



KINGDOM OF CAMBODIA
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ELECTRICITE DU CAMBODGE

TECHNICAL SPECIFICATION

EDC-DTS-MV009

Surge Arresters


August 2019

Version 2.0





ELECTRICITE DU CAMBODGE

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Modification from version 1.0 to version 2.0 are of COV (Uc) and maximum residual voltages for all kind of Surge arresters.



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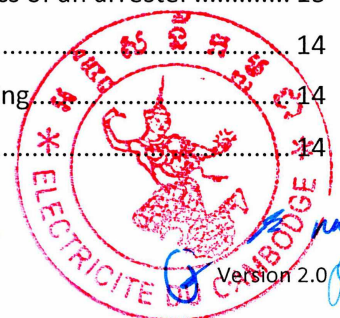
Version 2.0

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Content

1	Scope	7
2	Standards.....	7
3	Definitions	8
4	Testing and Inspection	8
4.1	General Notes for Test.....	8
4.2	Type Tests.....	8
4.3	Routine Tests and Acceptance Tests	8
4.3.1	Test file	9
5	Quality Management	9
6	Technical Specification.....	9
6.1	General	9
6.2	Ambient Conditions.....	9
6.3	Arrester Identification/ Classification.....	10
6.4	Specification of the Surge Arrester.....	10
6.4.1	Standard ratings	11
6.4.2	Design voltage	11
6.4.2.1	Arrester for 35kV system with artificial neutral grounded through impedance and resistor distribution system (3 phases - 3 wires).....	11
6.4.2.2	Arrester for 35kV system with isolated neutral (3 phases - 3 wires).....	12
6.4.2.3	22 kV system with artificial neutral grounded through impedance and resistor distribution system (3 phases - 3 wires).....	12
6.4.3	Service conditions.....	12
6.4.4	Requirements	12
6.4.4.1	Insulation withstand of the arrester housing	12
6.4.4.2	Reference voltage	13
6.4.4.3	Maximal residual voltages	13
6.4.4.4	Partial discharges	13
6.4.4.5	Seal leakage	13
6.4.4.6	Long duration current impulse Insulation withstand of the arrester housing.....	13
6.4.4.7	Operation of arresters	13
6.4.4.8	Power frequency voltage versus time characteristics of an arrester	13
6.4.4.9	Pressure relief/Short circuit withstand.....	14
6.4.4.10	Behavior of arresters in case of failure of the housing.....	14
6.4.5	Disconnecter withstand.....	14



6.4.5.1	Disconnecter operation	14
6.5	Constructive Devices.....	14
6.5.1	Composition.....	14
6.5.2	Weight.....	14
6.5.3	Position of the surge arrester in the system.....	14
6.5.4	Identification file.....	15
6.6	Marking.....	15
6.7	Delivery.....	15
7	Technical Data Sheet	16
7.1	35 kV System Surge Arrester	16
7.2	22 kV System Surge Arrester	18



Surge Arresters

1 Scope

This specification is applicable to the supply of non-linear metal oxide resistor surge arresters (Gapless metal oxide varistor), with disconnecter, without air gaps, with polymeric housing, rated discharge currents of 10kA (Heavy duty) to be used on 35kV and 22 kV distribution systems of Cambodia.

This specification defines the conditions that the surge arresters must comply with, specifically the electrical, mechanical and size characteristics, as well as the tests they must succeed.

This document completes, details, reinforces and amends the articles of IEC 60099-4 or ANSI C62-11 or equivalent standard.

Reference in this document to IEC 60099-4 or ANSI C62-11 or equivalent standard also includes any amendments to it.

2 Standards

IEC : International Electrotechnical Commission

IEC 60071-1 : Insulation coordination. Part 1: Terms, definitions, principles and rules

IEC 60071-2 : Insulation coordination. Part 2: Application guidelines

IEC 60099-1 : Surge arresters. Part 1: Non-linear resistor type gapped arresters for ac systems

IEC 60099-4 : Metal oxide surge arresters without gaps for ac systems

IEC 60270 : Partial discharge measurements

IEC 60815 : Guide for the selection of insulators in respect of polluted conditions

IEC 61109 (1992): Composite insulators for pole top ac lines with rated voltages greater than 1000 V. Definitions, test methods and acceptance criteria.

