ACCREDITATION No. 20053

Accredited for compliance with ISO/IEC 17025 – Testing

CabLab

TEST REPORT

Test Report No.: **CLTR20100R1**

Client: **Dubai Cable Company Pvt Ltd**

Opp. Jebel Ali Shooting Club,
Old Abu Dhabi Road, Jabel Ali, Dubai, UAE

Product: XLPE insulated HDPE sheathed electric cable

Manufacturer: Dubai Cable Company Pvt Ltd

Model(s): 1.5/1.5kV DC 1Cx400mm2 Al/XLPE/NYLON/HDPE underground cable

Test specification: **Testing to:**
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

Tested by:		**Authorised by:**	
2020-07-22		2020-07-22	
(date)	Shriram Mathavan (Test Engineer)	(date)	J.G. Doering (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 samples were received on 2020-06-09 from client and received on 2020-06-18 from end-user (Downer), in good condition without any visible damage. The provided samples are completed cables from factory production / engineering samples.
6. The required tests were performed between: 2020-06-09 and 2020-07-22.
7. Specification applied: AS/NZS 1429.1:2006 (R2017) fully as far as applicable to the test item (solar DC cable), with the following deviations as requested by client:
    a. 4 h high voltage testing performed as per AS/NZS 5000.1 at 8 kVa.c.
    b. Sheath thickness requirements applied as per AS/NZS 5000.1:2005
    c. Annex C (water penetration test) was excluded:

DESCRIPTION OF TEST ITEM:

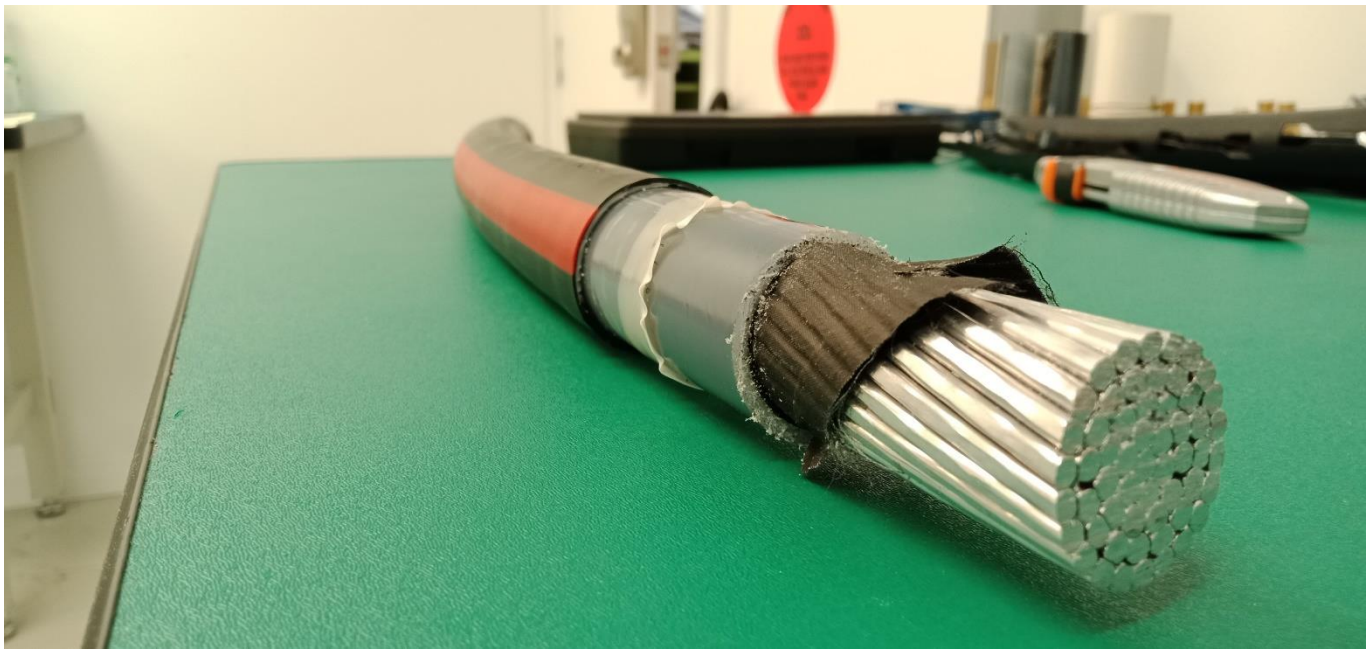
Test item is branded: **OIPL**, model: **1Cx400SQMM** electric cable. It is 1 core, 400mm^2 aluminium conductor – semi-conductive conductor screen – XLPE insulation –Nylon 12 natural– HDPE outer oversheath constructed cable, rated to 1.5/1.5kV DC.

