

ตารางแสดงวงเงินงบประมาณที่ได้รับจัดสรรและราคากลาง (ราคาอ้างอิง)

ในการจัดซื้อ/จัดจ้างที่มีชิ้นงานก่อสร้าง

๑. ชื่อโครงการ จัดซื้อวัสดุขาดแคลน จำนวน ๒ รายการ งบผู้ใช้ไฟ โดยวิธีเฉพาะเจาะจง.....  
 / หน่วยงานเจ้าของโครงการ การไฟฟ้าส่วนภูมิภาคอำเภอหล่มสัก จังหวัดเพชรบูรณ์.....
๒. วงเงินงบประมาณที่ได้รับจัดสรร ๔๙๗,๙๗๘.๐๐บาท..... (รวมภาษีมูลค่าเพิ่ม ๗%).....
๓. วันที่กำหนดราคากลาง(ราคาอ้างอิง) ๑๒ มกราคม ๒๕๖๔.....

ที่	รหัสวัสดุ	รายการ/รายละเอียด	จำนวน (หน่วย)	ราคากลาง			
				ต่อหน่วย	จำนวนเงิน	ภาษีมูลค่าเพิ่ม ๗%	ราคารวม ภาษีมูลค่าเพิ่ม
๑	๑๐๔-๐๐๑-๐๐๐๒	ดรอพเอาต์ฟิวส์คัทเออร์ ๒๒ เควี ๑๐๐ แอมป์	๑๗๖ ชิ้น	๒,๑๕๐	๓๗๘,๕๐๐	๒๖,๕๘๘	๔๐๕,๐๘๘.๐๐
๒	๑๐๔-๐๐๐-๐๓๐๐	ล่อฟ้า ๒๕๐-๕๐๐ โวลต์๒.๕-๕.๐ กิโลแอมป์	๖๐๐ ชิ้น	๑๔๕	๘๗,๐๐๐	๖,๐๙๐	๙๓,๐๙๐.๐๐
(ราคารวมภาษีมูลค่าเพิ่ม).....(สี่แสนเก้าหมื่นเจ็ดพันเก้าร้อยเจ็ดสิบแปดบาทถ้วน)							๔๙๗,๙๗๘.๐๐

๔. แหล่งที่มาของราคากลาง (ราคาอ้างอิง)

- เป็นราคากลางวัสดุหลัก-รอง ปี ๒๕๖๓ ครั้งที่ ๒ อนุมัติ รพท.(อ) ลว. ๓๐ ก.ค.๒๕๖๓ บันทึกที่ กวพ.(ก) ๓๕๑๓๒/๒๕๖๓ ลว. ๓๐ ก.ค.๒๕๖๓

๕. รายชื่อเจ้าหน้าที่ผู้กำหนดราคากลาง (ราคาอ้างอิง)

- ๕.๑ นายปริญญา โตใหญ่ ผู้จัดการ การไฟฟ้าส่วนภูมิภาคอำเภอหล่มสัก จังหวัดเพชรบูรณ์



(นายปริญญา โตใหญ่)  
ผจก.กฟอ.ลสมส.



**Invitation to Bid No:**

**C Material, equipment, and specifications for LOW VOLTAGE SURGE ARRESTERS**

**C1 General material and packing instructions**

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

**1a Scope**

These specifications cover LV surge arresters of non-linear metal-oxide resistor type without spark gaps, for a.c. power systems and outdoor installation.

**1b Standard**

The LV surge arresters shall be manufactured and tested in accordance with the following standard:

International Electrotechnical Commission (IEC)

IEC 61643-1: 2002 Surge protective devices connected to low-voltage power distribution systems –  
Part 1: Performance requirements and testing methods

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

PEA will also accept the LV surge arresters tested in accordance with the later edition of the above standard.

**1c Principal requirement**

**1c.1 General**

The housing of the LV surge arresters shall be polymeric housing.

Each LV surge arrester shall be hermetically sealed for using in tropical climatic area and highly contaminated atmosphere or heavy pollution level.

**1c.2 Service conditions and installation**

The LV surge arresters shall be suitable for connecting directly to the line and operation under the following conditions:

Altitude	:	up to 1,000 m above sea level
Maximum ambient temperature	:	up to 40°C
Mean annual relative humidity	:	79 %
Mean maximum annual relative humidity	:	94 %
Climatic	:	tropical climate



### 1c.3 Characteristic

The LV surge arresters shall have characteristics equal to or better than those specified in Table 1.

**Table 1**

**Characteristics of LV Surge Arresters according to IEC 61643-1: 2002 or later edition**

Rated voltage ( $U_r$ )	V, r.m.s.	480
Maximum continuous operating voltage ( $U_c$ )	V, r.m.s.	480
Rated frequency	Hz	50
Nominal discharge current ( $I_n$ ), 8/20 $\mu$ s waveshape	kA, peak	5
Maximum discharge current ( $I_{max}$ ), 8/20 $\mu$ s waveshape	kA, peak	10
Test classification	-	Class II
Short circuit withstand capability test ( $I_p$ )	kA, r.m.s.	10
Dielectric withstand test, 1 min	kV, r.m.s.	3.3
Measured limiting voltage	kV, peak	2

### 1c.4 Disconnecting device

Each LV surge arrester shall be fitted with disconnecting device.

### 1c.5 Line terminal and connector

The line terminal of the LV surge arresters shall be the suspension clamp for connecting with aluminium conductor (see **C3 Schedule of detailed requirement**).

### 1c.6 Ground lead and connector

The ground lead of the LV surge arresters shall be the flexible copper insulated wire (see **C3 Schedule of detailed requirement**).

The connector shall be bolted type for connecting the flexible copper insulated ground lead to galvanized steel stranded conductor (see **C3 Schedule of detailed requirement**).

### 1c.7 Marking

PEA's trademark, as the figure below, shall be made an integral part of each LV surge arrester or on the nameplate.





**1c.8 Sample**

Sample shall be supplied on request. In case the samples are requested by PEA, the bidder have to supply samples of LV surge arrester in quantity requested within fifteen (15) calendar days.

The bidders who can not supply the requested samples shall be rejected.

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

The samples shall not be returned.

**1d Tests and test reports**

**Type tests**

The LV surge arresters shall be passed the type tests in accordance with IEC 61643-1: 2002 or later edition. In addition, the LV surge arresters shall be passed the additional tests in accordance with IEC 61643-1: 2002 or later edition at least eight (8) items, as follows:

1. Operating duty test
2. Disconnecter test
3. Temperature withstand test
4. Thermal stability test
5. Short-circuit withstand capability test ( $I_p = 10$  kA, r.m.s.)
6. TOV failure test
7. TOV characteristic test
8. Dielectric withstand test

The LV surge arrester shall be passed all items of type tests conducted by the acknowledged independent testing laboratories.

The following independent testing laboratories accepted by PEA:

- KEMA : KEMA Laboratories (HOLLAND)
- V'Fall : Statens Vattenfallsverk, The Swedish State Power Board (SWEDEN)
- CRIEPI : Central Research Institute of Electric Power Industry (JAPAN)
- EdF : Electrical de France (FRANCE)
- CESI : Centro Elettrotecnico Sperimentale Italiano (ITALY)
- PLI : Powertech High Power Laboratory (CANADA)
- STRI : Swedish Transmission Research Institute (SWEDEN)
- ..... : Testing and Certification (AUSTRALIA)
- ..... : Ontario Hydro Technologies (CANADA)
- EGAT : The Electricity Generating Authority of Thailand (THAILAND)
- ..... : Testing Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University (THILAND)



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- SATS : Scandinavian Association for Testing Electric Power Equipment (NORWAY)
- ASTA : ASTA certification services (UK)

The bidder are at liberty to quote the LV surge arresters which are tested by the other independent testing laboratories not mentioned above, but have to be subjected to approval of PEA before the tests are proceeded.

The bidders have to submit the type test reports with the bids or within fifteen (15) calendar days after the bid closing date.

The Item offered without submitting the type test reports shall be rejected.