IEC/CISPR 16 : Specifications for radio-electrical disturbance measuring devices and methods

ANSI : American National Standards Institute

ANSI C62-11 : IEEE standard for Metal-Oxide Surge arrester for alternating current power circuits

ISO : International Standard Organization

ISO 2063 : Metallic coating-protection of iron and steel against corrosion

ISO/IEC 17025 : General requirements for the competence of testing and calibration laboratories

ISO 9001 : Quality management systems – Requirements

Unless if standard year is specified, the latest version and all amendments of the above standards apply.

The supplier may propose alternative standards, provided it is demonstrated that they give an equivalent degree of quality as the referenced standard. Acceptability of any alternative standard is at the discretion of the EDC.



3 Definitions

The definitions of the relevant IEC, ANSI and ISO standards apply to this technical specification.

4 Testing and Inspection

4.1 General Notes for Test

Surge arresters may be inspected at the manufacturer's factory by EDC's representatives.

The inspection and routine tests shall be carried out in accordance with the provisions of the relevant IEC/ANSI recommendations.

4.2 Type Tests

All type tests required by the relevant IEC or ANSI standards shall be carried out.

Type test reports shall be carried out by internationally recognized electrical testing laboratories.

Full copies of type test reports shall be submitted within the bid of the manufacturer/supplier. Type test reports older than 7 years will not be accepted.

If the manufacturer is certified by EDC, it is not necessary to submit type test reports for the considered equipment.

Nevertheless, in case the testing laboratory is not internationally recognized, the testing laboratory shall be mandatorily accredited ISO/IEC 17025 by an international or national accreditation body specialized in testing laboratories accreditation/acceptance. In that case, the testing laboratory shall prove mandatorily its capability/capacity to carry out all type tests mentioned in the type tests reports by supplying: Full description of all tests the laboratory can carry out, list of testing equipment with full characteristics, drawing of testing rooms with location of testing equipment etc..., supported by pictures and copy of the ISO/IEC 17025 accreditation certificate.

Acceptability of any accredited testing laboratory is at the discretion of the EDC.

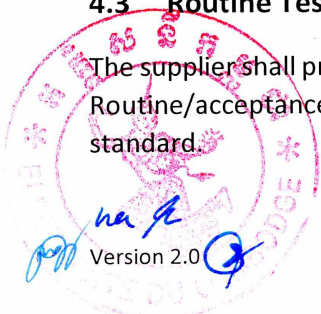
The followings type test shall be carried out:

- Insulation withstand tests
- Residual voltage
- Long duration current impulse withstand test
- Operating duty tests
- Pressure relief/ Short circuit withstand
- Test of arrester disconnectors
- Artificial pollution test
- Partial discharge
- Seal leakage test
- Results of 5000 hours ageing and climatic test according IEC 61109:1992

These test reports shall be submitted. If not the offer shall be rejected.

4.3 Routine Tests and Acceptance Tests

The supplier shall provide a representative document which specify the routine test done on the batch. Routine/acceptance tests shall be carried out according to the requirement of the relevant IEC or ANSI standard.



4.3.1 Test file

In this file the manufacturer shall provide all the information required for the performance of the tests. It shall also contain all the details and results of tests carried out by the manufacturer on the arrester and specifically those carried out in accordance with these specifications.

The files shall include the following documents:

- Results of short-circuit tests
- Results of combined operation tests (electrical tests)
- Results of mechanical tests
- Results of water tightness tests
- Results of tests to check the unitary withstand voltage of the arrester housing in salt spray
- Results of tests to check the dielectric withstand in salt spray
- Results of partial discharge creation tests

5 Quality Management

Design, development and production of the proposed equipment shall be ISO 9001 certified. The ISO 9001 certificate shall be submitted within the bid.