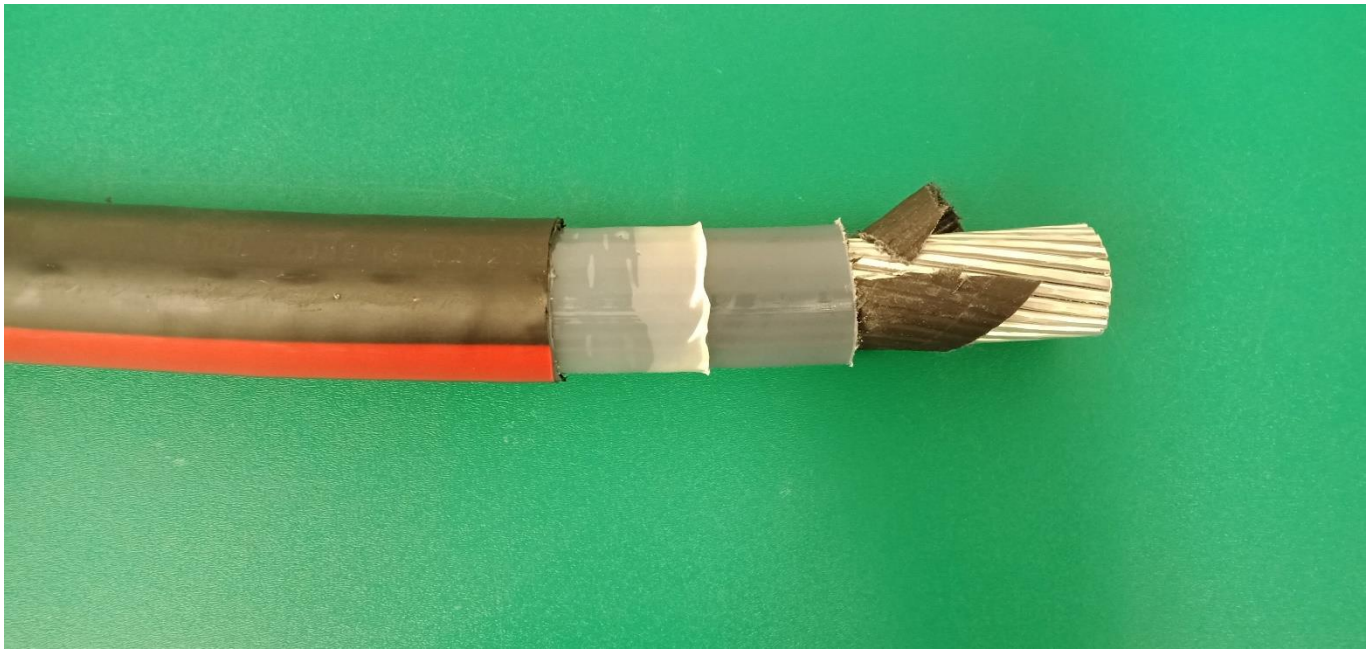
MARKING ON THE CABLE:

"OIPL P01516 02/2020 ELECTRIC CABLE DCF 1.5/1.5 KV 1C X 400 SQMM AL/X-90/NYLON/HDPE FOR DC USE ONLY GEN. AS/NZS 1429.1" Embossed.

