C Material, equipment, and specifications for PREFORMED DEAD-END FOR LOW VOLTAGE PVC INSULATED ALUMINIUM CABLES

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 low voltage PVC insulated aluminium cables according to TIS 293.

1b Standards

The preformed dead-end shall be made of heat-treated aluminium-alloy 6061 in accordance with standard below.

ASTM B 211/B211M – 19: Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire.

AS/NZS 1865– 1997: Aluminium and aluminium alloys drawn wire, rod, bar and strip

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 jacket of low voltage PVC insulated aluminium cables according to TIS 293. 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 which preformed dead-end is used with
(4) Holding strength
(5) Purchase order number (PO)

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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 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 be 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 proposed preformed dead-end shall pass the type test items sequentially specified in **Table 1**.

Table 1

Type test items of preformed dead-end

No.	Test items	Test method	Requirement
1	Chemical composition test (See noted*)	Optical emission spectrometer	ASTM B 211/B211M-19 or AS/NZS 1865– 1997
2	Dimension tests (See noted**)	PEA's test procedure; see **(1)**, the method how to measure diameter of rod of preform dead-end	PEA's specification, and manufacturer's drawing
3	Tensile test (See noted**)	In accordance with **Drawing No. SB2-015/63004**	

Noted: (*) - For preformed dead-end designed from nominal rod diameter less than 3 mm, PEA will accept the test report or test certificate from third party laboratory or manufacturer.

- PEA will also accept result of the chemical composition test of preformed dead-end with tolerance of -10% of minimum value of each substance specified in reference standard.
- One of the samples is required for chemical composition test.

(**) - For type test, two (2) samples are required for the tests

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(1) Dimension tests for diameter of rod of preform dead-end

Diameter of rod of each preformed dead-end sample will be measured at the point that the rods have no deformation or have a minimal deformation and no neoprene coated on, as show on the **Figure A1** below.

One of the rods' diameter of preformed dead-end shall be randomly measured at (0^0) zero and (90^0) ninety degree with vernier calipers the accuracy of which are not less than 0.01 mm. The average value diameter of measured rod shall be in accordance with the nominal rod diameter declared in the manufacturer's drawing with tolerance ± 0.15 mm, but the average value diameter of measured rod after including tolerance ± 0.15 mm shall not be less than minimum diameter of rods as specified in C3 Schedule of detailed requirement of this specification.

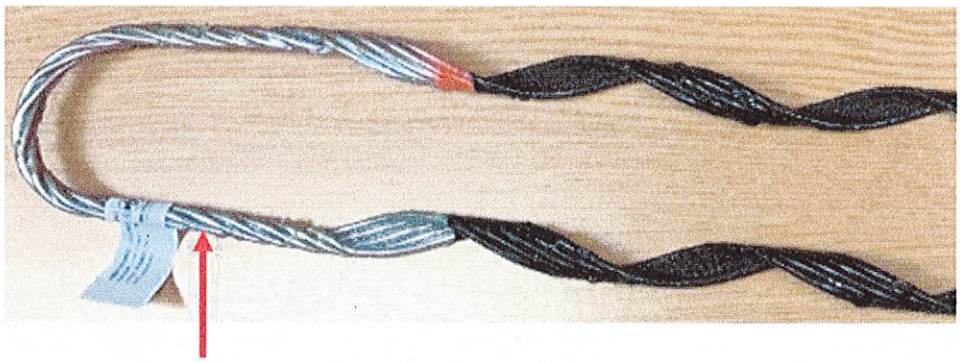

Figure A1 Example of a point for measuring rod diameter

1e.1.1 Type test procedure

Before the type tests are proceeded, the following these shall be sent to PEA for approval.

- Four (4) samples of preformed dead-end
- Outline drawing of preformed dead-end the information of which shall be declared;
  - Dimensions as required by this specification
  - Manufacturer's name or trade-mark
  - Diameter range in mm of cable for which the preformed dead-end is designed
  - Rods per set
  - Nominal rod dimeter to be used to design preformed dead-end
  - Overall length, which shall be declared in nominal value
  - Holding strength
  - Colour code

All samples shall be signed by with marker pen by PEA's representative before proceeding the type tests.

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Then, one sample of the submitted preformed dead-end will be kept by PEA (by Electrical Equipment Standard and Quality Control Division) to be used as a reference sample for bid consideration and acceptance processes.

The other samples will be sent to acknowledged independent testing laboratories/institutes, which have qualification mentioned below for testing preformed dead-end with test items as specified in **Table 1**. PEA will send representatives for witnessing the test.

