

Australian/New Zealand Standard™

**Electric cables—Polymeric insulated—
For distribution and service applications**



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AS/NZS 4961:2003

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Australian/New Zealand Standard™

Electric cables—Polymeric insulated— For distribution and service applications

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-003, Electric Wires and Cables.

The objective of this Standard is to specify a range of cables for distribution and service applications at working voltages up to and including 0.6/1(1.2) kV. This Standard supplements existing Standard AS/NZS 4026.

Section 2 of this Standard will supersede AS/NZS 3155:1995, *Approval and test specification—Electric cables—Neutral screened—For working voltages up to and including 0.6/1 kV*.

Section 3 of this Standard will supersede AS 1178—1986, *Concentric wire neutral cables—XLPE insulated—For electricity supply at working voltages of 0.6/1 kV*.

Section 4 of this Standard specifies a range of single core PVC or XLPE insulated distribution and service cables used in New Zealand.

Section 5 of this Standard is based on Table 11 of superseded AS/NZS 3198:1996, *Approval and test specification—Electric cables—XLPE insulated—For working voltages up to and including 0.6/1 kV*.

Section 6 of this Standard specifies a range of single core XLPE insulated distribution and service cables.

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.

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Australian/New Zealand Standard**Electric cables—Polymeric insulated—For distribution and service applications**

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the construction of a range of cables for distribution and service applications at working voltages up to and including 0.6/1(1.2) kV.

NOTES:

- 1 Guidelines on information that should be supplied with enquiries or orders are provided in Appendix A.
- 2 Recommended installation bending radius for a cable is given in Appendix B.
- 3 Recommendations for installation are given in Appendix C.

1.2 APPLICATION

For the purpose of this Standard, the cables shall comply with the requirements of the following Sections, as appropriate:

- | | |
|-----------|--|
| Section 2 | PVC or XLPE insulated neutral wire screened cables for use in electrical installations including overhead and underground lines. |
| Section 3 | XLPE insulated waveform concentric wire neutral cables for use in electrical installations. |
| Section 4 | PVC or XLPE insulated single-core distribution and service cables for use in electrical installations. |
| Section 5 | XLPE insulated bundled distribution and service cables for use in underground electrical installations. |
| Section 6 | XLPE insulated single-core distribution and service cables for use in electrical installations. |

1.3 REFERENCED DOCUMENTS

AS/NZS

- | | |
|----------|---|
| 1125 | Conductors in insulated electric cables and flexible cords |
| 1660 | Test methods for electric cables, cords and conductors |
| 1660.2.1 | Method 2.1: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods for general application |
| 1660.3 | Method 3: Electrical tests |
| 3100 | Approval and test specification—General requirements for electrical equipment |
| 3808 | Insulating and sheathing materials for electric cables |
| 5000 | Electric cables—Polymeric insulated |
| 5000.1 | Part 1: For working voltages up to and including 0.6/1 kV |

1.4 DEFINITIONS

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

1.4.1 Approximate thickness

A thickness which is neither guaranteed nor checked. It is used, for example, for the calculation of other dimensional values.

1.4.2 Core

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

1.4.3 Direction of lay

Direction of slope of a core in a laid-up multicore cable or other helically applied cable component.

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.

1.4.4 Maximum continuous conductor temperature

Maximum temperature at which the conductor of the cable may be operated continuously and is the temperature resulting from the combined effect of the ambient temperature and the current loading on the conductor.

1.4.5 Routine tests

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

1.4.6 Sample tests

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

1.4.7 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. These tests are of such a nature that, after they have been made, they need not be repeated unless changes are made in the cable materials or design which might change the performance characteristics.

1.4.8 Voltage designation

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

where

- U_o 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 and 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.

1.4.9 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 multi-core cable, wire of a stranded conductor or screen.

1.5 VOLTAGE DESIGNATION

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

1.6 MAXIMUM CONTINUOUS CONDUCTOR TEMPERATURE

The maximum permissible continuous conductor temperature of cables shall be as follows:

- (a) For cables insulated with V-75 or V-90 75°C.
- (b) For cables insulated with X-90 or X-90UV 90°C.

SECTION 2 PVC OR XLPE INSULATED NEUTRAL WIRE SCREENED CABLES

2.1 SCOPE OF SECTION

This Section specifies the construction, dimensions and tests for PVC or XLPE insulated neutral wire screened cables intended for use in electrical installations including overhead and underground lines at working voltages up to and including 0.6/1(1.2) kV.

Except where otherwise specified, the cables shall comply with the requirements of AS/NZS 5000.1.

NOTE: The neutral screen of a 5-conductor cable may be used as a separate earth conductor.

2.2 CONSTRUCTION

The cable shall consist of one core, two cores laid parallel or two, three or four cores laid up with fillers (where necessary); V-75, V-90 or X-90 insulated with all the cores surrounded by a helically applied concentric wire outer conductor and sheathed. Pilot cores may be included.

