

ETS 0059

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Revision History

This amendment replaces amendment no. 0 and the NNSW Aerial Bundled Cables Technical Specification. All changes are highlighted in this document with grey colouring.

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Contents

1	Documentation Scope	4
2	References	4
3	Definitions and Abbreviations	5
4	General Requirements	6
4.1	Requirements exceeding the Australian Standards	6
4.2	Health, safety and environment (HSE) requirements	7
4.3	Quality assurance	7
4.4	Service history	8
4.5	General Drum Requirements	8
4.6	General Testing Requirements	9
5	LVABC Requirements	11
5.1	Technical Requirements	11
5.2	LVABC Drum Requirements	13
5.3	Cable Markings	14
5.4	Laminate Tape	14
5.5	Testing Requirements	14
6	Non-metallic screened high voltage aerial bundled cable (NMSHVABC)	20
6.1	Technical Requirements	20
6.2	NMSHVABC Drum Requirements	24
6.3	Markings	25
6.4	Testing Requirements	25
7	Authorities and Responsibilities	34
8	Annexure 1 – Standard aerial bundled cable sizes	35

1 Documentation Scope

This specification covers the design, engineering, manufacture, testing, supply and delivery of low voltage aerial bundled cable (LVABC) and non-metallic screened high voltage aerial bundled cable (NMSHVABC) for use on Endeavour Energy's overhead distribution network.

2 References

External Regulations

Electricity Supply Act 1995 (NSW)

Electricity Supply (Safety and Network Management) Regulation 2014

National Electricity (NSW) Law 1997 National Electricity Rules

External Standards

AS 1531:1991 – Conductors – Bare overhead – Aluminium and aluminium alloy

AS/NZS 1125:2001 – Conductors in insulated electric cables and flexible cords

AS/NZS 1660.1:1998 – Test methods for electric cables, cords and conductors – Conductors and metallic components

AS/NZS 1660.2.1:1998 – Test methods for electric cables, cords and conductors – Insulation, extruded semi-conductive screens and non-metallic sheaths – Methods for general application

AS/NZS 1660.2.4:1998 – Test methods for electric cables, cords and conductors – Insulation, extruded semi-conductive screens and non-metallic sheaths – Methods specific to polyethylene and polypropylene materials

AS/NZS 1660.3:1998 – Test methods for electric cables, cords and conductors – Electrical tests

AS/NZS 2857:1996 – Timber drums for insulated electric cables and bare conductors

AS/NZS 3560.1:2000 – Electric cables – Cross-linked polyethylene insulated – Aerial bundled – For working voltages up to and including 0.6/1(1.2)kV. Part 1: Aluminium conductors

AS/NZS 3599.2:1999 – Electric cables - Aerial bundled - Polymeric insulated - Voltages 6.35/11 (12) kV and 12.7/22 (24) kV. Part 2: Non-metallic screened

AS/NZS 3808:2000 – Insulating and sheathing materials for electric cables

AS/NZS 3983:1991 – Metal drums for insulated electric cables and bare conductors

AS/NZS ISO 9001:2016 – Quality management systems – Requirements

AS/NZS ISO 14001:2016 – Environmental management systems - Requirements with guidance for use

BS 2627:1970 – Specification for wrought aluminium for electrical purposes. Wire

Company Policies and Procedures

Company Policy 9.2.1 – Network Planning

Company Policy 9.2.5 – Network Asset Design

Company Policy 9.2.10 – Network Asset Ratings

Company Policy 9.7.1 – Network Asset Construction

3 Definitions and Abbreviations

Abbreviation	Meaning
AAAC	All aluminium alloy conductor
AAC	All aluminium conductor
AC	Alternating Current
AS	Australian Standard
BS	British Standard
CSA	Cross Sectional Area
DC	Direct Current
HDPE	High density polyethylene
HV	High voltage (11kV or 22kV phase-to-phase)
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
LV	Low voltage (230V phase-to-earth or 400V phase-to-phase)
LVABC	Low voltage aerial bundled cable
MSDS	Material Safety Data Sheet
NATA	National Association of Testing Authorities
NMSHVABC	Non-metallic screened high voltage aerial bundled cable
NZS	New Zealand Standard
RMS	Root Mean Square
XLPE	Cross linked polyethylene

4 General Requirements

All aerial bundled cable must comply with the requirements of:

- this specification;
- AS/NZS 3560.1:2000 for LVABC and other standards and codes referenced therein;
- AS/NZS 3599.2:1999 for NMSHVABC and other standards and codes referenced therein; and,
- all other relevant standards as listed in Clause 2 of this specification.

Where this specification conflicts with a standard, this specification will prevail.

It is the supplier's responsibility to ensure that any changes to the Australian Standards, referenced in this specification, that occur whilst the product(s) are being supplied and affect the design, engineering, manufacture and / or testing of the cables being supplied are approved by the Mains Assets Manager prior to the changes being implemented.

Endeavour Energy may consider aerial bundled cables manufactured to other recognised international standards provided the standards are at least equivalent to the relevant Australian/IEC standards.

The aerial bundled cables required for use in Endeavour Energy's network are listed in Annexure 1 – Standard aerial bundled cable sizes.

Endeavour Energy may require cable samples to be provided by the supplier. When requested, a minimum length of 1.5 metres of each cable type being offered must be provided. The cable markings complying with Clause 5.3 and Clause 6.3 of this specification for LVABC and NMSHVABC respectively must be clearly visible on each sample. Individual cores at both cable ends of each cable sample to be provided must be sealed in accordance with Clause 4.5 of this specification.

4.1 Requirements exceeding the Australian Standards

The requirements that are above those contained in AS/NZS 3560.1:2000 for LVABC and AS/NZS 3599.2:1999 for NMSHVABC are detailed in Table 1 below:

Table 1 – Requirements exceeding Australian Standards

Cable type	Reference Australian Standard	Requirement	Description	Reference Section/Clause in this Specification
LVABC	AS/NZS 3560.1:2000	Sealing of cable ends	Individual cores at both cable ends must be sealed to prevent the moisture ingress into the cable.	6.2
		Sample test	Additional sample test for core identification markings.	5.5.2.1
NMSHVABC	AS/NZS 3599.2:1999	Type test	Tests for carbon black content/dispersion added to type tests for the HDPE outer sheath	6.4.1.2

Cable type	Reference Australian Standard	Requirement	Description	Reference Section/Clause in this Specification
Common	AS/NZS 3560.1:2000 and AS/NZS 3599.2:1999	Discharging of conductors after testing	The cable must be fully discharged from any residual test voltages/charges.	4.6
		Drum markings	Additional markings on the drum are: - • Australian Standard that the cable complies to; • The words, “Endeavour Energy”; • Endeavour Energy’s purchase order number; • Endeavour Energy’s stock code; • Net mass of the cable on the drum; • An arrow with the words “CABLE PULLING DIRECTION”	4.5.1
		Cable marking	Batch number must be printed on the outer surface of the insulation of one (1) active core in each cable length	5.3 and 6.3

4.2 Health, safety and environment (HSE) requirements

The supplier must provide with the offer, full details, including composition and toxicological information, regarding the health and safety aspects of all the materials offered in their offer or supplied equipment regardless of content.