MARKING ON THE CABLE DRUM:

PHOTOS OF TEST SAMPLE:





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 hard-drawn stranded conductors, see page 20	P
	Measures may be taken to achieve longitudinal water-blocking.	No water blocking used within the conductor	P
2.2	**CONDUCTOR SCREEN**		**P**
2.2.1	All cables shall have an extruded, cross-linked, semi-conductive screen applied on the conductor. A semi-conductive tape may be applied as part of the conductor screen and, where used, shall be applied directly on the conductor, preceding 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 13	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 13	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.	See page 25	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 19	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: From Ducab Positive core: 0.125 From Downer Positive core: 0.092 From Downer Negative core: 0.092	P
2.4	**INSULATION SCREEN**		**N/A**

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, semi-conductive compound applied directly over the insulation. A semi-conductive tape may be applied as part of the insulation screen and, where used, shall be applied over the extruded insulation screen.	No insulation screen	N/A
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 14	N/A
2.4.3	Requirements for stripping insulation screens		N/A
	(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 (c) on page 14	N/A
	(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**		**N/A**
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.	No metallic screen	N/A
	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.		N/A
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.		N/A
	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%.		N/A

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.		N/A
	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.		N/A
	For three-core cables, each core shall be screened with the same number of wires.		N/A
	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.		N/A
2.6	**IDENTIFICATION OF CORES**		**N/A**
	The cores of three-core and triplex cables shall be identified in one of the following ways:	Not such cable	N/A
	(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 semi-conductive 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.		N/A
	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.		N/A
2.7	**LAYING-UP**		**N/A**
	For three-core cables, the screened cores shall be laid up in a right-hand direction of lay.		N/A
	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.		N/A
	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**		**N/A**
	Any fillers, binders and barrier tapes shall be of a non-hygroscopic material, compatible with the cable components with which they are in contact.	No such fillers used	N/A
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 semi-conductive 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 See page 26	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	See table on page 19	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.	See table on page 19	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

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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.	See table on page 19	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 26	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.		N/A
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.	Black outer HDPE Sheath.	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 19	P
	The minimum thickness at any point shall not be less than minimum thickness = 0.80 ts − 0.20 mm	See table on page 19	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 19	N/A

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 19	N/A
	The minimum thickness of each layer shall be calculated for each layer and using the nominal thickness for that layer.	See table on page 19	N/A
2.14	**WATER-BLOCKING (OPTIONAL)**		**N/A**
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.	Not water-blocked conductor	N/A
	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.		N/A
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 semi-conductive water-blocking tape may need to be applied directly over the conductor.	No water blocking used within the conductor	N/A
	Water-blocking of the screens in three-core cables shall be achieved by a non-biodegradable, water-swellable tape applied under the screen wires.		N/A
	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 semi-conductive. The tape shall be compatible with other cable components with which it is in contact.		N/A
	The tapes shall be readily removable from the core and screen wires.		N/A
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.	Nylon (polyamide) 12 Natural used	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.		N/A
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:		P
	manufacturer's name, trade name or mark		P
	the year of manufacture		P
	And rating as appropriate		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.		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.		P
	The gap between the end of one set of characters and the beginning of the next shall be not greater than 500 mm.		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.		P
2.18	**PREPARATION FOR DELIVERY**		**N/A**
	The cable shall be wound onto drums meeting the requirements of AS/NZS 2857 for timber drums or AS 3983 for metal drums	Engineering samples only, drums were not prepared for delivery	N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	Both ends of the cable shall be sealed		N/A
2.19	**MARKING OF DRUMS**		**N/A**
	Every drum of cable shall be durably branded, stencilled or labelled on the outside of the flange with the following information:	Engineering samples only, drums were not prepared for delivery	N/A
	(a) A manufacturer's traceability number.		N/A
	(b) The name or registered trade name or mark of the manufacturer or other distinguishing mark.		N/A
	(c) The cable designated voltage expressed in the form U_0/U.		N/A
	(d) The number of cores, phase conductor size and material.		N/A
	(e) Appropriate wording to identify the insulation and sheaths, and other protective coverings		N/A
	(f) The gross mass of the drum and cable.		N/A
	(g) An arrow to indicate the recommended direction of rotation of the drum.		N/A
	(h) Where the cable is metre marked, the start and finish numbers of metre marking		N/A
3	**TESTS ACCORDING TO TABLE 3.1**		-
Test 1	**Conductor**	See page 20	P
Test 2	**Conductor screen**		P
	(a) Volume resistivity of extruded screen: maximum 500 Ω.m at 90 ±2°C	Measured: Ducab Positive Core: 87 Ω.m at 90 ±2°C	P
	(b) Thickness of the extruded layer: Minimum thickness at any point: 0.30 mm	Measured: Ducab Positive core: 0.72 mm Downer Positive core: 0.90 mm Downer Negative core: 0.62 mm	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 19	P
	(b) Concentricity - Compliance with Clause 2.3.4	See Clause 2.3.4 on page 4	P
	(c) Shrinkage - After 1 h at 130 ±3°C, max. 4%	2%	P
	(d) Determination of—		N/T
	(i) size of voids: max 0.08 mm		N/T

