



PROVINCIAL ELECTRICITY AUTHORITY

TECHNICAL SPECIFICATION DIVISION

SPACED AERIAL CABLES FOR RATED VOLTAGES OF 22 kV AND 33 kV

Specification No. RCBL-038/2560

Approved date : 13 พ.ย. 2560

Rev. No.: 2

Form No.: 04-5.2

Page 1 of 11

Invitation to Bid No.:

C Material, equipment, and specifications for SPACED AERIAL CABLES FOR RATED VOLTAGES OF 22 kV AND 33 kV

C1 General material and packing instructions

Additional to the general instructions, the following shall be observed:

1a Scope

These specifications cover 22 kV and 33 kV spaced aerial cables with compact stranded aluminium conductor, shield, insulation and jacket.

1b Standards

The spaced aerial cables shall be manufactured and tested in accordance with the following standards:

Thailand Industrial Standard (TIS)

TIS 2341-2555 Aluminium space aerial power cables with XLPE insulated and sheathed for rated voltage of 25 kV and 35 kV (Except insulation and jacket thickness used the technical data in **Table 1** and **Table 2**)

And all other relevant standards, unless otherwise specified in these specification.

PEA will also accept the spaced aerial cables tested in accordance with the later edition of the above standards.

1c Principal requirement

1c.1 General

The cables shall be compact stranded aluminium conductors, single-core type, with semi-conducting material conductor shield, cross-linked polyethylene insulation, and cross-linked polyethylene jacket.

The cables shall be capable of installing and operating under the following conditions:

System voltage : 3-phase, 22 kV and 33 kV

Rated frequency : 50 Hz

Conductor temperature

- for normal operation : 90°C continuously

- for emergency overload condition : 130°C

- for short-circuit condition : 250°C

Ambient air temperature : up to 40°C



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1c.2 Construction

The construction of 22 kV and 33 kV spaced aerial cables shall conform to the following requirements and technical data as shown in **Table 1** and **Table 2** respectively.

(1) Conductor

The aluminium conductor shall be compact round concentric-lay-stranded in accordance with the TIS 293 and technical data shown in **Table 1** and **Table 2**.

(2) Conductor shield

Over the conductor, semi-conductive cross-linked polyethylene shall be extruded as conductor shield layer. The semi-conductive extrusion shall be made in the process of tandem or simultaneous extrusion with the insulation and jacket. The conductor shield shall be of a material compatible with the conductor metal, and shall be uniformly and firmly bonded to the overlying insulation.

The average thickness and the minimum thickness of the conductor shield of 22 kV and 33 kV spaced aerial cables are specified in **Table 1** and **Table 2** respectively.

(3) Insulation

The insulation shall be unfilled, no carbon black cross-linked polyethylene (XLPE) processed from peroxide cross linking agent, whose properties meet all the requirements as specified in TIS 2341.

The average thickness of the insulation of 22 kV and 33 kV spaced aerial cables shall not be less than the nominal value specified in **Table 1** and **Table 2** respectively.

The minimum thickness of the insulation shall not be less than 90 percent of the nominal value.

(4) Jacket

The jacket shall be filled carbon black cross-linked polyethylene which contains no less than 2% and no more than 10% of carbon black by weight with tracking resistance, whose properties meet all the requirements as specified in TIS 2341.

The average thickness of the jacket of 22 kV and 33 kV spaced aerial cables shall not be less than the nominal value specified in **Table 1** and **Table 2** respectively.

The minimum thickness of the jacket shall not be less than 90 percent of the nominal value.