Recommended procedures must be provided for the safe handling, safe operation and maintenance of products supplied.

Material safety data sheets (MSDS) must be provided for each material used in the manufacturing of the cable.

Suppliers are required to demonstrate if each component of the product can be recycled and/or disposed of at the end of products life (e.g. recycling of aluminium conductor). Any materials that cannot be recycled must be listed and recommended disposal / handling processes provided.

4.3 Quality assurance

The supplier must provide the following quality assurance documentation with their offer:

ETS 0059 – Aerial Bundled Cable

- Quality Management System certificate in accordance with AS/NZS ISO 9001:2016 or similar; and/or,
- Environmental Management System certificate in accordance with AS/NZS ISO 14001:2016 or similar.

4.4 Service history

The supplier must provide service history information for aerial bundled cables to Endeavour Energy with the offer. As a minimum, the supplier must provide the following information:

- The period of service of the items being offered within the Australian environmental conditions;
- Australian customers or electricity supply authorities who have a service history of the items being offered; and,
- Contact names and telephone numbers of relevant employees of those customers/electricity supply authorities who can verify the service performance claimed.

4.5 General Drum Requirements

The aerial bundled cables must be supplied on either:

- timber drums manufactured in accordance with AS/NZS 2857:1996; or
- metal drums in accordance with AS/NZS 3983:1991;

The drums supplied must be suitable for outdoor storage and the spindle holes must be fitted with steel spindle plates. Drums with spindle tubes will not be accepted.

Refer to Clauses 5.2 and 6.2 for specific requirements for LVABC and NMSHVABC, respectively.

Only one (1) continuous length of cable must be wound on each drum.

Wooden drums must be treated or lined on both the barrel and the inner face of the flange with a robust and impervious material to prevent damage to the cable due to leaching of wood acids. Details of the treatment used must be provided by the supplier and must include the MSDS for the treatment applied.

Where the supplier allows for the drum recycling option, the supplier will be responsible for transporting the empty cable drums, at their own cost, from Endeavour Energy's store to the manufacturing plant or holding facility for re-use.

4.5.1 Cable drum markings

The cable drums must be marked in accordance with the requirements of Clause 2.11 of AS/NZS 3560.1:2000 for LVABC or Clause 14 of AS/NZS 3599.2:1999 for NMSHVABC.

The following information must be on the drums:

- The complying Australian Standard for the cable;
- A registered name or registered trade mark that enables the manufacturer of the cable to be identified;
- For NMSHVABC only, "6.35/11 kV" followed by the legend "ABC/H to AS/NZS 3599.2";

- Manufacturer's drum serial number;
- The words, "**Endeavour Energy**";
- Endeavour Energy's purchase order number;
- Endeavour Energy's stock code (in accordance with Annexure 1 – Standard aerial bundled cable sizes);
- Number and cross-sectional area of conductors;
- Length of cable and the start and finish numbers of the metre marking for the length;
- Gross mass of the drum and the cable;
- The net mass of the cable on the drum;
- An arrow with the words "**CABLE PULLING DIRECTION**" must be marked on the outer face of both flanges; and,
- Year of manufacture of the cable.

4.6 General Testing Requirements

All cables to be supplied must be type, sample and routine tested in accordance with these general requirements, specific testing requirements detailed in:

- Clause 5.5 of this specification, which is based on Section 3 of AS/NZS 3560.1:2000 for LVABC; and,
- Clause 6.4 of this specification, which is based on Section 15 of AS/NZS 3599.2:1999 for NMSHVABC.

An additional sample test for LVABC on core identification must be performed in accordance with Clause 5.5.2.1 of this specification.

All test reports must be submitted with the offer.

All ABC conductors, including the support conductor for NMSHVABC, must be fully discharged from any residual voltages / charge prior to being delivered to Endeavour Energy.

4.6.1 Test accreditation and reporting requirements

All type tests must be carried out by a testing authority/laboratory holding accreditation:

- by NATA Australia; or
- by an accreditation authority recognised by NATA Australia.

Tests from other testing authorities may be accepted at the discretion of Endeavour Energy.

All type test reports must be accompanied by copies of the accreditation certificate(s) issued to the testing laboratory. The accreditation certificate(s) must be valid for the relevant test(s) and for the duration of the test(s).

Type tests must be less than five (5) years old. Type tests beyond this limit may be submitted provided sufficient information to demonstrate that the manufacturing process, raw materials, design and quality

ETS 0059 – Aerial Bundled Cable

control processes have not significantly changed since the original test date is also submitted with the offer.

Separate type tests will be required for each manufacturing plant intended to be used for manufacturing aerial bundled cables to this specification. For example, if a supplier sources aerial bundled cables from more than one supplier, or a manufacturer operates more than one manufacturing facility, type tests will be required for each of the manufacturing facilities or sources of supply.

All sample and routine tests may be conducted at the manufacturing facility's test laboratory on the condition that sufficient evidence is provided with the offer to demonstrate the testing facility's capability to perform the specified tests. As a minimum, the following information must be provided:

- Qualifications/experience of testing staff;
- Test procedures for all routine tests;
- Testing facility quality control procedures; and
- Test instrument calibration certificates/procedures.

All documentation submitted (including reports, tests, testing procedures/policies, calibration certificates and the like) must be in English.

All test reports must specify the size and voltage of the aerial bundled cable tested, test assembly, procedure, test requirement and test results. Test reports only indicating that the items have passed without listing the test conditions above will be deemed non-compliant.

5 LVABC Requirements

5.1 Technical Requirements

All LVABCs must comply with the requirements specified in Table 2 below, which are based on the requirements from Table 2.1 of AS/NZS 3560.1:2000:

Table 2 – Technical requirements for LVABC

Characteristic	Unit	Nominal conductor CSA (mm ²)				
		16	25	50	95	150
Rated AC voltage, RMS (phase-to-earth / phase-to-phase)	kV	0.6 / 1				
Number of wires (strands) in conductor	#	7			19 or 19±1	
Minimum diameter of conductor	mm	4.5	5.8	8.0	11.3	14.1
Maximum diameter of conductor	mm	4.8	6.1	8.4	11.9	14.9
Maximum DC resistance of conductor at 20°C	Ω/km	1.91	1.20	0.641	0.320	0.206
Minimum breaking load of conductor	kN	2.2	3.5	7.0	13.3	21.0
Minimum average thickness of insulation excluding ribs	mm	1.3		1.5		1.7
Minimum thickness of insulation at any point	mm	1.07		1.25		1.43
Maximum thickness of insulation at any point excluding ribs	mm	1.9		2.1		2.3
Maximum diameter of core excluding ribs	mm	7.9	9.2	11.9	15.9	18.9
Load for adhesion of insulation	kg	N/A		100±1	190±1	300±1
No. of evenly spaced ribs on the neutral core (applicable to two (2) core and four (4) core cables only)	#	10	12	16	20	24

5.1.1 Conductors

All conductors must be stranded compacted circular aluminium complying with the requirements of Table 2 of this specification. The wires used in the manufacturing of the conductors must be made from alloy 1350 in accordance with AS/NZS 1125:2001.

