ACCREDITATION No. 20053

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CabLab

TEST REPORT

Test Report No.: **CLTR18066R3**

Client: **Ducab Cable Company (Private) Ltd**

Near Jabel Ali Shooting Club, Old Abu Dhabi Road, Jabel Ali, Dubai, United Arab Emirates

Product: XLPE insulated PVC/HDPE oversheathed electric cable, rated to 12.7/22kV

Manufacturer: Ducab Cable Company (Private) Ltd

Model(s): 12.7/22kV 3Cx300mm2 Al/WBT/TR-XLPE/WBT/CWS (5KA/S) /PVC/Nylon/HDPE

Test specification: **AS/NZS 1429.1:2006 (R2017)**
Electric cables - Polymeric insulated - For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

Test results: **The test item passed the test specifications.**

Test Laboratory: **CabLab Pty. Ltd.**

Unit 4, 174-186 Atlantic Drive,
Keysborough, VIC 3173, Australia

Compiled and authorised by:

2018-12-06
(date)

Gergo Bogdan
(Authorised Signatory)

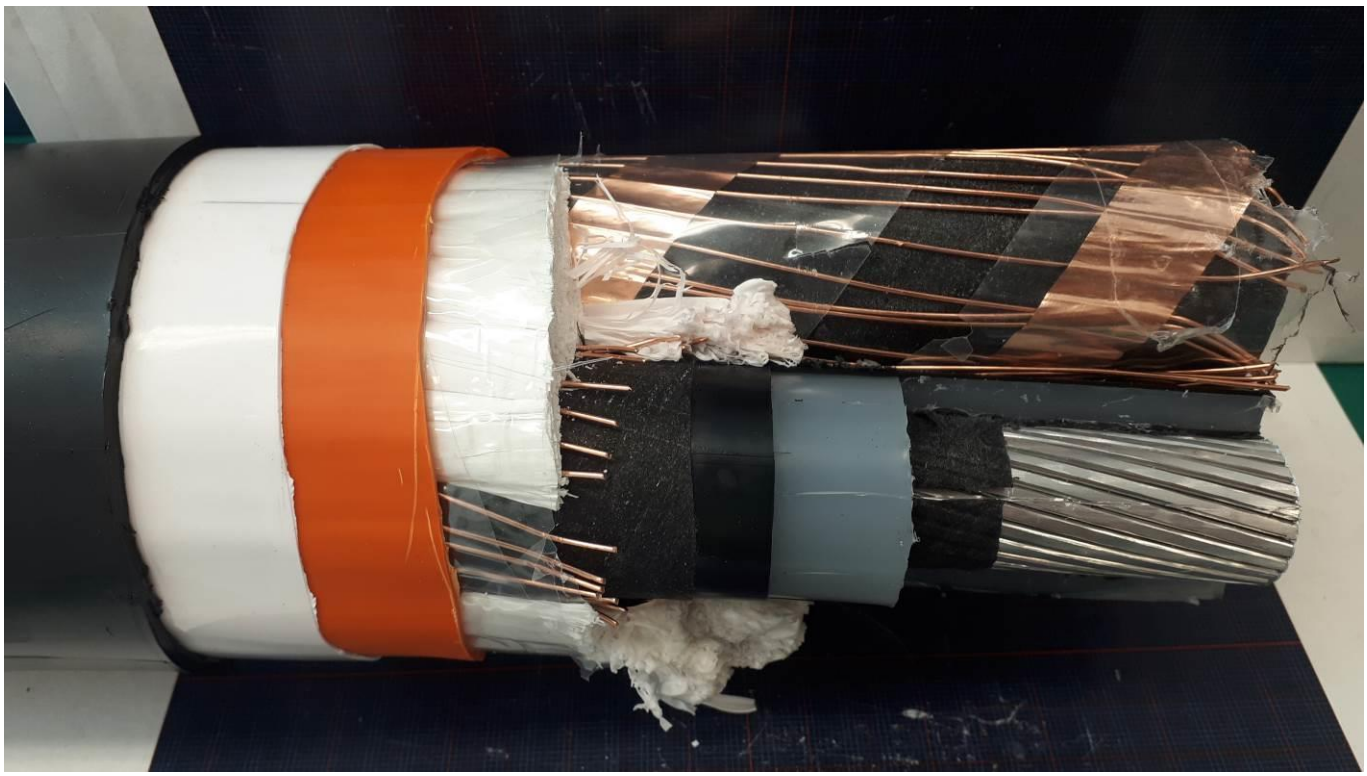
GENERAL NOTES:

1. This test report is the result of testing a sample of the product described. The laboratory has no control over the selection of samples to be tested. The information contained within reflects the findings on the particular sample(s), at the time of testing, as submitted by client. CabLab disclaims any and all responsibility or obligation for any other item.
2. This test report must not be reproduced, except in full, and must not be altered in any way (including but not limited to the content or appearance).
3. Throughout this report a point is used as the decimal separator. For each test, the test verdicts are shown with the following abbreviations: P –Passed, F – Failed, N/A – Not Applicable, N/T – Not Tested
4. Compliance judgement is made in accordance with NATA recommendations with the uncertainty of measurement taken into account at 95% confidence level.
    a. If a result of a test falls within the range of the specified limit, then a 'Pass' is reported. However, if the result when combined with its measurement uncertainty falls outside the specified limit, the result and its uncertainty of measurement is reported.
    b. If the result falls outside the range of the specified limit, then a 'Fail' is reported. However, if the result when combined with its associated measurement uncertainty falls inside the specified limit, the result and its uncertainty of measurement is reported.
5. Test sample was received on 2018-04-04, in good condition without any visible damage. The provided sample is completed cable from factory production. An additional sample was received on 2018-12-03 for the assessment of copper wire screen length of lay.
6. The required tests were performed between 2018-04-04 and 2018-07-03 by CabLab and between 2018-06-15 and 2018-09-17 by TICW.
7. This test report contains measurement results of both internally conducted and subcontracted tests. The subcontractor's test results have been consolidated into this test report for easy reading. The subcontracted work was carried out by China National Centre For Quality Supervision And Test Of Electric Wire And Cable (TICW) laboratory, CNAS accreditation no.: L0207, see test report CT18-03908 and CT18-03908X1.
8. Specification applied: AS/NZS 1429.1:2006 (2017). As per customers request the water penetration test in accordance with Annex C was carried out on the conductors rather than the whole cable as water penetration test is an optional requirement, see page 19.
9. This test report is a revised version of test report CLTR18066R2. As such it supersedes all previous revisions thus those must not be used. Editorial changes were made and copper wire screen length of lay measurement results were added.
10. The first sample had no marking on it, however the cable purchaser's marking specification and declaration from manufacturer was assessed.

