

Australian/New Zealand Standard™

Electric cables—Polymeric insulated

**Part 1: For working voltages up to and
including 0.6/1 (1.2) kV**



AS/NZS 5000.1:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-003, Electric Wires and Cables. It was approved on behalf of the Council of Standards Australia on 28 October 2005 and on behalf of the Council of Standards New Zealand on 4 November 2005.

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Australian Electrical and Electronic Manufacturers Association
Australian Industry Group
Canterbury Manufacturers Association New Zealand
Department of Primary Industries, Mine Safety (NSW)
Electrical Contractors Association of New Zealand
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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION
OF
AS/NZS 5000.1:2005
Electric cables—Polymeric insulated
Part 1: For working voltages up to and including 0.6/1 (1.2) kV

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NOTES

Australian/New Zealand Standard™

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-003, Electric Wires and Cables to supersede AS/NZS 5000.1:2003.

This Standard incorporates Amendment No. 1 (December 2006). 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 objective of this Standard is to provide manufacturers and suppliers with construction details, dimensions and tests for cables and flexible cables insulated with thermoplastic, elastomer or XLPE materials intended for use in electrical installations at working voltages up to and including 0.6/1 (1.2) kV.

This Standard differs from the 2003 edition as follows:

- (a) The method of specifying the thickness of insulation, separation layer, metallic sheath and oversheath has been aligned with IEC 60502-1.
- (b) A 1.0 mm² earth core conductor size has been included.
- (c) Optional aluminium wire armour has been included.
- (d) The conductor resistance test has been specified as being carried out on completed cable to align with AS/NZS 1660.3.
- (e) A legibility of marking test has been included.
- (f) Requirements for qualification testing have been included.

In the preparation of this Standard, consideration was given to IEC 60502-1, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = 1,2$ kV) up to 30 kV ($U_m = 36$ kV)*, Part 1: *Cables for rated voltages of 1 kV ($U_m = 1,2$ kV) and 3 kV ($U_m = 3,6$ kV)* and acknowledgment is made of the assistance received from that source.

The nominal cross-sectional areas of the conductors specified in this Standard are based on the values recommended in IEC 60228, *Conductors of insulated cables*.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

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

CONTENTS

	<i>Page</i>
1 SCOPE	4
2 REFERENCED DOCUMENTS	4
3 DEFINITIONS	5
4 VOLTAGE DESIGNATION	6
5 CONDUCTORS	6
6 INSULATION	7
7 ASSEMBLY OF CORES	9
8 BEDDING (OPTIONAL)	10
9 METALLIC LAYERS (OPTIONAL)	11
10 SEPARATION LAYER (OPTIONAL)	11
11 ARMOUR (OPTIONAL)	12
12 METALLIC SHEATH (OPTIONAL)	13
13 OVERSHEATH (OPTIONAL)	14
14 NON-METALLIC BRAID (OPTIONAL)	16
15 PROTECTION FROM INSECT ATTACK (OPTIONAL)	16
16 MARKING	16
17 TESTS	17
APPENDICES	
A PURCHASING GUIDELINES	21
B THE FICTITIOUS CALCULATION METHOD FOR THE DETERMINATION OF THE DIMENSIONS OF PROTECTIVE COVERINGS	22
C ROUNDING OF NUMBERS	28

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Electric cables—Polymeric insulated

Part 1: For working voltages up to and including 0.6/1 (1.2) kV

1 SCOPE

This Standard specifies construction, dimensions and tests for single- and multicore cables insulated with polymeric materials intended for use in electrical installations at working voltages up to and including 0.6/1 (1.2) kV.

It does not apply to polymeric insulated cables for special installations and service conditions or for which there are separate Australian/New Zealand Standards, e.g. neutral screened cables, welding cables, flexible cords and aerial bundled cables.

NOTES:

- 1 Purchasing guidelines are contained in Appendix A.
- 2 AS/NZS 3008.1 should be referenced to assist correct cable size selection for the intended application and installation.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

2706 Numerical values—Rounding and interpretation of limiting values

AS/NZS

1125 Conductors in insulated electric cables and flexible cords

1660 Test methods for electric cables, cords and conductors

1660.1 Method 1: Conductors and metallic components

1660.2.1 Method 2.1: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods for general application

1660.2.2 Method 2.2: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to elastomeric, XLPE and XLPVC materials

1660.2.3 Method 2.3: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to PVC and halogen free thermoplastic materials

1660.3 Method 3: Electrical tests

1660.5.6 Method 5.6: Fire tests—Test for vertical flame propagation for a single insulated wire or cable

2893 Electric cables—Lead and lead alloy sheaths—Composition

3000 Electrical installations

3008 Electrical installations—Selection of cables

3008.1 Part 1: Cables for alternating voltages up to and including 0.6/1 kV

3560 Electric cables—Cross-linked polyethylene insulated—Aerial bundled—For working voltages up to and including 0.6/1(1.2) kV (both Parts)

