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.

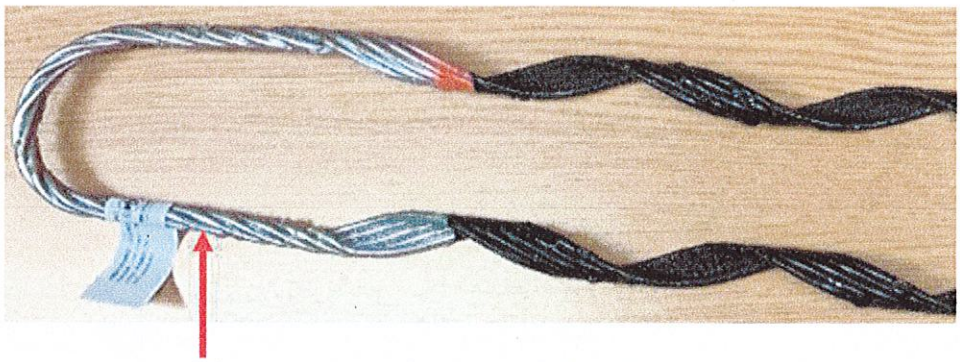

Figure A1 Example of a point for measuring rod diameter

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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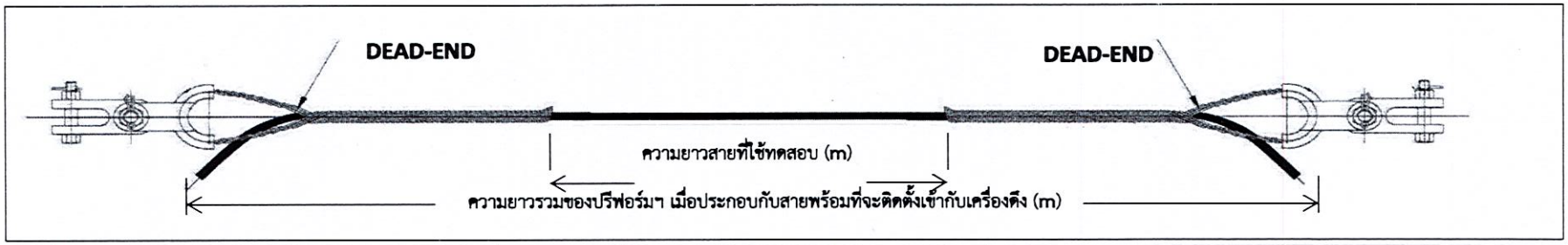

Item	PEA Mat No.	สายที่ใช้ทดสอบ		ความยาวสายที่ใช้ทดสอบ (m) (*1)	ความยาวปรีฟอร์มฯ (m)	ความยาวรวมน้อยที่สุดของปรีฟอร์มฯ เมื่อประกอบกับสายพร้อมที่จะติดตั้งเข้ากับเครื่องดึง (m) (ปรีฟอร์ม+สาย+ปรีฟอร์ม) (*2)	Minimum breaking strength of conductor (kgf)(*3) or Load for testing preformed deand-end (kgf) for 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

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.
2	1020260301	set(s)	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.
3	1020260302	set(s)	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)		
2	1020260301		Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 50 mm^2	set(s)		
3	1020260302		Preformed Dead-End for low voltage PVC insulated aluminium cables, aluminium conductors size 95 mm^2	set(s)		

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Invitation to Bid No.:

C Material, equipment, and specifications for COMPRESSION SPLICING SLEEVE FOR ALUMINIUM CONDUCTOR

C1 General material and packing instructions

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

1a Scope

These specifications cover compression splicing sleeve for aluminium conductor used in overhead transmission and distribution lines.

1b Standards

Unless otherwise specified in these specifications, the compression splicing sleeve shall be manufactured and tested in accordance with the following standards:

ANSI/NEMA CC1: 2009	Electric power connection for substations
BS 3288-1: 2014	Insulator and conductor fitting for overhead power lines – Part 1: Performance and general requirements
ASTM D2265: 2020	Standard test method for dropping point of lubricating grease over wide temperature range

PEA will accept compression splicing sleeve manufactured and tested in accordance with the later edition of the above standards.

