



STANDARDS
Australia

AS/NZS 3000:2007

Wiring Rules

(Incorporating Amendment Nos 1 and 2)

STANDARD

AS/NZS



Wiring Rules

AS/NZS 3000:2007

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-001, Wiring Rules. It was approved on behalf of the Council of Standards Australia on 19 October 2007 and on behalf of the Council of Standards New Zealand on 9 November 2007. This Standard was published on 12 November 2007.

The following are represented on Committee EL-001:

Association of Consulting Engineers Australia
Australian Building Codes Board
Australian Electrical and Electronic Manufacturers Association
Canterbury Manufacturers Association New Zealand
Communications, Electrical and Plumbing Union
Consumers' Federation of Australia
Electrical and Communications Association (Qld)
Electrical Contractors Association of New Zealand
Electrical Regulatory Authorities Council
Electrical Safety Organisation (New Zealand)
ElectroComms and Energy Utilities Industries Skills Council
Energy Networks Association
Engineers Australia
Institute of Electrical Inspectors
Ministry of Economic Development (New Zealand)
National Electrical and Communications Association
New Zealand Council of Elders
New Zealand Electrical Institute
Telstra Corporation Limited

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 Standards may also be withdrawn.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 or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

Alternatively, both organizations publish an annual printed Catalogue with full details of all current Standards. 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 06001 to DR 06010.

Australian/New Zealand Standard™

Electrical installations (known as the Australian/New Zealand Wiring Rules)

Originated as part of AS CC1—1931.
Previous edition AS/NZS 3000:2000.
Fifth edition 2007.
Reissued incorporating Amendment No. 1 (July 2009).
Reissued incorporating Amendment No. 2 (December 2012).

COPYRIGHT

© Standards Australia/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 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 0 7337 8391 0

PREFACE

A1 | This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-001, Wiring Rules, to supersede, in Australia/New Zealand, AS/NZS 3000:2000, Electrical installations (known as the Australian/New Zealand Wiring Rules).

This Standard incorporates Amendment No. 1 (July 2009) and Amendment No. 2 (December 2012). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The development of this Standard has been based on the following considerations:

- (a) Results of a survey of the electrical industry indicated that the industry wanted a document better suited to the present electrical regulatory structure, which flows more logically, is easier to understand, reinstates much of the guidance information removed from the 2000 edition and contains an increased level of diagrammatic representation of concepts, and more selected examples.
- (b) Experience gained in the application of the eleventh (2000) edition as expressed to Standards Australia and Standards New Zealand.

During preparation of this Standard, reference was made to IEC 60364, *Electrical installations of buildings* (all parts) and acknowledgment is made of the assistance received from this source.

The presentation of this edition differs from previous editions of AS/NZS 3000 in that the Standard comprises two parts but with both parts bound as one document.

Part 1 provides uniform essential elements that constitute the minimum regulatory requirements for a safe electrical installation.

It also provides an alternative regulatory vehicle for Australian and New Zealand regulators seeking to move from the present prescription of AS/NZS 3000 in electrical installation safety and licensing legislation.

Part 1 satisfies the following objectives:

- It is generally complete in itself to avoid cross-referencing to Part 2.
- It may be called up in regulation as a separate Part or together with Part 2.
- It provides 'high level' safety performance outcomes/conditions without prescriptive work methods that demonstrate means of compliance.
- It establishes an enforcement link to Part 2. Failure to comply with a work method provision in Part 2 would breach high level safety conditions of Part 1 unless an alternative mechanism is satisfied.
- It establishes the 'deemed to comply' status of Part 2, confirming that installations that comply with Part 2 comply with high level safety conditions of Part 1.

- It establishes 'deemed to comply' status of AS/NZS 3018, relating to simple domestic applications, and parts of other standards, confirming compliance with 'high level' safety conditions of Part 1.
- It maintains alignment with IEC 60364 developments at the level of essential safety.
- It provides a mechanism for acceptance of alternative design and installation practices that are not addressed, or are inconsistent with, those given in the 'deemed to comply' Part 2. This mechanism is intended to apply where departures from the methods in Part 2 are significant rather than minor aspects that remain within the flexibility of Part 2.
- It details responsibilities, documentation and verification criteria for designers or installers that seek to apply an alternative method to the 'deemed to comply' methods contained in Part 2.

Part 2 provides installation practices that achieve certainty of compliance with the essential safety requirements of Part 1.

It is primarily a revision of the 2000 edition to provide work methods and installation practices that are 'deemed to comply' with the associated performance outcomes/safety conditions.

Part 2 satisfies the following objectives:

- It may be called up in regulation in addition to Part 1 to reflect a range of regulatory adoption options.
- It incorporates and elaborates on all 'high level' performance outcomes of Part 1 with the addition of requirements and recommendations to clarify and support compliance.
- It establishes the 'deemed to comply' status of AS/NZS 3018 relating to simple domestic applications, and parts of other standards, confirming compliance with the work methods of Part 2 and the 'high level' safety conditions of Part 1.
- It generally retains the structure of AS/NZS 3000:2000, except that Verification (inspection and testing) has been moved to the final section of substantive text as it would be the last function performed in the formation of an electrical installation, and damp situations have been separated from other special electrical installations as they are the more commonly occurring of special electrical installations.
- New introductory selection and installation clauses have been included in Sections 2, 3, 4, 5, 6 and 7.
- It restores information from AS 3000—1991 as requirements, recommendations and examples of typical, effective compliant solutions.
- Emphasis has been placed on common, practicable and cost-effective methods that achieve safety compliance, fitness for purpose and a level of good practice rather than overly conservative or obscure measures.

