

Australian/New Zealand Standard™

**Conductors—Covered overhead—
For working voltages
6.35/11 (12) kV up to and including
19/33 (36) kV**



AS/NZS 3675:2002

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 7 May 2002 and on behalf of the Council of Standards New Zealand on 9 May 2002. It was published on 30 May 2002.

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Australian/New Zealand Standard™

Conductors—Covered overhead— For working voltages 6.35/11 (12) kV up to and including 19/33 (36) kV

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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 3675—1993 and NZS/AS 3675—1993, *Conductors—Covered overhead—For working voltages 6.35/11 up to and including 19/33 kV*.

The objective of this Standard is to provide the construction, dimensions and test requirements for overhead covered conductors intended for power distribution, operating at voltages 6.35/11 (12) kV up to and including 19/33 (36) kV. Lines constructed with covered conductors are an alternative to overhead bare conductor construction and aerial bundled cables.

A rationalized range of stranded circular aluminium alloy conductors only are specified in this Standard.

This Standard differs from the previous edition in the following significant ways:

- (a) The Standard has been published as a Joint Australian/New Zealand Standard.
- (b) The requirements of the covering materials have been referred to AS/NZS 3808.
- (c) The 20 mm² conductor size in the CC type has been deleted.
- (d) A 40 mm² conductor size in the CCT type has been added.

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.

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard specifies the construction, dimensions and test requirements for water blocked covered conductors, suitable for overhead lines for working voltages 6.35/11 (12) kV up to and including 19/33 (36) kV, 50 Hz a.c.

NOTES:

- 1 An application guide is provided in Appendix A.
- 2 Guidelines on information that should be supplied with enquiries or orders are provided in Appendix B.

1.2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

- 1531 Conductors—Bare overhead—Aluminium and aluminium alloy
- 3983 Metal drums for insulated electric cables and bare conductors

AS/NZS

- 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
- 1660.2.4 Method 2.4: Insulation, extruded semi-conductive screens and non-metallic sheaths—Methods specific to polyethylene and polypropylene materials
- 1660.3 Method 3: Electrical tests
- 2857 Timber drums for insulated electric cables and bare conductors
- 3008 Electrical installations—Selection of cables
- 3008.1 Part 1: Cables for alternating voltages up to and including 0.6/1 kV
- 3808 Insulating and sheathing materials for electric cables

IEC

- 60287 Electric cables—Calculation of the current rating

ASTM

- G155 Standard practice for operating xenon arc light apparatus for exposure of non-metallic materials

ESAA

- HB C(b)1 Guidelines for design and maintenance of overhead distribution and transmission lines

1.3 DEFINITIONS

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

1.3.1 Conductor

That portion of covered conductor which has the specific function of carrying current.

1.3.2 Covered conductor

A conductor around which is applied a specified thickness of insulating material. The types in this Standard are:

(a) CC

A covered conductor having a 2.0 mm thickness of covering for use on all working voltages up to and including 19/33 (36) kV.

(b) CCT

A covered conductor which has a specified thickness of covering for each of the nominated working voltages.

1.3.3 Covering

Insulating material of a specified thickness excluding any water blocking compound.

1.3.4 Maximum continuous conductor temperature

The maximum temperature at which the conductor can be operated continuously. It is the temperature resulting from the combined effect of all contributing thermal conditions.

1.3.5 Routine tests

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

1.3.6 Sample tests

Tests made by the manufacturer on samples of covered conductor, or components taken from a completed covered conductor, at a specified frequency, so as to verify that the finished product meets the specified requirements.

1.3.7 Type tests

Tests made before supplying, on a general commercial basis, a type of covered conductor covered by this Standard, in order to demonstrate satisfactory performance characteristics to 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 covered conductor materials or design or manufacturing process, which might change the performance characteristics. Where changes are made, repeat tests shall be limited to those needed to prove compliance with this Standard.

1.3.8 Ungreased conductor

A conductor which is dry and free from grease, other than a light residue of wire drawing lubricant that may be on the wires.

1.4 VOLTAGE DESIGNATION

Indication of the rated voltages shall be expressed in the form U_o/U (U_m)

where

U_o is the r.m.s. power frequency voltage to earth of the supply system, for which the covered conductor is designed.