Successive layers of wires in multilayer conductors must alternate in the direction of lay. The outermost layer of wires in all conductors must be right-hand direction of lay.

A certificate of chemical composition from the ingot supplier that is used to manufacture the conductor must be submitted with the offer.

The cable must be designed for a maximum continuous conductor operating temperature of 80°C, which is based on consideration of the performance of the fittings and strength of the conductors.

5.1.2 Insulation

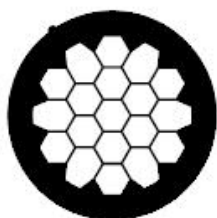
The conductor insulation must meet the requirements of X-90UV cross linked polyethylene material complying with AS/NZS 3808:2000. The insulation colour must be black. The carbon black content of the insulation must be not less than 2%.

The insulation must be homogenous, applied with a close fit, but being readily removable from the conductor and meet the requirements of Table 2 and Clause 5.5.1 of this specification.

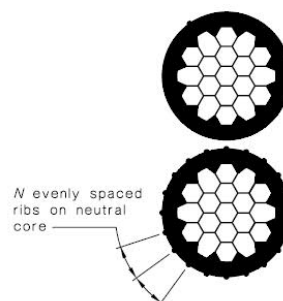
The use of a separator tape under the insulation (on the conductor) is optional. Where used, the separator tape must be non-hygroscopic (that is, not tending to absorb moisture from air). The separator tape must be coloured or opaque if it does not adhere to the insulation.

5.1.3 Cores

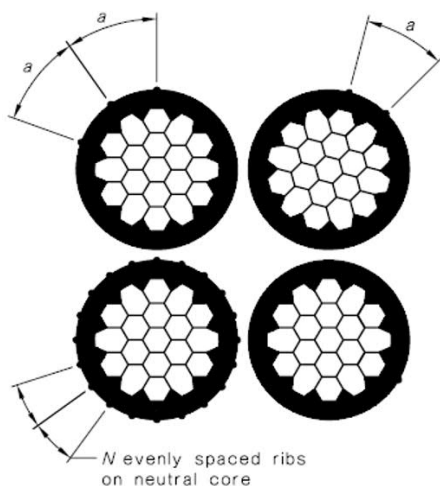
The cores must be identified by continuous, longitudinal raised ribs as set out in this clause, Figure 1 and Figure 2 below.



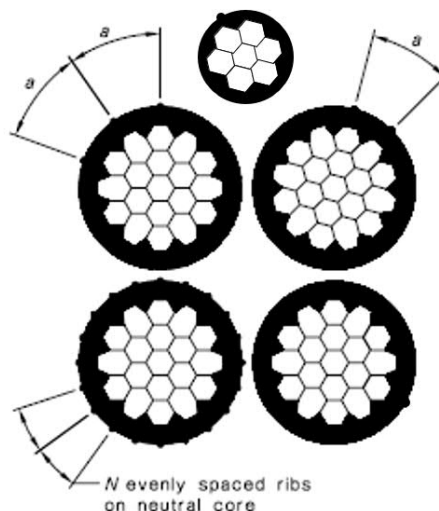
Drawing 1: Single core cable



Drawing 2: Two core cable



Drawing 3: Four core cable



Drawing 4: Four core + 1 x 16mm² cable

Figure 1 – Rib details for each core

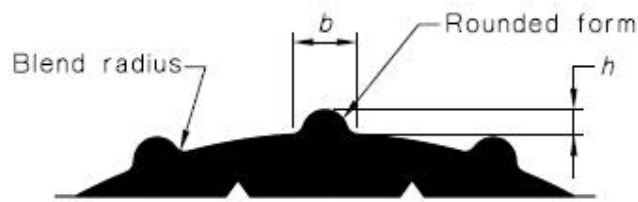


Figure 2 – Rib profile

The neutral core is incorporated in all LVABCs except items 1 and 2 of Table 15 – Standard LVABC sizes of Annexure 1. The ribs on the neutral core must be evenly spaced around the circumference and set out as shown in Figure 1 with quantities as specified in Table 2 of this specification.

The core of the cables in items 1 and 2 of Table 15 must be considered as an active core and must have one (1) rib. The active core or cores for the remaining items in Table 15 of Annexure 1 must be set out in accordance with Figure 1 of this specification for the respective cables.

An additional compacted 16mm² core is required for items 7 and 8 in Table 15 of Annexure 1. This core will be used to provide controlled supply for street light circuits and must be marked with a single rib. This core must be located between any two other cores and must not be located in the centre of the bundle.

The ribs on all cores must have a uniform profile and dimensional requirements for spacing 'a', rib base width 'b' and rib height 'h' must be in accordance with Table 3 below. Refer to Figure 2 above for rib profile details.

Table 3 – Rib dimensional requirements

Core type	Rib base width (b)	Rib height (h)	Rib spacing (a)
Active cores	1.0±0.2 mm	0.5±0.1 mm	3±1 mm for conductor size ≤ 25 mm² 5±1 mm for all other conductor sizes
Neutral core	0.6±0.2 mm	0.3±0.1 mm	Evenly spaced around the circumference of the neutral core (as shown in Figure 1) to suit the number of ribs specified in Table 2 of this specification

The cores of the cable must be laid up with a left-hand direction of lay. The sequence of cores for four core cables must be neutral, 1, 2, 3.

The length of lay of the cores must be not less than 22 times, nor more than 28 times the calculated maximum diameter of a circumscribing circle over the laid-up cores.

5.2 LVABC Drum Requirements

All drums wound with LVABC must meet the general requirements detailed in Clause 4.5 and specific requirements detailed below.

Every drum length of cable must meet the following requirements, which are in accordance with the Clause 2.10 of AS/NZS 3560.1:2000:

- Individual cores at both cable ends must be sealed to prevent the ingress of moisture to the conductors;
- Both ends of cable must be fitted with temporary binders to prevent the cores from separating;

- c) One end of the bundled cable must be coloured red and the other green. When phasing the cable end, the end at which the rotational sequence of the cores (for 4-core cable - neutral, 1, 2, 3) is clockwise, must be coloured red, and the other end must be coloured green.

The temporary binder in Item b) above may be coloured to satisfy this requirement.

- d) The cable must be wound on the drum so that the red end is at the drum barrel and at least 0.5m of cable at the drum barrel (that is, the inner end of the cable) is protruding. The cable must be adequately secured to the drum (e.g. with the use of saddles) to prevent it becoming free during installation. The use of string to secure the inner end of the cable to the drum is not permitted.
- e) The cable drum must be lagged to protect the cable from damage. The inner end of the cable projecting from the drum must be protected.

5.3 Cable Markings

The active cores must be identified by the numerals and letters **1 ONE**, **2 TWO** and **3 THREE** printed along the core as required for each item, the numeral corresponding to the number of ribs on the core. With normal or corrected vision, the markings must be legible from a distance of 1 metre and must remain legible after exposure to sunlight for a period of 12 months.

The height of the numbers must be not less than 3mm for conductors up to and including 25mm² and not less than 5mm for all other conductor sizes. The space between numbers must not exceed 100mm. The numerals must be offset to the identification ribs but may occasionally cross them.

