



# PROVINCIAL ELECTRICITY AUTHORITY

## POWER SYSTEM STANDARD DIVISION

### AL, AL-ALLOY, ACSR, ARMOUR TAPE, AND TIE WIRE

Specification No.: RCBL-039/2551

Approved date : 1-09-2008

Rev. No. : 1

Form No. 04-2&3

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Invitation to Bid No. : N2.EB.(จข.)-22-2564 รายการที่ 3

**C Material, equipment, and specifications for ALUMINIUM STRANDED CONDUCTOR, ALUMINIUM-ALLOY STRANDED CONDUCTOR, ALUMINIUM CONDUCTOR STEEL REINFORCED, ARMOUR TAPE, AND TIE WIRE**

**C1 General material and packing instructions**

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

**1a Scope**

These specifications cover aluminium stranded conductor, aluminium-alloy stranded conductor, aluminium conductor steel reinforced, armour tape, and tie wire.

**1b Standard**

Aluminium stranded conductor, aluminium-alloy stranded conductor, aluminium conductor steel reinforced, shall be manufactured and tested in accordance with the latest edition of the following standard :

TIS 85 : Round wire concentric lay overhead electrical stranded conductors

Aluminium used for the armour tape, and tie wire shall be manufactured and tested in accordance with the latest edition of the following standard :

ASTM B 609 : Specifications for aluminium 1350 round wire, annealed and intermediate tempers, for electrical purposes

or equivalent, and all other relevant standard, unless otherwise specified in these specifications.

**1c Principal requirement**

Aluminium conductor steel reinforced shall be applied a neutral grease on all steel wires.

The conductor sizes and characteristics of aluminium stranded conductor, aluminium-alloy stranded conductor, aluminium conductor steel reinforced shall be according to Table 1, Table 2 and Table 3 respectively.

Armour tape shall be rounded at the edges and soft-drawn.

Tie wire shall be round and soft-drawn.

Test : Besides manufacturer's test certificate, PEA shall test the properties of conductors according to the above-mentioned standard at PEA's testing laboratory before acceptance as well.





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**Table 1 Characteristics of Aluminium Stranded Conductor (A1 conductor)**

Code Number	Area	Number Of wires	Diameter		Linear mass	Rated strength	D.C. resistance
			Wire	Cond.			
	mm <sup>2</sup>		mm	mm	kg/km	kN	Ohm/km
35	34.91	7	2.52	7.56	96	5.94	0.8202
50	50.14	7	3.02	9.06	137	8.27	0.5711
95	94.76	19	2.52	12.60	261	16.11	0.3036
120	121.21	19	2.85	14.25	333	20.61	0.2374
185	184.54	37	2.52	17.64	509	31.37	0.1563
240	242.54	61	2.25	20.25	670	43.66	0.1191
400	389.14	61	2.85	25.65	1075	66.15	0.0742

**Table 2 Characteristics of Aluminium-alloy Stranded Conductor (A3 conductor)**

Code Number	Area	Number Of wires	Diameter		Linear mass	Rated strength	D.C. resistance
			Wire	Cond.			
	mm <sup>2</sup>		mm	mm	kg/km	kN	Ohm/km
35	34.36	7	2.50	7.5	94	11.17	0.9682
50	49.48	7	3.00	9.0	135	16.08	0.6724
95	93.27	19	2.50	12.5	256	30.31	0.3584

**Table 3 Characteristics of Aluminium Conductor Steel Reinforced (A1/S1A conductor)**

Code number	Steel ratio	Area			Number of wire		Wire diam.		Diameter		Linear mass	Rated strength	D.C. resistance
		Alum.	steel	Total	Al	St	Alum.	steel	Core	Cond.			
	%	mm <sup>2</sup>	mm <sup>2</sup>	mm <sup>2</sup>			mm	mm	mm	mm	kg/km	kN	Ohm/km
35	17	34.3	5.7	40.0	6	1	2.70	2.70	2.70	8.1	139	12.37	0.8352
50	17	48.3	8.0	56.3	6	1	3.20	3.20	3.20	9.6	195	16.81	0.5946
95	16	94.4	15.3	109.7	26	7	2.15	1.67	5.01	13.6	381	34.93	0.3059
120	16	121.6	19.8	141.4	26	7	2.44	1.90	5.70	15.5	491	44.50	0.2375
185	16	183.8	29.8	213.6	26	7	3.00	2.33	6.99	19.0	741	65.27	0.1571
380	13	382.0	49.5	431.5	54	7	3.00	3.00	9.00	27.0	1443	121.30	0.0757





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#### 1d Packing

- 1d.1** The conductors shall be packed on non-returnable wooden reels with hub reinforcements. Reels shall be lagged with suitable wooden battens to protect the conductors 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 for conductor sizes up to  $400 \text{ mm}^2$  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 the latest TIS 515, see Table 4 to a dry net salt retention of  $12.0 \text{ kg/m}^3$ .