- U is the r.m.s. power frequency voltage between phases of the supply system, for which the covered conductor is designed.
- U_m is the maximum r.m.s. power frequency voltage between any two phases of the supply system for which covered conductors 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 temporary voltage variations due to fault conditions and sudden disconnection of large loads.

1.5 MAXIMUM CONDUCTOR TEMPERATURE

The temperature of the conductor shall not exceed the following values:

- (a) Normal operation 80°C
- (b) Emergency operation 100°C
- (c) Short-circuit operation (5 s max.) 210°C

NOTE: The maximum temperatures given are based upon the properties of the conductors, but in practice they may need to be derated to take account of joints and terminations.

Over the 30 year life expectancy the covered conductor should not operate at the emergency operation temperature more than three times in any 12 successive months nor for any single period exceeding 100 h.

At the emergency operating temperature, the cable covering may suffer deformation due to external forces applied at supports.

SECTION 2 CONSTRUCTION

2.1 CONDUCTORS

2.1.1 Materials

Conductors shall all be ungreased aluminium alloy, in accordance with AS 1531, of the sizes specified in Tables 2.1 or 2.2 herein.

For conductor water blocking requirements see Clause 2.3.

2.2 COVERING

2.2.1 Covered conductors (CC)

2.2.1.1 Material

The conductors shall be covered with ultraviolet (UV) stabilized X-90, complying with the requirements of AS/NZS 3808.

If the UV stabilization is achieved by the addition of a minimum of 2% carbon black then the covering shall comply with the requirements for unprotected X-90 insulation in AS/NZS 3808.

If the UV stabilization is achieved by other means then the requirements of Table 3.1 Test 3(h) shall be met.

2.2.1.2 Thickness

The thickness of the covering shall comply with Table 2.1.

2.2.2 Covered conductors (CCT)

2.2.2.1 Material

The conductors shall be covered with one of the following:

- (a) UV stabilized X-90, complying with the requirements of Clause 2.2.1.1.
- (b) X-90 with an outer layer of UV stabilized HDPE. X-90 shall comply with the requirements of AS/NZS 3808.

If the UV stabilization of the HDPE is achieved by the addition of carbon black then the material shall comply with the requirements for HDPE in AS/NZS 3808 and Table 3.1, Test 2.2(b).

If the UV stabilization of the HDPE is achieved by other means then the material shall comply with the requirements for HDPE in AS/NZS 3808 except for the carbon black content. The material shall also comply with the requirements of Table 3.1, Test 3(h).

2.2.2.2 Thickness

The thickness of the covering shall comply with the requirements of Table 2.2.

Where the covering is a combination of layers of X-90 and HDPE, the average thickness of HDPE shall be not more than 40% of the specified minimum average thickness, and in no case shall be less than 1.0 mm. The thickness of HDPE at any point shall be not less than 0.80 mm.

2.3 WATER BLOCKING

Water blocking measures shall be taken to prevent migration of water along the conductor and shall meet the requirements of Section 3.

The water blocking compound shall be a contrasting colour to that of the conductor

2.4 IDENTIFICATION

2.4.1 Information to be marked

Covered conductors shall be marked on the external surface with the following:

- (a) A registered name or registered mark which enables the manufacturer or supplier of the covered conductor to be identified.
- (b) Year of manufacture.
- (c) Metre marking in sequential numbers at 1 m intervals. The metre marking shall be limited to six digits, and any drum length may start at any integral number.
- (d) Type, i.e. CC or CCT, as appropriate.
- (e) Conductor material, e.g. AAAC/1120.
- (f) The applicable voltage (CCT only).

2.4.2 Means of marking

Marking shall be legible and durable and shall be embossed or printed in letters of height not less than 2 mm.

2.5 PREPARATION FOR DELIVERY

Covered conductors shall be wound onto drums meeting the requirements of AS/NZS 2857 for timber drums or AS 3983 for metal drums. Drums shall be lagged to protect the covered conductors from damage. The inner end of the covered conductors shall be secured to the drum to provide an anchorage for tension stringing.

2.6 MARKING OF DRUMS

Every drum of covered conductor shall be durably branded, stencilled or labelled on the outside of the flange with the following information:

- (a) A registered name or registered mark which enables the manufacturer or supplier of the covered conductor to be identified.
- (b) Type of construction, i.e. CC or CCT.
- (c) The applicable voltage (CCT only).
- (d) A manufacturer's traceability number preceded by the words 'DRUM NO'.
- (e) The start number of the metre marking on the inner end of the cable.
- (f) The length on the drum, in metres.
- (g) Nominal conductor size and material.
- (h) Gross mass.
- (i) An arrow to indicate the direction of rotation of the drum to ensure the covered conductor does not loosen on the drum during rolling.