The cable must also be metre marked in accordance with clause 2.5 AS/NZS 3560.1:2000, which specifies that one (1) active core in each cable length must be sequentially marked, numerically, at one (1) metre intervals. The metre marking must be limited to six (6) digits and any drum length may start at any integral number, however, the cable must be wound on the drum with the lowest number at the drum barrel end.

The batch number must be printed on the outer surface of the insulation of one (1) active core in each cable length.

A laminated polyethylene terephthalate tape must be laid over the conductor in active core 1 throughout the length of the core for identifying the manufacturer of the cable. The tape must be legibly marked with the manufacturer's name (as used in the registration of the business) or registered trade name/mark and the year of manufacture at intervals not greater than 100mm, an interval being the distance between the end of one block of marking and the beginning of the next.

No information specific to Endeavour Energy must be provided in or on the cable.

5.4 Laminate Tape

Laminated polyethylene terephthalate tape laid over the conductor in active core 1, through the length of the core shall be provided. The tape shall be legibly marked with the manufacture's name, and the year of manufacturers at intervals not greater than 100mm.

5.5 Testing Requirements

5.5.1 Type tests

All type tests must be carried out as set out in Table 7 below, which is prepared based on information given in Table 3.1 of AS/NZS 3560.1:2000. All type tests must be carried out according to the method specified in AS/NZS 1660 relevant to the test unless AS/NZS 3560.1:2000 suggests otherwise.

A type test comprises all tests specified in Tables 7, 9 and 10 of this specification. This includes sample and routine tests. The results of the test must be recorded and must be available in the form of a test report for approval of the product.

Type tests must be repeated if any of the following changes occur:

- Change in source of the raw material;
- Change in the materials used;
- Changes to the processes of manufacturing;
- Change in the manufacturing technology; or,
- Change to design, engineering and/or construction of the cable.

5.5.1.1 Type test qualification ranges

A type test need not be performed on all cable sizes. The following type test qualification guidelines will apply:

- A type test on a four-core cable will also qualify two-core and three-core cables having the same core size. For example, a type test on 4-core 25mm² cable will qualify a 2-core 25mm².
- A type test on one size of cable will qualify cables that incorporate conductors of the same number of wires (strands). For example, a type test on a 4-core 50mm² cable will qualify all cables with core sizes of 16mm² to 50mm².

Where type test qualification ranges are being submitted, the supplier must provide a list of all conductors in the qualification range as an attachment to the qualifying conductor type test report.

5.5.1.2 Required type tests

The type tests required to be submitted with the offer are listed in Table 7 below.

Table 4 – Type test requirements (LVABC)

	Test required	Test reference in AS/NZS 3560.1:2000	Pass criteria												
Conductor	Breaking load	Table 3.1 Test 1 (c)	The breaking load of the conductor must be reported as the mean of the three valid results and the minimum values must be as given in the table below:												
			<table><tr><td>Area of the conductor (mm²)</td><td>16</td><td>25</td><td>50</td><td>95</td><td>150</td></tr><tr><td>Breaking load (kN)</td><td>2.2</td><td>3.5</td><td>7.0</td><td>13.3</td><td>21</td></tr></table>	Area of the conductor (mm ²)	16	25	50	95	150	Breaking load (kN)	2.2	3.5	7.0	13.3	21
			Area of the conductor (mm ²)	16	25	50	95	150							
Breaking load (kN)	2.2	3.5	7.0	13.3	21										
Insula	Mechanical test before aging	Table 3.1	tensile strength ≥ 12.5 MPa.												

	Test required	Test reference in AS/NZS 3560.1:2000	Pass criteria
		Test 2 (a)	elongation at rupture (as a percentage of the unstretched length) $\geq 200\%$.
	Mechanical test after aging, as a percentage of values found in unaged specimens.		After aging in an air oven for 168 hrs at $135\pm 3^{\circ}\text{C}$: - tensile strength $\geq 75\%$. - elongation at rupture $\geq 75\%$.
	Determination of carbon black content		Minimum content of carbon black must be 2%.
	Carbon black dispersion test		< 5 when compared with the photomicrographs of magnification 100 that are provided in Figures 2.7.1 and 2.7.2 of AS/NZS 1660.2.4:1998, and no evidence of inferior dispersion e.g. striated pattern as in Figure 2.7.3 of AS/NZS 1660.2.4:1998.
	Insulation resistance constant (k_i)		- At $20^{\circ}\text{C} \geq 3000 \text{ G}\Omega\cdot\text{m}$ - At $90^{\circ}\text{C} \geq 3.0 \text{ G}\Omega\cdot\text{m}$
Core	Water absorption of insulation	Table 3.1 Test 3 (c)	After 5 days at $85\pm 2^{\circ}\text{C}$: No breakdown must occur.
	Determination of insulation shrinkage	Table 3.1 Test 3 (d)	After one hour in an air oven at $130\pm 3^{\circ}\text{C}$: Maximum shrinkage must be 4%.
Cable	High voltage AC test	Table 3.1 Test 4 (b)	No breakdown must occur

5.5.2 Sample tests

All sample tests must be carried out as set out in Table 6 below, which has been prepared based on information given in Table 3.1 of AS/NZS 3560.1:2000. All sample tests must be carried out according to the method specified in AS/NZS 1660 relevant to the test unless AS/NZS 3560.1:2000 suggests otherwise.

The sample test arrangement must be as follows:

- One (1) test sample of cable is to be taken from each production run or from each 5km of cable, whichever is the lesser;

ETS 0059 – Aerial Bundled Cable

- As described in Table 5, some tests are not required to be performed on all test samples. Where the requirement for testing is less than 100% of the test samples, the selection of test specimens from the test samples has to be random;
- If any test specimen fails a test, then two (2) specimens taken from two (2) further samples of cable from the same drum must be tested.
- If either of these tests fail, that drum of cable must be rejected and each of the remaining drums of cable in the production run must be tested.

The sample tests must be performed on specimens taken from a sample of completed core or cable according to the schedule of sample tests given in Table 5 below:

Table 5 – Schedule of sample tests (LVABC)

Test required	Test reference in AS/NZS 3560.1:2000	Percentage of samples to be tested	Number of cores to be tested
Conductor diameter	Test 3.1, Test 1 (b)	10%	On one core of cable sample
Rib dimensions	Table 3.1, Test 2 (b)	10%	On each core of cable sample
Insulation thickness	Test 3.1, Test 2 (c)	100%	
Core diameter	Table 3.1, Test 3 (a)	10%	
Adhesion of insulation	Table 3.1, Test 3 (b)	10%	
Core identification	Additional sample test (Refer to Clause 5.5.2.1 below)	10%	On each of the three active cores of cable sample

5.5.2.1 Additional sample test – Core identification

An additional sample test for core identification of the LVABC is required.

The core identification markings on the external surface of each of the three (3) active cores must be first rubbed by hand and then with a cloth soaked with water, each for 15 seconds.

At the completion of the test the colouring and markings must still comply with the requirements for active core markings as specified in Clause 5.3 of this specification.

5.5.2.2 Required sample tests

The sample tests required to be submitted with the offer are listed in Table 6 below.