PEA will also accept compression splicing sleeve manufactured and tested in accordance with the previous edition of the above standards, if there is no significant change in any test items or no additional test item(s) compared with the above standards. On the other hand, if there is significant change in any test items or any additional test items, the previous edition type test report with the additional test report(s) of the significant change test item(s) and/or additional test item(s) will be also accepted.

1c Principal requirement

1c.1 Service conditions and installation

The compression splicing sleeve shall be designed and constructed for outdoor installation, and suitable for operation under the following conditions:

Altitude	:	up to 1,000 m above sea level
Ambient air temperature	:	up to 50°C
Average relative humidity in any one year	:	up to 94%
Climatic condition	:	tropical climate

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1c.2 Construction and characteristics

The finished product of the proposed compression splicing sleeve shall be of aluminium grade 1050, 1070, 1100 or 1350, which shall be standard grade or designation in accordance with international standards, i.e. SAE, AISI, JIS, ASTM, ANSI or BS. It shall be suitable for using with aluminium stranded conductor in accordance with ANNEX attached, Table A and Table B.

The full tension sleeves and partial tension sleeves shall withstand at least 90% and 10% respectively, of the minimum breaking strength of the conductors which they are designed for using with.

Dimension of compression splicing sleeve shall be according to **Drawing No. SB2-015/64002**.

1c.3 Oxide inhibiting contact grease

The contact surface of the proposed compression splicing sleeve shall be thoroughly filled with oxide inhibiting contact grease the minimum thickness of which shall not be less than 0.5 mm.

Characteristics of the contact grease shall be as follows:

- The contact grease shall be used to improve electrical conductivity and to provide continuous protection against corrosion of electrical joint in outdoor service environment.
- Color of the contact grease shall be dark gray.
- The contact grease shall have a dropping point/melting point of not less than 150^{o}C.
- The contact grease shall consist of at least 15% zinc particles. The zinc particles shall be less than 65 microns in size and shall act as multi-contact current carrying bridges between the surfaces of the electrical connections.

The bidders shall submit detail and/or catalogue of the contact grease with the above characteristics with the bid.

1c.4 Marking

The proposed compression splicing sleeve shall be marked by mean of engraving, knurling, hot stamping or laser marking on the body at least data listed below, which is clearly visible and durable; foil-coated marking, i.e. printing with toner or laser toner with foil-coated, is not accepted.

(1) Manufacturer's name or Trademark
(2) Size of conductor to be used with
(3) Model or catalog/drawing number
(4) Marking reference at the center of sleeve: marking width not less than 6 mm
(5) Purchase order number

Marking's alphabets shall not be less than 3 mm in height.

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1c.5 Samples

The bidders shall submit at least one (1) sample for each proposal item within five (5) working days counted from bid closing date for consideration; otherwise, the proposal will be rejected.

PEA's bids committee will initially check the sample by comparing with the color photograph in the proposed type test report and PEA's specification. PEA's bid committee will reject a proposal if there are any parts of compression splicing sleeve differing from the color photograph in the type test report and PEA's specification.

The sample will be returned after consideration, except sample of the successful bidder will be used as a reference sample in acceptance process. The supplied compression splicing sleeve with a different design compared with the reference sample shall be rejected.

1d Packing

Both ends of each Compression splicing sleeve shall be closed by plastic caps and shall be packed in suitable carton. Number of compression splicing sleeves in each carton shall not more than twenty-five (25) pieces. Each carton box shall be marked with the name of manufacturer, details of compression splicing sleeve such as size of conductor to be used with, gross weight and net weight.

1e Tests and test report

1e.1 Type tests

The proposed compression splicing sleeve shall pass all type test items with reference standards and test method as specified in **Table 1**.

