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ELECTRICITE DU CAMBODGE

TECHNICAL SPECIFICATION

EDC-DTS-MV019

Outdoor Single Phase MV Capacitors

May 2023



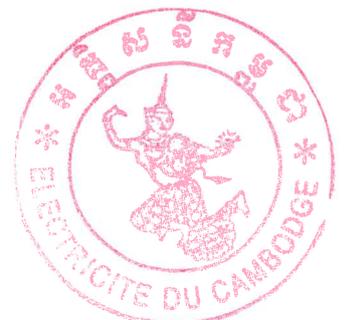
EDC-DTS-MV019-Outdoor Single Phase MV Capacitors

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Content

1	Scope.....	6
2	Standards	6
3	Definitions.....	6
4	Testing and inspection.....	6
4.1	General Notes for Test.....	6
4.2	Type Tests	7
4.3	Routine Tests	7
5	Quality Management.....	7
6	Technical requirements	7
6.1	General	7
6.2	Ambient conditions.....	8
6.3	Voltage rating	8
6.4	Frequency	8
6.5	Connection.....	8
6.6	Rated capacity.....	8
7	Technical Characteristics	9
7.1	Insulation levels	9
7.2	Tank.....	9
7.3	Bushings.....	9
7.4	Technology.....	10
7.5	Operating temperature	10
7.6	Earthing.....	10
8	Label and Rating Plates.....	10
9	Delivery	10
10	Technical data sheets	11



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Outdoor Single Phase MV Capacitors

1 Scope

This specification covers the design, manufacturing, testing, supply, delivery and performance requirements of single phase with 2 bushings 22 kV and 35kV capacitors for power factor improvement to be used outdoor on the Power Distribution networks of EDC.

Capacitors shall have a minimum life expectancy of 100 000 hours.

2 Standards

IEC : International Electro technical Commission

IEC 60071 : Insulation coordination

IEC 60871-1 : Shunt capacitors for AC power systems having a rated voltage above 1 000 V
- Part 1: General

IEC TS 60871-2 + AMD1: Shunt capacitors for AC power systems having a rated voltage above 1 000 V - Part 2: Endurance testing

IEEE -18 : Standard for Shunt Power Capacitors

ISO : International Standard Organization

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 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 definition of the relevant IEC/IEEE standards apply to this technical specification.

4 Testing and inspection

4.1 General Notes for Test

Capacitors 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 60871 recommendations.

The capacitors shall be subjected to test as specified below.

4.2 Type Tests

All type tests required by the IEC 60871 shall be carried out.



Type test reports or certification **of similar capacitors (same technology)** shall be carried out by internationally recognized electrical testing laboratories.

As per the requirements of IEC 60871 a specific attention shall be paid on the special and particular conditions. Capacitor units shall be suitable for operation at voltage levels according to a withstand of:

- 110% of rated voltage less than 12 hours in every 24 hours
- 115% of rated voltage less than 30 minutes in every 24 hours
- 120% of rated voltage less than 5 minutes voltage rise at light load
- 130% of rated voltage less than 1 minute.

In addition, capacitors shall withstand an over current of 130%.

Full copies of type test reports or test certification shall be submitted within the bid of the manufacturer/supplier. It is understood that the proposed equipment is the type tested equipment according to the latest IEC standard (or equivalent) and other specified standards requirements, unless a standard year is stated in the technical specifications.

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.

Type tests shall be attached with the offer. Acceptability of any accredited testing laboratory is at the discretion of the EDC. **Failure of submitting type tests reports or type test certificates shall result in the rejection of the offer.**

4.3 Routine Tests

The routine tests requested by IEC 60871 shall be carried out on all capacitors.

The full set of routine test reports shall be sent to EDC prior the shipment for EDC acceptance.

The routine testing and special tests procedures to be carried out during EDC approval inspection shall be sent to EDC for approval.

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 requirements

6.1 General

Outdoor capacitors shall be single phase type with 2 bushings and suitable to be installed on poles thanks a metallic frame.

They shall be of oil impregnated technology.



6.2 Ambient conditions

The capacitors 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	1.20c m/W
Maximum	3.00c m/W
Solar Emissivity	0.8
Solar absorption	0.8
Wind Velocity:	
Average	37 km/h (10.3 m/s)
Maximum	72 km/h (20 m/s)

6.3 Voltage rating

The capacitors to be supplied will have the following voltage rating:

Service Rated Voltage	22 kV	35 kV
Maximum Voltage	24 kV	38 kV or 40.5 kV

6.4 Frequency

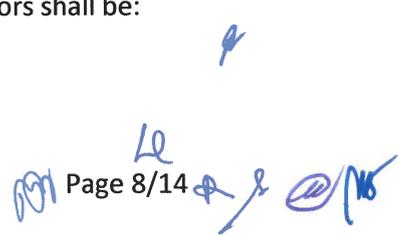
The frequency of the distribution system is **50 Hertz**.