2.3 CORE CONDUCTORS

Core conductors shall be of plain or tinned copper or aluminium and shall comply with the appropriate requirements of AS/NZS 1125. Where tinning is provided wires taken from the finished cables need not pass the continuity test for tin plating in AS/NZS 1125.

The construction for aerial cables shall comprise core conductors of plain or tinned hard drawn copper conductors.

2.4 INSULATION

2.4.1 Material

The insulation shall be V-75, V-90 or X-90 in accordance with AS/NZS 3808.

2.4.2 Thickness

The average thickness of the insulation, determined by the method specified in AS/NZS 1660.2.1, shall be not less than the thickness specified in Tables 2.2 or 2.3 as appropriate, and the minimum thickness at any point shall not fall below the specified thickness (t_i) by more than 10 percent of the specified thickness plus 0.10 mm, i.e.

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

2.4.3 Core identification

The cores shall be identified by suitable means. The following scheme is recommended:

- (a) 2-conductor cable..... red core.
- (b) 3-conductor cable..... red and white (or uncoloured) cores.
- (c) 4-conductor cable..... red, white (or uncoloured) and blue cores.
- (d) 5-conductor cable..... red, white (or uncoloured), blue and black cores.

The colours green or yellow, or the colours green and yellow in any combination shall not be used for a core of a neutral screened cable.

2.5 CONFIGURATION

2.5.1 2-conductor cable

Single core

2.5.2 3-conductor flat cable

2 cores laid parallel

2.5.3 3-conductor circular cable

2 cores laid up helically with fillers (where necessary)

2.5.4 4-conductor cable

3 cores laid up helically with fillers (where necessary)

2.5.5 5-conductor cable

4 cores laid up helically with fillers (where necessary)

2.6 FILLERS AND BINDER TAPES

Where used, fillers and binder tapes shall be of a suitable non-metallic material compatible with the other materials of the cable with which they are in contact.

2.7 SCREEN

2.7.1 Construction

The screen conductor shall be of plain or tinned annealed copper wires complying with AS/NZS 1125, helically applied and uniformly distributed over the core or cores. Where tinning is provided, wires taken from the finished cable need not pass the continuity test for tin plating in AS/NZS 1125.

2.7.2 Resistance

The d.c. resistance of the screen shall not exceed the maximum allowable resistance of the largest core conductor.

2.7.3 Coverage

Coverage by the screen shall be not less than 80 percent for 2-conductor cable and 60 percent for 3-, 4-, and 5-conductor cables when calculated by the following equation:

$$\text{Percentage coverage} = \frac{W}{m} \times 100 \quad \dots 2.7.3(1)$$

where

W = number of wires $\times$ diameter in millimetres of a single wire

$$m = \frac{L\pi d}{\sqrt{[(\pi d)^2 + L^2]}} \quad \dots 2.7.3(2)$$

where

L = axial length or pitch of one complete turn of a screen wire, in millimetres

d = pitch diameter of screen, in millimetres (see Clause 2.7.4)

2.7.4 Pitch diameter

For circular and flat cables the pitch diameter of the screen d is expressed as follows:

- (a) For circular cables

$$d = d_{\text{ns}} - d_{\text{sw}} \quad \dots 2.7.4(1)$$

- (b) For flat cables

$$d = (d_i \times 1.637) + d_{\text{sw}} \quad \dots 2.7.4(2)$$

where

d_{ns} = the nominal diameter over the screen, in millimetres

d_i = the nominal diameter over the insulation, in millimetres

d_{sw} = diameter of one screen wire, in millimetres

2.8 SHEATH

2.8.1 Material

The sheath shall be either V-75 or V-90 in accordance with AS/NZS 3808.

- (a) For cables with cores insulated with V-75

Sheath of V-75

- (b) For cables with cores insulated with V-90 or X-90

Sheath of V-90

Unless otherwise specified the sheath shall contain not less than 1 percent carbon black added during compounding or extrusion.

2.8.2 Thickness

The average thickness of the sheath, determined by the method specified in AS/NZS 1660.2.1, shall be not less than the thickness specified in Tables 2.2 or 2.3 as appropriate.

Cables for direct burial in New Zealand without further protection shall have a specified sheath thickness (t_s) of not less than 3.2 mm.

The specified thickness (t_s) for cables with pilot cores shall be calculated in accordance with AS/NZS 5000.1.

The minimum thickness at any point shall not fall below the specified thickness (t_s) by more than 10 percent of the specified thickness plus 0.10 mm i.e.

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

2.9 MARKING OF CABLE

2.9.1 Information to be marked

Cables shall be marked with the following information on the sheath:

- A registered name or registered mark, which enables the manufacturer or supplier of the cable to be identified.
- Year of manufacture.
- Designation of insulation (see Clause 2.4.1).
- The words 'NS ELECTRIC CABLE' and the voltage rating, e.g. 0.6/1 kV.
- The word 'AERIAL', if applicable.
- The word 'UNDERGROUND' in New Zealand, if the sheath thickness is 3.2 mm.