Table 1

Type test items of the compression splicing sleeve

Item	Test Items	Reference standards/Test method
1	Visual and dimension check	PEA's specification, see **(1)**
2	Chemical composition tests	Optical emission spectrometer, see **(2)**
3	Temperature rise tests	ANSI/NEMA CC1, see **(3)**
4	Tensile strength tests	BS 3288-1, see **(4)**
5	Test for oxide inhibiting contact grease	
	5.1 Content in percentage of zinc particles in oxide inhibiting contact grease	Thermogravimetric analysis (TGA), see **(5)**
	5.2 Zinc particles size	Microscope, see **(6)**
	5.3 Dropping point	ASTM D2265, see **(7)**

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(1) Visual and dimension check

At least four (4) samples are required for the type test.

Each sample shall have markings in accordance with clause **1c.4,** except purchase order number is not necessary to be marked at this stage.

Dimensions of each sample shall be measured and recorded in the test report. The dimensions of all samples shall be according to **Drawing No. SB2-015/64002** and drawings of manufacturer.

(2) Chemical composition test

One (1) sample is required for the type test. The compression splicing sleeve shall be tested by means of optical emission spectrometer for verification grade* or designation* of aluminium alloy, which shall be grade or designation as mentioned in clause **1c.2**.

Note:

* PEA will also accept result of the chemical composition test of the compression splicing sleeve with tolerance of -10% of minimum value of each substance specified in reference standard.

(3) Temperature rise tests

At least two (2) samples are required for the type test. The temperature rise tests shall be according to ANSI/NEMA CC1 and during the test, mechanical tension of 10-20% of the rated tensile strength of the conductor shall be applied to the assembly of compression splicing sleeve.

(4) Tensile test

At least two (2) samples are required for the type test. The tensile test shall be according to BS 3288: 2014 or later edition.

(5) Contents in percentage of zinc particles in oxide inhibiting contact grease

At least 50 grams of oxide inhibiting contact grease are required for the type test. The contact grease shall be tested by means of thermogravimetric analysis (TGA) for verification of the content in percentage of zinc particles, which shall be in accordance with clause **1c.3**.

(6) Zinc particles size

At least 50 grams of oxide inhibiting contact grease are required for the type test. The contact grease shall be tested by means of microscope for verification of the size of zinc particle, which shall be in accordance with clause **1c.3**.

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(7) **Dropping point**

At least 50 grams of oxide inhibiting contact grease are required for the type test. The contact grease shall be tested by means of microscope for verification of dropping point of oxide inhibiting contact grease which shall be in accordance with clause **1c.3**.

The test shall be according to ASTM D2265: 2020 or later edition.

Note: For the dropping point test, Innovation Institute PTT's laboratory is accepted by PEA.

1e.1.1 Type test procedure

Before the type tests are proceeded, manufacturer shall submit following samples to PEA for approval

- Seven (7) samples of compression splicing sleeve (All sample will be signed by PEA's representative)
- Drawing showing specified dimensions and all information according to **Drawing No. SB2-015/64002**; the total length of compression splicing sleeve shall be declare in nominal value.
- Standard to be used as a reference of grade or designation of compression splicing sleeve.
- One hundred fifty (150) grams of oxide inhibiting contact grease
  (If manufacture of compression splicing sleeve do not use his own product, the catalog of oxide inhibiting contact grease to be used shall be also submitted.)
- The details of tools and compression dies used for compressing the compression splicing sleeve shall be submitted as following:
  - The catalogue of tools and compression die which specify the model and the name of manufacturer.
  - The dimensions of compression die are required in case of the manufacturer of compression splicing sleeve uses his own compression die in the type test processes.

Two (2) samples will be sent to Electrical Equipment Standard and Quality Control Division; One (1) sample shall be tested by means of Brinell hardness tester. the hardness test value and the other sample shall be kept at Electrical Equipment Standard and Quality Control Division to be used as a reference for bid consideration and acceptance processes.

The other samples and oxide inhibiting contact grease will be sent to acknowledged independent testing laboratories/institutes, mentioned below, for type testing in accordance with the test items in **Table 1**. PEA will send representative for witnessing the test.

The type tests of compression splicing sleeve 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, standard 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:
- NSTDA Characterization and testing service center (NCTC)
- Thailand Institute of Scientific and Technological Research (TISTR)
- 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)
- Laboratory of manufacturers approved by PEA

(3) Other laboratories as follow:
- In case the foreign manufacturers have experience of more than twenty (20) years in design, manufacture and sell compression splicing sleeve, 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 compression splicing sleeve 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.