6 Technical Specification

6.1 General

All designations shall be conformed to the definitions of section 2 of IEC 60099.4 or ANSI C62-11 or equivalent standard.

6.2 Ambient Conditions

The surge arresters shall be suitable to operate in the ambient conditions described here after:

Altitude	Sea level to 1,000 meters
Climate	Tropical
Annual Rainfall	1,300 mm.140 days
Monsoon Period	June to November
Ambient Air Temperatures:	
Average	27.5°C
Minimum	13.3°C
Maximum	40.5°C
Relative Air Humidity	65-100%
Soil Thermal Resistivity,:	
Average	1.20 cm/W



Maximum	3.00 cm/W
Solar Emissivity	0.8
Solar absorption	0.8
Keronic Level	80
Wind Velocity:	
Average	37 km/h (10.3 m/s)
Maximum	72 km/h (20 m/s)

6.3 Arrester Identification/ Classification

Metal-oxide surge arresters shall be identified by the following minimum information which shall appear on a nameplate permanently attached to the arrester:

- continuous operating voltage
- rated voltage
- nominal discharge current at 8/20 μ s impulse
- manufacturer's name or trade mark
- type and identification of the complete arrester
- year and month of manufacture
- individual serial number

Surge arresters with rated nominal discharge current of 10 kA will be used for the protection of the distribution transformers and overhead pole mounted equipment.

6.4 Specification of the Surge Arrester

1. Protecting equipment from surges

- Limit surges by discharging the energy to the earth.

2. Resisting mechanical forces

- Adapted to on-site handling and storage.
- Resistant, once in place, to operational mechanical stress.

3. Adapting to the operational constraints of the system

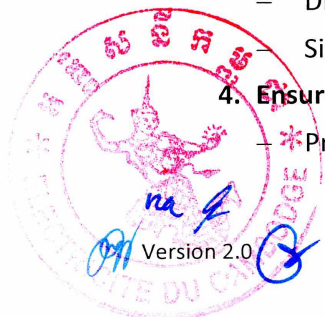
- Installed between the phase and earth, as near as possible to the equipment being protected.

• Withstand the following successive stress due to operation cycle after tripping

- Withstand over-voltage
- Recover thermal equilibrium following a lightning impulse followed by an over-voltage
- Disconnection of earth connector in case of arrester failure
- Signal indicator in case of failure.

4. Ensure the continuation of the initial performances

- *Preventing from vandalism



- Preventing from climatic conditions
- Preventing from moisture ingress

5. Protect the environment

- Does not present a danger of injury to the fauna
- No fire risk
- Limits the external signs of the operation of the fault indication and when the surge arrester failed.

6.4.1 Standard ratings

Standard rated characteristics

Nominal discharge current (8/20) μ s	10 kA
High current impulse withstand (4/10) μ s	100 kA

6.4.2 Design voltage

6.4.2.1 Arrester for 35kV system with artificial neutral grounded through impedance and resistor distribution system (3 phases - 3 wires)

Rated system voltage	38 kV
Operating Voltage	35 kV
Frequency	50 Hz
Continuous Operating Voltage (Uc)	32 kV (\pm 10%)
Minimum Creepage distance: (1)	
Pollution level II area (medium): 20 mm/kV	760 mm
Pollution level III area (heavy): 25 mm/kV	950 mm

(1) Pollution level III area: Coastal band of 10 km large. Pollution level II area: rest of Cambodia.

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6.4.2.2 Arrester for 35kV system with isolated neutral (3 phases - 3 wires)

Rated system voltage	38 kV
Operating Voltage	35 kV
Frequency	50 Hz
Continuous Operating voltage (Uc)	≥ 38 kV
Minimum Creepage distance: (1)	
Pollution level II area (medium): 20 mm/kV	760 mm
Pollution level III area (heavy): 25 mm/kV	950 mm

(1) Pollution level III area: Coastal band of 10 km large. Pollution level II area: rest of Cambodia.

