manual reset.....	46
6.6 Key control	46
6.7 Laser radiation emission warning	47
6.8 Beam stop or attenuator.....	47
6.9 Controls.....	47
6.10 Viewing optics.....	47
6.11 Scanning safeguard	47
6.12 Safeguard for Class 1C products	48
6.13 "Walk-in" access	48
6.14 Environmental conditions	48
6.15 Protection against other hazards.....	48
6.15.1 Non-optical hazards.....	48
6.15.2 Collateral radiation	49
6.16 Power limiting circuit.....	49
7 Labelling.....	49
7.1 General.....	49
7.2 Class 1 and Class 1M	51
7.3 Class 1C	52
7.4 Class 2 and Class 2M	53
7.5 Class 3R.....	53
7.6 Class 3B	54

	<i>Page</i>
7.7	Class 4 54
7.8	Aperture label 55
7.9	Radiation output and standards information 55
7.10	Labels for access panels 56
	7.10.1 Labels for panels 56
	7.10.2 Labels for safety interlocked panels 57
7.11	Warning for invisible laser radiation 57
7.12	Warning for visible laser radiation 57
7.13	Warning for potential hazard to the skin or anterior parts of the eye 57
8	Other informational requirements 58
	8.1 Information for the user 58
	8.2 Purchasing and servicing information 59
9	Additional requirements for specific laser products 60
	9.1 Other parts of the standard series IEC 60825 60
	9.2 Medical laser products 60
	9.3 Laser processing machines 60
	9.4 Electric toys 60
	9.5 Consumer electronic products 60
	Annex A (informative) Maximum permissible exposure values 61
	A.1 General remarks 61
	A.2 Limiting apertures 66
	A.3 Repetitively pulsed or modulated lasers 67
	A.4 Measurement conditions 68
	A.4.1 General 68
	A.4.2 Limiting aperture 68
	A.4.3 Angle of acceptance 68
	A.5 Extended source lasers 69
	Annex B (informative) Examples of calculations 70
	B.1 Symbols used in the examples of this annex 70
	B.2 Classification of a laser product – Introduction 71
	B.3 Examples 75
	Annex C (informative) Description of the classes and potentially associated hazards 80
	C.1 General 80
	C.2 Description of classes 80
	C.2.1 Class 1 80
	C.2.2 Class 1M 80
	C.2.3 Class 1C 80
	C.2.4 Class 2 81
	C.2.5 Class 2M 81
	C.2.6 Class 3R 81
	C.2.7 Class 3B 82
	C.2.8 Class 4 82
	C.2.9 Note on nomenclature 82
	C.3 Limitations of the classification scheme 84
	C.4 References 85
	Annex D (informative) Biophysical considerations 86
	D.1 Anatomy of the eye 86
	D.2 The effects of laser radiation on biological tissue 87

	<i>Page</i>
D.2.1	General 87
D.2.2	Hazards to the eye 89
D.2.3	Skin hazards..... 92
D.3	MPEs and irradiance averaging 93
D.4	Reference documents 93
Annex E (informative)	MPEs and AELs expressed as radiance 95
E.1	Background..... 95
E.2	Radiance values 95
E.3	Rationale 96
Annex F (informative)	Summary tables..... 99
Annex G (informative)	Overview of associated parts of IEC 60825..... 102
Bibliography.....	104
Figure 1 – Measurement set-up to limit angle of acceptance by imaging the apparent source onto the plane of the field stop	43
Figure 2 – Measurement set-up to limit angle of acceptance by placing a circular aperture or a mask (serving as field stop) close to the apparent source	43
Figure 3 – Warning label – Hazard symbol	50
Figure 4 – Explanatory label	51
Figure 5 – Alternative label for Class 1	52
Figure 6 – Alternative label for Class 1M.....	52
Figure 7 – Alternative label for Class 1C	52
Figure 8 – Alternative label for Class 2	53
Figure 9 – Alternative label for Class 2M.....	53
Figure 10 – Alternative label for Class 3R	54
Figure 11 – Alternative label for Class 3B	54
Figure 12 – Alternative label for Class 4	55
Figure 13 – Alternative label for laser aperture	55
Figure B.1 – Flowchart guide for the classification of laser products from supplied output parameters.....	72
Figure B.2 – Flowchart guide for the classification of Class 1M and Class 2M laser products.....	73
Figure B.3 – AEL for Class 1 ultra-violet laser products for selected emission durations from 10^{-9} s to 10^3 s	74
Figure B.4 – AEL for Class 1 ultra-violet laser products for emission durations from 10^{-9} s to 10^3 s at selected wavelengths	74
Figure B.5 – AEL for Class 1 visible and selected infra-red laser products (case $C_6 = 1$).....	75
Figure D.1 – Anatomy of the eye.....	86
Figure D.2 – Diagram of laser-induced damage in biological systems	88
Figure E.1 – Radiance as a function of wavelength	95
Table 1 – Additivity of effects on eye and skin of radiation of different spectral regions.....	25
Table 2 – Times below which pulse groups are summed	28
Table 3 – Accessible emission limits for Class 1 and Class 1M laser products and $C_6 = 1$	34