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 certificate 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:
- 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)

(3) Other laboratories as follow:
- In case the foreign manufacturers have experience of more than twenty (20) years in design, manufacture and sell preformed dead-end, 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 preformed dead-end with other laboratories without the qualification mentioned above, the detail of laboratory and the test facilities 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 or witness the tests.

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The type test reports conducted by the laboratories/institutes 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 type test reports conducted by the laboratories/institutes in other countries shall be valid within ten (10) years counted from the issued date in the test report to the bid closing date.

The cost of all type tests and report shall be borne by the Bidders/Manufacturers.

The type test report of the proposed preformed dead-end shall be submitted with the bid.

PEA will also accept other documents instead of the type test reports in the following cases:

(1) In case the proposed preformed dead-end has been sold to PEA at PEA's Procurement Department (from PEA's head office), The bidder can submit the Purchase Order (PO) on the bid closing date, or

(2) In case the proposed preformed dead-end has been registered for PEA Product Acceptance[(1)], the Bidder can submit the valid registration certificate on the bid closing date, or

(3) In case the proposed preformed dead-end has been registered for Product lists for transmission and substation turnkey project[(2)], the Bidder can submit the valid registration certificate on the bid closing date.

However the document in case (1), (2) and (3) mentioned above shall be proved by the bidding committee that the preformed dead-end specified in the PO or registration certificate is the same product, type/model and all ratings as the proposed preformed dead-end for this bid.

Note: (1) PEA Product Acceptance (PPA) is the process for enhancing quality of electrical apparatus which PEA procure by making quality control system and certification of product's quality by reliable Certification Body (CB). PPA is taken responsibility by Electrical Equipment Standard and Quality Control Division.

(2) Product lists for transmission and substation turnkey project is the process of registration of electrical apparatus used in PEA's power system. Product lists is taken responsibility by Substation Project Management Division.

1e.1.2 Type test report

- **The type test reports shall consist of the necessary as follow; otherwise, it is not accepted by PEA**
  - (1) The test results of all test items as specified in **Table 1**.
  - (2) Outline drawing of preformed dead-end.
  - (3) The color photographs of preformed dead-end as following:
    - Marking
    - Preformed dead-end to be tested
- **The type test reports will be completed only when they are approved and signed by Electrical and mechanical Engineering Division**

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1e.2 Acceptance tests

PEA reserves the right to have acceptance tests conducted by PEA's laboratory or by manufacturer's factory or by acknowledge independent testing laboratories as mentioned in **1e.1.1**

PEA reserves the right to send representatives to witness the tests

The cost of the acceptance tests and report shall be borne by the Contractor.

PEA will randomly choose the samples of preformed dead-end per delivery lot for testing with the number specified in **Table 2**.

Table 2

Number of samples for acceptance test

Number of preformed dead-end per delivery lot (sets)	Number of samples for acceptance test (sets)
not more than 500	3
more than 500	5

Note: - The samples shall not be returned and shall not be used in the system.

- After the tests, the additional preformed dead-end, with the equal number of the samples for acceptance test, shall be supplied by the contractor with free of charge to complete the number of preformed dead-end in the purchase contract.

The samples of preformed dead-end shall pass the acceptance test items sequentially as specified in **Table 3.** If there is sample failing in any test sequences, the tests shall not continue to the next test sequence and all preformed dead-end in that delivery lot will be reject.

Table 3

Acceptance test items of preformed dead-end

No.	Test items	Test method	Requirement
1	Chemical composition test (See **Table 1**)	Optical emission spectrometer	ASTM B 211/B211M-19 or AS/NZS 1865– 1997
2	Visual & Dimension tests	PEA's test procedure; see **Table 1**	PEA's specification, type test report and manufacturer's drawing
3	Tensile test	In accordance with **Drawing No. SB2-015/63004**	

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1f Guarantee

The Contractor shall guarantee the quality for one (1) years commencing from the date PEA receive the above-mentioned preformed dead-end in the condition as specified in note below.

Note:

ภายในกำหนดระยะเวลารับประกันคุณภาพ หากการไฟฟ้าส่วนภูมิภาคนำ Preformed dead-end ไปใช้งานตามปกติแล้วปรากฏว่าชำรุด ขัดข้อง หรือบกพร่อง คู่สัญญาจะต้องนำ Preformed dead-end อันใหม่มาเปลี่ยนทดแทนของที่ชำรุด ภายใน 30 วัน นับถัดจากวันที่ได้รับแจ้งจากการไฟฟ้าส่วนภูมิภาค และหากการชำรุด ขัดข้อง หรือบกพร่องดังกล่าว มีสาเหตุมาจากคุณสมบัติที่ไม่เป็นไปตามสเปคของการไฟฟ้าส่วนภูมิภาค คู่สัญญาจะต้องเปลี่ยนสิ่งของที่ส่งมอบตามสัญญาทั้งหมดให้แก่การไฟฟ้าส่วนภูมิภาค โดยไม่คิดค่าใช้จ่ายใดๆ ทั้งสิ้น

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C2 Material and packing data of the proposed preform dead-end shall be submitted with the bid

Critical documents of the proposed preformed dead-end

Required technical document	Proposed technical document	Reference document (Page/Item)
1. The type report or test certificate of the preform rods and type test report of the proposed preformed dead-end (see **1e.1**), or	☐ YES ☐ No	
Purchase Order (PO) from PEA's Procurement Department (from PEA's head office), or	☐ YES ☐ No	
PEA Product Acceptance registration certificate, or	☐ YES ☐ No	
Product lists registration certificate	☐ YES ☐ No	
2. Catalogues and/or drawings showing dimensions in mm and necessary information as follow: - Dimensions as required by this specification - Manufacturer's name or trade-mark - Diameter range in mm of cable for which the preformed dead-end is designed - Rods per set - Nominal rod dimeter to be used to design preformed dead-end - Overall length, which shall be declared in nominal value - Holding strength - Colour code	☐ YES ☐ No	
3. Packing details	☐ YES ☐ No	

Note:

Critical documents shall be submitted with the bid; otherwise, the proposal shall be rejected.

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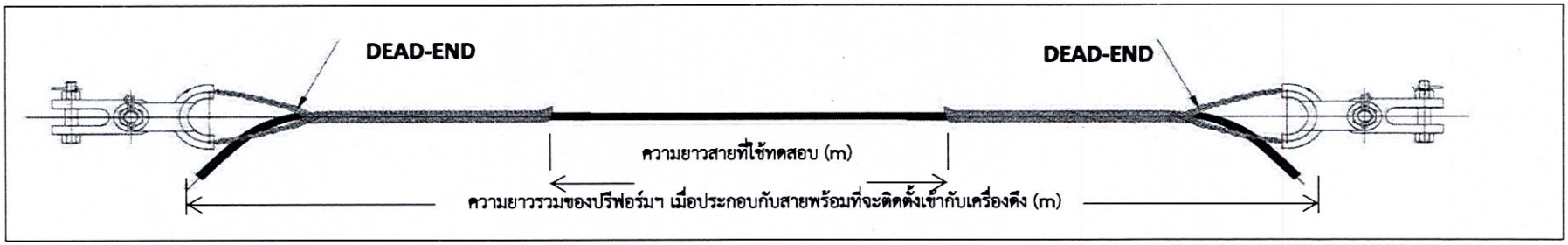

Item	PEA Mat No.	สายที่ใช้ทดสอบ		ความยาวสายที่ใช้ทดสอบ (m) (*1)	ความยาวปรีฟอร์มฯ (m)	ความยาวรวมน้อยที่สุดของปรีฟอร์มฯ เมื่อประกอบกับสายพร้อมที่จะติดตั้งเข้ากับเครื่องดึง (m) (ปรีฟอร์ม+สาย+ปรีฟอร์ม) (*2)	Minimum breaking strength of conductor (kgf)(*3) or Load for testing preformed deand-end (kgf) for PEA Mat No 1020260302(*4)				
		ชนิด	ขนาด (mm^2)				100%	40%	50%	90%	95%
1	1020260300	PVC insulated aluminium cables TIS 293	25	≥ 0.91	≥ 0.5	1.91	420	170	210	380	399
2	1020260301	PVC insulated aluminium cables TIS 293	50	≥ 1.16	≥ 0.7	2.56	745	298	372	670	710
3	1020260302	PVC insulated aluminium cables TIS 293	95	≥ 1.54	≥ 0.9	3.34	1210	485	605	1090	1150