Table 6 – Sample test requirements (LVABC)

	Test required	Test reference in AS/NZS 3560.1:2000	Pass criteria
Conductor	Measurement of conductor diameter	Table 3.1 Test 1 (b)	The measured conductor diameter of the completed cable must be within the maximum and minimum values specified in Table 2 of this specification.
Insulation	Measurement of rib dimensions	Table 3.1 Test 2 (b)	All recorded information must comply with the requirements specified in Table 3 of this specification.
	Insulation thickness	Table 3.1 Test 2 (c)	The measured values, excluding ribs, must comply with the minimum average thickness, minimum insulation thickness at any point and maximum insulation thickness at any point as specified in Table 2 of this specification.
Core	Measurement of core diameter	Table 3.1 Test 3 (a)	The measured values, excluding ribs, must comply with the maximum diameter of the core as specified in Table 2 of this specification.
	Adhesion of insulation	Table 3.1 Test 3 (b)	No slip > 3mm as measured must occur
	Additional test: Core identification	Refer to Clause 5.5.2.1 of this specification	The colouring and marking must comply with the requirements as specified under Clause 5.5.2.1 of this specification

5.5.3 Routine tests

All routine tests must be carried out as set out in Table 7 below, which has been prepared based on information given in Table 3.1 of AS/NZS 3560.1:2000. All routine tests must be carried out in according to the method specified in AS/NZS 1660 relevant to the test.

The routine tests must be conducted on all production lengths of the completed LVABC cable.

5.5.3.1 Required routine tests

The routine tests required to be submitted with the offer are listed in Table 10 below.

ETS 0059 – Aerial Bundled Cable

Table 7 – Routine test requirements (LVABC)

	Test required	Test reference in AS/NZS 3560.1:2000	Pass criteria
Conductor	Conductor DC resistance	Table 3.1 Test 1 (a)	The value converted to 20°C must not exceed that specified in Table 2 of this specification.
Cable	Spark test	Table 3.1 Test 4 (a)	No breakdown of insulation must occur

6 Non-metallic screened high voltage aerial bundled cable (NMSHVABC)

6.1 Technical Requirements

The voltage rating of the NMSHVABC must be suitable for system highest operating voltage of 12.1 kV, and the cable must be manufactured with stranded compacted circular conductor.

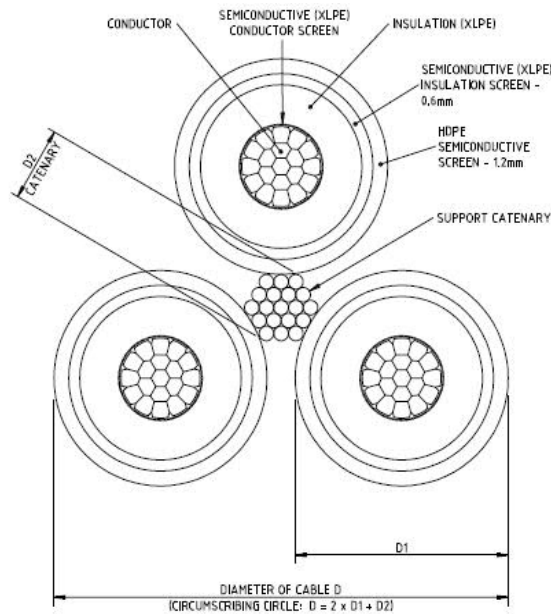


Figure 3 – Cross-section of 6.35/11kV NMSHVABC

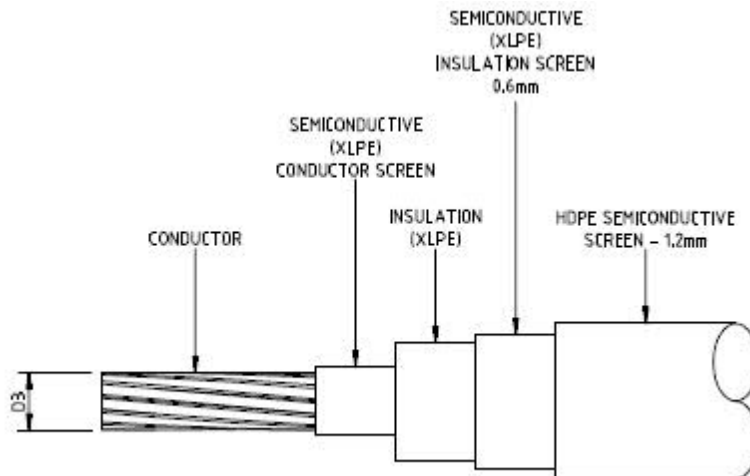


Figure 4 – Components of phase cable of 6.35/11kV NMSHVABC

All NMSHVABCs must comply with the requirements specified in Table 8 below, which is prepared based on the requirements of AS/NZS 3599.2:1999.

Table 8 – Technical requirements for NMSHVABC

Requirement	Nominal conductor CSA (mm ²)	
	50	150
Configuration of the cable construction	Three phase cables laid up around the support conductor	Three phase cables laid up around the support conductor
Direction of lay	Right-hand	
Nominal circumscribing circle diameter in mm	56	72
Minimum number of strands in the phase conductor	6	15
Maximum DC resistance of the phase conductor at 20°C	0.641 Ω/km	0.206 Ω/km
Condition for wires (strands) of phase conductor as described in BS 2627:1970	H68	
Typical diameter of phase conductor (refer to D ₃ in Figure 4)	8mm	14.5mm
Minimum tensile strength of wires (strands) of phase conductor	120MPa	
Maximum tensile strength of wires (strands) of phase conductor	205MPa	
Minimum thickness at any point of semi-conductive cross-linked insulation extruded over the conductor	0.3mm	
Minimum average thickness of semi-conductive cross-linked insulation extruded over the conductor	1.0mm	
Minimum average thickness of XLPE insulation	3.4mm	
Minimum thickness at any point of the XLPE insulation	2.96mm	
Minimum average thickness of semi-conductive cross-linked screen over the XLPE insulation	0.6mm	
Density of the semi-conductive HDPE outer layer	> 0.941 g/cm ³	

Requirement	Nominal conductor CSA (mm ²)	
	50	150
Minimum average thickness of semi-conductive HDPE outer layer	1.2mm	
Typical diameter over the semi-conductive HDPE outer layer (refer to D ₁ in Figure 3)	19mm	26mm
Number of wires (strands) in the support conductor	7	19
Minimum diameter of strands in the support conductor (measured before stranding)	4.703mm	3.465mm
Maximum diameter of strands in the support conductor (measured before stranding)	4.798mm	3.535mm
Ultimate tensile stress of the support conductor wires (strands)	230MPa	240MPa
Minimum diameter of the compacted support conductor (refer to D ₂ in Figure 3)	14.1mm	17.3mm
Maximum diameter of the compacted support conductor (refer to D ₂ in Figure 3)	14.4mm	17.7mm

6.1.1 Phase cable conductors

The phase cable conductors must be stranded circular compacted aluminium, made up from wires in the H68 condition as specified in BS 2627:1970. The wires used in the manufacturing of the conductors must be made from alloy 1350 in accordance with AS/NZS 1125:2001.