**Table 4**  
**Active Ingredients of CCA**

Description		TIS 515 - 2527		
		Group 3		
		Type 1	Type 2	Type 3
Copper, as CuO	%	16.0 - 20.9	18.0 - 22.0	17.0 - 21.0
Chromium, as CrO <sub>3</sub>	%	59.4 - 69.3	33.0 - 38.0	44.5 - 50.5
Arsenic, as, As <sub>2</sub> O <sub>5</sub>	%	14.7 - 19.7	42.0 - 48.0	30.0 - 38.0

The conductor in each reel shall be supplied in production length as mentioned in Table 5, Table 6 and Table 7 with variation of  $\pm 5\%$ .

For aluminium stranded conductor sizes up to  $400 \text{ mm}^2$ , aluminium-alloy stranded conductor sizes up to  $95 \text{ mm}^2$ , and aluminium conductor steel reinforced sizes up to  $380/50 \text{ mm}^2$  shall be supplied in reels as shown in Page 7 of 7 and in production lengths specified in the Table 5, Table 6, and Table 7 (see Page 6 of 7).

Both terminals of conductor in each reel shall be permanently marked with manufacturer's symbol, for checking the original length.

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

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

- 1d.2** The armour tape shall be supplied in coil, preferably 10 kg per coil.

The dimensions of coil shall be as follows :

- Inside diameter : 18 cm, approximately
- Height : 10 cm, approximately

- 1d.3** The tie wire shall be supplied in coil, preferably 25 kg per coil, or in manufacturer's standard weights which shall be round figure.





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#### C2 Material and packing data to be given by bidder

##### 2a Aluminium stranded conductor and aluminium-alloy stranded conductor details

Nominal cross-sectional area of conductor in  $\text{mm}^2$ .

Actual cross-sectional area of conductor in  $\text{mm}^2$ .

Number of wires.

Diameter of wire in mm.

Overall diameter of conductor in mm.

Construction of conductor.

Minimum calculated strength in N or kgf.

Maximum resistance at  $20^\circ\text{C}$  in ohm/km.

Weight resistivity of aluminium wire at  $20^\circ\text{C}$  in ohm-g/m<sup>2</sup>.

Weight of conductor in kg/km.

##### 2b Aluminium conductor steel reinforced details

Nominal cross-sectional area of conductor in  $\text{mm}^2$ .

Actual cross-sectional area of conductor in  $\text{mm}^2$ .

Number of wires (A1/S1A).

Diameter of wire (A1/S1A) in mm.

Overall diameter of conductor in mm.

Construction of conductor.

Minimum calculated strength in N or kgf.

Maximum resistance at  $20^\circ\text{C}$  in ohm/km.

Weight resistivity of aluminium wire at  $20^\circ\text{C}$  in ohm-g/m<sup>2</sup>.

Weight of conductor in kg/km.

##### 2c Armour tape details

Dimension (cross-section) in mm x mm.

Breaking strength in N or kgf.

Weight of armour tape in kg/km.

##### 2d Tie wire details

Diameter (cross-section) in mm.

Cross-sectional area in  $\text{mm}^2$ .

Breaking strength in N or kgf.

Weight of tie wire in kg/km.



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#### 2e Packing details

##### 2e.1 Packing details for conductor

Packing method (shown by drawing(s), describe packing materials, details of wood treatment, name and composition of preservatives and details of conductor terminal marking) .

Number of reels .

Principal dimensions of reel in mm .

Gross weight of one reel in kg .

Net weight of one reel in kg .

Length of uncut conductor per reel in m .

##### 2e.2 Packing details for armour tape and tie wire

Packing method.

Dimensions (cross-section) of armour tape in mm x mm .

Diameter (cross-section) of tie wire in mm .

Cross-section area of tie wire in mm<sup>2</sup> .