หมายเหตุ

1. ปรีฟอร์มเข้าปลายสายจะต้องผ่านการทดสอบแรงดึง ดังนี้
   - ปรีฟอร์มเข้าปลายสายต้องประกอบเข้ากับสายที่ใช้ทดสอบตามคำแนะนำของผู้ผลิต และนำไปติดตั้งในเครื่องทดสอบแรงดึง โดยความยาวสายที่ใช้ทดสอบระหว่างปรีฟอร์มเข้าปลายสายจะต้องไม่น้อยกว่า 100 เท่าของเส้นผ่านศูนย์กลางรวมของสายที่ใช้ทดสอบ
   - โหลดด้วยแรง 40% ของค่า minimum breaking strength of conductor คงไว้เป็นเวลา 1 นาที นำโหลดออก และถอดปรีฟอร์มเข้าปลายสายออกจากสายที่ใช้ทดสอบตามคำแนะนำของผู้ผลิต
   - นำปรีฟอร์มเข้าปลายสายมาประกอบเข้ากับสายที่ใช้ทดสอบที่ตำแหน่งเดิมอีกครั้ง และทำขั้นตอนการทดสอบซ้ำตามรายละเอียดในวรรคก่อน
   - นำปรีฟอร์มเข้าปลายสายมาประกอบเข้ากับสายที่ใช้ทดสอบที่ตำแหน่งเดิมอีกครั้ง และโหลดด้วยแรงประมาณ 50% ของค่า minimum breaking strength of conductor ทำเครื่องหมายที่สายที่ใช้ทดสอบ ในลักษณะที่หากปรีฟอร์มเข้าปลายสายที่ประกอบเข้ากับสายที่ใช้ทดสอบเกิดการเลื่อน แล้วสามารถตรวจพบได้โดยง่าย
   - จากนั้นเพิ่มโหลดขึ้นอย่างต่อเนื่องไปจนถึง 95% ของค่า minimum breaking strength of conductor แล้วลดลงเหลือ 90% ของค่า minimum breaking strength of conductor และคงไว้เป็นเวลา 1 นาที
   - ในสภาพนั้น ปรีฟอร์มเข้าปลายสายที่ประกอบเข้ากับสายที่ใช้ทดสอบจะต้องไม่เกิดการเลื่อน ในระหว่างช่วงเวลา 1 นาที และปรีฟอร์มเข้าปลายสายจะต้องไม่เกิดความเสียหาย
2. (*1) ความยาวสายที่ใช้ทดสอบไม่น้อยกว่า 100 เท่าของ Overall cable diameter
3. (*2) ความยาวรวมน้อยที่สุดของปรีฟอร์มฯ เมื่อประกอบกับสายพร้อมที่จะติดตั้งเข้ากับเครื่องดึง
4. (*3) ค่า Minimum breaking strength of conductor ที่ 100% เป็นค่าที่ระบุไว้ตามสเปคสายไฟฟ้าของ กฟภ.
5. (*4) กระบวนการทดสอบปรีฟอร์มเข้าปลายสาย PVC insulated aluminium cables TIS 293 รหัส (1020260302) ตามข้อ 1 .ค่าโหลดในการทดสอบ ให้ใช้ค่า Load for testing preformed deand-end แทน minimum breaking strength of conductor

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กองวิศวกรรมไฟฟ้าและเครื่องกล ฝ่ายวิศวกรรม การไฟฟ้าส่วนภูมิภาค		
มิติเป็น - วันที่.....	รายละเอียดการทดสอบเฉพาะแบบ (Type test) และการทดสอบเพื่อการตรวจรับ (Acceptance test) ปรีฟอร์มเข้าปลายสาย PVC insulated aluminium cables TIS 293	แบบเลขที่ SB2-015/63004 แผ่นที่ 1 ของจำนวน 1 แผ่น

PROVINCIAL ELECTRICITY AUTHORITY

การไฟฟ้าส่วนภูมิภาค PROVINCIAL ELECTRICITY AUTHORITY

ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

Specification No. : RCBL-070/2565 PREFORMED DEAD-END FOR LOW VOLTAGE PVC INSULATED ALUMINIUM CABLES

C3 Schedule of detailed requirement

Invitation to Bid No. :

	Item	PEA Material No.	Quantity	Description
	1	1020260300	set(s)	Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 25 mm^2 with; Rods per set : not less than 4 rods Diameter of rods : not less than 2.2 mm Overall length : not less than 500 mm Holding strength : not less than 380 kgf Cross over marked with yellow colour to indicate starting point.
(7)	2	1020260301	set(s) 9,870 EA	Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 50 mm^2 with; Rods per set : not less than 5 rods Diameter of rods : not less than 2.5 mm Overall length : not less than 700 mm Holding strength : not less than 670 kgf Cross over marked with blue colour to indicate starting point.
(8)	3	1020260302	set(s) 9,600 EA	Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 95 mm^2 with; Rods per set : not less than 5 rods Diameter of rods : not less than 3.0 mm Overall length : not less than 900 mm Holding strength : not less than 1,090 kgf Complete with: Cross over marked with orange colour to indicate starting point.

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PROVINCIAL ELECTRICITY AUTHORITY

ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

Specification No.: RCBL-070/2565 : PREFORMED DEAD-END FOR LOW VOLTAGE PVC INSULATED ALUMINIUM CABLES

C4 Price schedule

Invitation to Bid No.:

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)
	1	1020260300		Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 25 mm^2	set(s)		
(7)	2	1020260301		Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 50 mm^2	9,870 EA set(s)	(เสนอราคาในระบบ e-GP เท่านั้น)	
(8)	3	1020260302		Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 95 mm^2	9,600 EA set(s)		

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