DESCRIPTION OF TEST ITEM:

Test item is branded: **OIPL**, model:**12.7/22kV 3Cx300mm2 Al/WBT/TR-XLPE/WBT/CWS (5KA/S)/PVC/Nylon/HDPE** electric cable. It is a 3 core, 300mm^2 circular, compacted aluminium conductor (with water blocking tape within) – semi-conductive water blocking tape – extruded semi-conductive conductor screen – TR-XLPE insulation – extruded semi-conductive insulation screen – semi-conductive water blocking tape – combined copper wire and copper tape screen – non-hygroscopic filler – 5V-90 PVC inner sheath – Polyamide 11 insect protection layer – HDPE outer oversheath constructed cable, rated to 12.7/22kV.

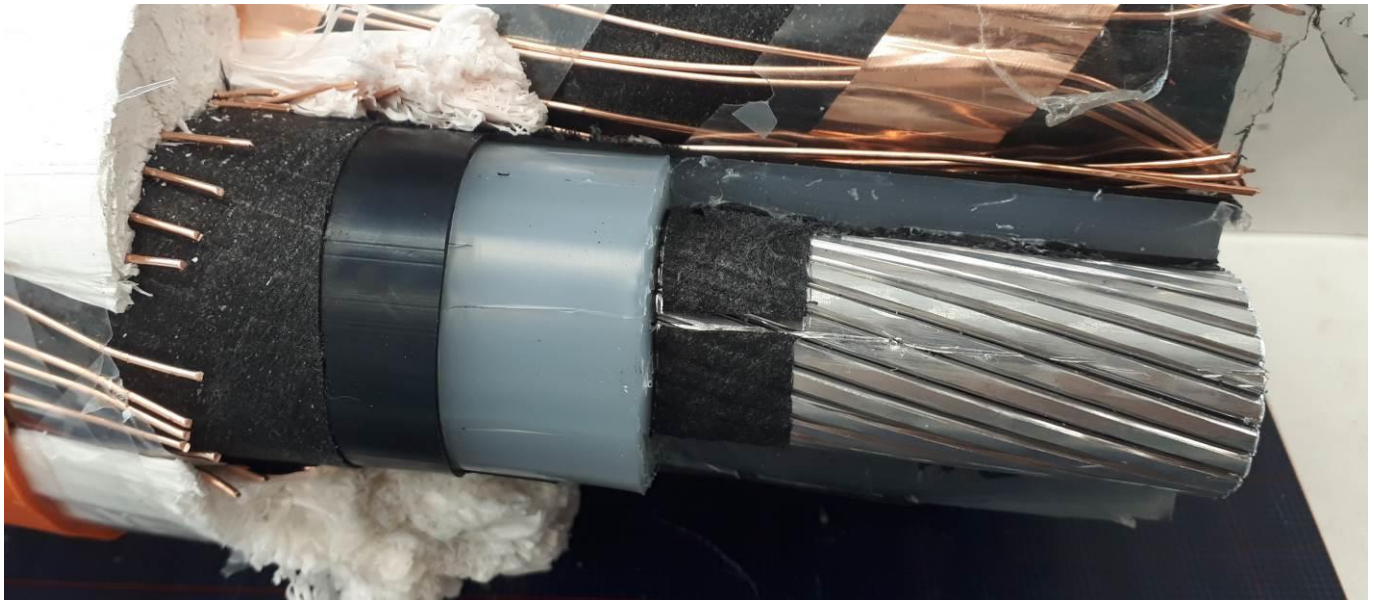
PHOTOS OF TEST SAMPLE:



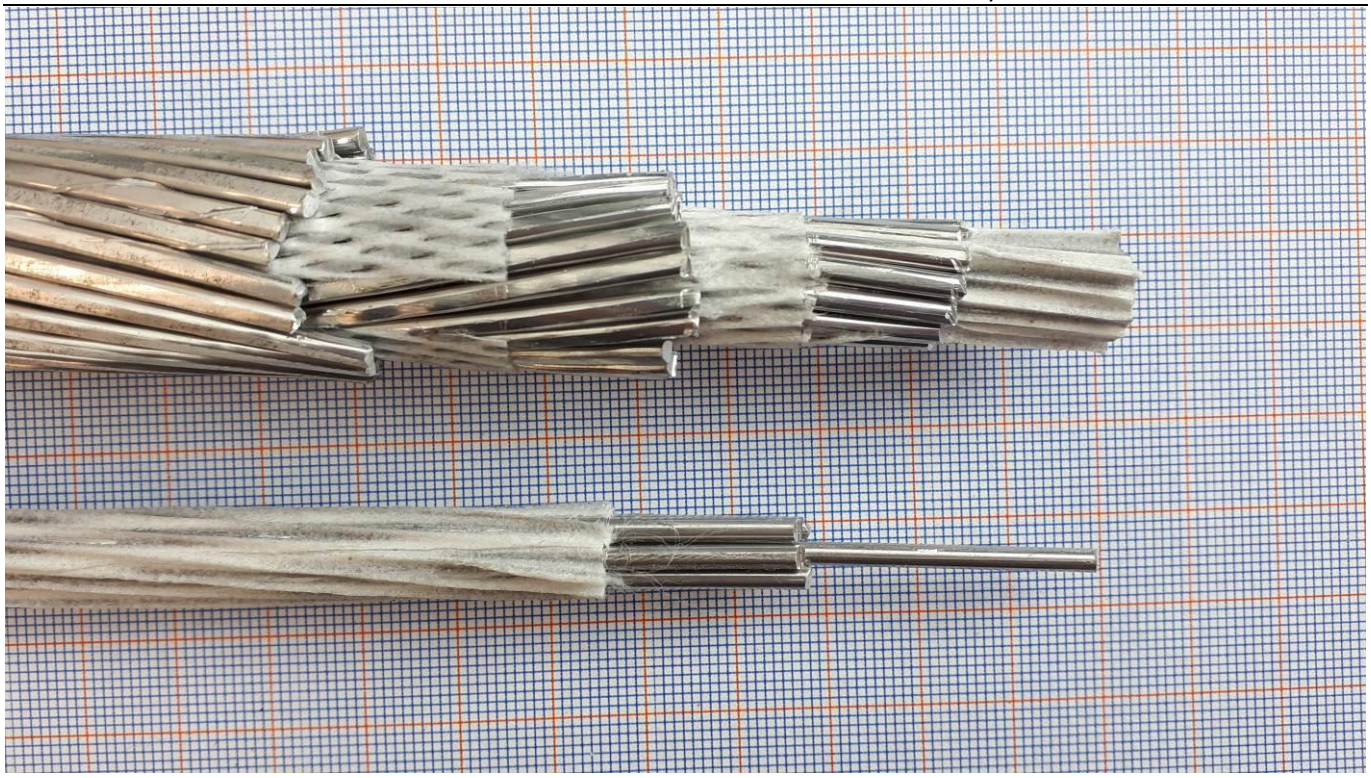
Construction of cable

Construction of cable

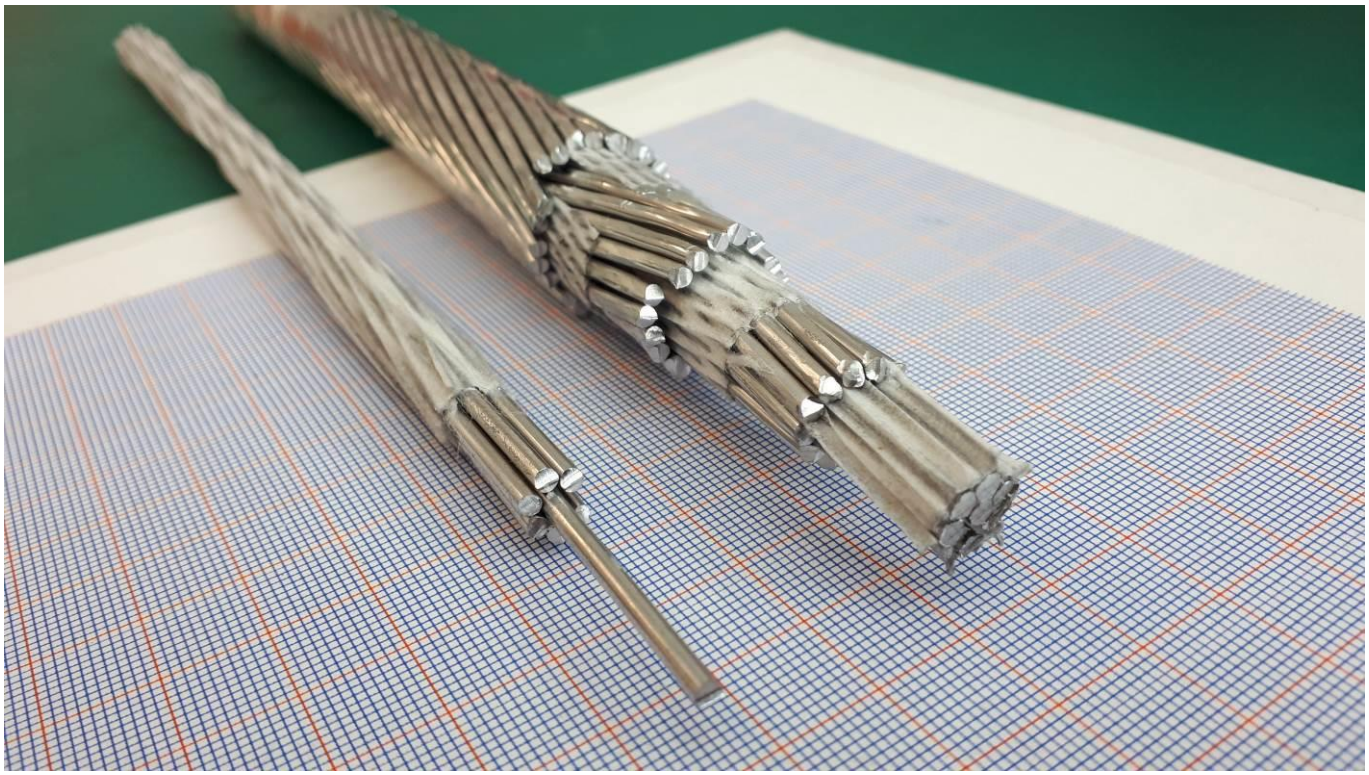
Cross sectional view of sample



Construction of 1 core - detail



Construction of conductor



Construction of conductor

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.1	**CONDUCTORS**		**P**
	Conductors shall have a circular profile and consist of either aluminium or plain or tinned copper, complying with the requirements of AS/NZS 1125	Plain compacted conductors, see page 22	P
	Measures may be taken to achieve longitudinal water-blocking.	Water blocking tapes used within the conductor and under the conductor screen, see photos	P
2.2	**CONDUCTOR SCREEN**		**P**
2.2.1	All cables shall have an extruded, cross-linked, semiconductive screen applied on the conductor. A semiconductive tape may be applied as part of the conductor screen and, where used, shall be applied directly on the conductor, preceding the extruded layer.	Semi-conductive water blocking tape used under the extruded layer	P
2.2.2	The thickness of the extruded layer shall be not less than that specified in Table 3.1.	See Test 2 (b) on page 15	P
2.2.3	The conductor screen shall be readily removable from the conductor.		P
2.2.4	The outer surface of the conductor screen shall be free of irregularities larger than those permitted in Table 3.1.	See Test 2 (c) on page 15	P
2.3	**INSULATION**		**P**
2.3.1	Insulation shall be XLPE (including materials known as tree-retardant XLPE) or EPR and shall comply with the requirements of AS/NZS 3808.	TR-XLPE used, See page 24	P
2.3.2	The insulation shall bond to the conductor screen so that it is not possible to separate the two without damage at their interface. The insulation shall be homogeneous.		P
2.3.3	The nominal thickness of insulation (ti) and the insulation minimum thickness at any point shall be in accordance with Tables 2.1 and 2.2. The values for minimum at any point are derived from the equation: 0.90 ti − 0.10 mm.	See table on page 21	P
2.3.4	The thickness of insulation shall be measured at the thickest point (tmax) and the thinnest point (tmin) and the following concentricity requirement shall be met: $\frac{t_{max} - t_{min}}{t_{max}} \leq 0.15$	Measured concentricity: Red core: 0.03 White core: 0.05 Blue core: 0.04	P
2.4	**INSULATION SCREEN**		**P**