A certificate of chemical composition from the ingot supplier that is used to manufacture the conductor must be submitted with the offer.

The maximum conductor operating temperatures based upon the properties of the insulation are specified in Table 9 below.

Table 9 – NMSHVABC maximum conductor operating temperature

Operational condition	Maximum conductor operating temperature
Normal operation	90°C
Emergency operation	105°C
Short circuit operation (5s max.)	250°C

The continuous current carrying capacity must be calculated based on the conditions specified in Table 10 below.

Table 10 – Conditions for calculating continuous current carrying capacity of NMSHVABC

Condition	Requirement
Conductor temperature	90°C
Ambient temperature	40°C
Solar radiation	1000 W/m ²
Wind speed, normal to the axis of the cable	0.5 m/s

6.1.2 Conductor screen

All cables must have a cross-linked semi-conductive screen extruded over the stranded and compacted conductor. The thickness of the semi-conductive conductor screen must comply with the relevant requirements provided in Table 8 of this specification. The extruded conductor screen must be readily removable from the conductor.

6.1.3 Insulation

The conductor insulation must be cross-linked polyethylene (XLPE) in accordance with AS/NZS 3808:2000 and must comply with the relevant requirements provided in Table 8 of this specification.

The XLPE insulation must bond to the conductor screen so that it is not possible to separate the two without damage to their interface. The insulation must be homogeneous and must be applied by the extrusion process.

6.1.4 Insulation screen

The insulation screen must comply with the requirements specified in Clause 9 of AS/NZS 3599.2:1999 and Table 8 of this specification, as described below.

The insulation screen must consist of an inner layer of cross-linked semi-conductive compound extruded directly over the XLPE insulation and an outer layer of semi-conductive HDPE, of which the base HDPE must have nominal density greater than 0.941g/cm³, extruded over the semi-conductive insulation screen, in accordance with Clause 9 of AS/NZS 3599.2:1999.

The HDPE of the outer layer must contain a minimum of 2% carbon black. The outer layer must have volume resistivity not more than 500Ωm measured at temperature 90±2°C. The carbon black percentage must be limited to a minimum in order to increase the flexibility of the material.

The strippability of the semi-conductive HDPE outer layer must be such that the HDPE layer will be able to separate cleanly from the cross-linked semi-conductive screen without damaging the cross-linked semi-conductive screen or leaving any semi-conductive HDPE material on the cross-linked semi-conductive screen that cannot be readily removed.

The semi-conducting XLPE layer must have bond strength (bond to XLPE insulation) in the range of 20 to 75 Newtons for each 12mm wide strip.

The conductor screen, insulation and the first layer of the insulation screen of each core must be extruded in one continuous pass through the manufacturing process.

6.1.5 Support conductor

The support conductor must be a compacted bare all-aluminium alloy conductor with material designation AAAC/1120 in accordance with AS 1531:1991 and must have a smooth finish. The support conductor must not be greased.

A certificate of chemical composition from the ingot supplier that is used to manufacture the conductor must be submitted with the offer.

The support conductor must comply with the relevant requirements specified in Table 8 of this specification.

6.1.6 Laying up of the NMSHVABC

The three phase cables must be laid up around the support conductor with a lay length not less than 22 times nor more than 25 times the calculated overall diameter of a circumscribing circle over the laid-up bundled cable. The direction of lay must be right-hand.

The circumscribing circle diameter (D_C) must be derived from the following equation:

$$D_C = 2 \times D_1 + D_2$$

where:

D_1 = the nominal diameter of one phase of the cable; and,

D_2 = the nominal diameter of the support conductor.

6.2 NMSHVABC Drum Requirements

All drums wound with NMSHVABC must meet the general requirements detailed in Clause 4.5 and specific requirements detailed below.

The cable must be bound together at locations two (2) metres from each end of the drum length. These bindings must hold the phase conductors to the support conductor without damage to the cable and must be able to be left permanently in place or removed during installation.

In practice, during installation of the cable, the cable will be winched through the pole mounted rollers away from the drum trailer. The cable is then tensioned by the winch at the drum trailer.

At correct tension, the cable is terminated at the roller on the first pole. This procedure tends to waste about 25m of cable from the first pole roller to the drum.

An acceptable method to avoid this cable wastage is to extend the support conductor by 25m and the extended piece must be wound onto the drum first. The support conductor must be firmly anchored onto the drum barrel using a U-bolt. The supplier may provide an alternative method to avoid this cable wastage.

The cable must be wound on steel drums manufactured in accordance with AS/NZS 3983:1991. Drums must be suitable for use with round spindles and suitable for outdoor storage.

The cable in drums must comply with the following requirements, which are in accordance with Clause 13 of AS/NZS 3599.2:1999:

- a) In the case of cable length marking, the progressive lengths must begin at the inner end of the drum.
- b) Individual cores at both cable ends must be sealed to prevent the ingress of moisture to the conductors.

- c) Both ends of cable must be fitted with temporary binders to prevent the cores from separating.
- d) One end of the bundled cable must be coloured red and the other green. When phasing the cable end, the end at which the rotational sequence of the cores (for 4-core cable - neutral, 1, 2, 3) is clockwise, must be coloured red, and the other end must be coloured green.

The temporary binder in Item b) above may be coloured to satisfy this requirement.

- e) The cable must be wound on the drum so that the red end is at the drum barrel and at least 0.5m of cable at the drum barrel (that is, the inner end of the cable) is protruding. The cable must be adequately secured to the drum (e.g. with the use of saddles) to prevent it becoming free during installation. The use of string to secure the inner end of the cable to the drum is not permitted.
- f) The cable drum must be lagged to protect the cable from damage. The inner end of the cable projecting from the drum must also be protected.

6.3 Markings

The phase cables must be marked in accordance with the requirements of Clause 10 of AS/NZS 3599.2:1999, as described below.

The phase cables must be identified by the numerals **1 ONE**, **2 TWO** and **3 THREE** printed as figures and words on the outer surface of the extruded insulation screen.

One of the phase cables must be marked with the following information:

- Manufacturer's name or registered trade name, as provided in the supplier's product approval application;
- Batch number, in each cable length;
- Cable voltage designation, **6.35/11 kV**; and,
- Year of manufacture.

Another phase cable must be printed with sequential numbers to indicate the length remaining on the drum of the completed cable.

The height of the individual characters must be not less than 3mm and the gap between the end of one set of characters and the beginning of the next set must be not greater than 150mm for phase numbering and 500mm for manufacturer's identification, batch number, voltage designation and year of manufacture. The length marking must be at one (1) meter intervals.

The characters must be printed legibly in a colour contrasting with the phase cable surface.

No information specific to Endeavour Energy must be provided in or on the cable.

6.4 Testing Requirements

6.4.1 Type tests

All type tests must be carried out as set out in Table 8 below, which has been prepared based on Table 2 of AS/NZS 3599.2:1999 and Table 10 of AS/NZS 3808:2000. All type tests must be carried out according to the method specified in AS/NZS 1660 relevant to the test unless AS/NZS 3599.2:1999 or AS/NZS 3808:2000 suggest otherwise.