- Greater use has been made of illustrations and examples to promote understanding of common or difficult aspects, e.g. line diagrams, alternative overcurrent device locations, International Protection (IP) rating summary, switchboard access.
- Testing and inspection provisions have been updated in alignment with AS/NZS 3017, including provisions for periodic inspection in accordance with AS/NZS 3019.

Other major changes to the content of AS/NZS 3000:2000 include the following:

- (i) Revised or new definitions for—
 - electrical installation;
 - circuit;
 - basic protection (protection against direct contact);
 - fault protection (protection against indirect contact);
 - outbuilding;
 - isolation; and
 - competent person.
- (ii) Requirements for alterations, additions and repairs have been expanded and clarified through the integration of information contained in a number of frequently asked questions.
- (iii) Illustration of normal and alternative location, and omission of, overcurrent devices.
- (iv) Discrimination/selectivity of protective devices.
- (v) A single main switch (per tariff) for a single domestic installation.
- (vi) Illustration of basic clearances for switchboard access.
- (vii) Expansion of the use of residual current devices (RCDs) to all socket-outlet and lighting circuits rated up to 20 A.
- (viii) Limiting the number of circuits connected to any one RCD to three.
- (ix) Requiring the division of lighting circuits between RCDs where the number of both RCDs and lighting circuits exceeds one.
- A2 | (x) Arc fault protection is required for all switchboards with a nominal supply rated above 800 A. It is recommended for all other switchboards.
- (xi) Full-size neutral conductors are required on consumers mains, multiphase submain and final subcircuits subject to some conditions, for example overcurrent detection is fitted.
- (xii) Allowance for a voltage drop of up to 7% where a substation is located on the premises.
- (xiii) Installation couplers are recognised as a suitable method of connecting cables.

- (xiv) The colour identification of conductors has been clarified, particularly for European alternatives for single-phase and three-phase applications.
- (xv) Restrictions on cable supports in suspended ceilings.
- (xvi) Additional illustrations of the protection of wiring systems near building surfaces have been included.
- (xvii) Segregation from telecommunications, gas and water services has been clarified and a summary table of separation distances given.
- A1 | (xviii) The location of underground cables must be marked at entry to or exit from a structure or recorded on a map.
- (xix) Aerial cable clearances have been updated to distribution industry standards.
- (xx) Requirements have been added for the prevention of the spread of fire.
- (xxi) Requirements for clearances of recessed luminaires to combustible building material and thermal insulation have been critically revised.
- (xxii) Electricity generating systems, such as engine-driven generator sets, stand-alone power systems, grid-connected inverter systems and batteries, have been moved to Section 7.
- A1 | (xxiii) Illustrations of the multiple earthed neutral (MEN) system have been improved and clarification of the relationship of the MEN system to the IEC systems has been added.
- (xxiv) Earthing electrode types and installation conditions have been specified.
- (xxv) Main earthing conductors to be labelled at the connection to the earth electrode.
- (xxvi) Requirements for MEN switchboards in outbuildings have been clarified.
- (xxvii) Illustration of equipotential bonding of conductive water piping has been included.
- (xxviii) Reinforced concrete slabs in a shower or bathroom must be equipotentially bonded.
- (xxix) Information on earth fault-loop impedance, previously included in Section 1, has been moved to Section 5.
- (xxx) Bath and shower figures have been corrected to fix the Zone 2 discrepancy in the 2000 edition and now appear with corresponding plan and elevation views on facing pages.
- (xxxi) The Zone 1 horizontal dimension for spa pools and tubs with water capacity less than 5 000 L has been increased to 1.25 m, instead of 1.0 m. This dimension has been changed from AS/NZS 3000:2000 to align with the limit of arm's reach defined in Clause 1.4.12 and Figure 1.1.

- (xxxii) In locations containing sauna heaters (Clause 6.5), Zone 4 (the 300 mm below the ceiling) has been removed to align with IEC 60364-7-703. Zones 1 and 3 have been extended to incorporate this area.
- (xxxiii) Sanitization operations have been added to hosing-down operations to clearly cover food-handling and produce areas, such as chicken farms, where corrosive chemicals are used in the cleaning and hosing-down process.
- (xxxiv) Hosing-down zones have been modified.
- (xxxv) 'Emergency systems' have been renamed 'Safety services' in line with IEC 60364.
- (xxxvi) Generating systems are dealt with in greater detail, particularly in the areas of the suitability of RCDs with respect to waveforms of the supply and to the connection to an electrical installation. Illustration is provided for generator supply interconnection.
- (xxxvii) Electrical separation is dealt with in greater detail with a new requirement for double pole switching, the provision of testing requirements in addition to those of Section 8 and the inclusion of illustrations.
- (xxxviii) Separation of extra-low voltage (ELV) circuits from live parts of other circuits [both separated extra-low voltage (SELV) and protected extra-low voltage (PELV)] and earth (SELV only) must be verified by insulation resistance testing.
- A2 (xxxix) The requirements for high voltage installations (Clause 7.6) have been substantially reduced and provide a pointer to AS 2067 and the New Zealand Electricity (Safety) Regulations 2010.
- (xl) Reference to other Standards and documents has been clarified to highlight their status. Specific electrical installation Standards are now grouped as—
- (A) providing additional requirements that have to be complied with;
 - (B) deemed to comply Standards; and
 - (C) Standards providing guidance for specific electrical installations.
- (xli) AS/NZS 3012, *Electrical installations—Construction and demolition sites*, and AS/NZS 3003, *Electrical installations—Patient areas of hospitals and medical, dental practices and dialyzing locations*, have been elevated from the status of guidance Standards to that of Standards providing additional requirements that have to be complied with.
- (xlii) Verification of operation of RCDs where supply is connected is now mandatory in Australia.
- A1 (xliii) Verification of earth fault-loop impedance for socket-outlet circuits not protected by an RCD is now a mandatory test for both Australia and New Zealand.