6.4.2.3 22 kV system with artificial neutral grounded through impedance and resistor distribution system (3 phases - 3 wires)

Rated system voltage	24 kV rms
Operating voltage	22 kV
Frequency	50Hz
Continuous Operating voltage (Uc)	19.2kV ≤ Uc ≤ 20.5 kV
Minimum Creepage distance: (1)	
Pollution level II area (medium): 20 mm/kV	480 mm
Pollution level III area (heavy): 25 mm/kV	600 mm

(1) Pollution level III area: Coastal band of 10 km large. Pollution level II area: rest of Cambodia.

6.4.3 Service conditions

For the particular conditions: exposure to pollution type 2 and 3 (IEC 60815 or equivalent standard) as mentioned afore.

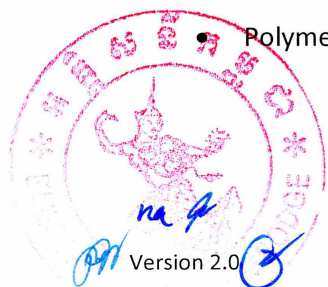
6.4.4 Requirements

6.4.4.1 Insulation withstand of the arrester housing

In accordance with IEC 60099.4 section 5.1 with following complements:

The arrester housing shall comply with IEC 60815 “Guide for the selection of insulators in respect of polluted conditions” regarding:

- Creepage withstand
- Fire behavior
- Polymeric arrester housings shall respect the climatic constraints



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6.4.4.2 Reference voltage

The reference voltage of each arrester shall be measured by the manufacturer for the reference chosen current. The reference current shall lie in the range 1mA-10 mA peak value. The minimum value of the reference voltage for the reference current used during the individual tests shall be stated, and it shall be included in the information supplied by the manufacturer.

These tests will be in accordance with IEC 60099.4 section 5.11.

6.4.4.3 Maximal residual voltages

The residual voltages for the arresters covered by these specifications correspond to the following current lightning impulse (8/20 μ s).

The maximum values for the residual voltage for lightning impulses shall be below the values defined in the table here after.

Maximal residual voltage 8/20 μ s 10 kA peak	
- 35 kV System isolated neutral	135 kV
- 35 kV System resistive artificial neutral	120 kV
- 22 kV System resistive artificial neutral	75 kV

6.4.4.4 Partial discharges

The partial discharges in the arrester energized at 1.05 times its maximum continuous operating voltage shall not exceed 10 pC.

6.4.4.5 Seal leakage

The components of the arresters must be completely sealed under the specified service conditions.

6.4.4.6 Long duration current impulse Insulation withstand of the arrester housing

Arresters shall withstand long duration currents as checked during type tests.

Visual examination of the test results after the test shall reveal no evidence of puncture, flash-over, cracking or other significant damage of the metal-oxide resistors as well as the housing.

The residual voltage measured before and after the long duration current test shall not change by more than 5%.

6.4.4.7 Operation of arresters

Arresters shall be able to withstand the combination of stresses arising in service as demonstrated by the operating duty tests. These stresses shall not cause damage or thermal runaway.

The arrester passes the test if thermal stability is achieved, if the residual voltage measured before and after the test does not change by more than 5 %, and if examination of the test samples after the test reveals no evidence of puncture, flash-over or cracking of the non-linear metal-oxide resistors as well as the housing.

6.4.4.8 Power frequency voltage versus time characteristics of an arrester

This section is conforming to IEC 60099.4 section 5.10.



6.4.4.9 Pressure relief/Short circuit withstand

This section is conforming to IEC 60099.4 section 5.11.

6.4.4.10 Behavior of arresters in case of failure of the housing

The failure of an arrester shall not cause the shattering of the housing or fire hazard.

The test sample satisfies these test conditions: see IEC 60099.1 section 5.11

- the arrester self-extinguishes within a maximum of 30 seconds,
- the nameplate of the arrester is legible
- no projections of materials (except for small pieces of the synthetic housing)
- the disconnecter will be ejected

6.4.5 Disconnecter withstand

The surge arrester shall be associated with a disconnecter, this device shall withstand, without operating, each of the following tests:

- long duration current impulse test, in compliance with IEC 60099.4 section 7.6.2.1
- Operating duty test, in compliance with IEC 60099.4 section 7.6.2.2.