**Routine tests**

The LV surge arresters shall be passed the manufacturer's standard routine tests, and also pass the routine tests in accordance with IEC 61643-1: 2002 or later edition at least two (2) items, as follows:

1. Measurement of continuous operating current ( $I_c$ ) at maximum continuous operating voltage ( $U_c$ )
2. Measurement of reference voltage ( $U_{ref}$ ) at reference current ( $I_{ref}$ )

**Acceptance tests**

The LV surge arresters shall be passed the acceptance tests in accordance with IEC 61643-1: 2002 or later edition at least four (4) items, as follows:

1. Verification of the identification and markings
2. Test of indelibility of markings
3. Measurement of continuous operating current ( $I_c$ ) at maximum continuous operating voltage ( $U_c$ )
4. Measurement of reference voltage ( $U_{ref}$ ) at reference current ( $I_{ref}$ )

Each lot of the LV surge arresters supplied, PEA reserves the right to have the acceptance test made by the supplier's factory or the acknowledged independent testing laboratories on the random samples, which are chosen by PEA's acceptance committee, as follows:

1. Five (5) samples, for the supply of no more than 5,000 surge units
2. Ten (10) samples, for the supply of more than 5,000 surge units

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



**1e Packing**

Each set of the LV surge arresters including all accessories shall be packed in a suitable package. Plastic foam shall not be accepted.

One hundred (100) packages of the LV surge arrester including all accessories shall be packed in suitable carton box to avoid damage during transportation, fifteen (15) carton boxes per pallet base crate or pallet base wooden case.

Each pallet base crate / pallet base wooden case shall be strong enough for stacking over with at least another one.

If the pallet base crate(s) or pallet base wooden case(s) is made of rubber wood (Yang-para or Hevea brasiliensis), the wooden parts shall be treated with wood preservative.

The details of wood treatment shall be described.

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

For each item offered, the following details shall be submitted:

**2a Details of LV surge arresters**

Manufacturer's name/country of origin

Catalogue number

Description of materials used for the component parts

Surface finishing of the component parts

Details about working of metal-oxide

Details of sealing and testing

Performance characteristics:

Applied standard	IEC	
Rated voltage ( $U_r$ )	V, r.m.s.	
Maximum continuous operating voltage ( $U_c$ )	V, r.m.s.	
Rated frequency	Hz	
Nominal discharge current ( $I_n$ ), 8/20 $\mu$ s waveshape	kA, peak	
Maximum discharge current ( $I_{max}$ ), 8/20 $\mu$ s waveshape	kA, peak	
Test classification	-	
Measured limiting voltage	kV, peak	
Short circuit withstand capability test ( $I_p$ )	kA, r.m.s.	
Dielectric withstand test, 1 min	kV, r.m.s	
Material of arrester housing	-	
Weight of one set of surge arrester including accessories	kg	



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- 2b Drawings of surge arresters including all accessories with main dimensions in mm
- 2c Drawings of connectors, clamps, and earth leads with dimensions in mm; and specifications of materials used for the component parts
- 2d Drawing of disconnecting devices showing the internal construction, and time-current characteristic curves of disconnecting devices
- 2e Manufacturer's name and technical data of arrester housings
- 2f List of routine tests

2g Packing details

Packing method (shown by drawing(s), and describe packing materials)

Number of set(s) in each package/carton box

Dimensions of each package/carton box in cm

Gross weight of each package/carton box in kg

Net weight of each package/carton box in kg

Number of packages/carton boxes

If several packages/carton boxes are contained in pallet base crate(s) or pallet base wooden case(s), further details are required:

Dimensions of each pallet base crate/pallet base wooden case in cm

Volume of each pallet base crate/pallet base wooden case in m<sup>3</sup>

Gross weight of each pallet base crate/pallet base wooden case in kg

Number of packages/carton boxes in pallet base crate/pallet base wooden case

Number of pallet base crates/pallet base wooden cases

Type of storage facility required (indoor, outdoor)

**Note: Conditions for documentation and consideration**

1. The Contractor has to supply reports of routine test, in **English and/or Thai**, before shipment/delivery, to the following address:

Power System Standard Division

Provincial Electricity Authority

200 Ngam Wong Wan Road, Chatuchak

Bangkok Metropolis 10900

Thailand

2. The bidders have to submit the sufficient references describing the previous experience of the suppliers (e.g. list of supply of equipment and/or materials having the same or similar design as proposed, field experience, the registration of TISI, the copies of license, and/or the inspection to supplier's factory by PEA's inspectors, etc.) to the satisfaction of PEA .



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### Addendum

This addendum is made to be a part of specifications it's attached.

1. Replace the packing detail only for the specific items in the specifications by the packing detail specified in **Table A1** below:

**Table A1: Packing Detail**

Item	Equipment	PEA's material No.	Packing method	Quantity per package/case	Number of packages/cases per pallet
<b>Connectors and cable accessories:</b>					
1	Hot line bail clamp (hot line stirrup clamp), for main aluminium conductor size 25 mm <sup>2</sup> to 50 mm <sup>2</sup>	1-02-033-0000	Sealed package	40	49
2	Hot line protected thread clamp for main aluminium conductor size 25 mm <sup>2</sup> to 50 mm <sup>2</sup>	1-02-033-0100	Sealed package	50	100
3	Hot line protected thread clamp for main aluminium conductor size 50 mm <sup>2</sup> to 120 mm <sup>2</sup>	1-02-033-0101	Sealed package	50	50
4	Compression splicing sleeve, full tension, for aluminium conductor size 50 mm <sup>2</sup>	1-02-040-0002	Suitable package	100	100
5	Compression splicing sleeve, full tension, for aluminium conductor size 95 mm <sup>2</sup>	1-02-040-0004	Suitable package	50	100
6	Compression splicing sleeve, full tension, for aluminium conductor size 185 mm <sup>2</sup>	1-02-040-0007	Suitable package	30	50
7	Compression splicing sleeve, full tension, for aluminium conductor size 400 mm <sup>2</sup>	1-02-040-0009	Suitable package	30	50
8	Compression splicing sleeve, partial tension, for aluminium conductor size 50 mm <sup>2</sup>	1-02-041-0002	Suitable package	100	100
9	Terminal connector (lug), compression type, for aluminium conductor size 185 mm <sup>2</sup>	1-02-041-0106	Suitable package	50	50
10	Pin terminal, for aluminium conductor size 50 mm <sup>2</sup>	1-02-042-0400	Suitable package	50	100
<b>Overhead line hardware:</b>					
11	Angle steel crossarm, size 150x100x12 mm, length 4,500 mm	1-00-012-0002	Bundle	10	-
12	Channel steel crossarm, size 100x50x5 mm, length 4,200 mm	1-01-000-0103	Bundle	20	-
13	Channel steel crossarm, size 100x50x5 mm, length 4,500 mm	1-01-000-0104	Bundle	20	-
14	Channel steel crossarm, size 150x75x6 mm, length 2,800 mm	1-01-000-0300	Bundle	20	-
15	Channel steel crossarm, size 150x75x6.5 mm, length 4,000 mm	1-01-000-0301	Bundle	20	-





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Item	Equipment	PEA's material No.	Packing method	Quantity per package/case	Number of packages/cases per pallet
16	Channel steel beam, size 150x75x6.5 mm, length 4,500 mm	1-01-000-0302	Bundle	20	-
17	Channel steel beam, size 150x75x6.5 mm, length 6,000 mm	1-01-000-0303	Bundle	20	-
18	Channel steel beam, size 150x75x6.5 mm, length 2,500 mm	1-01-000-0304	Bundle	20	-
19	Channel steel crossarm, size 150x75x9 mm, length 3,000 mm	1-00-012-0004	Bundle	20	-
20	Angle steel beam, size 65x65x6 mm, length 1,000 mm	1-01-001-0000	Bundle	100	-
21	Bolt, machine, M 16 x 170 mm	1-01-011-0201	Sack	100	56
22	Bolt, machine, M 16 x 300 mm	1-01-011-0204	Sack	80	56
23	Bolt, machine, M 16 x 350 mm	1-01-011-0205	Sack	80	56
24	Bolt, machine, M 16 x 450 mm	1-01-011-0207	Sack	40	56
25	Bolt, machine, M 16 x 500 mm	1-01-011-0208	Sack	40	50
26	Bolt, machine, M 16 x 600 mm	1-01-011-0209	Sack	40	50
27	Bolt, machine, hexagon head, M 16 x 75 mm	1-01-011-0400	Sack	200	56
28	Bolt, machine, hexagon head, M 16 x 550 mm	1-01-011-0401	Sack	40	50
29	Bolt, machine, hexagon head, M 16 x 600 mm	1-01-011-0402	Sack	40	50
30	Bolt, machine, hexagon head, M 16 x 650 mm	1-01-011-0403	Sack	30	50
31	Bolt, double arming, full thread, M 16 x 450 mm	1-01-012-0001	Sack	40	50
32	Bolt, double arming, full thread, M 16 x 500 mm	1-01-012-0002	Sack	40	50
33	Bolt, double arming, full thread, M 16 x 550 mm	1-01-012-0003	Sack	40	50
34	Bolt, double arming, full thread, M 16 x 600 mm	1-01-012-0004	Sack	40	50
35	Bolt, double arming, full thread, M 16 x 650 mm	1-01-012-0005	Sack	30	50
36	Bolt, double arming eye, M 16 x 450 mm	1-01-013-0001	Sack	40	56
37	Bolt, double arming eye, M 16 x 500 mm	1-01-013-0002	Sack	40	50
38	Bolt, double arming eye, M 16 x 650 mm	1-01-013-0005	Sack	30	50
39	Bolt, round eye, M 16 x 200 mm	1-01-014-0001	Sack	80	56
40	Bolt, round eye, M 16 x 250 mm	1-01-014-0002	Sack	80	56
41	Bolt, round eye, M 16 x 300 mm	1-01-014-0003	Sack	50	56
42	Bolt, oval eye, M 16 x 150 mm	1-01-015-0000	Sack	80	56
43	Bolt, oval eye, M 16 x 200 mm	1-01-015-0001	Sack	80	56
<b>Insulators and accessories:</b>					
44	Insulator, pin-post type, TIS 1251, Type 56/57-2	1-03-001-0101	Export package	2	30
45	Clevis-eye	1-03-014-0000	Suitable package	40	56
46	Ball-clevis, ANSI Type K	1-03-014-0001	Suitable package	30	56