- A2 | (xlv) The date of initial energization of an installation is required to be available on-site.
- (xlv) Appendix B has been renamed 'Circuit protection guide' to reflect its content more accurately. It has been expanded to provide illustration of circuit arrangements of an installation, guidance information on automatic disconnection of supply as an introduction to the treatment of earth fault-loop impedance and a better illustration of an MEN system with earth fault-loop. Table B4.1 of the 2000 edition, Maximum values of earth fault-loop impedance (Z_s) at 230 V a.c., has been relocated to Section 8 Verification.
- (xlvi) Appendix C has been expanded to cover more than the calculation of maximum demand and the information provided on maximum demand has been clarified and updated. The Appendix has been renamed 'Circuit arrangements' and includes guidance information on simplified cable current ratings, simplified voltage drop calculations, the number of points connected to circuits and the number of cables that can be installed in conduits similar to that in the 1991 edition of AS 3000, but not included in AS/NZS 3000:2000.
- (xlvii) Appendix D has been updated to provide more comprehensive guidance information for the construction of private aerial lines.
- (xlviii) Appendix E has been added to provide some information on the electrical requirements contained in National Building Codes (the Building Code of Australia (BCA) and the New Zealand Building Code (NZBC)).
- (xlix) Appendix F has been added to provide information and guidance on the installation of surge protective devices (SPDs).
- (l) Appendix G has been added to provide information and guidance on the degree of protection of enclosed equipment (International Protection or IP rating).
- (li) Appendix H has been added to provide information and guidance on the classification of wiring systems (WS classification).
- (lii) Appendix I has been added to provide information and guidance on the ratings of overload protective devices where alterations, additions or repairs involve the use of existing conductors of an imperial size.
- (liii) Appendix J has been added to provide a full listing of electrical symbols used in this Standard.
- A2 | (liv) Text deleted
- (lv) An improved index has been provided to make using the document more intuitive.

- (lvi) The electric shock survival (resuscitation) guide has been updated to incorporate current practice. It is, however, only provided for guidance. Persons associated with the installation and repair of electrical installations and electrical equipment should obtain training in resuscitation methods.

This Standard may be applied through legislative requirements, as indicated in Clause 1.2. As this Standard supersedes AS/NZS 3000:2000, it would usually apply to electrical installations from its date of publication, but it is recommended that it not be applied on a mandatory basis before a date at least six months after publication. However, if work on an installation was commenced before publication of this edition, the relevant regulatory authority or electricity distributor may grant permission for the installation to be completed in accordance with AS/NZS 3000:2000.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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

CONTENTS

	<i>Page</i>
FOREWORD	19
Part 1: Scope, application and fundamental principles	
SECTION 1 SCOPE, APPLICATION AND FUNDAMENTAL PRINCIPLES	
1.1 SCOPE.....	21
1.2 APPLICATION.....	21
1.3 REFERENCED DOCUMENTS	22
1.4 DEFINITIONS.....	22
1.5 FUNDAMENTAL PRINCIPLES.....	39
1.6 DESIGN OF AN ELECTRICAL INSTALLATION	51
1.7 SELECTION AND INSTALLATION OF ELECTRICAL EQUIPMENT	52
1.8 VERIFICATION (INSPECTION AND TESTING)	54
1.9 MEANS OF COMPLIANCE.....	54
Part 2: Installation practices—Sections 2 to 8	
SECTION 2 GENERAL ARRANGEMENT, CONTROL AND PROTECTION	
2.1 GENERAL	58
2.2 ARRANGEMENT OF ELECTRICAL INSTALLATION	58
2.3 CONTROL OF ELECTRICAL INSTALLATION.....	62
2.4 FAULT PROTECTION	74
2.5 PROTECTION AGAINST OVERCURRENT.....	75
2.6 ADDITIONAL PROTECTION BY RESIDUAL CURRENT DEVICES	98
2.7 PROTECTION AGAINST OVERVOLTAGE	105
2.8 PROTECTION AGAINST UNDERVOLTAGE.....	106
2.9 SWITCHBOARDS	107
SECTION 3 SELECTION AND INSTALLATION OF WIRING SYSTEMS	
3.1 GENERAL	120
3.2 TYPES OF WIRING SYSTEMS	120
3.3 EXTERNAL INFLUENCES	123
3.4 CURRENT-CARRYING CAPACITY	126
3.5 CONDUCTOR SIZE	129
3.6 VOLTAGE DROP	131
3.7 ELECTRICAL CONNECTIONS	132
3.8 IDENTIFICATION.....	136
3.9 INSTALLATION REQUIREMENTS.....	140
3.10 ENCLOSURE OF CABLES.....	156
3.11 UNDERGROUND WIRING SYSTEMS	159
3.12 AERIAL WIRING SYSTEMS.....	168
3.13 CABLES SUPPORTED BY A CATENARY	174