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.4.1	The screen shall consist of a layer of extruded, cross-linked, semiconductive compound applied directly over the insulation. A semiconductive tape may be applied as part of the insulation screen and, where used, shall be applied over the extruded insulation screen.	Semi-conductive water blocking tape used over the extruded layer	P
2.4.2	The thickness of the extruded layer shall be not less than that specified in Table 3.1.	See Test 4 (d) on page 16	P
2.4.3	Requirements for stripping insulation screens		P
	(a) Where the insulation screen is designed to be hand-stripped without preconditioning (heating), it shall meet the strippability and adhesion tests specified in tests 4(b) and (c) of Table 3.1.	See Test 4 (b) and 4 (c) on page 16	P
	(b) Where the insulation screen is designed to be hand-stripped after preconditioning (heating), the strippability and adhesion requirements specified in tests 4(b) and (c) of Table 3.1 do not apply. However, it shall be possible to peel the screen cleanly from the insulation while the screen is hot.		N/A
2.5	**METALLIC SCREEN**		**P**
2.5.1	Metal sheaths (see Clause 2.9) may be used as screens and may be supplemented with wire screens, in continuous electrical contact, to achieve the required electrical fault rating. The screens shall be of a gross cross-sectional area not less than required by purchaser.	A combination of copper wires and a single copper tape screen is used	P
	For three-core cables, the screens shall be in continuous electrical contact throughout the length of the cable. In which case the gross cross-sectional area of the screen shall be equally shared amongst the three cores.	Each core screened with 25 wires and a tape	P
2.5.2	The screen wires shall comprise plain or tinned annealed copper wires, generally complying with AS/NZS 1125. Where tinned screens are provided, wires taken from the completed cable need not comply with the tinning test specified in AS/NZS 1125.	Plain annealed copper used	P
	All wires shall be of the same nominal diameter and in no case less than 0.60 mm. Wires shall not vary from the nominal diameter by more than 5%.	All wires are the same diameter, 0.81mm	P

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.5.3	The wires shall be helically applied with a length of lay not exceeding 10 times the pitch circle diameter of the screen wires over the core, and shall be in electrical contact with the core throughout the length of the cable.	Length of lay measured: 9.33	P
	The design gap, i.e. the gap between adjacent wires when equally spaced, calculated by taking into account the number and nominal diameter of wires and the calculated pitch circle diameter of the metallic screen, shall not exceed 4 mm.	Equally spaced, approx. 3.5mm apart	P
	For three-core cables, each core shall be screened with the same number of wires.	Each core is screened with 25 wires	P
	For single-core cables with a metal sheath, the screen shall be applied over semi-conductive tapes over the metal sheath. Where the tape is not of the water-blocking type the tape shall be non-hygroscopic.	Water blocking tape applied under wire screen, but no metal sheath used	N/A
2.6	**IDENTIFICATION OF CORES**		**P**
	The cores of three-core and triplex cables shall be identified in one of the following ways:		P
	(a) By the printed numeral and word 1 ONE, 2 TWO or 3 THREE, as appropriate, on the outer surface of each core.		N/A
	(b) By the printed word RED, WHITE or BLUE, as appropriate, on the outer surface of each core.		N/A
	(c) By colour-marking the semiconductive tape or adding coloured strips to each core throughout the full length of the cable, the colour to be red, white or blue as appropriate.	Each core is marked with a coloured strip applied between the insulation screen and the water blocking tape for the full length	P
	Where identified by printing, the characters shall be in a colour contrasting with the core surface. They shall be applied so that they shall remain legible during the service life of the cable.		N/A
	The height of the individual characters shall be not less than the following values: (i) For conductor of nominal cross-sectional area less than 70 mm^2: 1.5 mm. (ii) For conductor of nominal cross-sectional area 70 mm^2 and larger: 3.0 mm.		N/A
	The gap between the end of one set of characters and the beginning of the next set shall be not greater than 150 mm.		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	Where coloured strips are used for identification, their width shall be not less than 3 mm nor more than 5 mm.	Measured width: 3.22mm	P
2.7	**LAYING-UP**		**P**
	For three-core cables, the screened cores shall be laid up in a right-hand direction of lay.		P
	Unless otherwise requested, fillers and binder/barrier tapes shall be used to form a substantially compact and circular cross-section core assembly with a reasonably smooth surface without creasing of the tapes.		P
	For triplex cable, the three individual phase cores shall be laid up with a length of lay not less than 15 times, nor more than 30 times the overall diameter of the circumscribing circle over the laid-up bundled cable. The direction of lay shall be right hand. Fillers and binder tapes are not a requirement.	Not a triplex cable	N/A
2.8	**FILLERS, BINDERS, AND BARRIER TAPES**		**P**
	Any fillers, binders and barrier tapes shall be of a non-hygroscopic material, compatible with the cable components with which they are in contact.	See compatibility test	P
2.9	**METAL SHEATH (OPTIONAL)**		**N/A**
	Appropriate precautions are required to prevent corrosion of metal sheaths and to provide adequate mechanical protection, including installation conditions. When the sheath is used as a screen it may require wire screens to provide the required fault current rating. (Refer to Clause 2.5.1).	No metal sheath used	N/A
2.9.2	**Lead alloy sheath**		**N/A**
2.9.2.1	Lead alloy sheath barrier should be used for cables permanently immersed in water or where cable might be subject to contamination by hydrocarbons, such as in a petrochemical refinery or similar installation.		N/A
2.9.2.2	The material shall be lead alloy E in accordance with AS/NZS 2893.		N/A
2.9.2.3.1	**Application over single-core cable**		**N/A**
	The lead alloy sheath shall be applied over water-swellable semiconductive tape(s) applied over the core.		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.9.2.3.2	**Application over three-core cable**		**N/A**
	The lead alloy sheath shall be closely applied over an extruded bedding and shall be readily removable.		N/A
2.9.2.4	The nominal thickness of lead alloy sheath (Tm) shall be calculated from the following equation and rounded off to the nearest 0.1 mm, subject to a minimum thickness of 1.0 mm: Tm = 0.025 Du + 0.700 mm		N/A
	The minimum thickness at any point of the lead alloy sheath shall not be less than: minimum thickness = 0.95 Tm – 0.10 mm		N/A
2.9.3	Corrugated metal sheath of aluminium, copper or steel may be used. Constructional requirements and testing are to be negotiated between supplier and purchaser.		N/A
2.10	**SEPARATION SHEATH**		**N/A**
2.10.1	The separation sheath, if required in accordance with Clause 2.12, shall comprise one or more of the materials specified in Clause 2.13 and shall be applied as specified for oversheath in Clause 2.13.	No separation sheath used	N/A
2.10.2	The nominal thickness of the separation sheath (Ts) shall be calculated from the following equation and rounded off to the nearest 0.1 mm, subject to a minimum thickness of 1.2 mm: Ts = 0.02 Du + 0.60 mm		N/A
	The minimum thickness at any point of the separation sheath shall not be less than: minimum thickness = 0.80 Ts - 0.20 mm.		N/A
2.11	**BEDDING**		**N/A**
2.11.1	Bedding, if required in accordance with Clause 2.9 or 2.12, shall comprise extruded or lapped non-metallic material.	No bedding used	N/A
	Any hygroscopic bedding material such as jute yarn, hessian or other textile tapes shall be impregnated and additional waterproofing compound shall be applied, if necessary, to make such bedding become non-hygroscopic.		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	Where the lead alloy sheath is covered by a lapped bedding it shall also have two layers of impregnated paper tape, or elastomeric or plastic tape, applied over the lead sheath (under the bedding).		N/A
	The bedding materials shall be compatible with the other materials of the cable with which they are in contact, and shall be capable of operating continuously at 90°C.		N/A
2.11.2.1	Extruded bedding shall be close fitting to the underlying component and shall be readily removable.		N/A
2.11.2.2	Lapped bedding shall be a helically applied continuous layer.		N/A
2.11.3	The approximate thickness of bedding (t_B) shall be determined in accordance with Table 2.3.		N/A
2.12	**ARMOUR (OPTIONAL)**		**N/A**
2.12.1	Armour of single-core cables intended for use in a.c. circuits shall be non-magnetic.	No armour used	N/A
	Armour wires for three-core cables shall comply with AS/NZS 3863.		N/A
2.12.2	Armour wires shall be applied helically with a minimum gap between adjacent wires.		N/A
	Where double-wire armour is required, a separator comprising a layer of non-hygroscopic material meeting the requirements of Clause 2.11 and approximately 0.5 mm thick shall be applied between the concentric layers of armour.		N/A
	For single-wire armour, the direction of lay shall be opposite to that of the laid-up cores.		N/A
	For double-wire armour, the direction of lay of the inner layer shall be opposite to that of the laid-up cores and the direction of lay of the outer layer shall be the same as that of the laid-up cores.		N/A
2.12.3	For cables without metal sheath the armour shall be applied over a separation sheath in accordance with Clause 2.10. In the case where additional extruded layers are applied between the screens and the armour, then the armour shall be applied over a bedding in accordance with Clause 2.11.		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.12.4	For cables without metal sheath the armour shall be applied over a separation sheath in accordance with Clause 2.10. In the case where additional extruded layers are applied between the screens and the armour, then the armour shall be applied over a bedding in accordance with Clause 2.11.		N/A
2.12.5	The nominal diameter of the armour wires shall be not less than the appropriate values given in Table 2.4.		N/A
2.13	**OVERSHEATH**		**P**
2.13.1	The oversheath shall be one or more of the listed materials, which shall comply with the requirements of AS/NZS 3808.	See page 25	P
	Where an HDPE oversheath is required directly over a laid-up core assembly, the sheath shall be a composite sheath consisting of a combination of an inner layer of V-90, 5V-90 or LLDPE and an outer layer of HDPE. A single-layer oversheath of HDPE applied directly over the laid-up core assembly shall not be used.	Composite sheath, using 5V-90 PVC inner and HDPE outer layer	P
2.13.2	The oversheath shall be close fitting and be readily removable from the cable without damage to the underlying cable component. Any barrier tape or binder may, however, adhere to the oversheath.		P
2.13.3	The colour of the outermost sheath shall be black unless otherwise indicated. For composite sheaths, the inner layer should be a contrasting colour.	Orange inner PVC layer and Black outer HDPE layer with White polyamide layer in-between	P
	The nominal thickness of the oversheath or combined layers of sheath material (ts) shall not be less than calculated from the following equation: ts = 0.035 Du + 1.0 mm	See table on page 21	P
	The minimum thickness at any point shall not be less than minimum thickness = 0.80 ts − 0.20 mm	See table on page 21	P
	Where the oversheath is a composite sheath, the nominal thickness of the inner layer shall be between 30 % and 50 % of the total nominal thickness but in no case shall be less than 1.0 mm.	See table on page 21	P