Principal dimensions of each coil in mm .

Net weight of each coil in kg .

Length of uncut armour tape or tie wire per coil in m .





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Table 5

#### Packing Details for Aluminium Stranded Conductor

PEA Material No.	Code number	Nominal cross-sectional area (mm <sup>2</sup> )	Reel size (mm)	Production length per reel (m)
1020010001	35	35 (35-A1-7)	1,000	4,500
1020010002	50	50 (50-A1-7)	1,000	3,100
1020010004	95	95 (95-A1-19)	1,400	4,500
1020010005	120	120 (120-A1-19)	1,400	3,500
1020010007	185	185 (185-A1-37)	1,400	2,400
1020010008	240	240 (240-A1-61)	1,400	1,500
1020010009	400	400 (400-A1-61)	1,800	1,500

Table 6

#### Packing Details for Aluminium-alloy Stranded Conductor

PEA Material No.	Code number	Nominal cross-sectional area (mm <sup>2</sup> )	Reel size (mm)	Production length per reel (m)
1020030001	35	35 (35-A3-7)	1,000	4,500
1020030002	50	50 (50-A3-7)	1,000	3,100
1020030004	95	95 (95-A3-19)	1,400	4,500

Table 7

#### Packing Details for Aluminium Conductor Steel Reinforced

PEA Material No.	Code number	Nominal cross-sectional area (mm <sup>2</sup> )	Reel size (mm)	Production length per reel (m)
1020020001	35	35/6 (35-A1/S1A-6/1)	1,000	3,500
1020020002	50	50/8 (50-A1/S1A-6/1)	1,000	3,000
1020020004	95	95/15 (95-A1/S1A-26/7)	1,400	3,500
1020020005	120	120/20 (120-A1/S1A-26/7)	1,400	3,000
1020020007	185	185/30 (185-A1/S1A-26/7)	1,400	2,000
1020020008	380	380/50 (380-A1/S1A-54/7)	1,400	1,000





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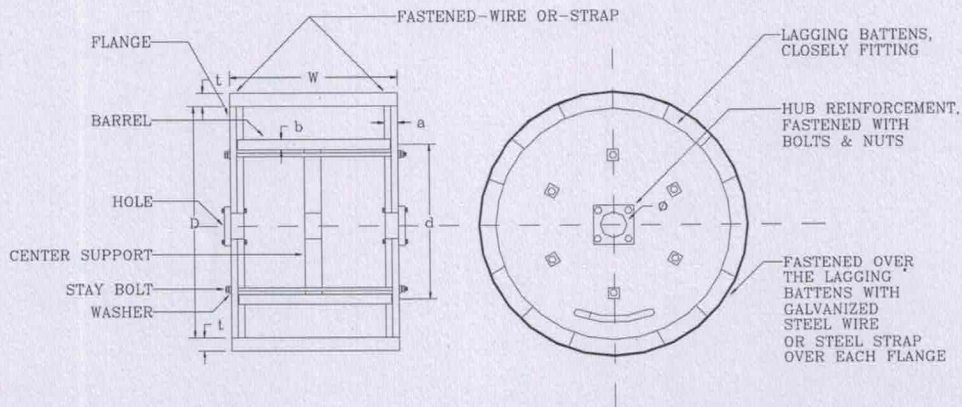
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#### WOODEN REELS



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

#### 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 bidder has to state the reel manufacturer's name; and PEA reserves the right to observe the manufacturing process from time to time.





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### C3 Schedule of detailed requirement