6.5 Connection

The connection shall be of Wye or Delta type as requested by the technical data sheet herein after.

6.6 Rated capacity

The rated capacity (kVAR) of the capacitors shall be:



 Page 8/14



EDC-DTS-MV019-Outdoor Single Phase MV Capacitors

Operating Voltage	Capacity kVAR			
	22 kV	50	100	150
35 kV	50	100	150	200

The allowed tolerance is -5 to +10%

All capacitors shall be capable to operate safely up to 135% of its rated capacity.

7 Technical Characteristics

7.1 Insulation levels

Capacitors shall be designed according the recommendations of IEC 60871 and tested to the following insulation levels:

Service Voltage	22 kV	35 kV	
Rated Service Voltage	24 kV	38 kV	40.5 kV
Power frequency withstand voltage (50Hz/1 mn)	50 kV	70 kV	95 kV
Rated impulse withstand voltage (1.2/50μs)	125 kV	190 kV	190 kV

7.2 Tank

The tank of the capacitors shall be made of stainless steel or aluminum coated by an epoxy/polyamide primer. The finish polyurethane paint shall be of dark grey color.

The tank of all capacitors shall be fitted with two lifting lugs or equivalent device allowing an easy installation on a pole.

7.3 Bushings

The capacitors shall be fitted with two bushings.

The bushings shall be made of porcelain or composite.

The creepage distances for the bushings and the insulators shall not be less than 25 mm/kV for the considered highest voltage:

Voltage Um	Minimum Creepage distance
24 kV	600 mm
38 kV or 40.5 kV	950 mm

Bushing terminals shall be fitted with M12 rods (washers and nuts supplied) for bi-metallic lugs or with specific tinned clamps accepting aluminum alloy conductors of 70 mm².



7.4 Technology

Capacitors shall be of PXE impregnated type. The non-toxic oil used shall not contain PCB.

The discharge device shall be capable to discharge the capacitor 75V in 10 minutes.

7.5 Operating temperature

Each capacitor shall be capable to operate with a temperature of 55°C

7.6 Earthing

One 10 mm diameter hole for connection of earth wires copper lug shall be provided on the capacitor.

8 Label and Rating Plates

Labels, plates, markings and instructions shall be clear and indelible and both in English and Khmer language. Case-in or molded-in words which are not English words shall be covered with permanently fixed non-ferrous labels inscribed in English.

A weatherproof rating plate shall be provided fixed onto the capacitor in accordance with IEC 60871 or IEEE 18 and showing the following items, indelibly marked by engraving or embossing:

- a) Manufacturer's Name
- b) Connection Symbol
- c) Type of Capacitor
- d) Serial Number
- e) Rated Capacity QN Yes
- f) Rated Capacitance C
- g) Rated Voltage UN
- h) Overload Current
- i) Insulation Level
- j) Temperature class
- k) Month/Year of manufacturing

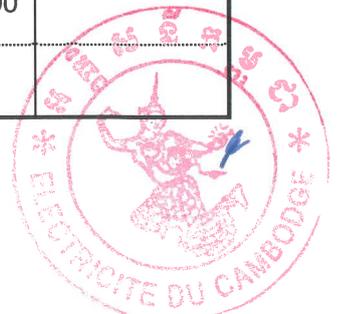
9 Delivery

Capacitors shall be delivered suitably protected for transport and storage on a strong enough non-returnable wooden case pallet.