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	The nominal thickness of the outer layer shall be the remainder of the total nominal thickness, but in no case shall be less than: (a) For three-core cables—1.0 mm. (b) For single-core cables—1.0 mm. (c) For phase cable to be bundled—1.8 mm.	See table on page 21	P
	The minimum thickness of each layer shall be calculated for each layer and using the nominal thickness for that layer.	See table on page 21	P
2.14	**WATER-BLOCKING (OPTIONAL)**		**P**
2.14.1	The inclusion of water-blocking is optional. If it is used, the water-blocking shall comply with the requirements of Clause 2.14.2. Water-blocking measures may be taken to restrict water penetration along the cable in the region of the metallic screens and within the conductor.		P
	Hygroscopicity is an essential characteristic of a swellable water-blocking material. Where water-blocking materials are used, these materials are exempt from the requirement for non-hygroscopic materials.		-
2.14.2	Water-blocking of the conductor(s) shall be achieved by non-biodegradable, water-swelling yarns and/or tapes applied within the wires of the conductor. A semiconductive water-blocking tape may need to be applied directly over the conductor.	Water blocking tapes used within the conductor (under each layer, except the middle wire) and semiconductive tape water blocking tape used over the conductor.	P
	Water-blocking of the screens in three-core cables shall be achieved by a non-biodegradable, water-swellable tape applied under the screen wires.	Water blocking tape used under the copper wires screen	P
	In the case of single-core cable or phase cable in a triplex cable, the water-swellable tape may be applied under or over the screen wires, or both.	Not such cable	N/A
	Where applied under the screen wires, the tape shall be semiconductive. The tape shall be compatible with other cable components with which it is in contact.	The tape is semiconductive	P
	The tapes shall be readily removable from the core and screen wires.	Easily removable	P
2.15	**PROTECTION FROM INSECT ATTACK (OPTIONAL)**		**P**

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	Where protection against insect attack is required, an extrusion of Polyamide 11 or 12, or two copper, brass or stainless steel tapes helically applied, or other suitable means, may be incorporated in the cable construction.	Polyamide 11 layer is used. Measured minimum thickness: 0.30mm	P
	Where the means of insect protection is susceptible to damage during installation, it shall be inserted within a composite sheath or protected by a sacrificial layer or covered by other cable components.	Inserted between layers of composite sheath	P
2.16	**CABLE IDENTIFICATION**		**P**
	The outermost surface of cables shall be embossed, printed or, in the case of PVC sheath, may be indented with:	Embossing See Note 9. on page 2	P
	manufacturer's name, trade name or mark	OIPL – marked	P
	the year of manufacture	MM/YYYY – marked	P
	And rating as appropriate	12.7/22KV 3CX300SQMM – marked	P
	The letters and figures shall comprise upright block characters arranged along two approximately diametrically opposed lines, except that in the case of cables with a diameter less than or equal to 30 mm one line of characters is acceptable.	One line is accepted by purchaser	P
	The height of the characters shall be not less than 15% of the nominal diameter of the cable, but in no case shall it be less than 3 mm nor greater than 13 mm.	Approx. 10mm, in accordance with purchaser's requirement	P
	The gap between the end of one set of characters and the beginning of the next shall be not greater than 500 mm.	Approx. 250mm	P
2.17	**METRE MARKING ON CABLE (OPTIONAL)**		**P**
	The outermost surface of the cable may be sequentially marked with numbers, in a contrasting colour, at one metre intervals. Where applied, the metre marking shall be limited to six digits and any drum length may start at any integral number.	4 digit meter marking, printed in white, in accordance with purchaser's requirement	P
2.18	**PREPARATION FOR DELIVERY**		**N/T**
	The cable shall be wound onto drums meeting the requirements of AS/NZS 2857 for timber drums or AS 3983 for metal drums	Drums were not provided for assessment	N/T
	Both ends of the cable shall be sealed		N/T

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2.19	**MARKING OF DRUMS**		**P**
	Every drum of cable shall be durably branded, stencilled or labelled on the outside of the flange with the following information:		P
	(a) A manufacturer's traceability number	Order No and Drum No marked	P
	(b) The name or registered trade name or mark of the manufacturer or other distinguishing mark.	OIPL – marked	P
	(c) The cable designated voltage expressed in the form U_0/U.	12.7/22kV – marked	P
	(d) The number of cores, phase conductor size and material.	Cable description marked	P
	(e) Appropriate wording to identify the insulation and sheaths, and other protective coverings	Cable description marked	P
	(f) The gross mass of the drum and cable.		P
	(g) An arrow to indicate the recommended direction of rotation of the drum.		P
	(h) Where the cable is metre marked, the start and finish numbers of metre marking		P
3	**TESTS ACCORDING TO TABLE 3.1**		**P**
Test 1	**Conductor**	See page 22	P
Test 2	**Conductor screen**		P
	(a) Volume resistivity of extruded screen: maximum 500 Ω.m at 90 ±2°C	Measured: Red core: 15.9Ω.m White core: 16.2Ω.m Blue core: 15.2Ω.m	P
	(b) Thickness of the extruded layer: Minimum thickness at any point: 0.30 mm	See table on page 21	P
	(c) Any projections or irregularities at the conductor screen/insulation interface shall not protrude more than 0.25 mm into the insulation	No projections or irregularities found on the interface	P
Test 3	**Insulation**		P
	(a) The minimum thickness at any point shall comply with the requirements of Clause 2.3.3	See table on page 21	P
	(b) Concentricity - Compliance with Clause 2.3.4	See Clause 2.3.4 on page 6	P
	(c) Shrinkage - After 1 h at 130 ±3°C, max 4%	Measured: Red core: 2.0% White core: 2.3% Blue core: 2.3%	P
	(d) Determination of—		–

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	(i) size of voids: max 0.08mm	No voids found	P
	(ii) size of contaminants: max 0.15mm	No contaminants found	P
	(iii) size of discoloured translucents: max 1.25mm	No discoloured translucents found	P
	(iv) number of voids: ≤30 per 16 cm^3	No voids found	P
	(v) number of contaminants: ≤15 per 16 cm^3	No contaminants found	P
	(e) Hot-set test: 200kPa,15mins at 200 ± 3°C – XLPE		P
	(i) Elongation under load – max 175%	Measured: Red core: 80.0% White core: 77.50% Blue core: 75.0%	P
	(ii) Residual elongation after cooling – max 15%	Measured: Red core: -1.7% White core: -2.7% Blue core: -3.1%	P
	(f) compliance with AS/NZS 3808	See page 24	P
Test 4	**Insulation screen**		P
	(a) Volume resistivity of extruded screen: maximum 500 Ω.m at 90 ±2°C	Measured: Red core: 13.6Ω.m White core: 13.4Ω.m Blue core: 17.7Ω.m	P
	(b) Strippability of hand-strippable extruded screen - removable without damage	Removable without damage to insulations	P
	(c) Adhesion of hand-strippable extruded screen: 20 to 75 N for cables rated ≤12.7/22 kV and 40 to 90 N for cables rated >12.7/22 kV	Measured: Red core: 51N White core: 52N Blue core: 53N	P
	(d) Thickness of the extruded layer: Minimum thickness at any point: 0.60 mm	See table on page 21	P
Test 5	**Wire screen**		P
	(a) Diameter of wires - As specified in Clause 2.5.2	Measured: 0.81mm	P
	(b) Cross-sectional area - As specified in Clause 2.5.1	Measured cross section: 3x12.9mm^2 , fault current must be assessed for the particular application environment.	P
Test 6	**Separation and oversheath**		P
	(a) Separation sheath	No separation sheath used	N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	(i) compliance with AS/NZS 3808		N/A
	(ii) Thickness		N/A
	(iii) Spark test		N/A
	(b) Oversheath		P
	(i) compliance with AS/NZS 3808	Composite PVC inner / HDPE outer sheath used, See page 25	P
	(ii) Thickness	See table on page 21	P
	(iii) Spark test	Routine test, refer to manufacturer test records	N/A
Test 7	**Metal sheath thickness**	No metal sheath	N/A
Test 8	**Armour wire diameter**	No armour	N/A
Test 9	**Cable**		P
	(a) Partial discharge test		P
	20 pC at the voltage specified in Column 2 of Table 3.2,	Test voltage 25kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC	P
	nor 5 pC at the voltage specified in Column 3 of Table 3.2	Test voltage 19kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC	P
	(b) High voltage test for 5 min	High voltage of 42kVac applied, no breakdown on any core	P
	(c) High voltage 3.5kVa.c. test for 1 min, on separation sheath	Routine test, refer to manufacturer test records	N/A
	(d) Bending test followed by partial discharge test	See Clause 3.4 on page 18	P
	(e) DDF (tan δ) measurement as a function of voltage for EPR insulated cable only	Not EPR insulated cable	N/A
	(f) DDF (tan δ) measurement at elevated temperature	See Clause 3.6 on page 18	P
	(g) Heat cycling test followed by partial discharge test	See Clause 3.7 on page 19	P
	(h) Impulse withstand test followed by a high voltage test	See Clause 3.8 on page 19	P
	(i) High voltage a.c. test for 4 h	See Clause 3.9 on page 19	P
	(j) Water penetration test	See Annex C on page 19	P