	<i>Page</i>
3.14 SAFETY SYSTEMS.....	174
3.15 BUSWAYS, INCLUDING RISING MAINS SYSTEMS	174
3.16 EARTH SHEATH RETURN (ESR) SYSTEM	175
 SECTION 4 SELECTION AND INSTALLATION OF APPLIANCES AND ACCESSORIES	
4.1 GENERAL	176
4.2 PROTECTION AGAINST THERMAL EFFECTS	178
4.3 CONNECTION OF ELECTRICAL EQUIPMENT	181
4.4 SOCKET-OUTLETS	184
4.5 LIGHTING EQUIPMENT AND ACCESSORIES	187
4.6 SMOKE AND FIRE DETECTORS	195
4.7 COOKING APPLIANCES	195
4.8 APPLIANCES PRODUCING HOT WATER OR STEAM	196
4.9 ROOM HEATERS.....	197
4.10 ELECTRIC HEATING CABLES FOR FLOORS AND CEILINGS AND TRACE HEATING APPLICATIONS	197
4.11 ELECTRIC DUCT HEATERS	199
4.12 ELECTRICITY CONVERTERS	199
4.13 MOTORS.....	203
4.14 TRANSFORMERS.....	206
4.15 CAPACITORS	207
4.16 ELECTRICAL EQUIPMENT CONTAINING LIQUID DIELECTRICS.....	209
4.17 BATTERIES	210
 SECTION 5 EARTHING ARRANGEMENTS AND EARTHING CONDUCTORS	
5.1 GENERAL	213
5.2 EARTHING FUNCTIONS	217
5.3 EARTHING SYSTEM PARTS.....	218
5.4 EARTHING OF EQUIPMENT	230
5.5 EARTHING ARRANGEMENTS	234
5.6 EQUIPOTENTIAL BONDING.....	242
5.7 EARTH FAULT-LOOP IMPEDANCE	250
5.8 OTHER EARTHING ARRANGEMENTS	252
 SECTION 6 DAMP SITUATIONS	
6.1 GENERAL	253
6.2 BATHS, SHOWERS AND OTHER FIXED WATER CONTAINERS.....	254
6.3 SWIMMING POOLS, PADDLING POOLS AND SPA POOLS OR TUBS	270
6.4 FOUNTAINS AND WATER FEATURES	280
6.5 SAUNAS	285
6.6 REFRIGERATION ROOMS	289
6.7 SANITIZATION AND GENERAL HOSING-DOWN OPERATIONS.....	291

Page

SECTION 7 SPECIAL ELECTRICAL INSTALLATIONS	
7.1	GENERAL 293
7.2	SAFETY SERVICES..... 294
7.3	ELECTRICITY GENERATION SYSTEMS 304
7.4	ELECTRICAL SEPARATION (ISOLATED SUPPLY) 315
7.5	EXTRA-LOW VOLTAGE ELECTRICAL INSTALLATIONS..... 320
7.6	HIGH VOLTAGE ELECTRICAL INSTALLATIONS..... 324
7.7	HAZARDOUS AREAS (EXPLOSIVE GAS OR COMBUSTIBLE DUSTS)..... 326
7.8	SPECIFIC ELECTRICAL INSTALLATION STANDARDS..... 326
SECTION 8 VERIFICATION	
8.1	GENERAL 330
8.2	VISUAL INSPECTION..... 331
8.3	TESTING..... 333
8.4	DATE OF INITIAL ENERGISATION OF AN INSTALLATION..... 342
APPENDICES	
A	REFERENCED DOCUMENTS 343
B	CIRCUIT PROTECTION GUIDE..... 351
C	CIRCUIT ARRANGEMENTS 366
D	MINIMUM SIZES OF POSTS, POLES AND STRUTS FOR AERIAL LINE CONDUCTORS 401
E	ELECTRICAL INSTALLATION REQUIREMENTS IN NATIONAL BUILDING CODES 420
F	INSTALLATION OF SURGE PROTECTIVE DEVICES 425
G	DEGREES OF PROTECTION OF ENCLOSED EQUIPMENT 430
H	WS CLASSIFICATION OF WIRING SYSTEMS 435
I	PROTECTIVE DEVICE RATINGS AND METRIC EQUIVALENT SIZES FOR IMPERIAL CABLES USED IN ALTERATIONS ADDITIONS AND REPAIRS 443
J	SYMBOLS USED IN THIS STANDARD..... 446
K	(Deleted)
L	ELECTRIC SHOCK SURVIVAL—Australia..... 449
M	ELECTRIC SHOCK SURVIVAL—New Zealand..... 451
INDEX..... 446	

