

Report No.: TN22-4379E

Sample No.: CN22-4667

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Contract No.: ISTCW22-2110

Test Report

Consigner Henan Huadong Cable Co., Ltd
NORTH SIDE OF WESTERN YUNXIANG ROAD, INDUSTRIAL
DISTRICT COUNTY, JIAOZUO CITY, HENAN PROVINCE
Telephone: 86-371-86230866

Sample Name 19/33KV 3×120mm² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE
Power Cable

Type and Size 19/33KV 3×120mm² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE

Kind of test Type test

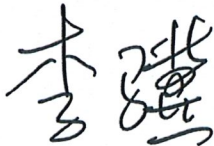
Sample Received Date October 28, 2022

Test Duration October 28, 2022 – November 22, 2022

Test Conclusion The sample has been conducted a series of type test items in accordance with AS/NZS 1429.1:2006. The test results indicate that the sample complies with the requirements of AS/NZS 1429.1:2006.

Authorized by Shanghai Intelligent Service and Technology Co., Ltd.

李骥 Li Ji



Issue date: 2022-11-24

Testing Engineer: 杨娟娟 Yang Juanjuan

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19/33KV 3×120mm² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE

1 Sample Description

Manufacturer	Henan Huadong Cable Co., Ltd
Type and Size	19/33KV 3×120mm ² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE
Quantity	25m
Marking	19/33kV 3*120mm ² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE make to AS/NZS 1429 Standard
Color	Red
Source	Sent by the consigner
Status	Normal appearance

2 Testing and Verdict Standards

2.1 Testing Standards

AS/NZS 1429.1: 2006 Electric cables—Polymeric insulated Part 1: For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

2.2 Verdict Standards

AS/NZS 1429.1: 2006 Electric cables—Polymeric insulated Part 1: For working voltages 1.9/3.3 (3.6) kV up to and including 19/33 (36) kV

3 Other Information

3.1 Description of the testing party

The sample's name, type and size, and manufacture name are provided by the consigner.

3.2 Testing location

Following items were conducted at No. 458 Haixiang Road, Fengxian, Shanghai:
Clause 4.1~4.10 of electrical tests

3.3 Symbol definition

Requirement: / not required by standard;
Verdict: P complying with requirement/Pass,
F not complying with requirement/Fail,
N not required.

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4 Electrical type tests

Following tests in 4.1 ~ 4.10 were conducted on one cable circuit.

4.1 Partial discharge test (Routine test)

According to AS/NZS 1429.1: 2006 Table 3.1 9(a), Table 3.2.

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Ambient temperature	18	°C
Sample temperature	18	°C
Test circuit	Direct method	
Power frequency	50	Hz
Calibration	5	pC
Background	0.7/0.7/0.7	pC

Core	Test Voltage, AC 50Hz		Duration (s)	PD Level (pC)
	... ×U ₀	(kV)		
Red	2	25.4	10	<0.9
	1.5	19	≤60	<0.8
Blue	2	25.4	10	<0.9
	1.5	19	≤60	<0.8
White	2	25.4	10	<0.9
	1.5	19	≤60	<0.9

Test Item	Requirement	Test Result	Verdict
Partial discharge test	The magnitude of discharge shall not exceed 20 pC at 2U ₀ nor 5 pC at 1.5U ₀ .	No detected discharge with sensitivity of 1.0pC.	P

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4.2 High voltage test for 5min (Routine test)

According to AS/NZS 1429.1: 2006 Table 3.1 9(b), Table 3.3.

Test method: AS/NZS 1429.1: 2006 Clause 3.3.

Test parameters:

Ambient temperature 18 °C

Voltage Arrangement		Test Voltage, AC 50Hz		Duration (min)		
Voltage applied	Grounded	...×U ₀	(kV)	Red	Yellow	Green
Conductor	Metal screen	-	63	5	5	5

Test Item	Requirement	Test Result	Verdict
High voltage test for 5min	No breakdown of the insulation or flashover shall occur.	No breakdown of the insulation occurred.	P

4.3 High voltage test for 1min on separation sheath (Routine test)

According to AS/NZS 1429.1: 2006 Table 3.1 9(c).