The tests must be performed at room temperature, unless otherwise specified.

6.4.1.1 Type test qualification ranges

A type test on any 12.7/22kV cable will qualify all 6.35/11kV cables made from the same materials and of similar design.

A type test on a cable of conductor size and stated voltage rating will qualify all cables of conductor sizes equal to and above for that voltage rating. For example, a type test on a 6.35/11kV 3-core 50mm² cable will qualify a 6.35/11kV 3-core 150mm² cable.

Where type test qualification ranges are being submitted, the supplier must provide a list of all conductors in the qualification range as an attachment to the qualifying conductor type test report.

6.4.1.2 Required type tests

The type tests required to be submitted with the offer are listed in Table 11 below.

Table 11 – Type test requirements (NMSHVABC)

	Test required	Test reference	Pass criteria
Conductor screen	Volume resistivity of extruded screen	AS/NZS 3599.2:1999 Table 2, Test 2 (a)	At 90±2°C: • Volume resistivity ≤ 500 Ω.m
Insulation	Mechanical test before aging	AS/NZS 3599.2:1999 Table 2, Test 3 (d)	• Tensile strength ≥ 12.5MPa • elongation at rupture (as a percentage of the un stretched length) ≥ 200%.
	Mechanical test after aging, as a percentage of values found in un-aged specimens		After aging in an air oven for 168 hrs @135±3 °C: • tensile strength ≥ 75% • elongation at rupture ≥ 75%.
	Insulation resistance constant (k _i)		• At 20°C ≥ 40,000 GΩ.m • At 90°C ≥ 40 GΩ.m
Insulation screen	Volume resistivity of insulation screen	AS/NZS 3599.2:1999 Table 2, Test 4 (a)	At 90±2°C: Volume resistivity ≤ 500 Ω.m

	Test required	Test reference	Pass criteria
Semi-conductive HDPE insulation screen	Volume resistivity of insulation screen	AS/NZS 3599.2:1999 Table 2, Test 5 (a)	At 90±2°C: Volume resistivity ≤ 500 Ω.m
	Mechanical test without aging on conditioned specimens	AS/NZS 3599.2:1999 Table 2, Test 5 (d)	- Minimum tensile strength: 10 MPa - Minimum elongation at rupture: 150%
	Mechanical test after aging in an air oven	AS/NZS 3599.2:1999 Table 2, Test 5 (e)	After 168 hours at 100±3°C; - Minimum tensile strength: 6 MPa - Minimum elongation at rupture: 100%
	Determination of carbon black content	AS/NZS 3808:2000 Table 10, Test D	Minimum content of carbon black must be 2%
	Carbon black dispersion test	AS/NZS 3808:2000 Table 10, Test E	<5 when compared with the photo micrographs of magnification 100 that are provided in AS/NZS 1660.2.4:1998 as Figures 2.7.1 and 2.7.2, and no evidence of inferior dispersion e.g. striated pattern, as in Figure 2.7.3 of AS/NZS 1660.2.4:1998
	Environmental Stress Crack Resistance	AS/NZS 3808:2000 Table 10, Test F	No Failure within 250 hours
Completed cable	Bending test followed by the partial discharge test	AS/NZS 3599.2:1999 Table 2, Test 6 (c)	Performed on one phase cable of 10 to 15 m of completed cable and the magnitude of discharge must not exceed; 20 pC at 13 kV RMS.; and, 5 pC at 10 kV RMS.
	Measurement of DDF (tan δ) at elevated temperature	AS/NZS 3599.2:1999 Table 2, Test 6 (d)	Measured at 95+5,-0°C with a power frequency voltage of at least 2kV applied to the sample and must not exceed 80 x 10 ⁻⁴

Test required	Test reference	Pass criteria
Heat cycle test followed by partial discharge test	AS/NZS 3599.2:1999 Table 2, Test 6 (e)	Magnitude of discharge must not exceed; • 20 pC at 13 kV RMS; and, • 5 pC at 10 kV RMS.
Impulse withstand test followed by a 15 kV HV AC test for 15 min.	AS/NZS 3599.2:1999 Table 2, Test 6 (f)	After impulse voltage test 15 kV AC voltage at 40 Hz to 62 Hz must be applied at least 5 min. at ambient temperature. No breakdown must occur.

6.4.2 Sample tests

All sample tests must be carried out as set out in Table 12 below, which has been prepared based on information given in Table 2 of AS/NZS 3599.2:1999 and Table 3.1 of AS/NZS 1125:2001. All sample tests must be carried out in according to the method specified in AS/NZS 1660 relevant to the test unless AS/NZS 3599.2:1999 suggests otherwise.

Samples for tests must be taken from bundled cable on the following basis;

- One (1) sample for cable lengths > 2 km and ≤ 10 km.
- Two (2) samples for cable lengths > 10 km and ≤ 20 km.
- One (1) additional sample for each successive 10 km of cable.

Tests 6 (c) to 6 (g), inclusive, of Table 2 in AS/NZS 3599.2:1999 (as referred in Tables 11 and 12 of this document) must be carried out on the same sample of phase cable taken from completed bundled cable. The sample must be at least five (5) metres in length.

If the sample fails during test 6 (g) (High voltage AC test for four (4) hours), a new sample may be taken from the same cable and submitted to test 6 (g), provided that the sample is first submitted to tests 6 (c) and 6 (e).

With the exception of test 6 (g), if a sample fails in any of the sample tests, two (2) further samples must be taken from the same batch and subjected to the test or tests in which the original sample failed. If both additional test samples pass the test or tests, all the drum lengths in the batch from which they were taken will be deemed as complying with the requirements of this specification. If either of them fails, the whole batch from which these samples were taken will be deemed as failing to comply with the requirements of this specification.

The minimum number of individual wires to be tested for the tensile strength (test (b) i of Table 3.1 in AS/NZS 1125:2001) must be the square root of the total number of wires in the conductor (to the nearest whole number).

Sample tests on the support conductor must be carried out on wire samples taken before stranding of the support conductor. The tests must be performed at room temperature, unless otherwise specified.

6.4.2.1 Required sample tests

The sample tests required to be submitted with the offer are listed in Table 12 below.