NOTE: Manufacturers making a statement of compliance with this Australian/New Zealand Standard on a product, packaging or promotional material related to that product are advised to ensure that such compliance is capable of being verified.

TABLE 2.1
TECHNICAL REQUIREMENTS FOR COVERED CONDUCTORS (CC)

1	2	3	4	5	6
Characteristic	Units	Conductor size and type			
Nominal cross-sectional area	mm ²	40	80	120	180
Stranding and nominal wire diameter	No./mm	7/2.75	7/3.75	7/4.75	19/3.50
Material		AAAC/1120 or AAAC/6201			
Approximate conductor diameter*	mm	8.3	11.3	14.3	17.5
Covering thickness:					
(a) minimum average	mm	2.0	2.0	2.0	2.0
(b) minimum at any point	mm	1.70	1.70	1.70	1.70
(c) maximum at any point	mm	2.50	2.50	2.50	2.50
Resultant overall diameter range*	mm	12.2 to 13.3	15.1 to 16.4	18.1 to 19.4	21.3 to 22.7
Approximate mass*	kg/km	210	340	500	710

* Given for information only.

TABLE 2.2
TECHNICAL REQUIREMENTS FOR COVERED CONDUCTORS (CCT)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Characteristic	Units	Conductor size and type											
Nominal cross-sectional area	mm ²	40			80			120			180		
Stranding and nominal wire diameter	No./mm	7/2.75			7/3.75			7/4.75			19/3.50		
Material		AAAC/1120			AAC/1120 or AAAC/6201								
Approximate conductor diameter*	mm	8.3			11.3			14.3			17.5		
Voltage rating	kV	6.35/11	12.7/22	19/33	6.35/11	12.7/22	19/33	6.35/11	12.7/22	19/33	6.35/11	12.7/22	19/33
Covering thickness:													
(a) Minimum average	mm	3.4	5.5	8.0	3.4	5.5	8.0	3.4	5.5	8.0	3.4	5.5	8.0
(b) Minimum at any point	mm	2.96	4.85	7.10	2.96	4.85	7.10	2.96	4.85	7.10	2.96	4.85	7.10
(c) Maximum at any point	mm	4.00	6.40	9.30	4.00	6.40	9.30	4.00	6.40	9.30	4.00	6.40	9.30
Resultant overall diameter range*	mm	14.9 to 16.4	19.1 to 21.2	24.1 to 27.0	17.9 to 19.4	22.1 to 24.2	27.1 to 30.0	20.9 to 22.4	25.1 to 27.2	30.1 to 33.0	24.1 to 25.7	28.3 to 30.5	33.3 to 36.3
Approximate mass†	kg/km	255	370	540	450	635	900	640	845	1145	870	1105	1440

*Given for information only.

†Given for information only. Values are calculated for X-90 only.

SECTION 3 TESTS

3.1 ROUTINE TESTS

All routine tests shall be carried out as set out in Table 3.1.

3.2 SAMPLE TESTS

The frequency, sampling details and retest criteria of failed sample tests shall be as listed below, unless otherwise agreed between manufacturer and purchaser at the time of ordering (see Appendix B).

One sample of finished covered conductor shall be taken from each production run or from each 10 km of covered conductor, whichever is the lesser.

The tests shall be conducted on the samples selected as above. Where the requirements for testing are less than 100%, the selection of test specimens shall be random.

The test frequency is listed below:

Test	Percentage of samples to be tested
3(b) Covering thickness	100
3(c) Static water blocking	20
3(e) Stripping	20

If any test specimen fails, then two further specimens shall be taken from the same drum of covered conductor.

If either of these specimens fail, then that drum of covered conductor shall be rejected, and each remaining drum of covered conductor in the production run shall be tested.

3.3 TYPE TESTS

A type test report shall include the results of all type, sample and routine tests as set out in Table 3.1.

A type test on a finished covered conductor of a stated conductor size and thickness of covering shall qualify any other covered conductor with the same number of wires and thickness of covering.

A type test on covering material (Table 3.1, Test 2 and Test 3(h) and (i)) from any conductor size and thickness of covering shall qualify that material for any other covered conductor.