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Clause	Requirement	Result / Observation	Verdict
	(ii) size of contaminants: max. 0.15 mm		N/T
	(iii) size of discoloured translucents: max. 1.25 mm		N/T
	(iv) number of voids: ≤30 per 16 cm^3		N/T
	(v) number of contaminants: ≤15 per 16 cm^3		N/T
	(e) Hot-set test: 200 kPa,15 min at 200 ± 3°C – XLPE 250 ± 3°C – EPR		P
	(i) Elongation under load – max 175%	Measured: Ducab Positive core: 44% Downer Positive core: 46%	P
	(ii) Residual elongation after cooling – max 15%	Measured: Ducab Positive core: -4% Downer Positive core: -4%	P
	(f) compliance with AS/NZS 3808	See page 25	P
Test 4	**Insulation screen**		N/A
	(a) Volume resistivity of extruded screen: maximum 500 Ω.m at 90 ±2°C		N/A
	(b) Strippability of hand-strippable extruded screen - removable without damage		N/A
	(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		N/A
	(d) Thickness of the extruded layer: Minimum thickness at any point: 0.60 mm		N/A
Test 5	**Wire screen**		N/A
	(a) Diameter of wires - As specified in Clause 2.5.2		N/A
	(b) Cross-sectional area - As specified in Clause 2.5.1		N/A
Test 6	**Separation and oversheath**		P
	(a) Separation sheath		N/A
	(i) compliance with AS/NZS 3808	See page 26	N/A
	(ii) Thickness	See table on page 19	N/A
	(iii) Spark test	Routine test, refer to manufacturer test records	N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	(b) Oversheath		P
	(i) compliance with AS/NZS 3808	HDPE outer sheath used, See page 26	P
	(ii) Thickness	See table on page 19	P
	(iii) Spark test	Routine test, refer to manufacturer test records	N/T
Test 7	**Metal sheath thickness**		N/A
	Minimum thickness at any point shall comply with Clause 2.9.2.4		N/A
Test 8	**Armour wire diameter**		N/A
	Nominal diameter of armour wires shall comply with Clause 2.12.5		N/A
Test 9	**Cable**		-
	(a) Partial discharge test	Routine test, refer to manufacturer test records	N/A
	(b) High voltage test for 5 min	Routine test, refer to manufacturer test records	N/T
	(c) High voltage 3.5kVa.c. test for 1 min, on separation sheath		N/A
	(d) Bending test followed by partial discharge test	See Clause 3.4 on page 16	N/A
	(e) DDF (tan δ) measurement as a function of voltage for EPR insulated cable only	See Clause 3.5 on page 16	N/A
	(f) DDF (tan δ) measurement at elevated temperature	See Clause 3.6 on page 16	N/A
	(g) Heat cycling test followed by partial discharge test	See Clause 3.7 on page 16	N/A
	(h) Impulse withstand test followed by a high voltage test	See Clause 3.8 on page 16	N/A
	(i) High voltage a.c. test for 4 h (done as per AS/NZS 5000.1:2005)	See Clause 3.9 on page 17,	P
	(j) Water penetration test	See Appendix C on page 17	N/A
	(k) Compatibility test after ageing		P
	Test parameters of ageing: 240hrs @ 100°C		-
	i. a) Tensile Strength of insulation – min 75% of unaged materials	Req. 75%	P
		Meas. 131%	
	ii. a) Elongation of insulation – min 65% of unaged material	Req. 65%	P
		Meas. 135%	