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Table 1

Technical data of 22 kV spaced aerial cables

Description		Unit	Technical data			
Nominal system voltage		kV	22			
Conductor	Type of conductor	-	Aluminium			
	Nominal cross-sectional area	mm ²	50	95	120	185
	Stranding	-	Compact stranded			
	Outside diameter ± 1%	mm	8.00	11.45	12.95	15.98
	Calculated breaking strength Minimum	N	7,313	14,098	18,518	28,974
	Volume resistivity at 20 ⁰ C Maximum	Ω-mm ² /m	0.028264			
	DC resistance at 20 ⁰ C Maximum	Ω/km	0.641	0.320	0.253	0.164
Conductor shield	Thickness Minimum	mm	0.07			
	Average	mm	0.3			
	Volume resistivity at 90 ⁰ C Maximum	Ω-cm	50,000			
Insulation	Thickness	mm	4.85			
Jacket	Thickness	mm	1.75			
Cable	Overall outside diameter	mm	21.7-23.8	25.1-27.1	26.5-28.5	29.6-31.8
Electrical test voltage	AC test voltage for 5 minutes	kV	38			

Table 2

Technical data of 33 kV spaced aerial cables

Description		Unit	Technical data			
Nominal system voltage		kV	33			
Conductor	Type of conductor	-	Aluminium			
	Nominal cross-sectional area	mm ²	50	95	120	185
	Stranding	-	Compact stranded			
	Outside diameter ± 1%	mm	8.00	11.45	12.95	15.98
	Calculated breaking strength Minimum	N	7,313	14,098	18,518	28,974
	Volume resistivity at 20 ⁰ C Maximum	Ω-mm ² /m	0.028264			
	DC resistance at 20 ⁰ C Maximum	Ω/km	0.641	0.320	0.253	0.164
Conductor shield	Thickness Minimum	mm	0.07			
	Average	mm	0.3			
	Volume resistivity at 90 ⁰ C Maximum	Ω-cm	50,000			
Insulation	Thickness	mm	7.18			
Jacket	Thickness	mm	1.75			
Cable	Overall outside diameter	mm	26.3-28.3	29.7-31.7	31.1-33.1	34.2-36.2
Electrical test voltage	AC test voltage for 5 minutes	kV	49			

1c.3 Cable marking

The surface of the jacket shall be marked in **Thai** language, a distance of about 50 cm, by printing in white, as follows:

" การไฟฟ้าส่วนภูมิภาค สายเคเบิลอากาศอะลูมิเนียม หุ้มด้วยฉนวน และเปลือกนอกครอสลิงกด์พอลิเอทิลีน สำหรับใช้กับระบบ A เควี ขนาด B ตร.มม., สัญญาเลขที่ C, D, E, F, G "

Where

- A : Rated voltage (22 kV or 33 kV)
- B : Nominal cross-sectional area in mm²
- C : The purchase contract number
- D : Manufacturer's name and/or Trade mark
- E : PEA trade-mark as the figure below



- F : Year of manufacture
- G : Others according to manufacturer's design

The **cable length markings** shall be made on the cable jacket through whole length started from "0" with 1 meter increment.

1c.4 Terminal marking

Both terminals of cable in each reel shall be permanently marks with manufacturer's symbol for verifying the original length. The method of marking shall be stated.

1c.5 Cable end sealing

Immediately after factory tests the cable ends shall be sealed or covered with moisture-proof end caps.

1d Packing

The cables shall be packed on non-returnable wooden reels with hub reinforcements. Reels shall be closely lagged with suitable wooden battens to protect the cables against damage. After lagging, the galvanized steel wire or steel strap shall be fitted to the battens over each flange of the reel. Overall outside diameter of reel shall not exceed 2.0 meters.

The wooden parts of reels shall be treated with water-borne wood preservatives, Chromated Copper Arsenate (CCA), according to Group 3 of TIS 515, see **Table 3**, to a dry net salt retention of 12.0 kg/m³.



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Table 3

Active Ingredients of CCA

Description	TIS 515–2539 Group 3		
	Formular A	Formular B	Formular C
Copper, as CuO %	16.0 - 20.9	18.0 - 22.0	17.0 - 21.0
Chromium, as CrO ₃ %	59.4 - 69.3	33.0 - 38.0	44.5 - 50.5
Arsenic, as As ₂ O ₅ %	14.7 - 19.7	42.0 - 48.0	30.0 - 38.0

The cables shall be supplied in length per reel as mentioned in **Table 4** with variation of $\pm 10\%$.