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.

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The cost of all tests and report shall be borne by the Bidders or manufacturers.

The type test reports 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 compression splicing sleeve 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 compression splicing sleeve 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 compression splicing sleeve 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 compression splicing sleeve specified in the PO or registration certificate is the same product, type/model and all ratings as the proposed compression splicing sleeve 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) Details of tools and compression dies used for the compressing the compression splicing sleeve in the type test processes shall be declared as following:
- Catalogue of tools and compression die which specify the model and the name of manufacturer, or
- Dimensions of compression die are required in case of the manufacturer of compression splicing sleeve uses his own compression die in the type test processes.

(3) Outline drawing of the compression splicing sleeve, showing dimensions according to **Drawing No. SB2-015/64002**.

(4) The color photographs of compression splicing sleeve as following:
- Manufacturer's name or Trademark
- Size of conductor to be used with
- Model or catalog/drawing number compression splicing sleeve
- Oxide inhibiting contact grease

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- **The type test reports will be completed only when they are approved and signed by Electrical and mechanical Engineering Division**
- **For temperature rise test item of full tension splicing sleeve, the bidders can submit the type test report of temperature rise test of partial tension splicing sleeve instead, in case both sleeves have the same dimension, except the length of sleeves.**

1e.2 Acceptance tests

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

The cost of all tests shall be borne by the Contractor.

PEA's acceptance committee will randomly select the samples of compression splicing sleeve for each delivery lot with the number as specified in **Table 2**.

Table 2

Number of samples for acceptance tests

Number of compression splicing sleeves for each delivery lot (sets)	Number of samples (sets)
Up to 49	1
50 to 200	2
201 to 500	3
501 to 1,000	4
1001 and more	5

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

- After the tests, the additional compression splicing sleeves, with the equal number of the samples specified in **Table 2**, shall be supplied by the contractor with free of charge to complete the number of compression splicing sleeve in the purchase contract.

All sample(s) shall pass acceptance test items with reference standards and test method as specified in **Table 3**.

If PEA have any suspicions of quality of the delivered sleeves in some lots or batches, PEA reserves the right to have additional acceptance test items specified in **Table 1**. The cost of all tests shall be borne by the Contractor.

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Table 3

Acceptance test items of compression splicing sleeve

Item	Acceptance test items	Reference standards/Test method
1	Visual and dimension check	PEA's specification, see **Table 1**
2	Chemical composition test	Optical emission spectrometer, see **Table 1**
3	Dropping point of oxide inhibiting contact grease	ASTM D2265, see **Table 1**

1f Guarantee

The Contractor shall guarantee the quality of the compression splicing sleeve for three (3) years commencing from the date that the tapes are received by PEA.

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C2 Material and packing data shall be submitted with the bid:

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

Critical documents of the proposed compression splicing sleeve shall be submitted with the bid for each item offered:

(The bidders shall fill the table below; otherwise, the proposal shall be rejected)

No.	Required technical document	Proposed Technical document	Reference document (Page No.)
1	Type test report (see **1e.1**) or	☐ YES ☐ No	
	Purchase Order (PO) from PEA's Procurement Department (from PEA's head office) (see **1e.1**) or	☐ YES ☐ No	
	Product acceptance certificate (see **1e.1**)	☐ YES ☐ No	
	Product lists certificate (see **1e.1**)	☐ YES ☐ No	
2	Outline drawing(s) of the compression splicing sleeve, showing dimensions of compression splicing sleeve (see **1c.2**) (Outline drawing(s) by using PEA's drawings shall not be accepted)	☐ YES ☐ No	
3	Packing detail (see **1d**)	☐ YES ☐ No	