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Ambient temperature 18 °C

Voltage Arrangement		Test Voltage, AC 50Hz		Duration
Voltage applied	Grounded	...×U ₀	(kV)	(min)
Metal screen	Armour	-	3.5	1

Test Item	Requirement	Test Result	Verdict
High voltage test for 1min on separation sheath	No breakdown of the insulation or flashover shall occur.	No breakdown of the insulation occurred.	P

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4.4 Bending test followed by partial discharge test

4.4.1 Bending test

According to AS/NZS 1429.1: 2006 Table 3.1 9(d).

Test method: AS/NZS 1429.1: 2006 Clause 3.4.

Test parameters:

Ambient temperature	19 °C
Sample temperature	19 °C
Sample length	13 m

Conductor Diameter <i>d</i> (mm)	Cable Diameter <i>D</i> (mm)	Required bending diameter $D_r \leq 15(d+D)+5\%$ (mm)	Practical bending diameter <i>D_a</i> (mm)	Observation
13.1	83.7	≤1525	1500	3 cycles

Procedure	The cable sample shall be bent around a test cylinder at ambient temperature for three complete turns and unwound, without axial rotation. The sample shall then be rotated through 180° and the process repeated. This cycle of operation shall be carried out three times in total.
Observation	This test completed successfully.

4.4.2 Partial discharge test

According to AS/NZS 1429.1: 2006 Table 3.1 9(d), Table 3.2 and 3.4.3.

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Ambient temperature	18 °C
Sample temperature	18 °C
Test circuit	Direct method
Power frequency	50 Hz
Calibration	5 pC
Background	0.7/0.7/0.7 pC

Core	Test Voltage, AC 50Hz		Duration (s)	PD Level (pC)
	...×U ₀	(kV)		
Red	2	25.4	10	<0.9
	1.5	19	≤60	<0.9
Yellow	2	25.4	10	<0.9
	1.5	19	≤60	<0.9

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Core	Test Voltage, AC 50Hz		Duration (s)	PD Level (pC)
	...×U ₀	(kV)		
Green	2	25.4	10	<0.9
	1.5	19	≤60	<0.8

Test Item	Requirement	Test Result	Verdict
Partial discharge test	The magnitude of discharge shall not exceed 20 pC at 2U ₀ nor 5 pC at 1.5U ₀ .	No detected discharge with sensitivity of 1.0pC.	P

4.5 Tanδ measurement

According to AS/NZS 1429.1: 2006 Table 3.1 9(f), Table 3.2 and 3.4.3.

Test method: AS/NZS 1429.1: 2006 Clause 3.6.

Test parameters:

Effective length 13 m
 Conductor temperature 98 °C
 Standard capacitance 49.70 pF

Test Item	Applied voltage AC 50Hz (kV)	Unit	Requirement	Test Result			Verdict
				Red	Yellow	Green	
Tanδ	3.5		≤80×10 ⁻⁴	3.0×10 ⁻⁴	3.2×10 ⁻⁴	3.2×10 ⁻⁴	P

4.6 Heating cycle voltage test followed by partial discharge test

4.6.1 Heating cycle voltage test

According to AS/NZS 1429.1: 2006 Table 3.1 9(g).

Test method: AS/NZS 1429.1: 2006 中 3.7.

Test parameters:

Ambient temperature 12~20 °C
 Conductor steady temperature 105~109 °C

Cycles	Current (A)	Required conductor steady temperature (°C)	Heating duration of each cycle		Cooling duration of each cycle (h)
			Heating duration (h)	Steady duration of conductor temperature (h)	
20	523~541	105~110	5	2	3

Test Result	This test completed successfully.
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4.6.2 Following partial discharge test

According to AS/NZS 1429.1: 2006 Table 3.1 9(g).

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Ambient temperature	18	°C	
Sample temperature	18	°C	
Test circuit	Direct method		
Power frequency	50	Hz	
Calibration	5	pC	
Background	0.7/0.7/0.7	pC	

Core	Test Voltage, AC 50Hz		Duration (s)	PD Level (pC)
	...×U ₀	(kV)		
Red	2	38	10	<0.9
	1.5	29	≤60	<0.8
Yellow	2	38	10	<0.9
	1.5	29	≤60	<0.9
Green	2	38	10	<1.0
	1.5	29	≤60	<0.9

Test Item	Requirement	Test Result	Verdict
Partial discharge test	The magnitude of discharge shall not exceed 20 pC at 2U ₀ nor 5 pC at 1.5U ₀ .	No detected discharge with sensitivity of 1.0pC.	P

4.7 Impulse withstand test followed by a high voltage test

4.7.1 Impulse withstand test

According to AS/NZS 1429.1: 2006 Table 3.1 9(h), Table 3.4.