Table 4 – Accessible emission limits for Class 1 and Class 1M laser products in the wavelength range from 400 nm to 1 400 nm (retinal hazard region): extended sources	35
Table 5 – Accessible emission limits for Class 2 and Class 2M laser products	36
Table 6 – Accessible emission limits for Class 3R laser products and $C_6 = 1$	37
Table 7 – Accessible emission limits for Class 3R laser products in the wavelength range from 400 nm to 1 400 nm (retinal hazard region): extended sources	38
Table 8 – Accessible emission limits for Class 3B laser products	39
Table 9 – Correction factors and breakpoints for use in AEL and MPE evaluations	39
Table 10 – Measurement aperture diameters and measurement distances for the default (simplified) evaluation	41
Table 11 – Reference points for Condition 3	42
Table 12 – Limiting angle of acceptance γ_{ph}	43
Table 13 – Requirements for safety interlocking	45
Table A.1 – Maximum permissible exposure (MPE) for $C_6 = 1$ at the cornea expressed as irradiance or radiant exposure	62
Table A.2 – Maximum permissible exposure (MPE) at the cornea for extended sources in the wavelength range from 400 nm to 1 400 nm (retinal hazard region) expressed as irradiance or radiant exposure ^d	63
Table A.3 – Maximum permissible exposure (MPE) of Table A.1 ($C_6 = 1$) for the wavelength range from 400 nm to 1 400 nm expressed as power or energy ^{a, b}	64
Table A.4 – Maximum permissible exposure (MPE) of Table A.2 (extended sources) for the wavelength range from 400 nm to 1 400 nm expressed as power or energy ^{a, b, c, d, e, f, g}	65
Table A.5 – Maximum permissible exposure (MPE) of the skin to laser radiation	66
Table A.6 – Aperture diameters for measuring laser irradiance and radiant exposure	67
Table D.1 – Summary of pathological effects associated with excessive exposure to light ...	90
Table D.2 – Explanation of measurement apertures applied to the eye MPEs	93
Table E.1 – Maximum radiance of a diffused source for Class 1	96
Table F.1 – Summary of the physical quantities used in this Part 1	99
Table F.2 – Summary of manufacturer's requirements (1 of 2)	100
Table G.1 – Overview of additional data in associated parts of IEC 60825	103

FOREWORD

This edition includes the following significant technical changes with respect to the previous edition:

- a new class, Class 1C, was introduced;
- the measurement condition 2 (“eye loupe” condition) was removed;
- classification of the emission of laser products below a certain radiance level that are intended to be used as replacement for conventional light sources can, as an option, be based on the IEC 62471 series;
- the accessible emission limits (AELs) for Class 1, 1M, 2, 2M and 3R of pulsed sources, particularly of pulsed extended sources, were updated to reflect the latest revision of the ICNIRP guidelines on exposure limits (accepted for publication in Health Physics 105 (3): 271 – 295; 2013, see also www.icnirp.org).

This is a free preview. Purchase the entire publication at the link below:

AS/NZS IEC 60825.1 : 2014 : EN : COMBINED PDF

-
- ⊙ Looking for additional Standards? Visit SAI Global Infostore
 - ⊙ Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation
-

Need to speak with a Customer Service Representative - Contact Us