An amount not exceeding 10% of the total length may be delivered in random length, but any such length shall not be less than 50% and not exceed of the standard length on one reel.

On acceptance, the measured length of cable in each reel shall not be less than the packing length shown on the reel.

The reel shall be marked with at least the followings:

- (1) Cable type and size
- (2) System voltage
- (3) Manufacturer's name and/or Trade mark
- (4) Contract number and/or Year of manufacture
- (5) Length of cable
- (6) Gross weight and Net weight
- (7) Other according to standard and manufacturer's design

Table 4

Packing details for spaced aerial cables

PEA Material No.	Nominal cross-sectional area (mm ²)	System voltage (kV)	Production length per reel (m)
1020050000	50	22	1,500
1020050001	95	22	1,000
1020050002	120	22	1,000
1020050004	185	22	1,000
1020050100	50	33	1,000
1020050101	95	33	1,000
1020050102	120	33	1,000
1020050104	185	33	1,000



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1e Tests and Test reports

1e.1 Type tests

The cables shall be successfully passed type tests in accordance with the relevant TIS standards by the following test items:

- a) Marking durability test
- b) Test for determining the mechanical properties of insulation and jacket before and after ageing
- c) Hot creep test for insulation and jacket
- d) Determination of physical for conductor and dimension for each layer
- e) Resistance test on conductor
- f) Dielectric test
- g) Insulation resistance test
- h) Tracking resistance test on jacket
- i) Volume resistance test on conductor shield
- j) Capacitance and power factor test
- k) Accelerated water absorption test

The type tests shall be conducted or inspected by the acknowledged testing laboratories/institutes as following:

- (1) Independent laboratories/institutes which are members of the Short-circuit Testing Liaison (STL) or independent laboratories/institutes which are accredited according to TIS 17025 or ISO/IEC 17025 with the scope of accreditation covered the relevant test items, standards and equipment. The certification and scope of accreditation of the independent laboratories/institutes shall be submitted with the bid for consideration.
- (2) Thailand's national laboratories, institutes, universities and electric utilities, as follows:
 - National Metal and Materials Technology Center (MTEC)
 - Electrical and Electronic Products Testing Center (PTEC)
 - Thai Industrial Standards Institute (TISI)
 - Electrical and Electronics Institute (EEI)
 - Department of Science Service (DSS)
 - Testing Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University
 - Electricity Generating Authority of Thailand (EGAT)
 - Metropolitan Electricity Authority (MEA)
 - Provincial Electricity Authority (PEA)
 - Other laboratories, institutes, universities or electric utilities approved by PEA



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In case of the foreign manufacturers having experience of more than twenty (20) years in design, manufacture and sell spaced aerial cables, PEA will accept type test report(s) conducted by the manufacturer's laboratory or other independent laboratories without qualification mentioned in (1) or (2). Documents showing the manufacturer's experience such as reference list shall be submitted with the bid for consideration.

The bidders or manufacturers who prefer to carry out the type tests of the spaced aerial cables with the laboratories or by the manufacturer themselves without the qualification mentioned above, the detail of the test facilities of the laboratories or the manufacturer shall be submitted to PEA for approval before proceeding the tests and before the bid closing date. PEA reserves the right to send representatives to inspect and witness the tests with the cost of the bidders or manufacturers.

The type test report done by the laboratories in Thailand or local manufacturers shall be valid within five (5) years counted from the issued date in the test report to the bid closing date.

The costs of all tests and reports shall be borne by the Contractor.

1e.2 Acceptance tests

The proposed spaced aerial cables shall be passed the acceptance tests in accordance with the relevant TIS standards by the test items shown in **1e.1 Type tests** except capacitance and power factor test and accelerated water absorption test are not require.

The Test Form for Acceptance test is according to **Annex 1**.