LIST OF TABLES

	<i>Page</i>
3.1	CABLE TYPES AND THEIR APPLICATION IN WIRING SYSTEMS 122
3.2	LIMITING TEMPERATURES FOR INSULATED CABLES 127
3.3	NOMINAL MINIMUM CROSS-SECTIONAL AREA OF CONDUCTORS 129
3.4	CONDUCTOR COLOURS FOR INSTALLATION WIRING 137
3.5	UNDERGROUND WIRING SYSTEM CATEGORIES 161
3.6	UNDERGROUND WIRING SYSTEMS—MINIMUM DEPTH OF COVER 163
3.7	MINIMUM SEPARATION OF UNDERGROUND SERVICES 168
3.8	MINIMUM AERIAL CONDUCTOR CLEARANCES 171
3.9	AERIAL CONDUCTOR MAXIMUM SPANS 172
3.10	SPACING BETWEEN AERIAL CONDUCTORS AT SUPPORTS 173
4.1	TEMPERATURE LIMITS IN NORMAL SERVICE FOR PARTS OF ELECTRICAL EQUIPMENT WITHIN ARM'S REACH 180
4.2	MINIMUM DISTANCE BETWEEN LAMP AND FLAMMABLE MATERIALS 189
5.1	MINIMUM COPPER EARTHING CONDUCTOR SIZE 224
5.2	ACCEPTABLE EARTH ELECTRODES 228
6.1	GUIDANCE ON THE SELECTION AND INSTALLATION OF ELECTRICAL EQUIPMENT FOR BATHS, SHOWERS AND OTHER FIXED WATER CONTAINERS 259
6.2	GUIDANCE ON THE SELECTION AND INSTALLATION OF ELECTRICAL EQUIPMENT FOR SWIMMING POOLS, PADDLING POOLS AND SPA POOLS OR TUBS 276
8.1	MAXIMUM VALUES OF EARTH FAULT-LOOP IMPEDANCE (Z_s at 230 V) 340
8.2	MAXIMUM VALUES OF RESISTANCE 341
B1	MAXIMUM ROUTE LENGTHS, IN METRES, FOR DIFFERENT SIZES OF CONDUCTORS AND PROTECTIVE DEVICES USING APPROPRIATE MEAN TRIPPING CURRENTS (I_a)* 364
C1	MAXIMUM DEMAND—SINGLE AND MULTIPLE DOMESTIC ELECTRICAL INSTALLATIONS 368
C2	MAXIMUM DEMAND —NON-DOMESTIC ELECTRICAL INSTALLATIONS 377
C3	MAXIMUM DEMAND—ENERGY DEMAND METHOD FOR NON-DOMESTIC INSTALLATIONS 384
C4	MAXIMUM DEMAND—DOMESTIC COOKING APPLIANCES .. 386

	<i>Page</i>
C5	SIMPLIFIED PROTECTIVE DEVICE SELECTION FOR CABLES FROM 1 mm ² TO 25 mm ² USED IN SINGLE-PHASE APPLICATIONS 388
C6	SIMPLIFIED PROTECTIVE DEVICE SELECTION FOR CABLES FROM 1 mm ² TO 25 mm ² USED IN THREE-PHASE APPLICATIONS 389
C7	VOLTAGE DROP—SIMPLIFIED METHOD 391
C8	GUIDANCE ON THE LOADING OF POINTS PER FINAL SUBCIRCUIT 394
C9	GUIDE TO THE MAXIMUM NUMBER OF SINGLE-CORE SHEATHED CABLES INSTALLED IN CONDUIT 398
C10	GUIDE TO THE MAXIMUM NUMBER OF TWO-CORE AND EARTH CABLES INSTALLED IN CONDUIT 399
C11	GUIDE TO THE MAXIMUM NUMBER OF FOUR-CORE AND EARTH CABLES INSTALLED IN CONDUIT 400
D1	SINKING OF POSTS/POLES IN GROUND 402
D2	FORCE EXERTED BY AERIAL LINE CONDUCTORS 408
D3	SQUARE HARDWOOD POST (100 MPA TIMBER TO AS 2209) STRENGTH RATINGS 409
D4	SQUARE HARDWOOD STRUTS (100 MPA TIMBER TO AS 2209) STRENGTH RATINGS 410
D5	ROUND HARDWOOD POLE (100 MPA TIMBER TO AS 2209) STRENGTH RATINGS—HEIGHT REDUCED FROM BASE 410
D6	ROUND HARDWOOD POLE (100 MPA TIMBER TO AS 2209) STRENGTH RATINGS—HEIGHT REDUCED FROM TOP 411
D7	ANGLE IRON STRUTS GRADE 250 STRENGTH RATINGS (CROSS-SECTION DIMENSIONS × THICKNESS (mm)) 412
D8	ANGLE IRON STRUTS GRADE 300 STRENGTH RATINGS (CROSS-SECTION DIMENSIONS × THICKNESS (mm)) 413
D9	FABRICATED RIVERTON OCTAGONAL STEEL POLE STRENGTH RATINGS 413
D10	GRADE 250 STEEL-PIPE (DIAMETER × THICKNESS (mm)) STRENGTH RATINGS 414
D11	GRADE 350 STEEL-PIPE (DIAMETER × THICKNESS (mm)) STRENGTH RATINGS 415
D12(a)	GRADE 350 STEEL SQUARE SECTION (WIDTH × THICKNESS (mm)) STRENGTH RATINGS 416
D12(b)	GRADE 350 STEEL SQUARE SECTION (WIDTH × THICKNESS (mm)) STRENGTH RATINGS 417
D13(a)	GRADE 450 STEEL SQUARE SECTION (WIDTH × THICKNESS (mm)) STRENGTH RATINGS 418
D13(b)	GRADE 450 STEEL SQUARE SECTION (WIDTH × THICKNESS (mm)) STRENGTH RATINGS 419
H1	DEGREE OF PROTECTION INDICATED BY THE FIRST CHARACTERISTIC NUMERAL 436

	H2	DEGREE OF PROTECTION INDICATED BY THE SECOND CHARACTERISTIC NUMERAL	437
	I1	PROTECTIVE DEVICE RATINGS	444
	I2	SIZES OF IMPERIAL AND METRIC CABLES FOR CONNECTION IN PARALLEL	445
	J1	SYMBOLS USED IN THIS STANDARD	447
A1	K1	(Deleted)	
	K2	(Deleted)	