6.4.5.1 Disconnecter operation

The time delay for the operation of the disconnecter shall be determined for the following value of current. There shall be clear evidence of effective and permanent disconnection by the device.

Disconnecting for: 100 A / 0.1 sec

6.5 Constructive Devices

6.5.1 Composition

The surge arresters consists of a single element with a housing of a synthetic material of a white, greyish or black color.

The disconnecter consists of a single element fitted into the surge arrester.

The insulating bracket consists in an element which allows the fixing of the arrester to the support. The impulse withstand of this insulating bracket shall be 70 kV 1.2/50 μ s.

The equipment shall be sealed and waterproof.

6.5.2 Weight

The total weight of a surge arrester including the connection devices shall not exceed 6 kg.

6.5.3 Position of the surge arrester in the system

Surge arresters shall be installed: either vertically or horizontally.

The insulating brackets shall be fixed on cross arms through a hole of diameter 14 mm.

The part connected to the line has a flat base on the footing with a minimum diameter of 40 mm and a maximum of 100 mm, it comprises a stainless steel screw rod M12 diameter, two nuts and a cable grip washer which allows the connection of a 70 mm² Aluminum conductor. This connecting system shall allow a "through" connection with the possibility to connect a conductor without cutting it. This part connected to the line must be also fitted with UV resistant insulation cap in order to protect the equipment from fauna.



The terminal connected to the earth will comprise a stainless steel stud rod M12 diameter, two nuts and a clamp which allows the connection made of copper or aluminum cables from 16 mm² up to 70 mm². This connecting system shall allow a "through" connection with the possibility to connect a conductor without cutting it.

The NEMA pattern mounting brackets for mounting on steel cross arm and bearers shall be provided on specific request.

6.5.4 Identification file

The identification file shall comprise the following data.

- Name and reference for the device as given by the manufacturer.
- Drawing with cross-section showing the nature of the materials used.
- Current-voltage characteristics (U peak / I peak) of the complete arrester for a temperature of 20°C.
- Temporary over-voltage capability at an ambient temperature of 60°C:
 - New arrester
 - After one current impulse 100 kA (4/10µs)
 - After two current impulse 100 kA (4/10µs)
- The maximum continuous operating voltage of the arrester must be clearly stated in asymptotic form according to IEC 60099.4.

6.6 Marking

Each surge arrester shall be fitted with a plate mentioning (as a minimum) in indelible characters:

- Name of manufacturer
- Date of manufacturing
- Standard
- Current Discharge class
- Uc
- Rated voltage
- Maximal residual voltage 8/20 µs 10 kA peak
- year and month of manufacture
- individual serial number

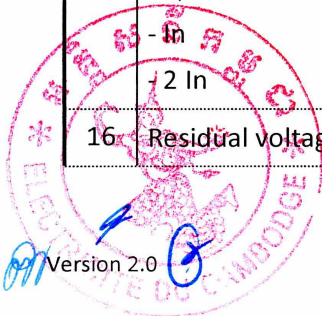
6.7 Delivery

Surge arresters shall be delivered in card box within a complete set of 3 arresters including all accessories.