AS/NZS 1429.1:2006 (R2017)					
Clause	Requirement	Result / Observation			Verdict
	(k) Compatibility test after ageing				P
	Test parameters of ageing : 240hrs @ 100°C	Red core	White core	Blue core	-
	i.a) Tensile Strength of insulation – min 75%of unaged materials	104	106	110	P
	ii.a) Elongation of insulation – min 65% of unaged material	102	104	106	P
	i.b) Tensile Strength of separation layer – min 75%of unaged materials	No separation layer used			P
	ii.b) Elongation of separation layer – min 65% of unaged material	No separation layer used			P
	i.c) Tensile Strength of oversheath – min 75%of unaged materials	PVC layer: 98 HDPE layer:89			P
	ii.c) Elongation of oversheath – min 65% of unaged material	PVC layer: 93 HDPE layer:94			P
3.3	**HIGH VOLTAGE TEST FOR 5 MIN**				**N/A**
	The voltage shall be applied between the conductors and the metallic screens, which shall be earthed.	Routine test, refer to manufacturer test records			N/A
3.4	**BENDING TEST FOLLOWED BY PARTIAL DISCHARGE TEST**				**P**
3.4.2	The diameter of the test cylinder	15(D+d) ±5%			P
	The sample shall be subjected to 3 cycles				P
3.4.3	Partial discharge test – The magnitude of discharge shall not exceed:				P
	20 pC at the voltage specified in Column 2 of Table 3.2,	Test voltage 25kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC			P
	nor 5 pC at the voltage specified in Column 3 of Table 3.2	Test voltage 19kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC			P
3.5	**MEASUREMENT OF DDF (TAN δ) AS A FUNCTION OF VOLTAGE**				**N/A**
	Maximum tan δ at U_o: 200 $\times 10^{-4}$	Not applicable for XLPE cable			N/A
	Maximum increment of tan δ between 0.5 and $2U_o$: 25 $\times 10^{-4}$				N/A
3.6	**MEASUREMENT OF DDF (TAN δ) AT ELEVATED TEMPERATURE**				**P**

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Clause	Requirement	Result / Observation	Verdict
	Maximum tan δ at 95 + 5, −0°C: XLPE insulated cable: 80 × 10^{-4}	Measured: Red core: 2.3 × 10^{-4} White core: 2.3 × 10^{-4} Blue core: 2.3 × 10^{-4}	P
3.7	**HEAT CYCLING FOLLOWED BY PARTIAL DISCHARGE TEST**		**P**
3.7.1	The sample shall be subjected to 20 cycles	Conductor temperature: 105-110°C	P
3.7.2	Partial discharge test – The magnitude of discharge shall not exceed:		P
	20 pC at the voltage specified in Column 2 of Table 3.2,	Test voltage 25kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC	P
	nor 5 pC at the voltage specified in Column 3 of Table 3.2	Test voltage 19kV, measured: Red core: <1.0pC White core: <1.0pC Blue core: <1.0pC	P
3.8	**IMPULSE WITHSTAND TEST FOLLOWED BY A HIGH VOLTAGE TEST**		**P**
3.8.1	The sample shall be heated to a steady temperature of between 95°C and 100°C.	Temperature maintained between 95°C and 100°C	P
3.8.2	The impulse voltage shall be applied between the conductors and the metallic screens	Impulse of 150kV(peak) applied, no breakdown on any core	P
3.8.3	The sample shall be subjected to a power frequency voltage test for 15 min.	High voltage of 42kVac applied, no breakdown on any core	P
3.9	**HIGH VOLTAGE A.C. TEST FOR 4H**		**P**
	The voltage shall be applied between the conductors and the metallic screens, which shall be earthed.	High voltage of 50kVac applied, no breakdown on any core	P
	APPENDIX C – WATER PENETRATION TEST		**P**
C3	**Preparation of sample**		P
	(a) A sample of completed cable at least 6 m in length which has not been subjected to any of the tests described shall be subjected to the bending test described in Clause 3.4.		P
	(b) A length of cable shall be cut from the length which has been subjected to the bending test and placed horizontally.		P

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Clause	Requirement	Result / Observation	Verdict
	(c) A ring of 50 mm minimum width shall be removed from the centre of the length.	In accordance with customer's request the water penetration test was carried out on the conductors rather than the whole cable, thus the layers have been removed all the way down to the conductors.	P
C5	**Procedure**		P
	(a) The tube is filled a height of 1000 mm above the cable centre. The sample shall be allowed to stand for 24 h.		P
	(b) The sample shall then be subjected to 10 heating cycles by passing current through the conductor, until the conductor reaches a steady temperature 5°C to 10°C above the maximum conductor temperature in normal operation, which shall not reach 100°C.		P
	(c) The heating cycle shall be of 8 h duration. The conductor temperature shall be maintained within the stated temperature limits for at least 2 h of each heating period. This shall be followed by at least 3 h of natural cooling in air to a conductor temperature less than 45°C.		P
	(d) The water head shall be maintained at 1000 mm.		P
	There shall be no evidence of water leakage at the cable ends	No evidence of water at the end of the cores.	P

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Clause	Requirement	Result / Observation	Verdict

	THICKNESS OF LAYERS			**P**
Item/Part	Measured average thickness (mm)	Measured minimum thickness (mm)	Required minimum thickness (mm)	-
Conductor screen – Red core	-	0.57	0.30	P
Conductor screen – White core	-	0.58	0.30	P
Conductor screen – Blue core	-	0.56	0.30	P
Insulation – Red core	5.3	5.20	4.85	P
Insulation – White core	5.2	5.12	4.85	P
Insulation – Blue core	5.3	5.18	4.85	P
Insulation screen – Red core	-	0.71	0.60	P
Insulation screen – White core	-	0.68	0.60	P
Insulation screen – Blue core	-	0.72	0.60	P
PVC layer of oversheath	1.6	1.32	1.08	P
Polyamide insect protection layer	-	0.30	-	N/A
HDPE layer of oversheath	2.3	2.16	1.59	P

AS/NZS 1125:2001+A1:2004			
Clause	Requirement	Result / Observation	Verdict
3	**ALUMINIUM CONDUCTORS**		**P**
3.2.1	Conductors shall be made from alloy 1350 as specified in AS 2848.1		P
3.2.2	**Stranded conductors**		**P**
	Tensile strength shall comply with Table 3.1.		P
	Stranded aluminium conductors normally do not have a cross-sectional area less than 10 mm^2, but 4 mm^2 and 6 mm^2 sizes may be used subject to special consideration of the suitability of the conductor for the type of cable and its application.	Not such cable	N/A
3.2.3	Solid conductors		N/A
	Solid sector-shaped conductors and solid sectoral circular conductors shall be made to the dimensions specified in BS 3988.	No solid conductor used	N/A
	Tensile strength shall comply with Table 3.1.		N/A
3.3	The conductors shall be circular, shaped, solid, stranded, compressed, compacted, Milliken, or solid sectoral circular, as required for a particular cable.	Circular, compacted conductors	P
3.4	**Joints in conductors**		**N/A**
3.4.1	**Stranded conductors other than in aerial cables**		**N/A**
	Joints are permitted only in the individual wires. When joining by resistance butt welding or fusion welding, no joint shall be within 60 mm of any other joint in the same layer. This restriction does not apply when joining by cold-pressure welding.	No joints are used	N/A
3.4.2	**Stranded conductors in aerial cables**		**N/A**
	Joints shall be made by cold-pressure butt welding and the minimum distance between two such joints shall be 15 m.		N/A
3.4.3	**Solid conductors**		**N/A**
	Joints shall not be made in the finished solid conductor.		N/A
3.5	**SOLID CONDUCTORS (CLASS 1)**		**N/A**
	The maximum d.c. resistance of conductors at 20°C shall be as specified in Table 3.2 for the relevant nominal cross-sectional area of the conductor.	No solid conductors used	N/A