For item b) Test for determining the mechanical properties of insulation and jacket before and after ageing, PEA will accept a test report which is carried out before acceptance tests process.

PEA reserves the right to have the acceptance test made by the supplier's factory or by acknowledge independent testing laboratories.

The costs of all tests and reports shall be borne by the Contractor.

Three (3) sets of test reports shall be submitted at the time of delivery.

Number of sample

Number of reels per lot	Number of sample for acceptance test
1 to 100	1
101 to 200	2
201 to 300	3
301 to 400	4
401 to 500	5
More than 501	6



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C2 Material and packing data of the spaced aerial cables

The following critical documents and details shall be submitted with the bid:

Critical documents of the proposed spaced aerial cables shall be submitted with the bid for each item offered:

Item	Description of document	Confirmation	Reference (Page No./folder)
1	Guarantee performance data of spaced aerial cables (See Pages 10 of 11 to 11 of 11)	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Type test certification and/or type test reports	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Illustration of the cable	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Packing detail	<input type="checkbox"/> Yes <input type="checkbox"/> No	

Note:

The bidders who do not submit all critical documents mentioned in the above table with the bid shall be rejected.

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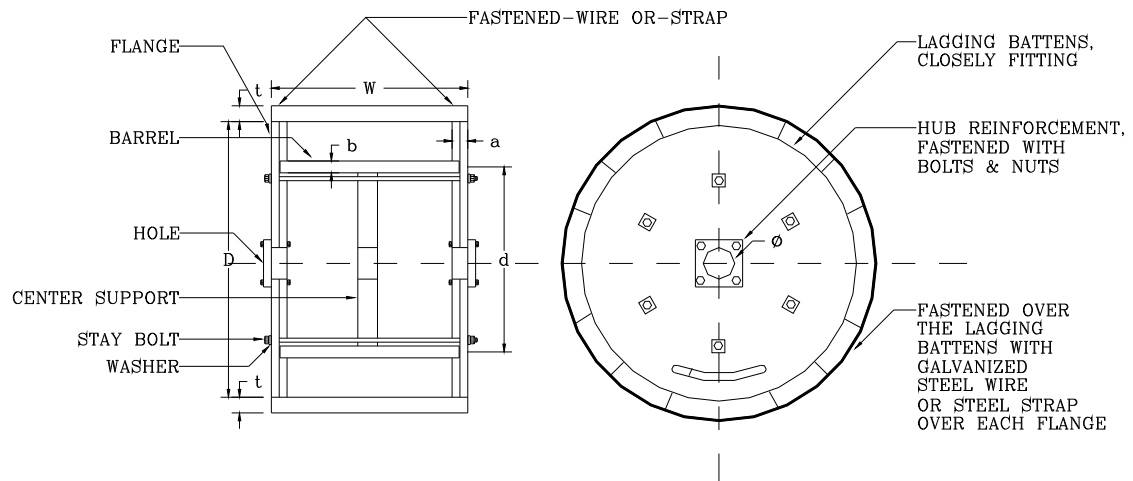
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WOODEN REELS



Reel size mm	D mm	d (min) mm	W mm	a (min) mm	b (min) mm	t (min) mm	Ø mm	Number of stay bolts (min.)
1,000	980-1,020	500	660-700	50	19	25	75-100	6
1,400	1,380-1,420	710	875-915	63	25	38	75-100	6
1,800	1,780-1,820	965	880-920	75	35	38	75-100	6
1,900	1,880-1,920	*	*	75	35	38	75-100	6

Note:

1. Minimum clearance between cable and the lagging battens shall not be less than 25 mm.
2. Both ends of barrel battens shall be embedded in the flanges.
3. If PEA requests, the bidders have to state the reel manufacturer's name; and PEA reserves the right to observe the manufacturing process from time to time.
4. *According to manufacturer's design.