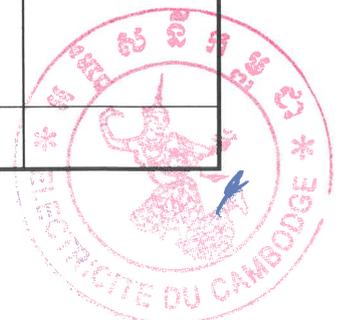
10 Technical data sheets

	Description	Unit	Requirement	Supplier's Offer
	Outdoor single phase MV Capacitors			
1				
2	Manufacturing Country		to be specified	
3	Manufacturer		to be specified	
4	Manufacturer's reference		to be specified	
5	Standard		IEC 60871-1, IEC 60871-2 or IEEE-18	
6	Type test reports or test certification per § IEC 60871 or IEEE- 18		To be provided with bid.	
7	ISO 9001 for design, development and production		Yes. Certificate to be provided	
General				
8	Capacitors for power factor improvement		Mandatory	
9	Outdoor type		Yes	
10	Operating life expectancy	hours	≥ 100 000	
11	Withstand Ambient conditions in § 6.2		Mandatory	
Electrical characteristics				
	Type of connection		<input type="checkbox"/> Wye <input type="checkbox"/> Delta	
	System and Rated voltage		22/24 kV <input type="checkbox"/> 35/38 or 40.5 kV <input type="checkbox"/>	
	Frequency		50Hz	
	Power frequency withstand voltage (50Hz/1 mn)	kV	50 <input type="checkbox"/> 38kV: 70 40.5kV: 95	
	Rated impulse withstand voltage (1.2/50 μs)kV	kV	125 <input type="checkbox"/> 38 kV:190 40.5kV:190	
	Rated Capacity (kVAr)		50 <input type="checkbox"/> 50 <input type="checkbox"/>	



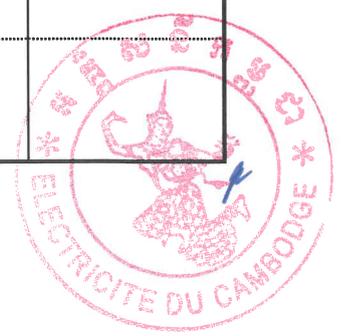
EDC-DTS-MV019-Outdoor Single Phase MV Capacitors

			100 <input type="checkbox"/>	100 <input type="checkbox"/>	
			150 <input type="checkbox"/>	150 <input type="checkbox"/>	
			200 <input type="checkbox"/>	200 <input type="checkbox"/>	
	Capacitors operated safely at 135% of kVAr rating		Yes		
	Capacitance Tolerance for capacitor units		(-5 to +10) %		
	Voltage Tests:				
	110% of rated voltage less than 12 hours in every 24 hours		Yes		
	115% of rated voltage less than 30 minutes in every 24 hours		Yes		
	120% of rated voltage less than 5minutes voltage rise at light load		Yes		
	130% of rated voltage less than 1minute		Yes		
	AC voltage test between terminals for 10 sec.		2.15*Un		
	DC test voltage		4.3*Un		
	Maximum permissible over current		130%		
	Operating temperature		Up to 55°C		
	Discharge device: Discharging to 75V in 10 minutes		Yes		
	Overpressure switch and protection		Yes		
	Protection type		To be mentioned		
	Dielectric Losses	W	< 0.1/kVAR		
	Construction				
	Tank made of stainless steel or Aluminum		Mandatory		
	Coated by an epoxy/polyamide primer		Yes		
	Finish polyurethane paint of dark grey color.		Yes		
	Lifting lugs		2		
	Bushing		Glazed porcelain or		



EDC-DTS-MV019-Outdoor Single Phase MV Capacitors

		Composite	
	Minimal creepage distance	mm	600 950
	Bushing terminals		M12 rod Tinned clamps for 70 mm ² ALU alloy
	Marking		
	English and Khmer		Yes
	Indelible		Mandatory
	a) Manufacturer's Name b) Connection Symbol c) Type of Capacitor d) Serial Number e) Rated Capacity f) Rated Capacitance g) Rated Voltage h) Overload Current i) Insulation Level j) Temperature class k) Month/Year of manufacturing		Yes Yes Yes Yes Yes Yes Yes Yes Yes
	Packing		
	Protected for transport and storage on a strong enough non-returnable wooden case pallet.		Yes
26	22 kV Capacitor Dimensions	mm	L x H x W 50 kVAR 100 kVAR 150 kVAR 200 kVAR
27	35 kV Capacitor Dimensions	mm	L x H x W 50 kVAR 100 kVAR 150 kVAR 200 kVAR
28	22kV capacitor weight	Kg	50 kVAR 100 kVAR



EDC-DTS-MV019-Outdoor Single Phase MV Capacitors

			150 kVAR	
			200 kVAR	
29	35kV capacitor weight	Kg	50 kVAR 100 kVAR 150 kVAR 200 kVAR	
30	Typical drawings and catalogues.		To be supplied with bid	
<p>Supplier's offer column must be properly filled with the right figures. "Compliant, Yes, ",√, etc..." are not accepted.</p> <p>Deviation from the technical specification:</p> <p>The bidder shall list point after point and explain here in after all deviation from the requested technical specification.</p> <p>1/ 2/ 3/</p> <p>Full technical information shall be supplied within the bid.</p> <p>Bidder signature:</p>				

4