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Item	Equipment	PEA's material No.	Packing method	Quantity per package/case	Number of packages/cases per pallet
47	Ball-hook, ANSI Type B	1-03-014-0002	Suitable package	40	56
48	Ball-clevis, ANSI Type B	1-03-014-0005	Suitable package	40	56
<b>Surge arresters:</b>					
49	LV surge arrester, 480 V, 5 kA	1-04-000-0300	Suitable package	100	5
<b>Meters:</b>					
50	Watt-hour meter, 15(45) A, 3-phase 4-wire	1-06-005-0107	Suitable corrugate-paper package	50	-
51	Watt-hour meter, 30(100) A, 3-phase 4-wire	1-06-005-0108	Suitable corrugate-paper package	50	-

2. Sacks used for packing equipment shall have enough durability and shall be made of hemp rope.
3. Bundle packing shall be using galvanized steel wires with diameter not less than 4 mm.
4. Pallets supplied to PEA shall have dimension not more than 1.1 m x 1.1 m (Width x Length) and the total height after containing the packages/cases shall be less than 1.5 m.



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### C3 Schedule of detailed requirement

Item	PEA Material No.	Quantity	Description
1	1040000300	set(s)	<p>LV surge arrester, suitable for 400 V supply system, with:</p> <p>Applied standard : IEC 61643-1:2002 or later edition</p> <p>Rated voltage (<math>U_r</math>) : 480 V</p> <p>Nominal discharge current (<math>I_n</math>) : 5 kA</p> <p>Maximum discharge current (<math>I_{max}</math>) : 10 kA</p> <p>Complete with line suspension clamp for aluminium conductor diameter of 5.9-12.9 mm (sizes 25-120 mm<sup>2</sup>), disconnecting device, flexible copper insulated ground lead diameter of no less than 3.0 mm (size 6 mm<sup>2</sup> or more) and length of no less than 430 mm, and ground connector (bolted type) for connecting the flexible copper insulated ground lead to galvanized steel stranded conductor diameter of 9.0 mm.</p>



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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)
1	1040000300		<p>LV surge arrester, suitable for 400 V supply system, with:</p> <p>Applied standard : .....</p> <p>Rated voltage (<math>U_r</math>) : .....V</p> <p>Nominal discharge current (<math>I_n</math>) : .....kA</p> <p>Maximum discharge current (<math>I_{max}</math>) : .....kA</p> <p>Complete with line suspension clamp for aluminium conductor diameter of 5.9 - 12.9 mm (sizes 25 - 120 mm<sup>2</sup>), disconnecting device, flexible copper insulated ground lead diameter of ..... mm (size ..... mm<sup>2</sup>) and length of ..... mm, and ground connector (bolted type) for connecting the flexible copper insulated ground lead to galvanized steel stranded conductor diameter of 9.0 mm.</p>	set(s)		
	<b>I</b>					



မြန်မာနိုင်ငံတော်  
ပြည်ထောင်စု  
စီးပွားရေးနှင့်  
ကုန်သွယ်ရေး  
ဝန်ကြီးဌာန  
ပြည်သူ့စီးပွားရေး  
အဖွဲ့အစည်း

# PROVINCIAL ELECTRICITY AUTHORITY

## POWER SYSTEM STANDARD DIVISION

### HIGH-VOLTAGE DISTRIBUTION FUSE CUTOUTS AND FUSE LINKS

Specification No.: RPRO-012/2556

Approved date: 19 ဇူ.ဂ.2556

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The bidder are at liberty to quote the fuse cutouts and fuse links which are tested at the other independent testing laboratories not mentioned above, but have to be subjected to approval of PEA before the tests are proceeded and before the bid closing date.

PEA will also accept type/design test reports accordance with the relevant IEEE standards conducted by the manufacturer or other independent testing laboratories not mentioned above. In this case the bidder shall submit evidence of the manufacturing experience of at least twenty (20) years of fuse cutouts and fuse links.

PEA will also accept the fuse cutouts and fuse links have been supplied to PEA and get the order from PEA's Procurement Department (from PEA's Head office), without test reports by laboratories mentioned above.

The type/design test certificates or test reports of the fuse cutouts and fuse links having same type/design as the proposed fuse cutouts and fuse links shall be submitted with the bid or within fifteen (15) calendar days after the bid closing date. The Item offered without submitting the type test reports shall be rejected.

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

PEA reserves the right to send the representatives at PEA's expense to inspect and witness test of the material and equipment during manufacturing, at the time of shipment or at any time he deems necessary. The supplier shall provide free access to the facilities where the equipment is being manufactured and shall satisfy the representatives that the material and equipment are in accordance with this specification and the purchase contract.

The acceptance inspection by PEA shall be as follows:

**- Dimension and pressure tests for the fuse holders**

Ten (10) samples of the fuse holders shall be selected at random from each lot and tested in accordance with following items:

(1) Dimensional test

The dimensions of all samples shall be measured by PEA's standard gauge as shown in drawing No.SA4-015/56005.

(2) Pressure test

The pressure test of all samples shall be tested by PEA's standard measuring device as shown in drawing No.SA4-015/56005.

In case of the test failed more than one (1) sample for either dimensional test or pressure test, another ten (10) samples of the fuse holders shall be selected and tested for dimension and pressure testing, all samples shall be passed the tests.

**- Mechanical strength (operation) test for the fuse cutouts**

Three (3) samples of the fuse cutouts shall be selected at random from each lot. The samples shall be mounted on the testing machine as shown in drawing No.SA4-015/56006 for mechanical strength (operation) test at 200 operations under load of  $475 \pm 25$  N. After the test all samples shall be no crack or loose on any part components.



မြန်မာပြည်သူ့  
ဓာတ်အားစီးပွားရေး  
အဖွဲ့အစည်း

# PROVINCIAL ELECTRICITY AUTHORITY

## POWER SYSTEM STANDARD DIVISION

### HIGH-VOLTAGE DISTRIBUTION FUSE CUTOUTS AND FUSE LINKS

Specification No.: RPRO-012/2556

Approved date: 19 ဇူ.လ.2556

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

**2a For each item offered, the following details shall be submitted:**

**Fuse cutouts**

Catalogue number

Manufacturer's name and technical data of insulators

Description of materials and surface finishing of the component parts of fuse cutouts, as follows:

- Contacts
- Fuse holders; fuse tubes, and fuse holder fittings
- Spring loaded flippers
- Spring latches
- Upper and lower terminal connectors
- Upper and lower shield mounting parts
- Upper contact shield
- Loadbuster hooks
- Insulator
- Lower contact shield (Hinge support)
- Mounting brackets
- etc.

Rated frequency in Hz

Rated maximum (design) voltage in kV r.m.s.

Rated continuous current in A r.m.s.

Rated interrupting current in kA r.m.s.

Basic impulse insulation level (BIL), with standard wave in kV peak

Minimum power frequency dry withstand test voltage, terminal to ground in kV r.m.s.