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Invitation to Bid No.:

Guarantee performance data of spaced aerial cables

Manufacturer's name					
Country of origin					
Applied standard, publication number and year					
Type/Model/Catalogue No.	-				
Nominal cross-sectional area	mm ²	50	95	120	185
Rated voltage, phase to phase	kV r.m.s.				
Design for highest system voltage	kV r.m.s.				
Rated frequency	Hz				
Number of cores	-				
Rated current, in free air (40 ^o C)	A				
Conductor					
Material	-				
Actual cross-sectional area	mm ²				
Minimum number of wires	-				
Diameter of wires	mm				
Stranding	-				
Maximum volume resistivity at 20 ^o C	Ω-mm ² /m				
Maximum d.c. resistance at 20 ^o C	Ω/km				
Conductor shield					
Material	-				
Average thickness	mm				
Thickness at any place, not less than	mm				
Maximum DC volume resistivity at 90 ^o C	Ω-cm				



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Invitation to Bid No.:

Guarantee performance data of spaced aerial cables (Continue)

Insulation					
Material	-				
Cross-linking agent (peroxide, silane, etc)	-				
Curing process (steam, nitrogen, etc.)	-				
Average thickness	mm				
Thickness at any place, not less than	mm				
Dielectric constant, measured at a conductor temperature of 90°C	-				
Power factor, measured at a conductor temperature of 90°C	-				
Range of diameters over insulation	mm				
Jacket					
Material	-				
Average thickness	mm				
Thickness at any place, not less than	mm				
Overall diameter	mm				
AC test voltage for 5 minutes	kV				
Packing					
Length per reel	m				
Gross weight	kg				
Net weight	kg				
Name of wood preservative	-				



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C3 Schedule of detailed requirement

Invitation to Bid No.:

Item	PEA Material No.	Quantity	Description
1	1020050000		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 50 mm ² , for system voltage 22 kV 50 Hz.
2	1020050001		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 95 mm ² , for system voltage 22 kV 50 Hz.
3	1020050002		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 120 mm ² , for system voltage 22 kV 50 Hz.
4	1020050004		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 185 mm ² , for system voltage 22 kV 50 Hz.
5	1020050100		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 50 mm ² , for system voltage 33 kV 50 Hz.
6	1020050101		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 95 mm ² , for system voltage 33 kV 50 Hz.
7	1020050102		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 120 mm ² , for system voltage 33 kV 50 Hz.
8	1020050104		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 185 mm ² , for system voltage 33 kV 50 Hz.



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C4 Price schedule

Invitation to Bid No.

Manufacturer :

Country of origin :

Trade-mark :

Ite	PEA Material No.	Catalogue No.	Description	Quantity	Unit Cost (See details & conditions attached)	Total Cost (See details & conditions attached)
1	1020050000		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 50 mm ² , for system voltage 22 kV 50 Hz.			
2	1020050001		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 95 mm ² , for system voltage 22 kV 50 Hz.			
3	1020050002		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 120 mm ² , for system voltage 22 kV 50 Hz.			
4	1020050004		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 185 mm ² , for system voltage 22 kV 50 Hz.			



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C4 Price schedule

Invitation to Bid No.

Manufacturer :

Country of origin :

Trade-mark :

Ite	PEA Material No.	Catalogue No.	Description	Quantity	Unit Cost (See details & conditions attached)	Total Cost (See details & conditions attached)
5	1020050100		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 50 mm ² , for system voltage 33 kV 50 Hz.			
6	1020050101		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 95 mm ² , for system voltage 33 kV 50 Hz.			
7	1020050102		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 120 mm ² , for system voltage 33 kV 50 Hz.			
8	1020050104		Spaced aerial cable, XLPE insulation and jacket, single-core, aluminium conductor size 185 mm ² , for system voltage 33 kV 50 Hz.			

Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 22 kV ขนาด 50 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5
Physical Properties								
(a)	Marking Durability	Rub with cloth 10 time	Durable	-				
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of insulation	Before Aging	Min. 250	%				
		After Aging	-	%				
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of Jacket	Before Aging	Min. 250	%				
		After Aging	-	%				
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
Dimension Properties								
(d)	Dimension cable	Overall diameter (D)	21.7-23.8	mm.				
		Material Conductor	Al Compact	-				
		Conductor diameter (d)	7.92-8.08	mm.				
		No. of wire in conductor	Min. 6	mm.				
		Conductor screen Thinkness	Min. 0.07	mm.				
			Average 0.3	mm.				
		Material Insulation	XLPE	-				
		Insulation Thinkness	Min. 4.37	mm.				
			Average 4.85	mm.				
		Material Jacket	XLPE	-				
Jacket Thinkness	Min. 1.58	mm.						
	Average 1.75	mm.						
Electrical Properties								
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.641	Ω/km				
(f)	HV dielectric	Test at 38 kVac for 5 min	No Breakdown	-				
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km				
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-				
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm				
สรุปผลการทดสอบ			PASS					

Witness By 1.

2. _____
3. _____
4. _____



Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 22 kV ขนาด 95 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5
Physical Properties								
(a)	Marking Durability	Rub with cloth 10 time	Durable	-				
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of insulation	Before Aging	Min. 250	%				
		After Aging	-	%				
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of Jacket	Before Aging	Min. 250	%				
		After Aging	-	%				
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
Dimension Properties								
(d)	Dimension cable	Overall diameter (D)	25.1-27.1	mm.				
		Material Conductor	Al Compact	-				
		Conductor diameter (d)	11.33-11.56	mm.				
		No. of wire in conductor	Min. 6	mm.				
		Conductor screen Thinkness	Min. 0.07	mm.				
			Average 0.3	mm.				
		Material Insulation	XLPE	-				
			Min. 4.37	mm.				
		Insulation Thinkness	Average 4.85	mm.				
			Material Jacket	XLPE	-			
Jacket Thinkness	Min. 1.58	mm.						
	Average 1.75	mm.						
Electrical Properties								
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.320	Ω/km				
(f)	HV dielectric	Test at 38 kVac for 5 min	No Breakdown	-				
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km				
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-				
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm				
สรุปผลการทดสอบ			PASS					

Witness By 1.

2. _____
3. _____
4. _____



Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 22 kV ขนาด 120 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5
Physical Properties								
(a)	Marking Durability	Rub with cloth 10 time	Durable	-				
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of insulation	Before Aging	Min. 250	%				
		After Aging	-	%				
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of Jacket	Before Aging	Min. 250	%				
		After Aging	-	%				
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
Dimension Properties								
(d)	Dimension cable	Overall diameter (D)	21.7-23.8	mm.				
		Material Conductor	Al Compact	-				
		Conductor diameter (d)	7.92-8.08	mm.				
		No. of wire in conductor	Min. 6	mm.				
		Conductor screen Thinkness	Min. 0.07	mm.				
			Average 0.3	mm.				
		Material Insulation	XLPE	-				
		Insulation Thinkness	Min. 4.37	mm.				
			Average 4.85	mm.				
		Material Jacket	XLPE	-				
Jacket Thinkness	Min. 1.58	mm.						
	Average 1.75	mm.						
Electrical Properties								
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.641	Ω/km				
(f)	HV dielectric	Test at 38 kVac for 5 min	No Breakdown	-				
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km				
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-				
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm				
สรุปผลการทดสอบ			PASS					

Witness By 1.