Table 12 – Sample test requirements (NMSHVABC)

	Test required	Test reference	Pass criteria
Conductor	Tensile strength	AS/NZS 1125:2001 Table 3.1, Test (b) i	Tensile strength is measured on samples taken prior to stranding of the phase conductors and must be ≥ 120 MPa and ≤ 205 MPa
Conductor screen	Thickness of the extruded layer	AS/NZS 3599.2:1999 Table 2, Test 2 (b)	Minimum at any point: 0.3 mm as given in Table 8.
	Projection or irregularity at conductor screen/insulation interface	AS/NZS 3599.2:1999 Table 2, Test 2 (c)	Any projection or irregularity must not protrude more than 0.25mm into the insulation
Insulation	Determination of insulation thickness	AS/NZS 3599.2:1999 Table 2, Test 3 (a)	As given in Table 8: - The average thickness ≥ 3.4mm - Minimum thickness at any point must be 2.96mm.
	Determination of insulation shrinkage	AS/NZS 3599.2:1999 Table 2, Test 3 (b)	After one hour in an air oven at $130 \pm 3^\circ\text{C}$: Maximum shrinkage must be 4%
	Determination of; i) size of voids; ii) size of contaminants iii) size of discoloured translucents; iv) number of voids; v) number of contaminants.	AS/NZS 3599.2:1999 Table 2, Test 3 (c)	i) Voids: ≤ 0.08mm ii) Contaminants: ≤ 0.15mm iii) Discoloured translucents: ≤ 1.25mm iv) Voids: ≤ 30 per 16cm^3 v) Contaminants: ≤ 15 per 16cm^3

	Test required	Test reference	Pass criteria
Cross-linked insulation screen	Strippability of cross-linked insulation screen	AS/NZS 3599.2:1999 Table 2, Test 4 (b)	Cross-linked screen must peel cleanly from insulation for 300mm without damaging the insulation or tearing or leaving any cross-linked screen material which cannot be readily removed.
	Adhesion test of cross-linked insulation screen	AS/NZS 3599.2:1999 Table 2, Test 4 (c)	Required force to remove strip must be not less than 20N or more than 75N for each 12mm wide strip.
	Measurement of thickness	AS/NZS 3599.2:1999 Table 2, Test 4 (e)	Minimum average thickness of cross-linked screen must be 0.6mm as given in Table 8.
Semi-conductive HDPE insulation screen	Strippability of semi-conductive HDPE	AS/NZS 3599.2:1999 Table 2, Test 5 (b)	The semi-conductive HDPE layer must separate cleanly from the cross-linked screen without damaging the cross-linked screen or leaving any semi-conductive HDPE material which cannot be readily removed.
	Measurement of thickness	AS/NZS 3599.2:1999 Table 2, Test 5 (c)	Minimum average thickness of the semi-conductive HDPE layer must be 1.2mm as given in Table 8.
Completed cable	High voltage AC test for four (4) hours.	AS/NZS 3599.2:1999 Table 2, Test 6 (g)	No breakdown of the insulation must occur.
Support conductor	Measurement of diameter of strands	AS/NZS 3599.2:1999 Table 2, Test 7 (a)	The values must be within the tolerance specified in Table 8.

Test required	Test reference	Pass criteria
Tensile test	AS/NZS 3599.2:1999 Table 2, Test 7 (b)	The value must be greater than or equal to the minimum ultimate tensile stress as specified in AS 1531:1991 relevant to the conductor as below: • ≥ 230 MPa for 50mm² cable • ≥ 240 MPa for 150mm² cable
Wrapping test	AS/NZS 3599.2:1999 Table 2, Test 7 (c)	In accordance with AS 1531:1991 (for AAAC/1120), no surface fracture must occur after wrapping the test specimen, at no more than 60 turns/minute, around a wire of its own diameter to form a close helix of eight turns.

6.4.3 Routine tests

All routine tests must be carried out according to the requirements of Table 13, which was prepared based on information given in Table 2 of AS/NZS 3599.2:1999.

All routine tests must be carried out according to the method specified in AS/NZS 1660 relevant to the test unless AS/NZS 3599.2:1999 suggests otherwise.

The tests must be performed at room temperature, unless otherwise specified.

Table 13 – Routine test requirements (NMSHVABC)

	Test required	Test reference in AS/NZS 3599.2:1999	Pass criteria
Conductor	Conductor examination and electrical resistance	Table 2 Test 1	The conductor form, material and resistance must comply with the appropriate requirements of AS/NZS 1125:2001. The maximum conductor DC resistance at 20°C must be as follows: • 0.641Ω/km for 50mm² cables; and, • 0.206Ω/km for 150mm² cables as given in Table 7.
	Partial discharge test on each phase cable	Table 2 Test 6 (a)	Magnitude of discharge at voltage applied between each phase conductor and support conductor must be: • ≤ 20pC at 13kV RMS • ≤ 5pC at 10 kV RMS
Completed cable	High voltage AC test for 5 minutes.	Table 2 Test 6 (b)	No breakdown of the insulation must occur.

6.4.4 Re-qualification tests

The following schedule of re-qualification tests in Table 14 is applicable when a change is made to the material in not more than two (2) non-metallic components of the cable construction.

Table 14 – Schedule for re-qualification tests for NMSHVABC

Component change	Tests for re-qualification (with reference to Table 2 of AS/NZS 3599.2:1999)
Conductor	-
Conductor screen	2 (a), 2 (c)
Insulation	3 (a), 3 (b), 3 (c), 3 (d), 4 (b) and 4 (c)
Cross-linked insulation screen	4 (a) to 4 (e)
Semi-conductive HDPE	5 (a), 5 (b)

6.4.4.1 Material changes

Tests in accordance with Table 14 above must be carried out and results appended to the re-qualification test report, in order to re-qualify cables in which a change has been made to nominated cable components.

6.4.4.2 Process changes

Where there are any changes in the core manufacturing process, required tests 2, 3, 4, 5 and 6 of Table 2 of AS/NZS 3559.2:1999 must be repeated. These tests have been included in Tables 11, 12 and 13 of this specification.

7 Authorities and Responsibilities

Role	Authority and Responsibilities
General Manager Asset Management	• Approving technical specifications including any variations. • Making all decisions concerning compliance in respect to this Specification. • Approving nominations of Endeavour Energy representatives. • Delegating any of these authorities and responsibilities to the Manager Asset Standards & Design.
Manager Asset Standards & Design	• Approving this instruction for minor changes and making recommendations to General Manager Asset Management for major changes in respect to this instruction. • Making recommendations concerning compliance in respect to this specification. • Making nominations of Endeavour Energy representatives.
Mains Assets Manager	• Keeping the contents of this instruction up to date. • Reviewing all test reports submitted and making recommendations to the Manager Asset Standards & Design.
Head of Procurement and Logistics	• Determining that all aerial bundled cables purchased by Endeavour Energy comply with the requirements of this specification.

8 Annexure 1 – Standard aerial bundled cable sizes

The standard sizes of aerial bundles cables used on the Endeavour Energy overhead distribution network are listed in Table 15 – Standard LVABC sizes and Table 16 – Standard NMSHVABC sizes below.

Table 15 – Standard LVABC sizes

Item no.	Voltage rating (kV phase-to-earth / phase-to-phase)	Conductor size (no. of cores x mm ²)	Conductor material	Endeavour Energy stock code
1	0.6 / 1	1 x 25	AAC/1350	SZ15383
2		1 x 50		1543495
3		2 x 25		SZ15251
4		4 x 25		SZ15278
5		4 x 95		1066213
6		4 x 150		1547686
7		4 x 95 + 1 x 16		1135466
8		4 x 150 + 1 x 16		1553569

Table 16 – Standard NMSHVABC sizes

Item no.	Voltage rating (kV phase-to-earth / phase-to-phase)	Conductor size (no. of cores x mm ²)	Conductor material	Support conductor size and material	Endeavour Energy stock code
1	6.35 / 11	3 x 50	AAC/1350 H68	7/4.75 AAAC/1120	SZ10020
2		3 x 150		19/3.50 AAAC/1120	SZ10055

Produced by Asset Standards and Design Branch

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