Creepage distance of porcelain insulator from live part to ground in mm

Creepage factor of insulator

Range of fuse links which can be used with the same fuse cutout

Contact resistance in  $\Omega$

Weight in kg/set

**Fuse links**

Catalogue number

Description of materials used for the component parts

Surface finishing of the contacts

Rated current in A

Chart of melting time (current in A depending on melting time in second)

Chart of clearing time (current in A depending on clearing time in second)

Weight in kg/100 pieces



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**2b Details and drawings, with main dimensions in mm, of:**

- Fuse cutouts
- Insulators
- Terminal connectors
- Hinge supports
- Fuse holders
- Fuse holder caps
- Mounting brackets
- Fuse links

**2c Packing details**

**Fuse cutout**

Packing method (shown by drawing(s) and describe packing materials)

Number of fuse cutout(s) in each carton box

Dimensions of each carton box in cm

Volume of each carton box in m<sup>3</sup>

Gross weight of each carton box in kg

Net weight of each carton box in kg

Number of carton boxes

If several carton boxes are contained in pallet base crate or pallet base wooden case, further details are required:

Number of carton boxes in each pallet base crate or pallet base wooden case

Dimensions of each pallet base crate or pallet base wooden case in cm

Volume of each pallet base crate or pallet base wooden case in m<sup>3</sup>

Gross weight of each pallet base crate or pallet base wooden case in kg

Number of pallet base crates or pallet base wooden cases

**Fuse link**

Packing method

Dimensions of each package in cm

Volume of each package in m<sup>3</sup>

Gross weight of each package in kg

Net weight of each package in kg

Number of packages



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If several packages are contained in one big case, further details are required:

Number of packages in each case

Dimensions of each case in cm

Volume of each case in m<sup>3</sup>

Gross weight of each case in kg

Number of cases

**Note: Conditions for documentation and consideration**

1. The **Contractor** has to supply documents as follows:

- (1) One (1) set of instruction book for installation, operation and maintenance of the fuse cutouts shall be packed together with each package in **English or Thai**.
- (2) Reports of type/design tests and routine tests of the proposed fuse cutouts and fuse links shall be sent to the Authority, thirty (30) calendar days before the first shipment, at the following address:

**Power System Standard Division**  
Provincial Electricity Authority  
200 Ngam Wong Wan Road, Chatuchak  
Bangkok Metropolis 10900 Thailand

2. Delivery time is one of the important factors to be considered.



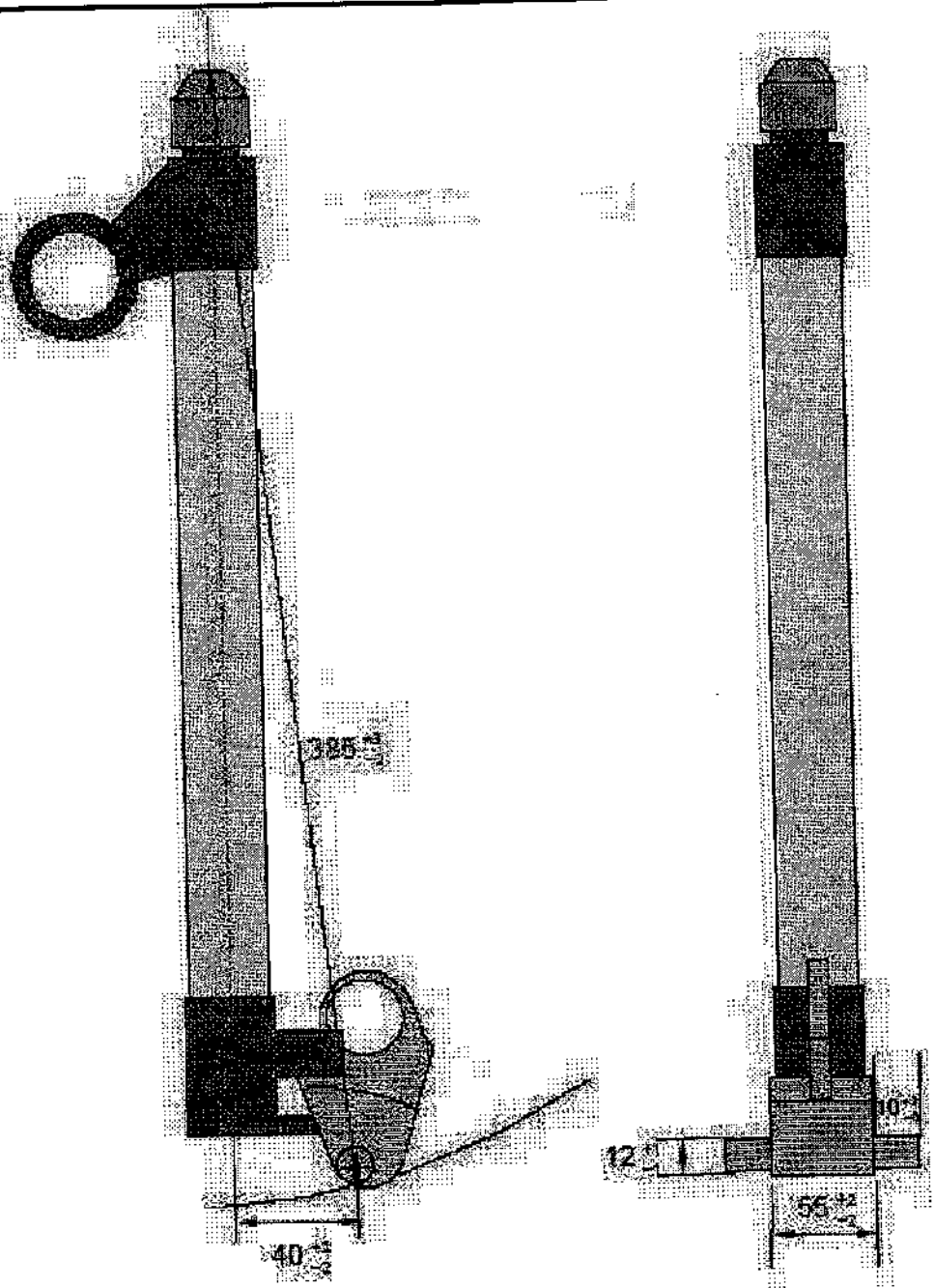


Figure 1.2 Fuse holder for 22 kv

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#### Invitation to Bid No:

#### **C Material, equipment, and specifications for HIGH-VOLTAGE DISTRIBUTION FUSE CUTOUTS AND FUSE LINKS**

#### **C1 General material and packing instructions**

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

#### **1a Scope**

These specifications cover high-voltage distribution fuse cutouts (fuse cutouts) and fuse links; suitable for installation in 22 kV and 33 kV 50 Hz distribution systems with solidly grounded neutral at substations.

#### **1b Standards**

The fuse cutouts and fuse links shall be manufactured and tested in accordance with following standard:

Institute of Electrical and Electronics Engineers (IEEE)

IEEE C37.42-2009 : IEEE Standard specifications for high-voltage (>1000 V) expulsion-type distribution-class fuses, fuse and disconnecting cutouts, fuse disconnecting switches, and fuse links, and accessories used with these devices

And all other relevant standard, unless otherwise specified in these specification

PEA will also accept the fuse cutouts and fuse links tested in accordance with the later version of the above standard.

#### **1c Principal requirement**

#### **1c.1 Service conditions and installation**

The fuse cutouts and fuse links shall be suitable for operation under the following conditions:

Altitude	: up to 1,000 m above sea level
Ambient air temperature	: up to 40°C
Relative humidity	: up to 94 %
Climatic condition	: tropical climate



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#### 1c.2 Fuse cutouts

The fuse cutout shall be single-pole, single throw, drop-open, outdoor single venting type, and shall have fuse holder. The construction of the fuse cutout is shown in **figure 1** in drawing No.SA4-015/56004 attached.

Each fuse cutout shall be comprised and equipped with:

- 1) Contacts, stationary and moving, of silver to silver
- 2) Fuse holder, suitable for removable buttonhead type fuse link. Thread dimension of solid cap of the fuse holder shall be M 22 x 2 mm . Fuse holder fittings shall be made of high conductivity copper-alloy casting. Fuse tube shall be made of fiberglass reinforced. Inner diameters of pulling eye and lifting eye shall be not less than 26 mm. Dimensions of the 22 kV and 33 kV fuse holders shall be according to **figure 2** and **figure 3** shown in drawing No.SA4-015/56004 respectively.
- 3) Spring loaded flipper. The spring loaded shall be designed for receiving pressure at the fuse holder of not less than 6 kg.
- 4) Spring latch to prevent opening under vibration
- 5) Upper and lower terminal connectors (pads) and cable lugs, 2-hole NEMA pad. The bolts, nuts, lockwashers and spring lockwashers (if any), furnished on the terminal pads and cable lugs, shall be made of stainless steel or better.
- 6) Upper and lower shield mounting parts, made of galvanized steel grade HR1, or better
- 7) Upper contact shield, made of galvanized steel grade HR1, or stainless steel grade 304, or brass with Cu  $\geq$ 80% (i.e. UNS C93600, JIS CAC 406 (BC 6))
- 8) Loadbuster hooks
- 9) Insulator, porcelain, alternate shed, single piece and bird-proofed, preferably brown glazed. Complete with insulator mounting support made of galvanized steel grade HR1, or better
- 10) Lower contact shield (Hinge support), made of stainless steel grade 304 or brass with Cu  $\geq$ 80% (i.e. UNS C93600, JIS CAC 406 (BC 6))
- 11) Mounting bracket, type B according to IEEE C37.42, suitable for cross-arm section range of 100 mm x 100 mm to 120 mm x 120 mm, with carriage bolts of not less than 150 mm long, see **figure 4** and **figure 5** shown in drawing No.SA4-015/56004
- 12) Others according to manufacturer's design.