LIST OF FIGURES

	<i>Page</i>
1.1 ZONE OF ARM'S REACH.....	24
1.2 DIRECT CONTACT	27
1.3 INDIRECT CONTACT.....	27
2.1 CLAUSES 2.5.1, 2.5.3.2 AND 2.5.4.2 GENERAL PROTECTION ARRANGEMENT.....	83
2.2 CLAUSE 2.5.1.3—OMISSION OF OVERCURRENT PROTECTION FOR SAFETY REASONS	84
2.3 CLAUSE 2.5.3.3 (a)—ALTERNATIVE POSITION OF OVERLOAD PROTECTIVE DEVICE	85
2.4 CLAUSE 2.5.3.3(b)—ALTERNATIVE POSITION OF OVERLOAD PROTECTIVE DEVICE	86
2.5 CLAUSE 2.5.3.4(b)(i)—OMISSION OF OVERLOAD PROTECTION—CONDUCTOR ON LOAD SIDE OF A CHANGE IN CURRENT-CARRYING CAPACITY	86
2.6 CLAUSE 2.5.3.4(b)(ii)—OMISSION OF OVERLOAD PROTECTION—FIXED LOAD NOT CAPABLE OF CAUSING AN OVERLOAD CURRENT	87
2.7 CLAUSE 2.5.4.3—ALTERNATIVE POSITION OF SHORT- CIRCUIT PROTECTIVE DEVICE	88
2.8 CLAUSE 2.5.4.4—OMISSION OF SHORT-CIRCUIT PROTECTION.....	88
2.9 EXAMPLE LOCATION OF PROTECTIVE DEVICE OPTIONS FOR RISING MAINS OR SUBMAIN DISTRIBUTION.....	89
2.10 DISCRIMINATION BETWEEN PROTECTIVE DEVICES— GENERAL	93
2.11 CIRCUIT-BREAKER CURVES—GENERAL EXPLANATION, SETTINGS AND ZONES	96
2.12 CIRCUIT-BREAKER CURVES WITH DISCRIMINATION REQUIREMENTS.....	96
2.13 FUSE CURVES WITH DISCRIMINATION REQUIREMENTS	97
2.14 FUSE AND CIRCUIT-BREAKER CURVES WITH DISCRIMINATION REQUIREMENTS.....	97
2.15 ACCESS TO SWITCHBOARDS—FREESTANDING SWITCHBOARD WITH RACK-OUT SWITCHGEAR.....	109
2.16 ACCESS TO SWITCHBOARDS— SWITCHBOARD IN CORNER POSITION	110
2.17 ACCESS TO SWITCHBOARDS— SWITCHBOARD WITH ONE END AGAINST WALL.....	110
2.18 ACCESS TO SWITCHBOARDS— SWITCHBOARDS WITH DOORS THAT OPEN INTO ACCESSWAYS OR NARROW PASSAGEWAYS.....	111
2.19 ACCESS TO SWITCHBOARDS— FACING SWITCHBOARDS	111
2.20 DELETED	115
3.1 SINGLE-PHASE CABLES.....	139
3.2 MULTI-PHASE CABLES	139
3.3 PROTECTION OF WIRING SYSTEMS WITHIN WALL SPACES.....	142

3.4	PROTECTION OF WIRING SYSTEMS WITHIN CEILINGS, FLOORS AND WALL SPACES.....	143
3.5	PROTECTION OF WIRING SYSTEMS WITHIN CONCRETE ROOFS, CEILINGS OR FLOORS.....	143
3.6	PROHIBITED CABLE LOCATION—ROOF OR WALL-LINING MATERIALS.....	144
3.7	PROTECTION OF WIRING BELOW ROOFING MATERIAL.....	145
3.8	SEPARATION OF LOW VOLTAGE CABLES AND TELECOMMUNICATIONS CABLES ON SURFACES OR CONCEALED IN FLOORS OR CEILINGS.....	151
3.9	SEPARATION OF LOW VOLTAGE CABLES FROM TELECOMMUNICATIONS CABLES IN UNDERGROUND TRENCHES.....	152
3.10	EXAMPLE OF A CATEGORY A WIRING SYSTEM WITH CABLE LOCATED BELOW Poured CONCRETE OF 75 MM MINIMUM THICKNESS.....	164
3.11	EXAMPLE OF A CATEGORY A UNDERGROUND WIRING SYSTEM WITH CABLE LOCATED BELOW NATURAL GROUND ...	164
3.12	EXAMPLE OF A CATEGORY A UNDERGROUND WIRING SYSTEM WITH CABLE LOCATED DIRECTLY BELOW POURED CONCRETE OF 75 MM MINIMUM THICKNESS WITHIN THE CONFINES OF A BUILDING.....	165
3.13	EXAMPLE OF A CATEGORY B UNDERGROUND WIRING SYSTEM WITH CABLE LOCATED BELOW Poured CONCRETE OF 75 MM MINIMUM THICKNESS.....	165
3.14	EXAMPLE OF A CATEGORY B UNDERGROUND WIRING SYSTEM WITH CABLE LOCATED BELOW NATURAL GROUND ...	166
3.15	EXAMPLE OF A CATEGORY B UNDERGROUND WIRING SYSTEM WITH CABLE LOCATED DIRECTLY BELOW POURED CONCRETE OF 75 MM MINIMUM THICKNESS WITHIN THE CONFINES OF A BUILDING.....	166
3.16	EXAMPLE OF A CATEGORY C UNDERGROUND WIRING SYSTEM.....	167
4.1	DIRECT CONNECTION.....	181
4.2	DIRECT CONNECTION BY INSTALLATION COUPLER.....	182
4.3	DIRECT CONNECTION BY INSTALLATION COUPLER- EXCEPTION.....	182
4.4	CONNECTION BY SOCKET-OUTLET.....	182
4.5	CONNECTION BY OTHER CONNECTING DEVICES.....	183
4.6	EQUIPMENT WIRING—EXCEPTION FOR PENDANT SOCKET- OUTLET.....	183
4.7	DEFAULT MINIMUM CLEARANCES FOR RECESSED LUMINAIRES.....	190
FI4.8	WARNING SIGN TO BE INSTALLED IN ACCESSIBLE ROOF SPACES CONTAINING RECESSED LUMINAIRES.....	191
4.9	DEFAULT MINIMUM CLEARANCES FOR RECESSED LUMINAIRES.....	194
4.10	HAZARDOUS AREA PRESENTED BY A GAS CYLINDER OUTDOORS FOR HEAVIER-THAN-AIR GASES.....	211