Test method: AS/NZS 1429.1: 2006 Clause 3.8, AS/NZS 1660.3:1998(R2017).

The conductor shall be heated by current to reach a steady temperature of (95~100)°C and shall be maintained within the stated temperature limits for at least 2h before applying impulse voltage.

Test parameters:

Ambient temperature	21	°C	
Conductor temperature	98	°C	

Required impulse voltage: 200 (kV)		Polarity	Applied voltage (% of required value)	Impulses
Voltage applied	Grounded			
Conductor	Metal sheath	Positive	50	1

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			65	1
			80	1
			100	10
Conductor	Metal sheath	Negative	50	1
			65	1
			80	1
			100	10

Polarity	Practical applied impulses (kV) (within ±3% deviation)									
Positive	101	131	162	-	-	-	-	-	-	-
	201	201	202	201	201	201	201	200	200	200
Negative	99	129	161	-	-	-	-	-	-	-
	200	201	201	200	201	200	201	201	201	201

Test Item	Requirement	Test Result	Verdict
Impulse withstand voltage test	The sample shall withstand without failure or flashover 10 positive and 10 negative voltage impulses of the appropriate value.	No failure or flashover occurred after withstanding 10 positive and 10 negative voltage impulses.	P

4.7.2 High voltage test for 15min

According to AS/NZS 1429.1: 2006 Table 3.1 9(h), Table 3.3.

Test method: AS/NZS 1429.1: 2006 Clause 3.8.3.

Test parameters:

Ambient temperature 21 °C

Voltage Arrangement		Test Voltage, AC 50Hz		Duration (min)		
Voltage applied	Grounded	... ×U ₀	(kV)	Red	Yellow	Green
Conductor	Metal sheath	-	63	15	15	15

Test Item	Requirement	Test Result	Verdict
Power frequency voltage test	No breakdown of the insulation or flashover shall occur.	No breakdown of the insulation occurred.	P

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4.8 High voltage a.c. test for 4h

According to AS/NZS 1429.1: 2006 Table 3.1 9(i), Table 3.5.

Test method: AS/NZS 1429.1: 2006 Clause 3.9.

Test parameters:

Ambient temperature 21 °C

Voltage Arrangement		Test Voltage, AC 50Hz		Duration (min)		
Voltage applied	Grounded	...×U ₀	(kV)	Red	Yellow	Green
Conductor	Metallic screen	-	75	240	240	240

Test Item	Requirement	Test Result	Verdict
Power frequency voltage test	No breakdown of the insulation or flashover shall occur.	No breakdown of the insulation occurred.	P

4.9 Measurement of electrical resistance of conductor

According to AS/NZS 1429.1: 2006 Table 3.1 1.

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Ambient temperature 19.6 °C

Duration 24 h

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
DC resistance of conductor at 20°C	Ω/km	≤0.153	0.150	0.150	0.150	P

4.10 Insulation resistance constant

According to AS/NZS 1429.1: 2006 Table 3.1 3(f) and AS/NZS 3808: 2000 Table 9.

Test method: AS/NZS 1660.3:1998(R2017).

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Insulation resistance constant						
- at 20°C	GΩ·m	≥40000	1900000	1830000	2100000	P
- at 90°C	GΩ·m	≥40	27800	28200	31100	P

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4.11 Resistivity of semi-conducting screens

According to AS/NZS 1429.1: 2006 Table 3.1 2(a),

Test method: AS/NZS 1660.3:1998(R2017).

Test parameters:

Measurement temperature 90 °C

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Resistivity						
- Conductor screen	Ω·m	≤500	7.09	7.57	8.29	P
- Insulation screen	Ω·m	≤500	1.31	2.64	1.98	P

5 Check of cable construction

According to AS/NZS 1429.1:2006 2, Table 2.1.

Test method: AS/NZS 1660.2.1:1998(R2017).