3808 Insulating and sheathing materials for electric cables

- 3863 Galvanized mild steel wire for armouring of cables
4507 Cables—Fire performance
4961 Electric cables—Polymeric insulated—For distribution and service applications

3 DEFINITIONS

For the purposes of this Standard, definitions given in the referenced Standards and those below apply.

3.1 Aerial cables

Cables used for applications where the cables are required to support their own weight when suspended unsupported in air.

3.2 Approximate value

A value which is neither guaranteed nor checked.

3.3 Core (of a cable)

The conductor with its insulation but not including any protective covering.

3.4 Direction of lay

The slope of the helically laid-up cores, screen wire or armour wire, armour tape or the like, when the cable is held vertically.

It is right hand when the slope is in the direction of the central part of the letter Z, and left hand when the slope is in the direction of the central part of the letter S.

3.5 Fictitious values

Values calculated according to an equation that is based only on cross-sectional area of conductor, number of cores and specified component dimensions, and which ignores conductor shape, degree of compaction of conductors, and the possibility of components having dimensions other than specified (see Appendix B).

3.6 Fixed cable

A cable that is designed to be supported and fixed in position.

3.7 Flexible cable

A cable with conductors, insulation and covering that afford flexibility. The conductors of any cross-sectional area comprise a substantial number of wires of small diameter.

3.8 Multicore cable

A cable comprising two or more cores.

3.9 Nominal value

Value by which a quantity is designated and which is often used in tables.

3.10 Non-hygroscopic material

A material that, after being pre-conditioned in an oven at $50 \pm 5^\circ\text{C}$ for 24 ± 1 h and allowed to cool in a desiccator, does not absorb more than 5 % by weight of moisture during a 48 h treatment in humidity of 95 ± 4 % at a temperature of $20 \pm 5^\circ\text{C}$.

3.11 Pitch circle diameter

The diameter of a circle which passes through the mid-points of the laid-up cores of a layer.

3.12 Qualification test report

A report of results obtained from all routine, sample and type tests.

3.13 Routine tests

Tests made by the manufacturer on each manufactured length of cable to check that each length meets specified requirements.

3.14 Sample tests

Tests made by the manufacturer on samples of completed cable, or components taken from completed cable, adequate to verify that the finished product meets the design specification.

3.15 Shall

Indicates that a statement is mandatory.

3.16 Should

Indicates a recommendation.

3.17 Type tests

Tests made before supplying on a general commercial basis a type of cable covered by this Standard, to demonstrate satisfactory performance characteristics that meet the intended application.

3.18 Voltage designation

For cables for a.c. systems, the rated voltages U_0 , U and U_m expressed in the form $U_0/U (U_m)$, or for cables for d.c. systems, the rated voltage U_0 —

where

- U_0 is the r.m.s. power frequency voltage to earth of the supply system or d.c. voltage of the supply system for which the cable is designed.
- U is the r.m.s. power frequency voltage between phases of the supply system for which the cable is designed.
- U_m is the maximum r.m.s. power frequency voltage between any two phase conductors for which cables and accessories are designed. It is the highest voltage that can be sustained under normal operating conditions at any time and at any point in a system. It excludes voltage variations due to fault conditions and sudden disconnection of large loads.

3.19 Wavelength or length of lay

The axial distance between successive crests of the waveform or turns of the helix formed, as appropriate, e.g. by a core of a multicore cable, wire of a stranded conductor, screen or armour wire, screen or armour tape or the like.

4 VOLTAGE DESIGNATION

The rated voltage, $U_0/U (U_m)$, recognized for the purposes of this Standard is 0.6/1 (1.2) kV.

5 CONDUCTORS

Conductors shall comply with the relevant requirements of AS/NZS 1125. Where tinning is provided, any wires taken from the completed cable need not comply with the continuity test for tin plating specified in AS/NZS 1660.1.

Aluminium may be used for conductors of cross-sectional areas of 16 mm² and above.

For aerial cables the conductors shall be hard-drawn copper or aluminium.