When mounting the fuse cutout on the mounting bracket, the center line through the top and bottom of the insulator shall be at an angle of 15° to 30° from the vertical.



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The fuse cutouts shall have characteristics as follows:

Characteristics	Nominal system voltage	22	33
	kV		
	Unit	Requirement	
Rated frequency	Hz	50	50
Rated maximum (design) voltage	kV r.m.s.	27	38
Rated continuous current	A r.m.s.	Stated in "C3 Schedule of detailed requirement"	
Rated interrupting current	kA r.m.s.		
Basic impulse insulation level (BIL), with standard wave	kV peak	not less than 125	not less than 150
Minimum power frequency dry withstand test voltage, terminal to ground	kV r.m.s.	42	70
Minimum creepage distance of porcelain insulator from live part to ground	mm	320	650
Minimum creepage factor of insulator (Creepage distance/Arcing distance)	-	2.0	2.3

#### 1c.3 Fuse links

The fuse links shall be removable button head type. Thread dimension of button head and arc shortening rod shall be 1/4"-28UNF. The fuse element shall be soldered each both end. Dimension of the fuse link shall be according to **figure 6** shown in drawing No.SA4-015/56004.

The electrical properties of the fuse link must be guaranteed and shall be designed to prevent the fuse holder damage from arc interruption when the fuse blows.

#### 1c.4 Samples

Samples shall be supplied on request. In case of samples are requested by PEA, The bidder have to supply samples of each item of the fuse cutouts or the fuse links within fifteen (15) calendar days. The bidders who cannot supply the requested samples shall be rejected.

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

The samples shall not be returned.



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#### 1c.5 Markings

The markings shall be marked legibly and durably as follows:

- 1) PEA's trademark (as figure below), manufacturer's name and/or trademark, month and year of manufacture, and contract number shall be marked on the fuse cutout body (insulator or metal part).



- 2) Manufacturer's name and/or trademark, month and year of manufacture, contract number, and ratings (rated maximum voltage, rated continuous current and rated interrupting current) shall be marked on the fuse holder (metal part only).
- 3) The marking on the fuse cutout body and fuse holder using plastic sticker shall not be accepted.
- 4) Amperage shall be marked on each buttonhead of the fuse links.
- 5) Other according to manufacturer's design

#### 1d Packing

The fuse cutouts shall be separately seaworthy packed in suitable carton boxes.

Each fuse link shall be separately packed in suitable packages.

The carton boxes/packages shall be packed in pallet base crate or pallet base wooden case to avoid damage during transportation, see Table 1 for packing detail.

If the pallet base crate or pallet base wooden case is made of rubber wood (Yang-para), the wooden parts shall be treated with wood preservative. The details of wood treatment shall be described.

**Table 1**  
**Packing details of fuse cutouts**

System voltage (kV)	Quantity per carton box (set)	Quantity per pallet base crate / pallet base wooden case (carton boxes)
22	1	50
33	1	40



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**1e Test inspection and test reports**

The fuse cutouts and fuse links shall be passed the manufacturer's standard routine tests, and also passed the routine tests in accordance with the relevant IEEE standard.

The routine test items shall be submitted with the bid.

The fuse cutouts and fuse links shall be passed all items of the type/design tests in accordance with the relevant IEEE standard and shall be passed additional type/design test items as follows:

Test items/Description	Nominal system voltage		
	kV	22	33
- Minimum basic impulse insulation level (BIL) (Procedure B according to IEEE 4 "Fifteen impulse of the specified shape and polarity at the withstand voltage level are applied to the test object. The requirements of the test are satisfied if not more than two disruptive discharges occur in the self-restoring part of the insulation.")	kV peak	125	150
- Minimum critical impulse flashover voltage (CFO)	kV peak	140	165
- Minimum power-frequency wet test voltage, terminal to ground, at 60 s	kV r.m.s.	36	60

All items of the type/design tests and additional type/design tests shall be conducted by the acknowledged independent testing laboratory.

The following independent testing laboratories accepted by PEA:

- KEMA : KEMA Laboratories (THE NETHERLANDS)
- V' Fall : Statens Vattenfallsverk, The Swedish State Power Board (SWEDEN)
- CRIEPI : Central Research Institute of Electric Power Industry (JAPAN)
- EdF : Electricite de France (FRANCE)
- CESI : Centro Elettrotecnico Sperimentale Italiano (ITALY)
- PLI : Powertech High Power Laboratory (CANADA)
- STRI : Swedish Transmission Research Institute (SWEDEN)
- TCA : Testing and Certification (AUSTRALIA)
- OHT : Ontario Hydro Technologies (CANADA)
- EGAT : The Electricity Generating Authority of Thailand (THAILAND)
- ..... : Testing Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University (THAILAND)
- SATS : Scandinavian Association for Testing Electric Power Equipment (NORWAY)
- ASTA : ASTA Certification Services (UK)