AS/NZS 1125:2001+A1:2004			
Clause	Requirement	Result / Observation	Verdict

3.6	**STRANDED CONDUCTORS (CLASS 2)**		**P**
	The minimum number of wires in conductors be as specified in Table 3.3 for the relevant nominal cross-sectional area of conductor.	Required min: 61pcs, Actual: 61pcs	P
	The maximum d.c. resistance of conductors at 20°C shall be as specified in Table 3.3 for the relevant nominal cross-sectional area of conductor.	See table below	P
	For stranded circular and circular compressed conductors the individual wires shall be the same nominal diameter.	Not such conductor	N/A
	For stranded shaped, circular compacted and Milliken conductors the ratio of the largest wire cross-sectional area to the smallest wire cross-sectional area in the conductor shall not exceed 4.		P
	When a Milliken conductor is required, the conductor shall consist of sector-shaped stranded conductors lightly insulated from each other.		N/A
Table 3.1	**TESTS FOR ALUMINIUM CONDUCTORS**		**P**
	Tensile strength:		P
	(a) Solid: (i) Circular conductors≥ 50 mm^2 and all sector shaped conductors (ii) Circular conductors 35 mm^2 and 25 mm^2 (iii) Circular conductors ≤16 mm^2	Not solid conductor	P
	(b) Stranded conductor wires: (i) For other than aerial Cables (ii) For aerial cables	Required: 120 - 205MPa All measured values are in the range	P
	Wrapping test of conductor wires taken from stranded circular conductors for aerial cables	Not aerial cable	N/A
	Conductor resistance		**P**

Item	Red core Measured resistance (Ω/km)	White core Measured resistance (Ω/km)	Blue core Measured resistance (Ω/km)	Required max resistance (Ω/km)	-
3Cx300SQMM AL	0.100	0.100	0.100	0.100	P

AS/NZS 3808:2000 +A1:2002+A2:2004			
Clause	Requirement	Result / Observation	Verdict

4	**MATERIALS**		-
4.1	Insulation material type	XLPE	-
4.2	Separation layer material type		-
4.2	Ovesheath material type	5V-90 and HDPE composite	-
5	**TESTS AND CRITERIA**		-
	The properties of materials are specified in the following tables:		-
	Requirements applicable for Insulation material:	Table 9, column 4	-
	Requirements applicable for separation layer material:		-
	Requirements applicable for Oversheath material:	Table 6, column 5 Table 10, column 4	-

Table 9	**TESTS AND CRITERIA FOR INSULATION**				**P**
A	Mechanical tests without ageing:	Red core	White core	Blue core	P
A.1	Tensile strength - min. 12.5 MPa	19.23	18.35	19.43	P
A.2	Elongation at rupture - min. 200%	550.9	524.4	547.0	P
B	Mechanical tests after ageing in air oven: 168h at 135 ± 3 °C				P
B.1	Tensile strength - min. 75% of value of unaged specimens	104	98	107	P
B.2	Elongation at break - min. 75% of value of unaged specimens	109	98	107	P
C	Melt flow index:	Not applicable for XLPE			N/A
D	Hot-set test: 200kPa,15mins at 200 ± 3°C	Excluded by main standard			N/A
D.1	Elongation under load - max 175%	-			N/A
D.2	Residual Elongation after cooling - max 15%	-			N/A
E	Carbon black content:	Not applicable for XLPE			N/A
F	Carbon black dispersion:	Not applicable for XLPE			N/A
G	Electrical Characteristics:	Red core	White core	Blue core	P
	1. Insulation resistance constant (Ki) - minimum 40 000GΩ.m at 20°C	1 620 000	1 680 000	1 620 000	P
	2. Insulation resistance constant (Ki) - minimum 40GΩ.m at 90°C	50 000	35 900	31 200	P

	TESTS AND CRITERIA FOR SEPARATION LAYER	**N/A**

AS/NZS 3808:2000 +A1:2002+A2:2004			
Clause	Requirement	Result / Observation	Verdict
	TESTS AND CRITERIA FOR OVERSHEATH		**P**
Table 6	**5V-90 LAYER**		**P**
A	Mechanical tests without ageing:		P
A.1	Tensile strength - min. 12.5 MPa	16.10	P
A.2	Elongation at rupture - min. 150%	198.9	P
B	Mechanical tests after ageing in air oven: 504h at 115 ± 2 °C		P
B.1	Tensile strength - min. 75% of value of unaged specimens	101	P
B.2	Elongation at break - min. 65% of value of unaged specimens	73	P
C	Loss of mass: 120h at 115 ±2 °C - max. 2.5 mg/cm^2 of exposed area	1.26	P
D	Pressure test at high temperature: 90 ± 2 °C, Indentation - max. 50%	44.2	P
E	Heat shock test:1h at 150°C - No cracks	No cracks	P
F	Hot-set test:	Not applicable for PVC	N/A
F.1	Elongation under load		N/A
F.2	Residual Elongation after cooling		N/A
G	Exudation of plasticiser - No greasiness or droplets of liquid	No visible greasiness	P
Table 10	**HDPE LAYER**		**P**
A	Mechanical tests without ageing:		P
A.1	Tensile strength - min. 22.0 MPa	37.6	P
A.2	Elongation at rupture - min. 400%	850	P
B	Mechanical tests after ageing in air oven: 336h at 110 ± 2 °C		P
	Elongation at rupture - min. 300%	770	P
C	Melt flow index - max. 0.4	0.3	P
D	Carbon black content – min 2%	2.5	P
D	Carbon black dispersion – count <5 and no inferior dispersion pattern	Count: 3 and no inferior dispersion	P
E	Environmental stress crack resistance – no failure within 250h	No failure	P

END OF TEST REPORT