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Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 22kV ขนาด 185 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5
Physical Properties								
(a)	Marking Durability	Rub with cloth 10 time	Durable	-				
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of insulation	Before Aging	Min. 75	% of unaged				
		After Aging	-	%				
	Tensile strength of jacket	Before Aging	Min. 250	%				
		After Aging	-	%				
	Elongation of Jacket	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Min. 75	% of unaged				
		Elongation After Cooling	Min. 75	% of unaged				
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
Dimension Properties								
(d)	Dimension cable	Overall diameter (D)	29.6-31.8	mm.				
		Material Conductor	Al Compact	-				
		Conductor diameter (d)	15.82-16.14	mm.				
		No. of wire in conductor	Min. 30	mm.				
		Conductor screen Thinkness	Min. 0.07	mm.				
			Average 0.3	mm.				
		Material Insulation	XLPE	-				
		Insulation Thinkness	Min. 4.37	mm.				
			Average 4.85	mm.				
		Material Jacket	XLPE	-				
Jacket Thinkness	Min. 1.58	mm.						
	Average 1.75	mm.						
Electrical Properties								
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.164	Ω/km				
(f)	HV dielectric	Test at 38 kVac for 5 min	No Breakdown	-				
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km				
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-				
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm				
สรุปผลการทดสอบ			PASS					

Witness By 1.

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Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 33 kV ขนาด 50 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5
Physical Properties								
(a)	Marking Durability	Rub with cloth 10 time	Durable	-				
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²				
		After Aging	-	N/mm ²				
	Elongation of insulation	Before Aging	Min. 75	% of unaged				
		After Aging	Min. 250	%				
	Tensile strength of jacket	Before Aging	Min. 75	% of unaged				
		After Aging	Min. 12.5	N/mm ²				
	Elongation of Jacket	Before Aging	Min. 75	% of unaged				
		After Aging	Min. 250	%				
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%				
		Elongation After Cooling	Max. 10	%				
Dimension Properties								
(d)	Dimension cable	Overall diameter (D)	26.3-28.3	mm.				
		Material Conductor	Al Compact	-				
		Conductor diameter (d)	7.92-8.08	mm.				
		No. of wire in conductor	Min. 6	mm.				
		Conductor screen Thinkness	Min. 0.07	mm.				
			Average 0.3	mm.				
		Material Insulation	XLPE	-				
		Insulation Thinkness	Min. 6.462	mm.				
			Average 7.18	mm.				
		Material Jacket	XLPE	-				
Jacket Thinkness	Min. 1.58	mm.						
	Average 1.75	mm.						
Electrical Properties								
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.641	Ω/km				
(f)	HV dielectric	Test at 49 kVac for 5 min	No Breakdown	-				
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km				
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-				
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm				
สรุปผลการทดสอบ			PASS					

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Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 33kV ขนาด 95 mm²

Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5	
Physical Properties									
(a)	Marking Durability	Rub with cloth 10 time	Durable	-					
	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²					
After Aging		-	N/mm ²						
		Min. 75	% of unaged						
Elongation of insulation		Before Aging	Min. 250	%					
	After Aging	-	%						
		Min. 75	% of unaged						
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²					
After Aging		-	N/mm ²						
		Min. 75	% of unaged						
Elongation of Jacket		Before Aging	Min. 250	%					
	After Aging	-	%						
		Min. 75	% of unaged						
	(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
Elongation After Cooling			Max. 10	%					
Hot creep for jacket		Under Load at 150°C at 15 min	Max. 175	%					
		Elongation After Cooling	Max. 10	%					
Dimension Properties									
(d)	Dimension cable	Overall diameter (D)	26.3-28.3	mm.					
		Material Conductor	Al Compact	-					
		Conductor diameter (d)	12.82-13.07	mm.					
		No. of wire in conductor	Min. 6	mm.					
		Conductor screen Thinkness	Min. 0.07	mm.					
			Average 0.3	mm.					
		Material Insulation	XLPE	-					
		Insulation Thinkness	Min. 6.462	mm.					
			Average 7.18	mm.					
		Material Jacket	XLPE	-					
Jacket Thinkness	Min. 1.58	mm.							
	Average 1.75	mm.							
Electrical Properties									
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.641	Ω/km					
(f)	HV dielectric	Test at 49 kVac for 5 min	No Breakdown	-					
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km					
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-					
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm					
สรุปผลการทดสอบ			PASS						

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Annex 1

Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 33 kV ขนาด 120 mm²



Factory Contract No. Date

No.	Description	Requirement	Reel No. Unit	1	2	3	4	5	
Physical Properties									
(a)	Marking Durability	Rub with cloth 10 time	Durable	-					
	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²					
After Aging		-	N/mm ²						
		Min. 75	% of unaged						
Elongation of insulation		Before Aging	Min. 250	%					
	After Aging	-	%						
		Min. 75	% of unaged						
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²					
After Aging		-	N/mm ²						
		Min. 75	% of unaged						
Elongation of Jacket		Before Aging	Min. 250	%					
	After Aging	-	%						
		Min. 75	% of unaged						
	(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%				
Elongation After Cooling			Max. 10	%					
Hot creep for jacket		Under Load at 150°C at 15 min	Max. 175	%					
		Elongation After Cooling	Max. 10	%					
Dimension Properties									
(d)	Dimension cable	Overall diameter (D)	26.3-28.3	mm.					
		Material Conductor	Al Compact	-					
		Conductor diameter (d)	12.82-13.07	mm.					
		No. of wire in conductor	Min. 6	mm.					
		Conductor screen Thinkness	Min. 0.07	mm.					
			Average 0.3	mm.					
		Material Insulation	XLPE	-					
		Insulation Thinkness	Min. 6.462	mm.					
			Average 7.18	mm.					
		Material Jacket	XLPE	-					
Jacket Thinkness	Min. 1.58	mm.							
	Average 1.75	mm.							
Electrical Properties									
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.641	Ω/km					
(f)	HV dielectric	Test at 49 kVac for 5 min	No Breakdown	-					
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km					
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-					
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm					
สรุปผลการทดสอบ			PASS						

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Annex 1



Test Form for Acceptance test

รายงานผลการตรวจรับสาย SAC ระดับแรงดัน 33 kV ขนาด 185 mm²

Factory Contract No. Date

No.	Description	Requirement	Unit	Reel No.						
				1	2	3	4	5		
Physical Properties										
(a)	Marking Durability	Rub with cloth 10 time	Durable	-						
(b)	Tensile strength of insulation	Before Aging	Min. 12.5	N/mm ²						
		After Aging	-	N/mm ²						
	Elongation of insulation	Before Aging	Min. 250	%						
		After Aging	-	%						
	Tensile strength of jacket	Before Aging	Min. 12.5	N/mm ²						
		After Aging	-	N/mm ²						
	Elongation of Jacket	Before Aging	Min. 250	%						
		After Aging	-	%						
(c)	Hot creep for Insulation	Under Load at 150°C at 15 min	Max. 175	%						
		Elongation After Cooling	Max. 10	%						
	Hot creep for jacket	Under Load at 150°C at 15 min	Max. 175	%						
		Elongation After Cooling	Max. 10	%						
Dimension Properties										
(d)	Dimension cable	Overall diameter (D)	34.2-36.2	mm.						
		Material Conductor	Al Compact	-						
		Conductor diameter (d)	15.82-16.14	mm.						
		No. of wire in conductor	Min. 30	mm.						
		Conductor screen Thinkness	Min. 0.07	mm.						
			Average 0.3	mm.						
		Material Insulation	XLPE	-						
		Insulation Thinkness	Min. 6.46	mm.						
			Average 7.18	mm.						
		Material Jacket	XLPE	-						
Jacket Thinkness	Min. 1.58	mm.								
	Average 1.75	mm.								
Electrical Properties										
(e)	Conductor resistance	Resistance at 20 °c	Max. 0.164	Ω/km						
(f)	HV dielectric	Test at 49 kVac for 5 min	No Breakdown	-						
(g)	Insulation resistance	Test at 500 Vdc at 15.6 °C	$IR = 6100 \log_{10} \frac{D}{d}$	MΩ-km						
(h)	Tracking Jacket	Test at 2kVac test 10 cycle	No Failure	-						
(i)	Volume conductor shield	at least 30 min at 90 °C	Max. 50,000	Ω-cm						
สรุปผลการทดสอบ			PASS							

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