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Conductor						
- Material		/	Copper	Copper	Copper	N
- Construction		/	Compact circular	Compact circular	Compact circular	N
- Wire number		≥18	19	19	19	P
- Overall diameter	mm	/	12.8	13.1	12.9	N
Conductor screen						
- Average thickness	mm	/	0.8	0.7	0.7	N
- Minimum thickness	mm	≥0.30	0.70	0.61	0.65	P
Insulation (XLPE)						
- Average thickness	mm	/	3.3	3.2	3.2	N
- Minimum thickness	mm	≥7.10	3.11	3.10	3.02	P
- Concentricity		≤0.15	0.07	0.06	0.08	P
Insulation screen						
- Average thickness	mm	/	0.8	0.7	0.8	N
- Minimum thickness	mm	≥0.60	0.64	0.61	0.62	P
- Overall diameter	mm	/	22.6	22.6	22.4	N
Metallic screen						
- Material		/	Copper wire + copper tape	Copper wire + copper tape	Copper wire + copper tape	N

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Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
- Number of wire		/	48	48	48	N
- Diameter of wire	mm	≥0.57	1.24	1.24	1.24	P
- Gap between adjacent wires	mm	≤4	0.5	0.5	0.5	P
- Width of tape	mm	/	20	20	20	N
- Thickness of tape	mm	/	0.10	0.10	0.10	N
Semiconductive water-blocking tape						
- Number of layers		/	2	2	2	N
- Width of tape	mm	/	40	40	40	N
- Thickness of tape	mm	/	0.2	0.2	0.2	N
- Overlap	%	/	25	25	25	N
Laying-up		Right-hand		Right-hand		P
Separation sheath						
- Color		/		Red		N
- Average thickness	mm	/		1.7		N
- Minimum thickness	mm	/		1.54		N
- Color		/		White		N
- Average thickness	mm	/		0.4		N
- Minimum thickness	mm	/		0.32		N
- Color		/		Black		N
- Average thickness	mm	/		1.7		N
- Minimum thickness	mm	/		1.41		N
Armour						
- Material		/		Steel wire		N
- Number of wire		/		72		N
- Diameter of wire	mm	/		2.5		N
Oversheath						
- Color		/		Red		N
- Average thickness	mm	/		3.4		N
- Minimum thickness	mm	≥2.84		2.86		P
Complete cable						
- Average diameter	mm	/		75.9		N

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6 Properties of insulation (XLPE)

6.1 Shrinkage test for insulation

According to AS/NZS 1429.1: 2006 Table 3.1 3(c).

Test method: AS/NZS 1660.2.1:1998(R2017).

Test parameters:

Distance <i>L</i> between marks	200	mm
Temperature	130	°C
Duration	1	h

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
- Shrinkage	%	≤4	2	2	2	P

6.2 Hot set test for insulation

According to AS/NZS 1429.1: 2006 Table 3.1 3(e).

Test method: AS/NZS 1660.2.2:1998(R2017).

Test parameters:

Air temperature	200	°C
Time under load	15	min
Mechanical stress	20	N/cm ²

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
- Elongation under load	%	≤175	103	103	103	P
- Permanent elongation after cooling	%	≤15	-3	-3	-3	P

6.3 Mechanical properties of insulation before and after ageing

According to AS/NZS 1429.1: 2006 Table 3.1 3(f) and AS/NZS 3808: 2000 Table 9.

Test method: AS/NZS 1660.2.1:1998(R2017).

Test parameters:

Ageing temperature	135	°C
Ageing duration	168	h
Test temperature	23	°C
Elongation speed	250	mm/min

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Test Item	Unit	Requirement	Test Result			Verdict
			Red	Blue	White	
Before ageing						
- Tensile strength	N/mm ²	≥12.5	19.8	21.0	21.9	P
- Elongation at break	%	≥200	530	530	550	P
After ageing						
- Tensile strength	N/mm ²	/	24.0	25.6	20.9	N
- Percentage of value found in the unaged specimens	%	≥75	121	122	95	P
- Elongation at break	%	/	570	580	560	N
- Percentage of value found in the unaged specimens	%	≥75	108	109	102	P

7 Properties of separation sheath (MDPE)

7.1 Mechanical properties of separation sheath before and after ageing

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.

Test method: AS/NZS 1660.2.1:1998(R2017).

Test parameters:

Ageing temperature	100	°C
Ageing duration	240	h
Test temperature	23	°C
Elongation speed	250	mm/min

Test Item	Unit	Requirement	Test Result	Verdict
Before ageing				
- Tensile strength	N/mm ²	≥10.0	28.0	P
- Elongation at break	%	≥300	850	P
After ageing				
- Tensile strength	N/mm ²	/	23.6	N
- Percentage of value in the unaged specimens	%	/	84	N
- Elongation at break	%	≥300	780	P
- Percentage of value in the unaged specimens	%	/	92	N

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7.2 Melt flow index of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Melt flow index		≤1.0	0.11	P

7.3 Carbon black content of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Carbon black content	%	≥2.0	Not applicable	

7.4 Carbon black dispersion of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Carbon black dispersion	%	≤5 and no evidence of inferior dispersion e.g. striated pattern	Not applicable	

7.5 Environmental stress crack resistance of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Environmental stress crack resistance		No failure within 250h	Complied	P

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8 Properties of oversheath (MDPE)

8.1 Mechanical properties of oversheath before and after ageing

According to AS/NZS 1429.1: 2006 Table 3.1 6(b)(i) and AS/NZS 3808: 2000 Table 8.