7 Technical Data Sheet

7.1 35 kV System Surge Arrester

No.	Description	Unit	Requirement		Supplier's Offer
			Resistive Neutral <input type="checkbox"/>	Isolated Neutral <input type="checkbox"/>	
	35 kV Systems Surge Arrester				
1	Country		to be specified		
2	Manufacturer		to be specified		
3	Manufacturer's reference		to be specified		
4	Standard		to be specified		
4.a	Type test		Supplied		
4.b	Type of metal oxide		to be specified		
5	Frequency	Hz	50		
6	Nominal discharge current (8/20) μ s (In)	kA	10		
7	Continuous operating voltage (Uc)	kV	32 (\pm 10%)	\geq 38	
8	Reference voltage	kV	to be specified		
9	Temporary overvoltage during 3s	kV (rms)	to be specified		
10	Residual voltage with 8/20 μ s 10 kA peak	kV	\leq 120	\leq 135	
11	Line discharge class		1		
12	High current impulse withstand (Im 4/10 μ s)	kA	to be specified		
13	Short circuit withstand	kA (rms)/1s kA (rms)/0.2s	to be specified		
14	Support insulating bracket with disconnector		to be Supplied		
14.a	Disconnector sensibility.		100A(rms)/0.1s		
15	Residual voltage at				
	- 0,5 In	kV (rms)	to be specified		
	- In	kV (rms)	to be specified		
	- 2 In	kV (rms)	to be specified		
16	Residual voltage at step current (4 /10 μ s)	kV (rms)	to be specified		



17	Minimum Creepage distance: -Pollution level II area (medium): 20 mm/kV -Pollution level III area (heavy): 25 mm/kV	mm mm	760 950	
18	Mechanical stress -Cantilever strength -Tensile strength -Torque strength	N.m N N.m	to be specified to be specified to be specified	
19	Partial discharge	pC	≤ 10	
20	Termination and brackets, bolts, washers, nuts,		To be specified	
20.a	NEMA bracket to be supplied		<input type="checkbox"/>	
20.b	Through connection on live and earth connector. Stainless steel M12 connecting rods		Yes	
20.c	Insulating bracket impulse withstand	kV 1.2/50 μs.	70	
21	Housing		Polymer To be specified and described	
22	Weight	kg	to be specified	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

Deviation from the technical specification:

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

- 1/
- 2/
- 3/
- x/

Full technical information shall be supplied within the bid.

Bidder signature:



7.2 22 kV System Surge Arrester

No.	Description	Unit	Requirement	Supplier's Offer
	22 kV System Surge Arrester			
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		to be specified	
4a	Type tests		Supplied	
4b	Type of metal oxide		to be specified	
5	Frequency	Hz	50	
6	Nominal discharge current (8/20) μ s (In)	kA	10	
7	Continuous operating voltage (Uc)	kV	$19.2 \text{ kV} \leq U_c \leq 20.5 \text{ kV}$	
8	Reference voltage	kV	to be specified	
9	Temporary overvoltage during 3s	kV (rms)	to be specified	
10	Residual voltage 8/20 μ s 10 kA peak	kV peak	≤ 75	
11	Line discharge class		1	
12	High current impulse withstand (Im 4/10 μ s)	kA	to be specified	
13	Short circuit withstand	kA (rms)/1s kA (rms)/0.2s	to be specified	
14	Support insulating bracket with disconnector		to be Supplied	
14a	Disconnector sensibility.		100A(rms)/0.1s	
15	Residual voltage at - 0,5 In - In - 2 In	kV (rms) kV (rms) kV (rms)	to be specified to be specified to be specified	
16	Residual voltage at step current (4 /10 μ s)	kV (rms)	to be specified	
17	Minimum Creepage distance: -Pollution level II area (medium): 20 mm/kV -Pollution level III area (heavy): 25 mm/kV	mm mm	480 600	

18	Mechanical stress -Cantilever strength -Tensile strength -Torque strength	N.m N N.m	to be specified to be specified to be specified	
19	Partial discharge	pC	≤ 10	
20	Termination and brackets, bolts, washers, nuts,		To be specified	
20.a	NEMA bracket...		<input type="checkbox"/>	
20.b	Through connection on live and earth connector. Stainless steel M12 connecting rods		Yes	
20.c	Insulating bracket impulse withstand	kV 1.2/50 μs.	70	
21	Housing		Polymer To be specified and described	
22	Weight	kg	to be specified	

Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ", V , etc..." are not accepted.

Deviation from the technical specification:

The bidder shall list point after point and explain here in after all deviation from the requested technical specification.

- 1/
- 2/
- 3/
- x/

Full technical information shall be supplied within the bid.

Bidder signature:

