



HIGH VOLTAGE SURGE ARRESTERS FOR VERY HEAVY POLLUTION AREA

Specification No.: RPRO-003/2558

Approved date: 16/06/2558

Rev. No.: 0

Form No. 05-1.3

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Invitation to Bid No.:

C Material, equipment, and specifications for HIGH VOLTAGE (HV) SURGE ARRESTERS FOR VERY HEAVY POLLUTION AREA

C1 General material and packing instructions

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

1a Scope

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

1b Standards

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

Thai Industrial Standards (TIS):

TIS 2366-2551 [IEC 60099-4 Metal-oxide surge arresters without gaps for a.c. systems
Edition 2.1 (2006-07)]

International Electrotechnical Commission (IEC)

IEC 60099-4 Surge arresters Part 4 :Metal-oxide surge arresters without gaps for a.c. systems

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

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

1c Principal requirement

1c.1 General

The housing of the HV surge arresters shall be polymeric material.

Each HV surge arrester shall be hermetically sealed and suitable for outdoor installation and using in tropical climatic area and highly contaminated atmosphere or very heavy pollution level.

1c.2 Service conditions and installation

The HV 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	: 40°C
Mean minimum annual relative humidity	: 79%
Mean maximum annual relative humidity	: 94%
Climatic	: tropical climate



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1c.3 Ratings and characteristics

The HV surge arresters shall have ratings and characteristics equal to or better than those specified in **Tables 1 Ratings and characteristics of HV surge arresters.**

1c.4 Disconnecting device

Each 5 kA HV surge arrester and 10 kA HV surge arrester with line discharge class 2 shall be fitted with disconnecting device.

The disconnecting device is not required for 10 kA HV surge arrester with line discharge class 3.

1c.5 Line terminal and connector

Line terminal of the HV surge arrester shall be the threaded stud type.

Connector (Terminal lug) suitable for connecting aluminium conductor to the line terminal shall be provided. The connector shall be compression type and shall be made of aluminium. Each connector shall be furnished with one (1) nut, two (2) flat washers and one (1) spring lock washer. The nuts, washers and spring lock washers shall be made of stainless steel, or better. Sizes of the aluminium conductors are specified in **C3 Schedule of detailed requirement.**

1c.6 Ground terminal and connectors

Ground terminal of the HV surge arresters shall be the threaded stud type.

Connector (Terminal lug) suitable for connecting flexible copper insulated ground lead to the ground terminal shall be provided. The connector shall be compression type and shall be completed with one (1) nut, one (1) flat washer and one (1) spring lock washer. The nuts, washers and spring lock washers shall be made of stainless steel, or better.

Connector, M 8 U-bolt clamp type, suitable for connecting the flexible copper insulated ground lead to galvanized steel stranded conductor shall be provided.

Sizes of the flexible copper insulated ground leads and galvanized steel stranded conductors are specified in **C3 Schedule of detailed requirement.**

1c.7 Marking

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





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1c.8 Insulated mounting base

Each 5 kA HV surge arrester and 10 kA HV surge arrester with line discharge class 2 shall be assembled with an additional insulating mounting base for connecting to a wide variety of mounting brackets.

1c.9 Mounting bracket

Mounting brackets for the 5 kA HV surge arrester and 10 kA HV surge arrester with line discharge class 2, if required (see C3 Schedule of detailed requirement), shall be similar to EEI-NEMA mounting bracket and shall be suitable for mounting on cross-arm, section of 100 mm x 100 mm to 120 mm x 120 mm, with carriage bolts of not less than 150 mm long.

10 kA HV surge arrester with line discharge class 3 shall be self-supporting and mounted on solid hot-dip galvanized steel supporting structures suitable for mounting on cross-arm as specified above.

1c.10 Bird guard cap

Each line terminal of the HV surge arresters shall have a bird guard cap made of ultra-violet resistant and tracking resistant material, e.g. polypropylene, neoprene, etc; which is suitable for exposure to sunlight.

1c.11 Samples

Samples shall be supplied on request. In case the samples are requested by PEA, the bidder have to supply samples of each type of HV surge arresters in quantity requested 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.

1d Tests and test reports

The HV surge arresters shall be passed type tests (design tests) in accordance with TIS 2366-2551 [IEC 60099-4 Edition 2.1 (2006-07)] by the following test items¹⁾:

- 1) Insulation withstand tests on the arrester housing
- 2) Residual voltage tests
- 3) Long-duration current impulse withstand tests
- 4) Operating duty tests
- 5) Short-circuit tests²⁾
- 6) Tests of arrester disconnectors (when fitted)
- 7) Internal partial discharge tests
- 8) Bending moment tests



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9) Environment tests

10) Weather ageing tests³⁾

Note:

- ¹⁾ PEA will also accept the HV surge arresters passed the type tests in accordance with the later edition of the above standard which may have a different test items or test procedure comparing with TIS 2366-2551 [IEC 60099-4 Edition 2.1 (2006-07)].or IEC 60099-4 (2006-7).
- ²⁾ The test current shall not be less than 10 kA r.m.s. for 5 kA surge arresters and shall not be less than 20 kA r.m.s. for 10 kA surge arresters.
- ³⁾ The duration of the tests shall not be less than 1,000 hours (Test series A).

The type tests shall be conducted by the acknowledged independent testing laboratories.

The following independent testing laboratories and institutes are accepted by PEA:

- KEMA : KEMA Laboratories
- V'Fall : Statens Vattenfallsverk, The Swedish State Power Board
- CRIEPI : Central Research Institute of Electric Power Industry
- EdF : Electrical de France
- CESI : Centro Elettrotecnico Sperimentale Italiano
- PLI : Powertech High Power Laboratory
- STRI : Swedish Transmission Research Institute
- : Testing and Certification
- : Ontario Hydro Technologies
- SATS : Scandinavian Association for Testing Electric Power Equipment
- Intertek : Intertek
- EGAT : The Electricity Generating Authority of Thailand
- HVRL : High Voltage Research Laboratory, Electrical Engineering Department, Faculty of Engineering, Chulalongkorn University
- TISI : Thai Industrial Standards Institute

The bidder are at liberty to quote the HV 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 and before the bid closing date.

The type test certificate(s) or test report(s) of the HV surge arresters having same type as the proposed HV surge arresters 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.



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The HV surge arresters shall be passed the routine tests in accordance with TIS 2366-2551 [IEC 60099-4 Edition 2.1 (2006-07)] or IEC 60099-4 (2006-7) at least the following tests items:

- 1) Measurements of reference voltage (U_{ref}) at the reference current (I_{ref})
- 2) Residual voltage tests on complete arresters, assembled arrester units or on a sample comprising one or several resistor elements
- 3) Internal partial discharge tests

The HV surge arresters shall be passed the acceptance tests in accordance with TIS 2366-2551 [IEC 60099-4 Edition 2.1 (2006-07)] or IEC 60099-4 (2006-7) at least the following tests items:

- 1) Measurements of power-frequency voltage on the complete arresters at the reference current (I_{ref})
- 2) Lightning impulse residual voltage tests on complete arresters or arrester units
- 3) Internal partial discharge tests

Note:

PEA will also accept the HV surge arresters passed the routine tests and the acceptance tests in accordance with the later edition of the above standard which may have a different test items or test procedure comparing with TIS 2366- 2551 [IEC 60099-4 Edition 2.1 (2006-07)] or IEC 60099-4 (2006-7).

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

- 1) Three (3) samples, for the supply of no more than 5,000 units
- 2) Five (5) samples, for the supply of more than 5,000 units

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

1e Packing

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

The packages of the same item shall be packed in seaworthy wooden case(s) to avoid damage during transportation; or the packages of the same item shall be packed in suitable package(s) for delivery by container.

Each wooden case(s) shall be strong enough for stacking over with at least another one.

If the 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.



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C2 Material and packing data to be given by bidder

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

2a Details of the HV 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

2b Design data and guarantee of the proposed HV surge arresters:

Proposed Item.....

Characteristics	Unit	Proposed data
Applied standard	-	
Rated voltage (U_r)	kV r.m.s.	
Continuous operating voltage (U_c)	kV r.m.s.	
Rated frequency	Hz	
Nominal discharge current (I_n)	kA peak	
Maximum residual voltage (U_{res}) at nominal discharge current	kV peak	
Rated short-circuit current (I_s)	kA r.m.s.	
Total duration of test current	s	
High-current impulse withstand	kA peak	
Line discharge class	-	
Minimum long-duration current impulse withstand	A peak	
Virtual duration of peak	μ s	
Material of arrester housing	-	
Minimum creepage distance from live part to ground	mm	
Weight of one surge arrester including accessories	kg	

2c Drawings of surge arresters including all accessories with main dimensions in mm



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2d Drawings of connectors, clamps, earth leads, and mounting brackets with dimensions in mm; and specifications of materials used for the component parts

2e Drawing of disconnecting devices showing the internal construction, and time-current characteristic curves of disconnecting devices

2f Manufacturer's name and technical data of arrester housings

2g List of routine tests

2h Packing details

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

Number of sets in each package (one)

Dimensions of each package in cm

Gross weight of each package in kg

Net weight of each package in kg

Number of packages

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

Dimensions of each case in cm

Volume of each case in m³

Gross weight of each case in kg

Number of packages in each case

Number of cases

Type of storage facility required (indoor/outdoor)

Note: Conditions for documentation and consideration

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

Technical Specification Division

Provincial Electricity Authority

200 Ngam Wong Wan Road, Chatuchak

Bangkok Metropolis 10900

Thailand



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



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Table 1

Ratings and characteristics of HV surge arresters

Characteristics	Unit	Requirements
Rated voltage (U_r)	kV r.m.s.	30
Rated frequency	Hz	50
Nominal discharge current (I_n)	kA peak	5 10 10
Maximum residual voltage (U_{res}) at nominal discharge current	kV peak	100 85.5
Rated short-circuit current (I_s)	kA r.m.s.	10 20
High-current impulse withstand	kA peak	65 100
Line discharge class	-	2 3
Minimum long-duration current impulse withstand	A peak	75 -
Virtual duration of peak	μ s	1,000 2,000
Minimum creepage distance from live part to ground	mm	1,100 1,100



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C3 Schedule of detailed requirement

Item	PEA Material No.	Quantity	Description
1	1040000102	set(s)	<p>High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with :</p> <p>Rated voltage (U_r) : 30 kV r.m.s.</p> <p>Nominal discharge current (I_n) : 5 kA peak</p> <p>Minimum creepage distance : not less than 1,100 mm from live part to ground</p> <p>Complete with :</p> <ol style="list-style-type: none"> (1) Disconnecting device (2) Line terminal and connector (terminal lug) suitable for aluminium conductor diameter of 7.5 mm - 9.0 mm (sizes 35 mm² – 50 mm²). (3) Ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm² and length of no less than 430 mm (4) M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm. (5) Insulated mounting base with mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm. (6) Bird guard cap.



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C3 Schedule of detailed requirement

Item	PEA Material No.	Quantity	Description
2	1040000103	set(s)	<p>High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with:</p> <p>Rated voltage (U_r) : 30 kV r.m.s.</p> <p>Nominal discharge current (I_n) : 10 kA peak</p> <p>Line discharge class : 2</p> <p>Minimum creepage distance : not less than 1,100 mm from live part to ground</p> <p>Complete with :</p> <ol style="list-style-type: none">(1) Disconnecting device(2) Line terminal and connector (terminal lug) suitable for aluminium conductor diameter of 7.5 mm - 9.0 mm (sizes 35 mm² – 50 mm²).(3) Ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm² and length of no less than 430 mm.(4) M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm.(5) Insulated mounting base with mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm.(6) Bird guard cap.



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C3 Schedule of detailed requirement

Item	PEA Material No.	Quantity	Description
3	1040000107	set(s)	<p>High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with:</p> <p>Rated voltage (U_r) : 30 kV r.m.s.</p> <p>Nominal discharge current (I_n) : 10 kA peak</p> <p>Line discharge class : 3</p> <p>Minimum creepage distance : not less than 1,100 mm from live part to ground</p> <p>Complete with :</p> <ol style="list-style-type: none"> (1) Line terminal and connector (terminal lug) suitable for aluminium conductor diameter of 7.5 mm - 9.0 mm (sizes 35 mm² - 50 mm²). (2) Ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm² and length of no less than 430 mm. (3) M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm. (4) Mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm. (5) Bird guard cap.



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C4 Price schedule

Invitation to Bid No.:

			Manufacturer : Country of origin : Trade-mark :	Unit Cost (See details & conditions attached)	Total Cost (See details & conditions attached)
		Description	Quantity		
1	1040000102	High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with: Rated voltage (U_r) : kV r.m.s. Nominal discharge current (I_n) : kA peak Minimum creepage distance : not less than mm from live part to ground Complete with disconnecting device, line terminal and connector (terminal lug) suitable for aluminium conductor diameter of mm (sizes $35 \text{ mm}^2 - 50 \text{ mm}^2$), ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm^2 and length of no less than mm and M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm, insulated mounting base with mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm, and bird guard cap.	set (s)		
	II				



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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)
2	1040000103		<p>High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with:</p> <p>Rated voltage (U_r) : kV r.m.s.</p> <p>Nominal discharge current (I_n) : kA peak</p> <p>Line discharge class :</p> <p>Minimum creepage distance : not less than mm</p> <p>from live part to ground</p> <p>Complete with disconnecting device, line terminal and connector (terminal lug) suitable for aluminium conductor diameter of mm (sizes 35 mm² – 50 mm²), ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm² and length of no less than..... mm and M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm, insulated mounting base with mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm, and bird guard cap.</p>	set (s)		
	II					



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ਪ੍ਰੋਵਿੰਸ਼ੀਅਲ ਬਿਜਲੀ ਅਥਾਰਿਟੀ
ਸ਼ਕਤੀ ਪ੍ਰਣਾਲੀ ਮਿਆਰੀ ਭਾਗ

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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)
3	1040000107		<p>High voltage (HV) surge arrester, suitable for 33 kV distribution system with solidly-grounded system, with:</p> <p>Rated voltage (U_r) : kV r.m.s.</p> <p>Nominal discharge current (I_n) : kA peak</p> <p>Line discharge class :</p> <p>Minimum creepage distance : not less than mm</p> <p>from live part to ground</p> <p>Complete with line terminal and connector (terminal lug) suitable for aluminium conductor diameter of mm (sizes 35 mm² – 50 mm²), ground terminal and connector (terminal lug) with flexible copper insulated ground lead size 16 mm² and length of no less than..... mm and M 8 U-bolt clamp type connector for connecting the ground lead to galvanized steel stranded conductor diameter of 9.0 mm, mounting bracket for mounting the arrester in vertical (90°) position on a cross-arm, and bird guard cap.</p>	set (s)		