Test method: AS/NZS 1660.2.1:1998(R2017).

Test parameters:

Ageing temperature	100	°C
Ageing duration	240	h
Test temperature	23	°C
Elongation speed	250	mm/min

Test Item	Unit	Requirement	Test Result	Verdict
Before ageing				
- Tensile strength	N/mm ²	≥10.0	26.6	P
- Elongation at break	%	≥300	890	P
After ageing				
- Tensile strength	N/mm ²	/	18.1	N
- Percentage of value found in the unaged specimens	%	/	68	N
- Elongation at break	%	≥300	980	P
- Percentage of value found in the unaged specimens	%	/	110	N

8.2 Melt flow index of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.

Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Melt flow index		≤1.0	0.60	P

8.3 Carbon black content of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.

Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Carbon black content	%	≥2.0	Not applicable	

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8.4 Carbon black dispersion of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Carbon black dispersion	%	≤5 and no evidence of inferior dispersion e.g. striated pattern	Not applicable	

8.5 Environmental stress crack resistance of separation sheath

According to AS/NZS 1429.1: 2006 Table 3.1 6(a)(i) and AS/NZS 3808: 2000 Table 10.
 Test method: AS/NZS 1660.2.4:1998(R2017).

Test Item	Unit	Requirement	Test Result	Verdict
Environmental stress crack resistance		No failure within 250h	Complied	P

9 Ageing tests on pieces of complete cable to check compatibility of materials

According to AS/NZS 1429.1: 2006 Table 3.1 9(k).
 Test method: AS/NZS 1660.2.1:1998(R2017).

Test parameters:

Ageing temperature	100	°C
Ageing duration	240	h
Test temperature	23	°C
Elongation speed	250	mm/min

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Insulation						
- Tensile strength	N/mm ²	/	22.5	22.4	23.1	N
- Percentage of value in the unaged specimens	%	≥75	114	107	105	P
- Elongation at break	%	/	540	560	570	N
- Percentage of value in the unaged specimens	%	≥65	102	106	104	P

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Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Separation sheath						
- Tensile strength	N/mm ²	/		27.4		N
- Percentage of value in the unaged specimens	%	≥75		98		P
- Elongation at break	%	/		840		N
- Percentage of value in the unaged specimens	%	≥65		99		P
Oversheath						
- Tensile strength	N/mm ²	/		27.0		N
- Percentage of value in the unaged specimens	%	≥75		102		P
- Elongation at break	%	/		900		N
- Percentage of value in the unaged specimens	%	≥65		101		P

10 Micro examination

According to AS/NZS 1429.1: 2006 Table 3.1 2(c), 3 (d).

Test method: AS/NZS 1660.2.5:1998.

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Insulation						
- Size of voids	mm	≤0.08	0	0	0	P
- Size of contaminants	mm	≤0.15	0	0	0	P
- Size of discoloured translucents	mm	≤1.25	0	0	0	P
- Number of voids	/16cm ³	≤30	0	0	0	P
- Number of contaminants	/16cm ³	≤15	0	0	0	P
Conductor screen/ insulation interface						
- Projection or irregularities	mm	≤0.25	0	0	0	P

19/33KV 3×120mm² CU/XLPE/CWS+CTS /MDPE/Nylon/SWA/MDPE

11 Strippability and adhesion of hand-strippable extruded insulation screen

According to AS/NZS 1429.1: 2006 Table 3.1 4(b) and 4(c).

Test method: AS/NZS 1660.2.5:1998.

Test Item	Unit	Requirement	Test Result			Verdict
			Red	Yellow	Green	
Strippability of insulation screen		The screen shall be removable without damaging the insulation, leaving no semiconductive material which cannot be readily removed	Complied	Complied	Complied	P
Force to remove strips	N	20~75	29.4~30.1	25.3~27.5	29.6~31.4	P

- The End. -