A separator tape may be used over the conductor. Any such tape that does not adhere to the insulation shall be coloured or opaque.

6 INSULATION

6.1 Material

6.1.1 General

Insulation shall comply with the requirements of one of the following materials, in accordance with AS/NZS 3808:

Material groups	Designation
Cross-linked elastomeric materials	R-EP-90, R-E-110, R-CSP-90, R-CPE-90, R-S-150
PVC materials	V-75, V-90, V-90HT
Reduced fire hazard cable materials—	
Thermoplastic	HFI-75-TP, HFI-90-TP
Cross-linked	X-HF-90, X-HF-110, R-HF-90, R-HF-110
Polyolefin materials	X-90, X-90UV

6.1.2 Aerial cables or fixed cables used in outdoor applications

The insulation of unsheathed cables subjected to direct sunlight shall be a PVC material complying with the requirements of Clause 6.1.1 and containing a minimum of 1 % carbon black by weight.

NOTES:

- 1 A manufacturer's statement is sufficient evidence of conformance for PVC due to the unavailability of a suitable compliance test.
- 2 Aerial cables insulated with polyolefin materials are covered by AS/NZS 3560.

6.2 Application

The insulation shall be applied over, but shall not adhere to, the conductor.

For insulated, unsheathed multicore flat cables adjacent cores shall be connected by a web such that the cores can be easily separated by tearing without damage to the insulation of any core.

6.3 Thickness

The average thickness of insulation, excluding any separator tape, shall be not less than the nominal thickness (t_i) specified in Table 1, and the minimum thickness at any point shall not fall below the nominal thickness by more than 10 % of the nominal thickness plus 0.1 mm, i.e.

$$\text{minimum thickness} = (0.90t_i - 0.10 \text{ mm}).$$

NOTE: The nominal thickness of insulation for 1.0 mm², 1.5 mm² and 2.5 mm² earth cores may be reduced, see Table 1, to match the size of active conductors with which they are commonly used.

TABLE 1
NOMINAL INSULATION THICKNESS

Nominal conductor cross- sectional area mm ²	Nominal insulation thickness (<i>t_i</i>)				
	mm				R-S-150
	HFI-75-TP, HFI-90-TP, V-75, V-90, V-90HT	R-EP-90, R-E-110, R-CSP-90, R-CPE-90, R-HF-90 and R-HF-110		X-90, X-90UV X-HF-90 and X-HF-110	
		Fixed	Flexible		
≤2.5	0.8	1.0	1.0	0.7	1.0
4	1.0	1.0	1.0	0.7	1.0
6	1.0	1.0	1.0	0.7	1.0
10	1.0	1.0	1.2	0.7	1.0
16	1.0	1.0	1.2	0.7	1.0
25	1.2	1.2	1.4	0.9	1.2
35	1.2	1.2	1.4	0.9	1.2
50	1.4	1.4	1.6	1.0	1.4
70	1.4	1.4	1.6	1.1	1.4
95	1.6	1.6	1.8	1.1	1.6
120	1.6	1.6	1.8	1.2	1.6
150	1.8	1.8	2.0	1.4	1.8
185	2.0	2.0	2.2	1.6	2.0
240	2.2	2.2	2.4	1.7	2.2
300	2.4	2.4	2.6	1.8	2.4
400	2.6	2.6	2.8	2.0	2.6
500	2.8	2.8	3.0	2.2	2.8
630	2.8	2.8	3.0	2.4	2.8
800	2.8	2.8	3.0	2.6	—
1000	3.0	3.0	—	2.8	—
1200	3.0	3.0	—	3.0	—
1.0 mm ² earth core	0.6	0.8	—	0.5	0.8
1.5 mm ² earth core	0.6	0.8	—	0.5	0.8
2.5 mm ² earth core	0.7	0.9	—	0.6	0.9

6.4 Core identification

6.4.1 Restricted colours

The colours green and yellow, either alone or in combination with any other colour shall not be used except—

- (a) when yellow printed characters identify cores by figures and words; or
- (b) for earth cores as described in Clause 6.4.2.

6.4.2 Method

For other than unsheathed aerial cables, cores shall be clearly and durably identified by either colours or figures followed by words, in accordance with Clause 6.4.3 or Clause 6.4.4, as appropriate.

For unsheathed multicore flat cables, including aerial cables, either one of the cores of a 2-core cable and the centre core of a 3-core cable shall be identified for use as a neutral by at least 4 evenly spaced (approximately) longitudinal ribs.