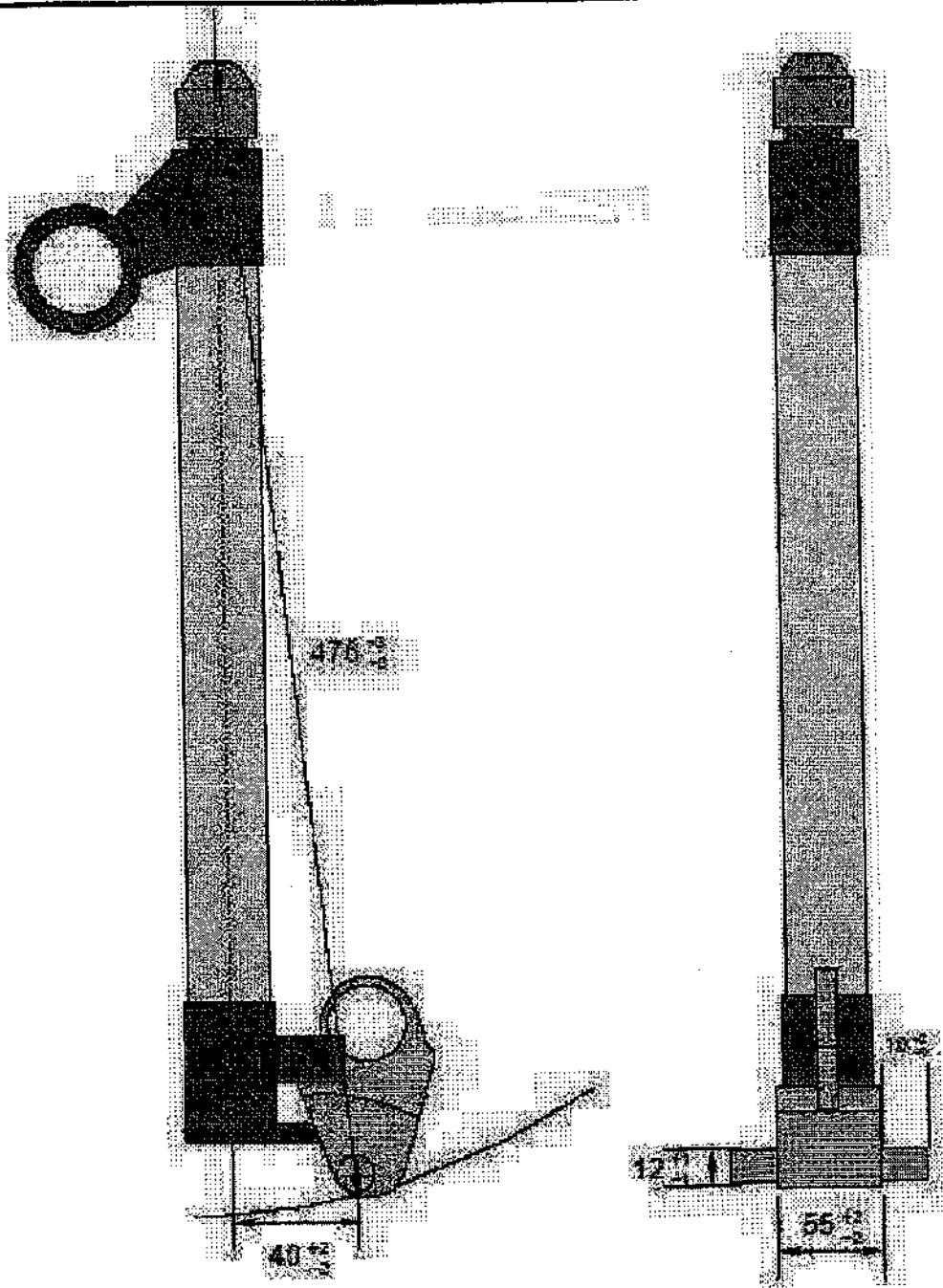


Figure 1.3 Fuse holder for 33 kV

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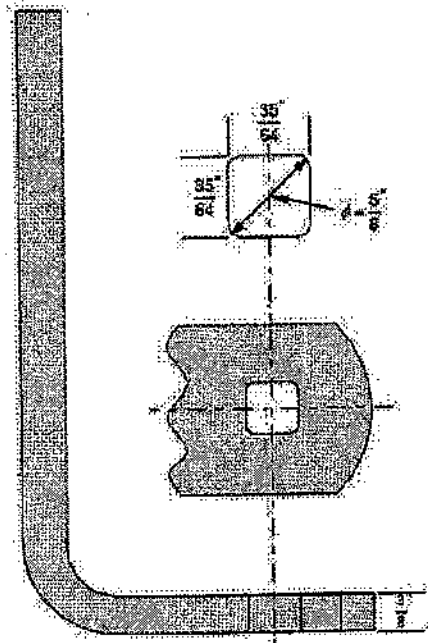


Figure 1.4 Type B mounting bracket according to IEEE C37.42

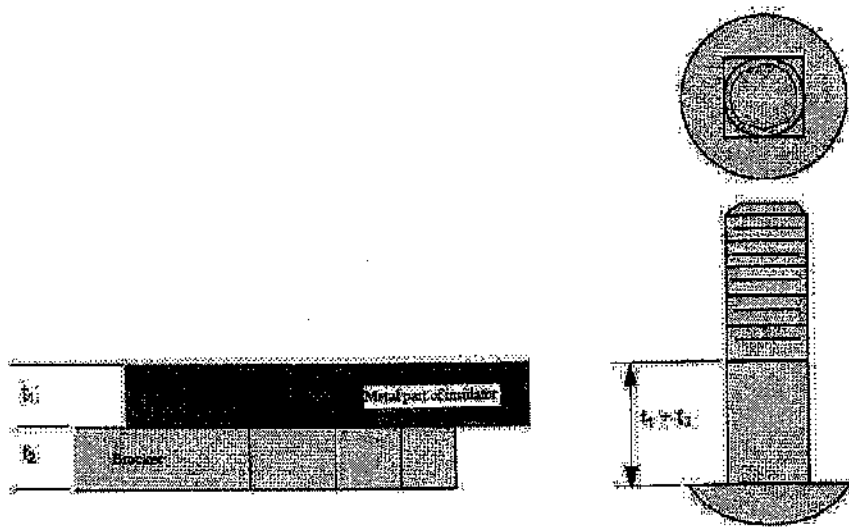


Figure 1.5 Bolt for connect bracket to metal part of insulator

Note :

- All dimension in inch.
- Tolerance of all dimensions shall be according to IEEE C37.42.

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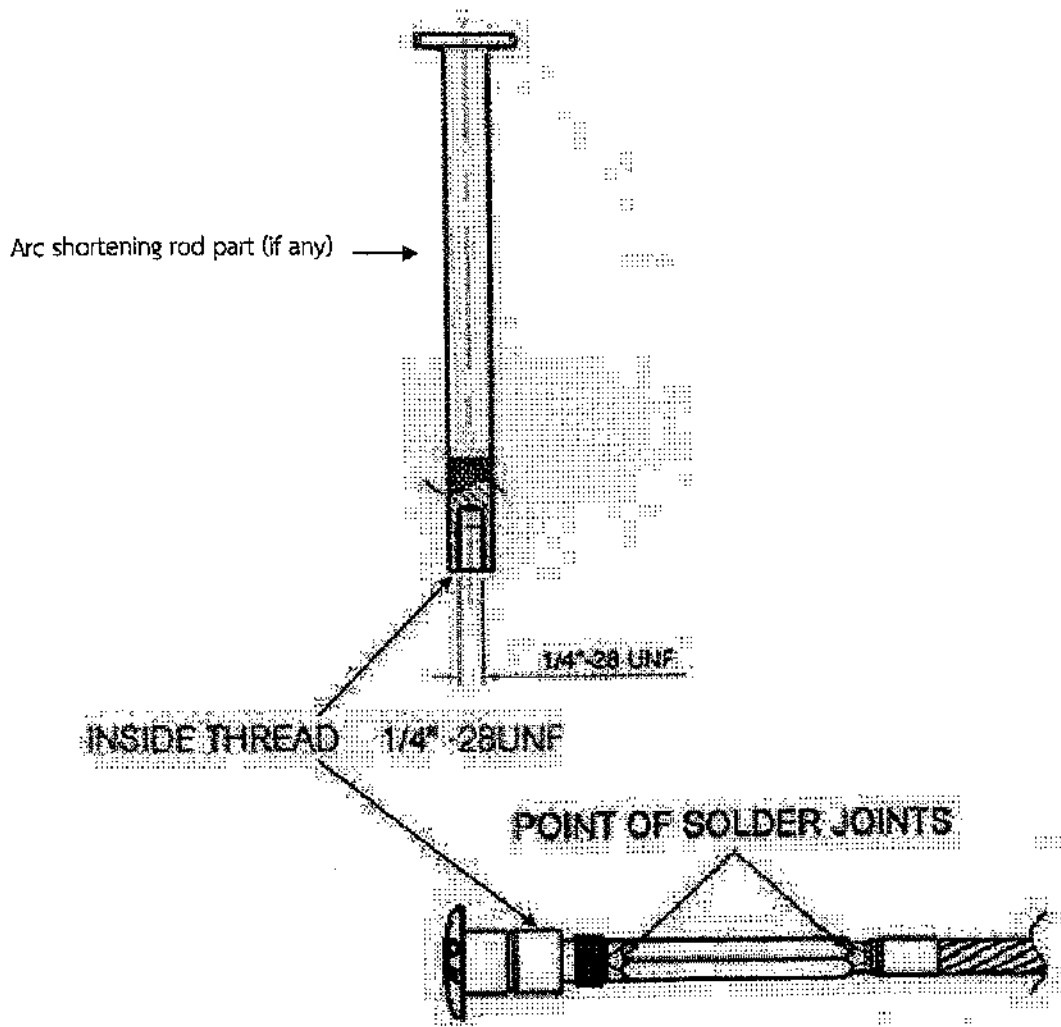


Figure 1.6 Thread dimension of button head and arc shortening rod

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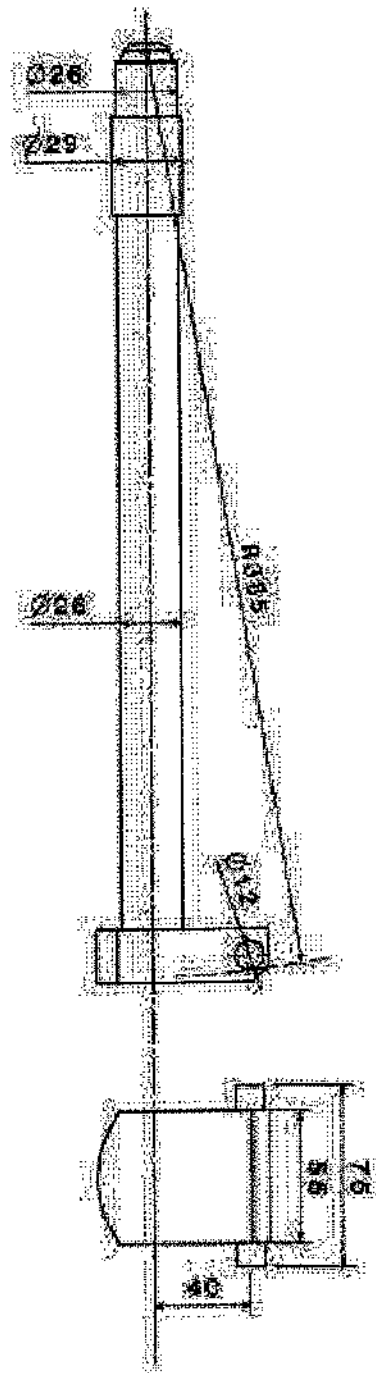
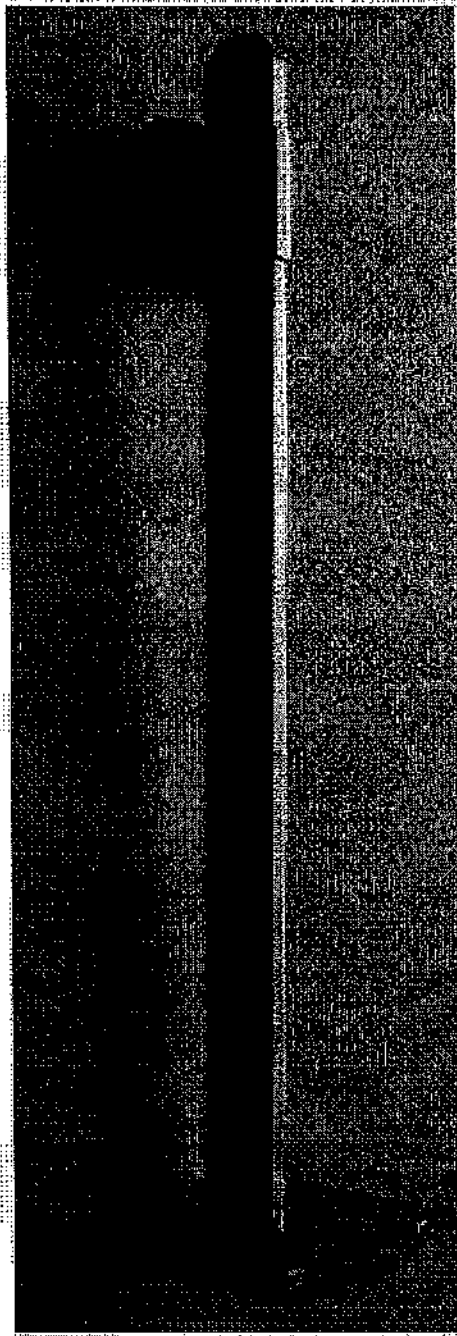


Figure 1.2 Fuse holder for 22 kV

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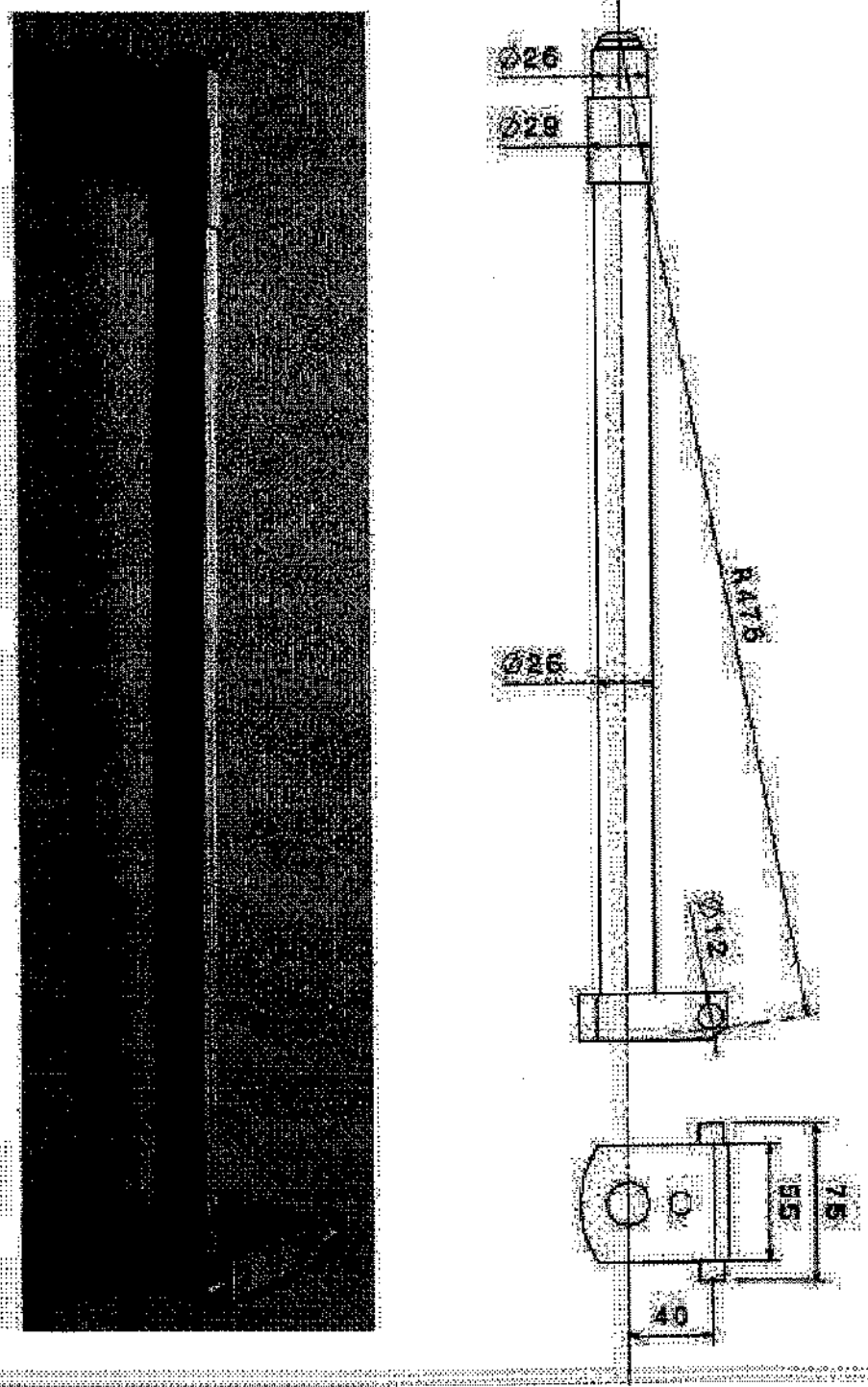
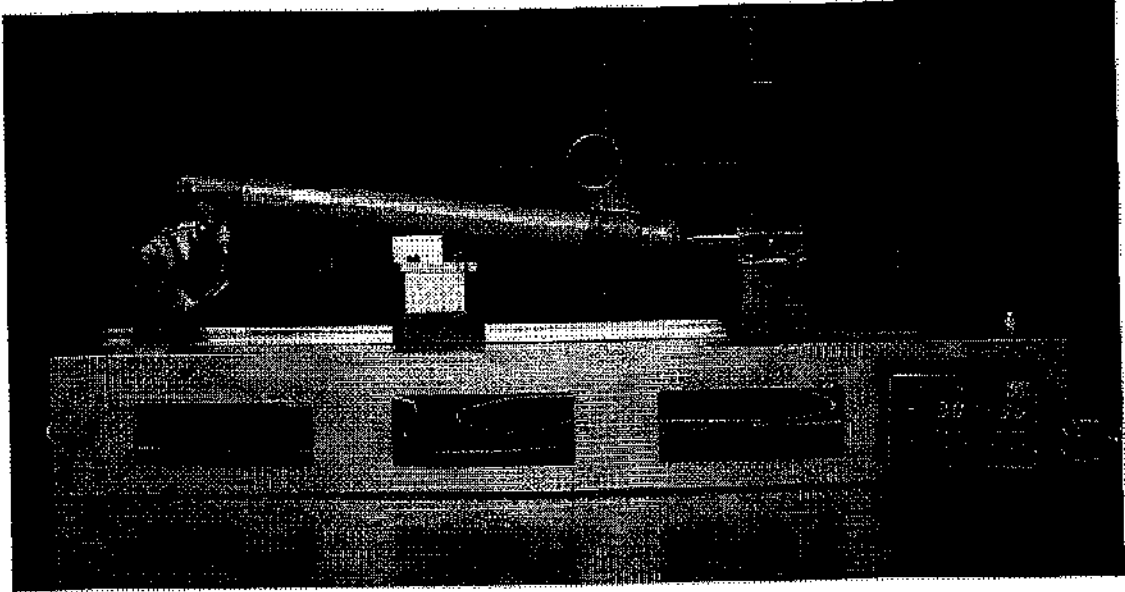
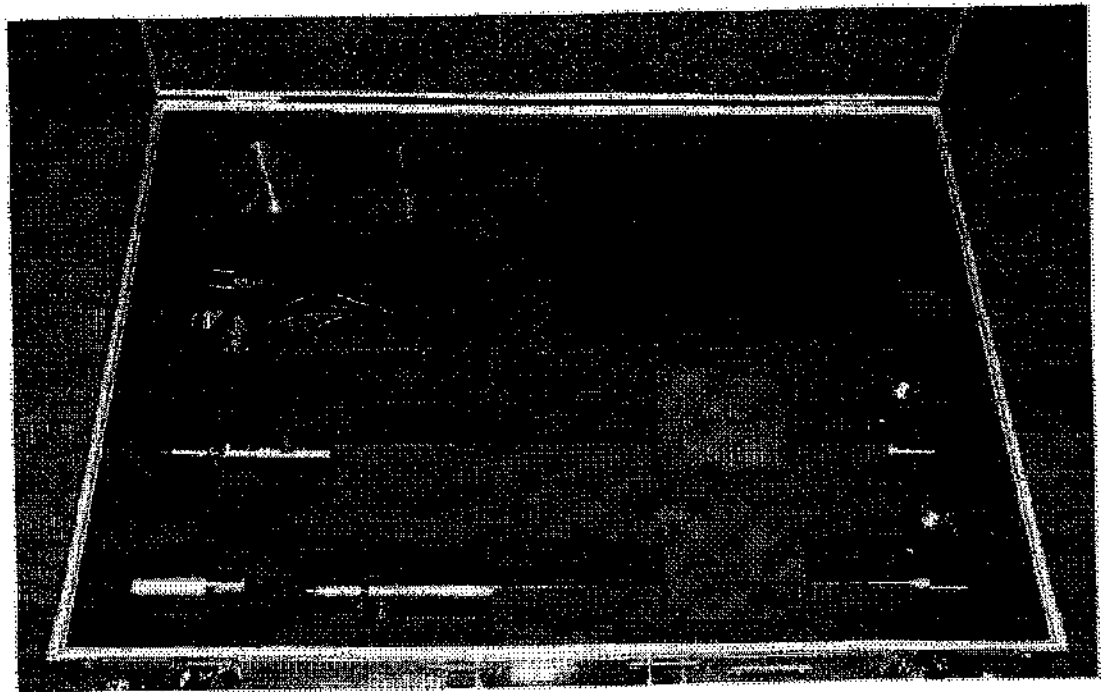


Figure 1.3 Fuse holder for 33 kV

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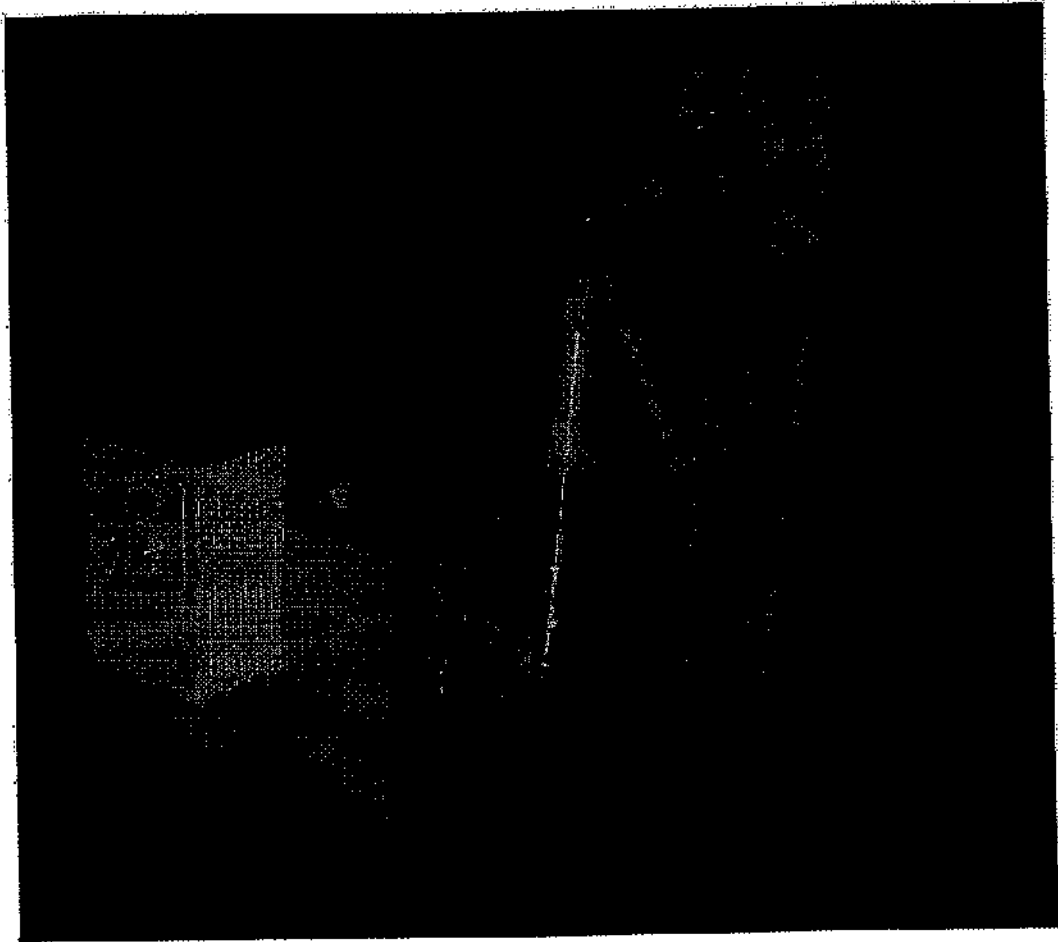


Fuse holder length measuring device



Fuse holder pressure measuring device

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Fuse cutout closing machine

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ผู้เขียน...จุมพล แก้วยิ้ม..... ผู้สำรวจ..... วิศวกร...จุมพล แก้วยิ้ม..... หัวหน้าแผนก.....	<b>Mechanical strength (operation) test for          the fuse cutouts</b>	เขียนเสร็จวันที่..... แก้มบวันที่..... มิติเป็น..... มาตรฐาน.....
ผู้อำนวยการกอง..... ผู้อำนวยการฝ่าย.....	<b>Appendix III</b>	แบบเลขที่ SA4-015/56006 แผ่นที่.....1.....ของจำนวน.....1.....แผ่น



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# PROVINCIAL ELECTRICITY AUTHORITY

## POWER SYSTEM STANDARD DIVISION

Specification No. RPRO-012/2556 : HIGH-VOLTAGE DISTRIBUTION FUSE CUTOUTS  
AND FUSE LINKS

Page 1 of 3

### C3 Schedule of detailed requirement

Item	PEA Material No.	Quantity	Description
1	1040010002	1 lot	1.1 _____ sets. Fuse cutout, with fuse holder having a solid cap, for 22 kV distribution system, with : Rated continuous current : 100 A Rated interrupting current at : not less than 8 kA, r.m.s. symmetrical, or X/R ratio of 12 : not less than 12 kA, r.m.s. asymmetrical Complete with mounting bracket, and accessories.
	1040010006		1.2 _____ pcs. Spare fuse holder, for the fuse cutout in 1.1 .
2	1040010100	1 lot	2.1 _____ sets. Fuse cutout, with fuse holder having a solid cap, for 33 kV distribution system, with : Rated continuous current : 100 A Rated interrupting current at : not less than 5 kA, r.m.s. symmetrical, or X/R ratio of 15 : not less than 8 kA, r.m.s. asymmetrical Complete with mounting bracket, and accessories.
	1040010102		2.2 _____ pcs. Spare fuse holder, for the fuse cutout in 2.1 .



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**Specification No. RPRO-012/2556 : HIGH-VOLTAGE DISTRIBUTION FUSE CUTOUTS AND FUSE LINKS**

C4 Price schedule		Manufacturer :			Total Cost (See details & conditions attached)
Invitation to Bid No.		Country of origin :			
		Trade-mark :			Unit Cost (See details & conditions attached)
Item	PEA Material No.	Catalogue No.	Description	Quantity	
1	1040010002		1.1 Fuse cutout, fuse holder having a solid cap, for 22 kV distribution system with : Rated continuous current : ..... A Rated interrupting current : ..... kA, r.m.s. symmetrical, or at X/R Ratio 12 ..... kA, r.m.s. asymmetrical Complete with mounting bracket and accessories.		
	1040010006		1.2 Spare fuse holder, for the fuse cutout in 1.1	Total of Item 1	