4.11	HAZARDOUS AREA FOR RETICULATED GAS SUPPLY REGULATORS.....	212
5.1	MULTIPLE EARTHED NEUTRAL (MEN) SYSTEM OF EARTHING—GENERAL ARRANGEMENT.....	215
	(Symbols are explained in Table J1.).....	215
5.2	MULTIPLE EARTHED NEUTRAL (MEN) SYSTEM OF EARTHING—ALTERNATIVE ARRANGEMENT	216
	(Symbols are explained in Table J1.).....	216
5.3	EXAMPLES OF EARTHING ARRANGEMENTS (CLAUSES 5.5.2.1 AND 5.5.2.2.3).....	237
5.4	EXAMPLES OF EQUIPOTENTIAL BONDING OF CONDUCTIVE WATER PIPING	244
5.5	EXAMPLES OF EQUIPOTENTIAL BONDING OF CONDUCTIVE WATER PIPING (WITH EXCEPTION).....	245
6.1	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)— BATH WITHOUT SHOWER OR FIXED BARRIER.....	260
6.2	BATHS AND SHOWERS, ZONE DIMENSIONS (ELEVATION)— BATH WITHOUT SHOWER OR FIXED BARRIER.....	261
6.3	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)— SHOWER WITH BASE WITHOUT BARRIERS.....	262
6.4	BATHS AND SHOWERS, ZONE DIMENSIONS (ELEVATION)— SHOWER WITH BASE WITHOUT BARRIERS.....	263
6.5	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)— BATH WITHOUT SHOWER WITH FIXED BARRIER	264
6.6	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)—BATH WITH SHOWER WITHOUT BARRIER	265
6.7	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)— ENCLOSED SHOWER	266
6.8	BATHS AND SHOWERS, ZONE DIMENSIONS (ELEVATION)— SHOWER WITH BARRIER.....	267
6.9	BATHS AND SHOWERS, ZONE DIMENSIONS (PLAN)— PARTIALLY ENCLOSED SHOWER	268
6.10	OTHER FIXED WATER CONTAINERS WITH A CAPACITY NOT EXCEEDING 45 L AND FIXED WATER OUTLETS, ZONE DIMENSIONS.....	269
6.11	OTHER FIXED WATER CONTAINERS WITH A CAPACITY EXCEEDING 45 L OR WITH A FLEXIBLE WATER OUTLET, ZONE DIMENSIONS	269
6.12	ZONE DIMENSIONS OF IN-GROUND SWIMMING POOLS.....	277
6.13	ZONE DIMENSIONS OF ABOVE-GROUND SWIMMING POOLS.....	277
6.14	ZONE DIMENSIONS OF SWIMMING POOLS WITH FIXED BARRIERS (MINIMUM 1.8 M HIGH)	278
6.15	ZONE DIMENSIONS OF IN-GROUND SPA POOLS AND TUBS WITH WATER CAPACITY NOT EXCEEDING 5000 L	279
6.16	ZONE DIMENSIONS OF ABOVE-GROUND SPA POOLS AND TUBS WITH WATER CAPACITY NOT EXCEEDING 5000 L	280
6.17	EXAMPLE OF DETERMINATION OF THE ZONES OF A FOUNTAIN (PLAN).....	284

6.18	EXAMPLE OF DETERMINATION OF THE ZONES OF A FOUNTAIN (ELEVATION)	285
6.19	CLASSIFIED ZONES FOR SAUNA HEATERS	288
7.1	TYPICAL ARRANGEMENT FOR SAFETY SERVICES	300
7.2	EXAMPLE OF CONNECTION OF AN ALTERNATIVE SUPPLY TO A SWITCHBOARD WITH A LOCAL MEN CONNECTION (THREE POLE/FOUR POLE CHANGEOVER)	310
	(Symbols are explained in Table J1.)	310
7.3	EXAMPLE OF CONNECTION OF AN ALTERNATIVE SUPPLY TO A SWITCHBOARD WITH A LOCAL MEN CONNECTION (THREE POLE/THREE POLE CHANGEOVER)	311
	(Symbols are explained in Table J1.)	311
7.4	EXAMPLE OF CONNECTION OF AN ALTERNATIVE SUPPLY TO A SWITCHBOARD WITH A LOCAL MEN CONNECTION BY MEANS OF A PLUG AND SOCKET	312
	(Symbols are explained in Table J1.)	312
7.5	EXAMPLE OF CONNECTION OF A GRID-CONNECTED INVERTER	313
7.6	EXAMPLE OF CONNECTION OF A STAND-ALONE SYSTEM TO A SWITCHBOARD WITH A LOCAL MEN CONNECTION	315
	(Symbols are explained in Table J1.)	315
7.7	SEPARATED (ISOLATED) SUPPLIES	319
	(Symbols are explained in Table J1.)	319
8.1	TESTING SEQUENCE	334
B1	EXAMPLE OF CIRCUIT ARRANGEMENTS OF AN ELECTRICAL INSTALLATION (TO THREE LEVELS)	352
	(Symbols are explained in Table J1.)	352
B2	TYPICAL OVERCURRENT PROTECTION OF CONDUCTORS	353
B3	COORDINATION OF THE CHARACTERISTICS OF CONDUCTORS AND PROTECTIVE DEVICES	354
B4	MAXIMUM DURATION OF PROSPECTIVE 50 Hz TOUCH VOLTAGE (Reproduced from IEC/TR 61200-413 Figure C2)	357
B5	MEN SYSTEM (SIMPLIFIED)—SHOWING FAULT CURRENT (I _a) PATH (EARTH FAULT-LOOP)	360
B6	TYPICAL TIME/CURRENT CURVES FOR CIRCUIT-BREAKERS AND FUSES	361
D1	GUIDE TO SELECTION OF POLES/POSTS	404
D2	GUIDE TO SELECTION OF STRUTS	405
F1.1	PRIMARY SPD ON MAIN SWITCHBOARD	426
F1.2	SECONDARY SPD ON DISTRIBUTION BOARD	427
F2	EXAMPLE OF HOW A TRANSIENT OVERVOLTAGE DEVELOPS A HAZARDOUS VOLTAGE DIFFERENCE IN A BUILDING	428
F3	PREFERRED METHOD OF BONDING THE PRIMARY TELECOMMUNICATIONS PROTECTOR TO THE MAIN EARTH	429
G1 (in part)	IP CODES	431
G1 (in part)	IP CODES	432
G.2	EXAMPLE OF 'IP' RATING	434
H1	WSX1 PROTECTION BY LOCATION	441
K1	(Deleted)	

FOREWORD

Application of different typefaces. There are four different typefaces used in this Standard and each of these has a specific purpose. The typefaces and their application are as follows:

- (a) **Bold print** These are opening statements defining the fundamental principle and are generally positioned at the beginning of a clause or major part of a section.
- (b) Normal print These are mandatory requirements that form the substance of a clause in that they indicate certain methods that satisfy the essential requirements.
- (c) *Italic print* These are exceptions or variations to mandatory requirements. These generally give specific examples where the essential requirements do not apply or where they are varied for certain applications. Italic print also represents examples or clarifications given.
- (d) Reduced normal print These are explanatory notes that may give advice. They are preceded by 'NOTE' in the manner used in previous editions.

It is important not to read any single typeface by itself as the preceding or following paragraphs may contain additional or modifying requirements.

Cross-references Throughout this Standard, where reference to another clause or portion of a clause has been made to avoid repetition, such reference, unless otherwise stated, shall include all appropriate subclauses and paragraphs of the clause or portion thereof referred to.

Frequently asked questions (FAQs) Clarifications to requirements of the Wiring Rules that were covered by rulings and interpretations in earlier editions will be included in FAQs as the need arises. These FAQs will be applicable throughout Australia and New Zealand and will be developed by the Joint Standards Australian/Standards New Zealand Committee EL-001, Wiring Rules. These FAQs can be found online at www.wiringrules.standards.org.au.

Provision for revision This Standard necessarily deals with existing conditions, but it is not intended to discourage invention or to exclude materials, equipment and methods that may be developed. Revisions will be made from time to time in view of such developments and amendments to this edition will be made only where essential.

Special national requirements Certain provisions of the Standard have a different application in Australia and New Zealand. The following symbols appearing in the outer margin indicate that the identified Section or Clause is:

1 Applicable in Australia only.

A

2 Applicable in New Zealand only.

NZ

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Electrical installations (known as the Australian/New Zealand Wiring Rules)

Part 1: Scope, application and fundamental principles

SECTION 1 SCOPE, APPLICATION AND FUNDAMENTAL PRINCIPLES

1.1 SCOPE

This Standard sets out requirements for the design, construction and verification of electrical installations, including the selection and installation of electrical equipment forming part of such electrical installations.

These requirements are intended to protect persons, livestock, and property from electric shock, fire and physical injury hazards that may arise from an electrical installation that is used with reasonable care and with due regard to the intended purpose of the electrical installation.

In addition, guidance is provided so that the electrical installation will function correctly for the purpose intended.

1.2 APPLICATION

This Standard may be applied through legislative requirements, made in each State and Territory of Australia and in New Zealand, concerned with the safety of electrical installations. The Standard may also be applied in conjunction with any additional requirements, exemptions or restrictions in such legislation.

The principal application of this Standard is to electrical installations in all types of premises and land used by electricity consumers. However, the Standard may also be referenced or applied through legislative or other requirements relating to the effect of electrical installations in matters such as the following:

- (a) Safety of workplaces.
NOTE: For example, Occupational Health & Safety legislation and associated codes.
- (b) Safe design and construction of buildings.
NOTE: For example, National Building Codes [such as the Building Code of Australia (BCA), New Zealand Building Code (NZBC)] and the associated referenced Standards.
- (c) Electricity generation, transmission and distribution systems.
- (d) Safe connection to electricity distribution systems.
NOTE: For example, service rules and conditions provided by local electricity distributors.
- (e) Qualifications of electricity workers.