AS/NZS 1429.1:2006 (R2017)				
Clause	Requirement		Result / Observation	Verdict
	i. b) Tensile Strength of separation layer – min 75% of unaged materials	Req.	75%	N/A
		Meas.	-	
	ii. b) Elongation of separation layer – min 65% of unaged material	Req.	65%	N/A
		Meas.	-	
	i. c) Tensile Strength of oversheath – min 75% of unaged materials	Req.	75%	P
		Meas.	92%	
	ii. c) Elongation of oversheath – min 65% of unaged material	Req.	65%	P
		Meas.	98%	
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**			**N/A**
3.4.2	The diameter of the test cylinder			N/A
	The sample shall be subjected to 3 cycles			N/A
3.4.3	Partial discharge test – The magnitude of discharge shall not exceed:			N/A
	20 pC at the voltage specified in Column 2 of Table 3.2,			N/A
	nor 5 pC at the voltage specified in Column 3 of Table 3.2			N/A
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**			**N/A**
	Maximum tan δ at 95 + 5, −0°C: XLPE insulated cable: 80 $\times 10^{-4}$ EPR insulation cable: 400 $\times 10^{-4}$			N/A
3.7	**HEAT CYCLING FOLLOWED BY PARTIAL DISCHARGE TEST**			**N/A**
3.7.1	The sample shall be subjected to 20 cycles			N/A
3.7.2	Partial discharge test			N/A
	The magnitude of discharge shall not exceed 20 pC at the voltage specified in Column 2 of Table 3.2 nor 5 pC at the voltage specified in Column 3 of Table 3.2			N/A
3.8	**IMPULSE WITHSTAND TEST FOLLOWED BY A HIGH VOLTAGE TEST**			**N/A**

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
3.8.1	The sample shall be heated to a steady temperature of between 95°C and 100°C.		N/A
3.8.2	The impulse voltage shall be applied between the conductors and the metallic screens		N/A
3.8.3	The sample shall be subjected to a power frequency voltage test for 15 min.		N/A
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.	Tested as per AS/NZS 5000.1:2005 but with test voltage as 8kVac/50Hz, no breakdown.	P
	APPENDIX C – WATER PENETRATION TEST		**N/A**
C3	**Preparation of sample**		N/A
	(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.		N/A
	(b) A length of cable shall be cut from the length which has been subjected to the bending test and placed horizontally.		N/A
	(c) A ring of 50 mm minimum width shall be removed from the centre of the length.		N/A
C5	**Procedure**		N/A
	(a) The tube is filled a height of 1000 mm above the cable centre. The sample shall be allowed to stand for 24 h.		N/A
	(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.		N/A
	(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.		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	(d) The water head shall be maintained at 1000 mm.		N/A
	There shall be no evidence of water leakage at the cable ends		N/A

AS/NZS 1429.1:2006 (R2017)			
Clause	Requirement	Result / Observation	Verdict

	THICKNESS OF LAYERS – Ducab Positive				**P**
Item/Part	Measured average thickness (mm)	Required average thickness (mm)	Measured minimum thickness (mm)	Required minimum thickness (mm)	-
Conductor Screen	-	-	0.72	0.30	P
Insulation	2.3	2.0	2.10	1.70	P
Nylon	0.5	0.5	0.38	0.20	P
Sheath (as per AS/NZS 5000.1:2005)	1.9	1.9	1.82	1.54	P

	THICKNESS OF LAYERS – Downer Positive				**P**
Item/Part	Measured average thickness (mm)	Required average thickness (mm)	Measured minimum thickness (mm)	Required minimum thickness (mm)	-
Conductor Screen	-	-	0.90	0.30	P
Insulation	2.3	2.0	2.18	1.70	P
Nylon	0.5	0.5	0.45	0.20	P
Sheath (as per AS/NZS 5000.1:2005)	2.1	1.9	1.84	1.54	P

	THICKNESS OF LAYERS – Downer Negative				**P**
Item/Part	Measured average thickness (mm)	Required average thickness (mm)	Measured minimum thickness (mm)	Required minimum thickness (mm)	-
Conductor Screen	-	-	0.62	0.30	P
Insulation	2.3	2.0	2.18	1.70	P
Nylon	0.6	0.5	0.40	0.20	P
Sheath (as per AS/NZS 5000.1:2005)	2.2	1.9	1.66	1.54	P

AS/NZS 1125:2001+A1:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict
2	**COPPER CONDUCTORS**		**N/A**
2.2	Material of conductor shall be high conductivity copper wire complying with the chemical composition designation C11000 in AS/NZS 1574.		N/A
2.3	Conductors shall be circular, shaped, solid, uniaxial, stranded, multiple-stranded circular, bunched circular, compressed, compacted, milliken or tinsel	Circular stranded	N/A
2.4	Joints in conductor	No joints	N/A
2.4.1	Joints are permitted in a solid conductor by welding only.		N/A
	Joints are also permitted in the individual wires of a stranded, uniaxial or bunched conductor and in the individual bunches or strands of a multiple-stranded conductor, from which it is formed. When joining conductors by silver-soldering, resistance butt welding or fusion welding, no joint in a wire shall be closer than 60 mm to that in any other wire or bunch in the same layer.		N/A
	Above restriction shall not apply when welding by cold pressure welding.		N/A
2.5	**Solid conductors (class 1)**		**N/A**
	Solid conductors shall be plain or metal-coated annealed or hard-drawn copper.	No solid conductors	N/A
	Solid conductors used up to max 2.5 mm^2 unless cable standard specifies otherwise		N/A
	The d.c. resistance of conductors at 20°C shall be as specified in Table 2.2 for the relevant nominal cross-sectional area of conductor.		N/A
2.6	**Stranded conductors (class 2)**		**N/A**
	Stranded conductors shall be plain or metal-coated annealed or hard-drawn copper.	Plain annealed	N/A
	The minimum number of wires shall be as specified in Table 2.3 for the relevant nominal cross-sectional area of conductor.	Required number of wires: 3 Number of wires: 7	N/A
	The d.c. resistance of conductors at 20°C shall be as specified in Table 2.3 for the relevant nominal cross-sectional area of conductor.	See page 22	N/A

AS/NZS 1125:2001+A1:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	For stranded circular, uniaxial and circular compressed conductors the individual wires shall be the same nominal diameter.	Wires are same diameter	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.	Not such conductor	N/A
	The use of circular compacted conductors shall be restricted to conductor sizes of 6 mm^2 or greater unless otherwise specified in the appropriate cable Standard.	Not such conductor	N/A
	When a Milliken conductor is required, the conductor shall consist of sector-shaped stranded conductors lightly insulated from each other.	Not such conductor	N/A
2.8	**Flexible conductors (class 5)**		**N/A**
	The wires in Class 5 conductors shall be plain or metal-coated annealed copper.	No flexible conductors	N/A
	The individual wires shall be the same nominal diameter. The maximum wire diameter shall be as specified in Table 2.4 for the relevant nominal cross-sectional area of conductor.		N/A
	The d.c. resistance of conductors at 20°C shall be as specified in Table 2.4 for the relevant nominal cross-sectional area of conductor.		N/A
2.9	**Flexible conductors (class 6)**		**N/A**
	The wires in Class 5 conductors shall be plain or metal-coated annealed copper.	No flexible conductors	N/A
	The individual wires shall be the same nominal diameter. The maximum wire diameter shall be as specified in Table 2.5 for the relevant nominal cross-sectional area of conductor.		N/A
	The d.c. resistance of conductors at 20°C shall be as specified in Table 2.5 for the relevant nominal cross-sectional area of conductor.		N/A
2.10	**Multiple Stranded conductors (rope lay)**		**N/A**
	Wires in conductors shall be plain or tinned annealed copper.	No multiple stranded conductors	N/A

AS/NZS 1125:2001+A1:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	The individual wires shall be the same nominal diameter. The maximum wire diameter shall be as specified in Table 2.6 for the relevant nominal cross-sectional area of conductor.		N/A
	The d.c. resistance of conductors at 20°C shall be as specified in Table 2.6 for the relevant nominal cross-sectional area of conductor.		N/A
2.11	**Tinsel conductors**		**N/A**
	Tinsel conductors shall consist of an assembly of strands, either rope-laid in groups, or rope-laid individually around a centre core of cotton or suitable textile thread. Each strand shall consist of one or more fine, flattened, plain copper wires wrapped around a centre core of cotton or suitable textile thread.	No tinsel conductors	N/A
	The rope lay shall be such that the strands are laid up helically and symmetrically so that within any one layer, the pitch of the strands is uniform.		N/A
	The d.c. resistance of the conductor shall not exceed 270 Ω/km at 20°C.		N/A
Table 2.1	**TESTS FOR PLAIN OR TINNED CONDUCTORS**		**N/A**
	Elongation of annealed conductor wires from stranded circular and bunched circular conductors.		N/A

Item	Diameter of wires (mm)	Measured average elongation (%)	Required average elongation (%)	No value below half of required	-
					N/A

	Coating continuity test for tinned conductors	Not required	N/A
	Conductor resistance		N/A

Item	Brown core Measured resistance (Ω/km)	Blue core Measured resistance (Ω/km)	Gr/Ye core Measured resistance (Ω/km)	Required max resistance (Ω/km)	-
					N/A

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**

AS/NZS 1125:2001+A1:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	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.		P
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.		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.		N/A
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.		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.		N/A
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.		P

AS/NZS 1125:2001+A1:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict
	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.		P
	For stranded circular and circular compressed conductors the individual wires shall be the same nominal diameter.		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	N/A
	(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	Measured resistance (Ω/km)	Required max resistance (Ω/km)	-
Ducab 1Cx400 SQMM positive core	0.0766	0.0778	P

AS/NZS 3808:2000 +A1:2002+A2:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict

4	**MATERIALS**		P
4.1	Insulation material type	XLPE	P
4.2	Separation layer material type		N/A
4.2	Oversheath material type	HDPE	P
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:	N/A	-
	Requirements applicable for Oversheath material:	Table 6, column 5 Table 10, column 4	-

Table 3.1	**TESTS AND CRITERIA FOR INSULATION**				**P**
	XLPE INSULATION				**P**
A	Mechanical tests without ageing:				P
A.1	Tensile strength - min. 12.5 MPa		19.0 MPa		P
A.2	Elongation at rupture - min. 200%		411 %		P
B	Mechanical tests after ageing in air oven: 168 h at 135 ± 3°C				P
B.1	Tensile strength - min. 75% of value of unaged specimens	Req.	75 %		P
		Meas.	131 %		
B.2	Elongation at break - min. 75% of value of unaged specimens	Req.	75 %		P
		Meas.	135 %		
C	Melt flow index:				N/A
D	Hot-set test: 200 kPa,15 min at 200 ± 3°C				P
D.1	Elongation under load – max. 175%		44% (from Ducab)	46% (from Downer)	P
D.2	Residual Elongation after cooling - max. 15%		-4% (from Ducab)	-4% (from Downer)	P
E	Carbon black content:				N/A
F	Carbon black dispersion:				N/A
G	Electrical Characteristics:				P
	1. Insulation resistance constant (Ki) - minimum 40 000 GΩ.m at 20°C		2 300 000 GΩ.m		P
	2. Insulation resistance constant (Ki) - minimum 40 GΩ.m at 90°C		1 500 GΩ.m		P

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Clause	Requirement	Result / Observation	Verdict
Table 3.1	**TESTS AND CRITERIA FOR SEPARATION LAYER**		**N/A**

	TESTS AND CRITERIA FOR OVERSHEATH			**N/A**
Table 6	**5V-90 LAYER**			**N/A**
A	Mechanical tests without ageing:			N/A
A.1	Tensile strength - min. 12.5 MPa			N/A
A.2	Elongation at rupture - min. 150%			N/A
B	Mechanical tests after ageing in air oven: 504 h at 115 ± 2°C			N/A
B.1	Tensile strength - min. 75% of value of unaged specimens	Req.		N/A
		Meas.		
B.2	Elongation at break - min. 65% of value of unaged specimens	Req.		N/A
		Meas.		
C	Loss of mass: 120 h at 115 ±2°C - max. 2.5 mg/cm^2 of exposed area			N/A
D	Pressure test at high temperature: 90 ± 2°C, Indentation - max. 50%			N/A
E	Heat shock test: 1 h at 150°C - No cracks			N/A
F	Hot-set test:			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			N/A
Table 10	**HDPE LAYER**			**P**
A	Mechanical tests without ageing:			P
A.1	Tensile strength - min. 22.0 MPa		37.9 MPa	P
A.2	Elongation at rupture - min. 400%		836 %	P
B	Mechanical tests after ageing in air oven: 336 h at 110 ± 2°C			P
	Elongation at rupture - min. 300%		761 %	P
C	Melt flow index - max. 0.4			N/T
D	Carbon black content – min 2%			N/T
D	Carbon black dispersion – count <5 and no inferior dispersion pattern			N/T
E	Environmental stress crack resistance – no failure within 200 h			N/T

AS/NZS 3808:2000 +A1:2002+A2:2004 (R2017)			
Clause	Requirement	Result / Observation	Verdict

END OF TEST REPORT