Invitation to Bid No.: N2.EB.(จข.)-22-2564 รายการที่ 3

Item	PEA Material No.	Quantity	Description
1	1020010001		Aluminium stranded conductors, 35 mm <sup>2</sup> (35-A1-7).
2	1020010002		Aluminium stranded conductors, 50 mm <sup>2</sup> (50-A1-7).
3	1020010004		Aluminium stranded conductors, 95 mm <sup>2</sup> (95-A1-19).
4	1020010005		Aluminium stranded conductors, 120 mm <sup>2</sup> (120-A1-19).
5	1020010007		Aluminium stranded conductors, 185 mm <sup>2</sup> (185-A1-37).
6	1020010008		Aluminium stranded conductors, 240 mm <sup>2</sup> (240-A1-61).
7	1020010009		Aluminium stranded conductors, 400 mm <sup>2</sup> (400-A1-61).
8	1020020001		Aluminium conductors steel reinforced, 35/6 mm <sup>2</sup> (35-A1/S1A-6/1).
9	1020020002		Aluminium conductors steel reinforced, 50/8 mm <sup>2</sup> (50-A1/S1A-6/1).
10	1020020004		Aluminium conductors steel reinforced, 95/15 mm <sup>2</sup> (95-A1/S1A-26/7).
11	1020020005		Aluminium conductors steel reinforced, 120/20 mm <sup>2</sup> (120-A1/S1A-26/7).
12	1020020007		Aluminium conductors steel reinforced, 185/30 mm <sup>2</sup> (185-A1/S1A-26/7).
13	1020020008		Aluminium conductors steel reinforced, 380/50 mm <sup>2</sup> (380-A1/S1A-54/7).
14	1020030001		Aluminium-alloy stranded conductors, 35 mm <sup>2</sup> (35-A3-7).
15	1020030002		Aluminium-alloy stranded conductors, 50 mm <sup>2</sup> (50-A3-7).
16	1020030004		Aluminium-alloy stranded conductors, 95 mm <sup>2</sup> (95-A3-19).
(3)17	1020200000	10,000 คก.	Armour tape, aluminium, cross-section 1 ± 0.1 mm x 10 ± 0.3 mm.
18	1020200002		Tie wire, aluminium, diameter 4 ± 0.04 mm.





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**C4 Price schedule**

Invitation to Bid No. N2.EB.(จท.)-22-2564 รายการที่ 3

Manufacturer :  
Country of origin :  
Trade-mark :

Item	PEA Material No.	Catalogue No.	Description	Quantity	Unit Cost (See details & conditions attached)	Total Cost (See details & conditions attached)
11	1020020005		Aluminium conductors steel reinforced, 120/20 mm <sup>2</sup> (120-A1/S1A-26/7).			
12	1020020007		Aluminium conductors steel reinforced, 185/30 mm <sup>2</sup> (185-A1/S1A-26/7).			
13	1020020008		Aluminium conductors steel reinforced, 380/50 mm <sup>2</sup> (380-A1/S1A-54/7).			
14	1020030001		Aluminium-alloy stranded conductors, 35 mm <sup>2</sup> (35-A3-7).			
15	1020030002		Aluminium-alloy stranded conductors, 50 mm <sup>2</sup> (50-A3-7).			
16	1020030004		Aluminium-alloy stranded conductors, 95 mm <sup>2</sup> (95-A3-19).			
(3)17	1020200000		Armour tape, aluminium, cross-section 1 ± 0.1 mm x 10 ± 0.3 mm.	10,000 กก.		(เสนอราคาในระบบ e-GP เท่านั้น)
18	1020200002		Tie wire, aluminium, diameter 4 ± 0.04 mm.			





# PROVINCIAL ELECTRICITY AUTHORITY

## POWER SYSTEM STANDARD DIVISION

Spec. No. RCBL-050/2551 : Covered tie wire for SAC and PIC cable

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### C3 Schedule of detailed requirement

Invitation to Bid No.: N2.EB.(จช.)-22-2564 รายการที่ 4

Item	PEA Material No.	Quantity	Description
(4) 1	1020200003	150,600 เมตร	<p>Covered tie wire, 1-core, solid aluminium conductor, having PE insulation for attachment Space aerial cable (SAC) and Partially insulated cable (PIC); with :</p> <p>Conductor :</p> <ul style="list-style-type: none"> <li>- standard of test method : ASTM B557/B557M</li> <li>- diameter : <math>4 \pm 0.04</math> mm</li> <li>- ultimate tensile strength : 87 - 138 kgf</li> </ul> <p>Insulation :</p> <ul style="list-style-type: none"> <li>- material : Polyethylene (PE)</li> <li>- average thickness : 1.0 mm</li> <li>- thickness, at any point : not less than 0.9 mm</li> </ul> <p>Length : 100 (+20, -0) m per coil</p> <p>Package : plastic cover</p> <p><b>Note :</b></p> <ol style="list-style-type: none"> <li>1) Marking on the surface of the sheath, it shall be marked at the interval of about 50 cm, by printing in white as manufacturer's name and/or trade mark, month/year of manufacture and others according to manufacturer's design.</li> <li>2) The bidders, have to submit test reports shall be submitted with the bid or within fifteen (15) calendar days after of the bid closing date. The item offered without submitting the type test reports shall be rejected.</li> </ol>