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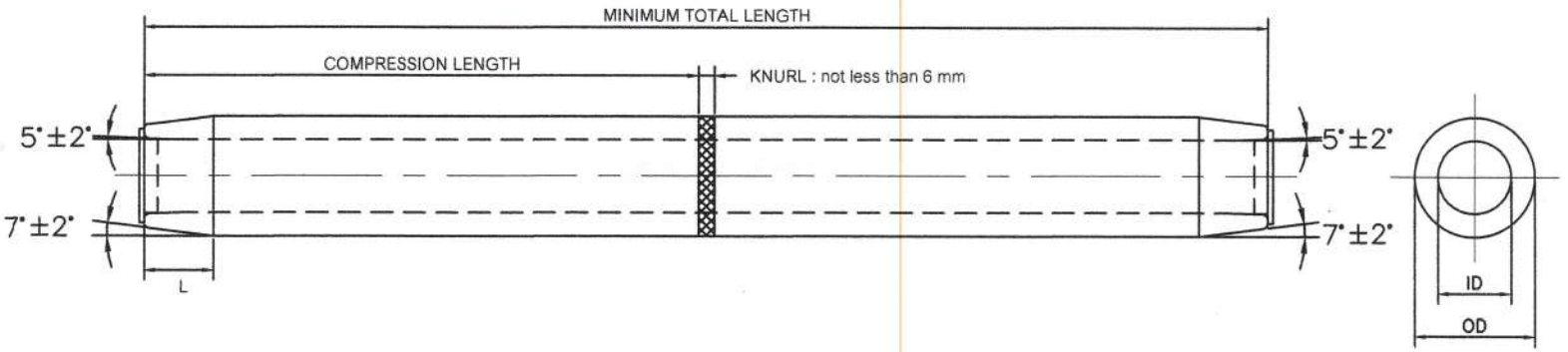

ALUMINIUM STRANDED CONDUCTOR (SQ.MM.)	DIAMETER	DIAMENSIONS OF COMPRESSION SPLICING SLEEVE			
		OD	ID	MINIMUM TOTAL LENGTH (FULL TENSION)	MINIMUM TOTAL LENGTH (PARTIAL TENSION)
50	9.06	16 ±0.5	10.5 ±0.5	150	75
185	17.64	30 ±0.5	19 ±0.5	290	145
400	25.65	45 ±0.5	27 ±0.5	420	210
COMPACT ALUMINIUM STRANDED CONDUCTOR (SQ.MM.)	DIAMETER	DIAMENSIONS OF COMPRESSION SPLICING SLEEVE			
		OD	ID	MINIMUM TOTAL LENGTH (FULL TENSION)	MINIMUM TOTAL LENGTH (PARTIAL TENSION)
50	8.00	16 ±0.5	9.5 ±0.5	150	75
185	15.98	30 ±0.5	17 ±0.5	290	145

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กองวิศวกรรมไฟฟ้าและเครื่องกล ฝ่ายวิศวกรรม	การไฟฟ้าส่วนภูมิภาค	ใช้แทนแบบ.....-..... ถูกแทนโดยแบบ.....-..... เขียนแบบเสร็จวันที่.10 มิ.ย. 2564 แก้แบบวันที่.....-..... มิติเป็น...มิลลิเมตร..... มาตราส่วน.....-..... แบบเลขที่...SB2-015/64002..... แผ่นที่.....1.....ของจำนวน.....1.....แผ่น
ผู้เขียน...ณรงค์เดช โพธิ์มล..... วิศวกร...ณรงค์เดช โพธิ์มล..... หัวหน้าแผนก..... ผู้อำนวยการกอง..... ผู้อำนวยการฝ่าย.....	หลอดต่อสายซนิดแบบบีบ สำหรับสายอะลูมิเนียม	
	COMPRESSION SPLICING SLEEVE FOR ALUMINIUM CONDUCTORS	

PROVINCIAL ELECTRICITY AUTHORITY

ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

Specification No.: RCBL-073/2564 COMPRESSION SPLICING SLEEVE FOR ALUMINIUM CONDUCTOR

C3 Schedule of detailed requirement

Invitation to Bid No. :

Item	PEA Material No.	Quantity	Description
1	1020400012	each(s)	Full tension compression splicing sleeve, for aluminium stranded conductor according to ANNEX Table A size 50 mm^2, length not less than 150 mm, see **Drawing No. SB2-015/64002**.
2	1020400017	each(s)	Full tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 185 mm^2, length not less than 290 mm, see **Drawing No. SB2-015/64002**.
3	1020400019	each(s)	Full tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 400 mm^2, length not less than 420 mm, see **Drawing No. SB2-015/64002**.
4	1020400022	each(s)	Full tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 50 mm^2, length not less than 150 mm, see **Drawing No. SB2-015/64002**.
5	1020400027	each(s)	Full tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 185 mm^2, length not less than 290 mm, see **Drawing No. SB2-015/64002**.
6	1020410014	each(s)	Partial tension compression splicing sleeve, for aluminium stranded conductor according to ANNEX Table A size 50 mm^2, length not less than 75 mm, see **Drawing No. SB2-015/64002**.
7	1020410017	each(s)	Partial tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A 185 mm^2, length not less than 145 mm, see **Drawing No. SB2-015/64002**.
8	1020410019	each(s)	Partial tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 400 mm^2, length not less than 210 mm, see **Drawing No. SB2-015/64002**.
9	1020410022	each(s)	Partial tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 50 mm^2, length not less than 75 mm, see **Drawing No. SB2-015/64002**.
10	1020410027	each(s)	Partial tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 185 mm^2, length not less than 145 mm, see **Drawing No. SB2-015/64002**. **Note:** Enclosed **Drawing No. SB2-015/64002**

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PROVINCIAL ELECTRICITY AUTHORITY

ELECTRICAL AND MECHANICAL ENGINEERING DIVISION

Specification No.: RCBL-073/2564: COMPRESSION SPLICING SLEEVE FOR ALUMINIUM CONDUCTOR

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	1020400012		Full tension compression splicing sleeve, for aluminium stranded conductor according to ANNEX Table A size 50 mm^2, length not less than 150 mm, see **Drawing No. SB2-015/64002**.	each(s)		
2	1020400017		Full tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 185 mm^2, length not less than 290 mm, see **Drawing No. SB2-015/64002**.	each(s)		
3	1020400019		Full tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 400 mm^2, length not less than 420 mm, see **Drawing No. SB2-015/64002**.	each(s)		
4	1020400022		Full tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 50 mm^2, length not less than 150 mm, see **Drawing No. SB2-015/64002**.	each(s)		

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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)
5	1020400027		Full tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 185 mm^2, length not less than 290 mm, see **Drawing No. SB2-015/64002**.	each(s)		
6	1020410014		Partial tension compression splicing sleeve, for aluminium stranded conductor according to ANNEX Table A size 50 mm^2, length not less than 75 mm, see Drawing No. SB2-015/64002.	each(s)		
7	1020410017		Partial tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A 185 mm^2, length not less than 145 mm, see **Drawing No. SB2-015/64002**.	each(s)		
8	1020410019		Partial tension compression splicing sleeve for aluminium stranded conductor according to ANNEX Table A size 400 mm^2, length not less than 210 mm, see **Drawing No. SB2-015/64002**.	each(s)		

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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)
9	1020410022		Partial tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 50 mm^2, length not less than 75 mm, see **Drawing No. SB2-015/64002**.	each(s)		
10	1020410027		Partial tension compression splicing sleeve for compact aluminium stranded conductor according to ANNEX Table B size 185 mm^2, length not less than 145 mm, see **Drawing No. SB2-015/64002**.	each(s)		

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ANNEX

Table A

Characteristics of aluminium Stranded Conductor

No.	Nominal cross-sectional area	Diameter of conductor	Rated tensile strength (RTS)
1	50 mm^2	9.06 ± 1%	8,270 N
2	185 mm^2	17.64 ± 1%	31,370 N
3	400 mm^2	25.65 ± 1%	66,150 N

Table B

Characteristics of compact aluminium Stranded Conductor

No.	Nominal cross-sectional area	Diameter of conductor	Rated tensile strength (RTS)
1	50 mm^2	8.00 ± 1%	7,313 N
2	185 mm^2	15.98 ± 1%	28,974 N

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