**PROVINCIAL ELECTRICITY AUTHORITY**  
**POWER SYSTEM STANDARD DIVISION**

Specification No. RCBL-050/2551 : Covered tie wire for SAC and PIC cable					Page 1 of 1	
C4 Price schedule					Manufacturer :	
Invitation to Bid No. N2.EB.(จข.)-22-2564 รายการที่ 4					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)
(4)1	1020200003		Covered tie wire, 1-core, solid aluminium conductor, having PE insulation for attachment Space aerial cable (SAC) and Partially insulated cable (PIC); with :  Conductor : - standard of test method : ..... - diameter : ..... - ultimate tensile strength : .....  Insulation : - material : ..... - average thickness : ..... - thickness, at any point : .....  Length : .....  Package : .....	150,600 เมตร	(เสนอราคาในระบบ e-GP เท่านั้น)	





การไฟฟ้าส่วนภูมิภาค  
PROVINCIAL ELECTRICITY AUTHORITY

TECHNICAL SPECIFICATION DIVISION

PREFORMED DEAD-END

Specification No. RCBL-058/2563

Approved date

11 SEP 2020

Rev. No.: 3

Form No. 12-3.2

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N2.EB.(จข.)-22-2564 รายการที่ 5

**C Material, equipment, and specifications for PREFORMED DEAD-END**

**C1 General material and packing instructions**

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

**1a Scope**

These specifications cover preformed dead-end designed for direct application over jacket of space aerial cable in 22 kV and 33 kV overhead distribution construction.

**1b Standards**

The preformed dead-end shall be made of heat-treated aluminium-alloy 6061 according to standard below.

ASTM B 211-05: Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

PEA will also accept the preformed dead-end made of heat-treated aluminium-alloy 6061 in accordance with the later edition of the above standards.

**1c Principal requirement**

**1c.1 Preform dead-end**

The preform dead-end shall be designed for direct application over conductors jacketed with polyethylene (PE), polyvinyl-chloride (PVC), cross-linked polyethylene (XLPE), or rubber. The dead-end legs shall be gritted and neoprene coated (black colour), and cross-over marked with colour code to indicate starting point for application.

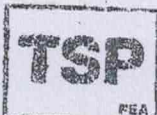
**1c.2 Marking**

Each preform dead-end shall have a weather-resistance plastic identification tape showing at least following information:

- (1) Manufacturer's name or Trademark
- (2) Catalog number or model
- (3) Overall cable diameter range with which preformed dead-end is used
- (4) Holding strength
- (5) Purchase order number (PO)

**1c.3 Samples**

The bidders have to submit one (1) sample for each proposed item of the preform dead-end free of charge, within five (5) working days counted from bid closing date, for consideration; otherwise, the proposal will







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# PROVINCIAL ELECTRICITY AUTHORITY

## TECHNICAL SPECIFICATION DIVISION

### PREFORMED DEAD-END

Specification No. RCBL-058/2563

Approved date: 1 SEP 2020

Rev. No.: 3

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be rejected. PEA reserves the right to test the sample according to PEA's testing procedure. In case of the failing test results, the bidders will be rejected.

The samples will not be returned.

#### 1d Packing

The delivered preformed dead-end shall be packed in carton box or in suitable package. Number of preformed dead-end shall not more than 100 pieces per carton box or package.

Each carton box or package shall be securely wrapped and sealed with a moisture-proof material to protect the contents and shall be marked with the name of manufacturer and gross weight.

#### 1e Test and test reports

##### 1e.1 Type tests

The preformed rods and the proposed preformed dead-end shall pass the type test items specified in Table 1.

Table 1

Type test items of preformed rods and preformed dead-end

No.	Test items	Test method and requirement
Preformed rods		
1	Chemical composition	according to ASTM B 211-05, or later edition *
2	Tensile properties	
Preformed dead-end		
1	Visual and dimension test	According to PEA's specification and C3 Schedule of detailed requirement
2	Tensile test	According to Drawing No. SB2-015/60001

**Note:** \* For the preformed rods, PEA will accept the test report or test certificate from third party laboratory or manufacturer.

The type test of preformed dead-end shall be conducted or inspected by the acknowledged independent testing laboratories/institutes as follows:

- (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) Laboratories, institutes, universities and electric utilities, as follows:

