KINGDOM OF CAMBODIA

Nation Religion King

ELECTRICITE DU CAMBODGE

TECHNICAL SPECIFICATION

EDC-DTS-MV010

MV Fuse Cut-out, Load break cut-out and Fuses

VERSION 2: July 2024

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Version	Date	Technical Specification Name	Authorized by : (name and signature)
1.0	February, 2017	MV Fuse Cut-Out and Fuses (Version 1)	
2.0	July, 2024	MV Fuse Cut-Out, Load Break Cut-Out and Fuses (Version 2)	AUN HEMRITH

Version	Drafted/reviewed by	Verified by	Approved by	Date
Draft 1	AD			
Draft 2 FINAL	AD			
Draft V2	EDC/AD			June 2023
Draft 2 V2 Final V2 Final V2/1	EDC/AD			August 2023 December 2023 July 2024

Version 2:

introduction of Load-break cut out

Rated Asymmetrical Interrupting Current (50 Hz) = 12kA instead of 10 kA

Replacement of Maximum clearing time of fuses by total clearing time curve

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Content

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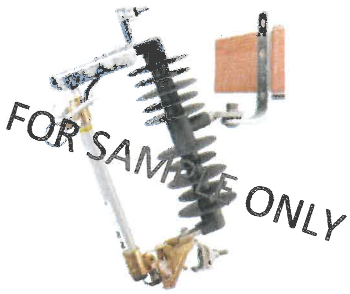
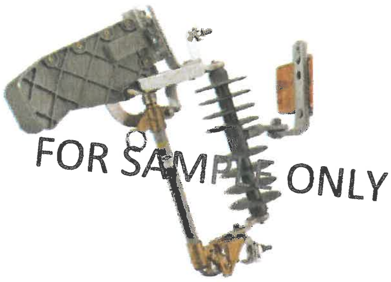
MV Fuse Cut-Out, Load Break Cut-Out and Fuses

1 Scope
Pole-mounted one pole, cut-out, fuse link units as well as load break cut-out shall be supplied to protect and provide protection/load break/isolation for distribution transformer and to medium voltage spurs of Electricité du Cambodge distribution networks.

1.1 Cut-out
Cut-out units for 35 kV and 22 kV shall be of the disconnecting type suitable for opening, closing and removal by an operating stick. They shall be fitted with fuse links. The rated current of the fuse link is the maximum current which it will carry continuously without deterioration and undue heating. The rated current of the fuse link shall be as stated in the schedules and each fuse link shall be suitable for the fuse units.



1.2 Load Break Cut-Out
Load break cut-out units for 35 kV and 22 kV shall be of load break disconnecting type suitable for opening on load, closing and removal by an operating stick. They shall be fitted with fuse links. The rated current of the fuse link is the maximum current which it will carry continuously without deterioration and undue heating. The rated current of the fuse link shall be as stated in the schedules and each fuse link shall be suitable for the fuse units.



1.3 Fuse link
The fuse links are required to give protection against short circuits. They shall be so rated and shall have such blowing characteristics as to be suitable for selective operations with the fuse links at present in use on the system namely Type K, i.e. fast (NEMA SG2).

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2 Standard

IEC : International Electro technical Commission

IEC 60129 Alternating current disconnectors and earthing switches

IEC 60168 Test on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000V

IEC 60265 High voltage switches

IEC 60282 High-voltage fuses

IEC 60282-2 High-voltage fuses - Part 2: Expulsion fuses

IEC 60383 Test on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1,000 V

IEC 60420 High-voltage alternating current switch-fuse combinations and fuse-circuit-breaker combinations. Withdrawn, Replaced with IEC 62271-105

IEC 60694 Common specifications for high-voltage switchgear and controlgear standards

IEC 62271-102 High-voltage alternating current disconnectors and earthing switches.

ANSI : American National Standards Institute

ANSI C 37-41 IEEE Standard Design Tests for High-Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches, and Accessories.

ANSI C 37-42 American National Standard Specification for High-Voltage Expulsion Type Distribution Class Fuses, Cut-outs, Fuse Disconnecting Switches and Fuse

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

MV fuse cut out and load break cut out may be inspected at the manufacturer's factory by EDC's representatives.

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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 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.

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.

4.3 Routine tests and acceptance tests

The Routine tests shall be carried out in accordance with ANSI C37-41, ANSI C37-42 standards or equivalent IEC standard.

4.4 Sample tests

EDC may call for type tests to be carried out at the Manufacturer's Works and witnessed by the EDC Representative. Such tests would be on random samples at the discretion of the EDC Representatives and failure to meet the conditions of test could result in the rejection of a complete batch of the equipment. When such tests are called for, they will comprise the following:

- Insulation level tests, including withstand tests at power frequency voltages on auxiliary equipment.
- Temperature rise test.
- Rated peak withstands current and rated short-time withstand current tests
- Tests to prove satisfactory operation and mechanical endurance.

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 General

The Expulsion Fuse Cut-outs and load break cut outs shall be of Class A as per IEC 60420 or updated equivalent IEC standard. It shall be suitable for use in outdoor circuits under tropical conditions stipulated in the general technical specification above. Pole-mounted single pole sets of overhead drop- out fuse units to IEC 62271-102 shall be supplied in various combinations to protect and provide isolation for:

- 3-wire, three phase 35 or 22/0.400 kV, Dyn11 distribution transformers (3 x 1 pole Fuse cut - outs required),

- 3-wire, three phase 35 or 22 kV spur lines (3 x 1 pole Fuse cut-outs required), and
- 2-wire, two phase 35 or 22/0.230 kV, I/I-O distribution transformers (2 x 1 pole Fuse cut outs required).
- On spurs for load break cut outs

The continuous current rating of the Expulsion fuse cut-outs shall be 200 A for use with Transformer and for Lines.

6.1 Ambient conditions

The Fuse cut out and fuse links 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)

7 Performance Characteristics

7.1 Cut-out

7.1.1 Ratings

Fuse Cut Out units shall comply with the following electrical characteristics:

MV system	22 kV	35 kV
Rated Voltage	24 kV	38 kV

Rated Frequency	50 Hz	50 Hz
Rated Continuous Current	200 A	200 A
Rated Impulse Withstand Voltage (1.2/50µs) – Terminal to earth Across insulating distance	 ≥125 kV ≥145 kV	 ≥170 kV ≥210kV
Power Frequency Withstand Voltage terminal to earth - dry 1min	≥50 kV	≥70 kV
Power Frequency Withstand Voltage across insulating distance dry 1min	≥60 kV	≥80 kV
Rated Asymmetrical Interrupting Current (50 Hz)	≥12 kA	≥12 kA
Inductive breaking capacity	1250 kVA	1250 kVA
Capacitive breaking capacity	10A	10A
Line charging current (no load) minimum breaking capacity	10 A	10A
Minimum Creepage distance: (1) Pollution level II area (medium): 20 mm/kV Pollution level III area (heavy): 25 mm/kV	 480 mm 600 mm	 760 mm 950 mm

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

7.1.2 Mounting arrangement and fabrication

The Pole-mounted fuse Cut-outs and Load break cut-outs shall be supplied complete with NEMA hot dip galvanized steel brackets, bolts, nuts and washers for mounting on a concrete pole or a galvanized steel cross arm. They shall be provided with a latch mechanism which will open the fused element when the fuse has operated. The latch mechanism shall be constructed to be easily operated from the ground with the aid of an operating stick.

Insulators shall be made of porcelain or polymer to withstand a mechanical force of 1600 N. Current carrying equipment shall be made of copper or copper alloy. The nominal rating of the units shall be 200 A for lines and for transformers. In addition, the units shall be capable of being opened under normal transformer magnetizing currents to permit transformer isolation.

Termination shall be suitable for the connection of terminal lugs and supplied with bolts, nuts, washers.

Load break cut-outs shall be capable of load break at least equal to 200 A.

7.1.3 Contacts

The Stationary and Movable Contact surfaces shall be Silver-plated to minimise contact resistance. The upper stationary contact assembly shall be provided with a safety latch to prevent the fuse carrier from dropping due to vibration. A back up spring made out of stainless steel or phosphor bronze shall be provided to ensure constant pressure between the upper stationary contact and the upper movable contact of the fuse carrier. The lower stationary contact support and the fuse carrier shall be machined at the swivelling or axle point to enable the fuse carrier with the fuse link to be correctly guided into the latching position by an operating rod. The hinge at the stationary contact shall be designed so as to prevent the dropping off of the fuse carrier in the drop-out position, due to shock and vibration. A suitable guiding arrangement shall be provided in the upper contact to ensure easy engagement of the fuse carrier. The asymmetrical current ratings shall be engraved/punched on the upper metal part (contact).

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7.1.4 Fuse Carrier

The fuse carrier shall be of fiberglass epoxy, or suitable insulating tubing for outdoor use with suitable inner layer for generating arc quenching gas and the outer layer of the insulating tubing shall be protected against deterioration due to ultra-violet radiation of the sun. The fuse carrier shall be suitable for use with removable button head type fuse links and interrupting the fault current stipulated above. The lower part of the fuse carrier shall be of a suitable spring loaded stainless steel flipper arranged toggle mechanism to ensure wiping action during arc interruption and fast clearance drop-out sequence. The installation and removal of the fuse carrier shall be facilitated by inserting the operating rod into a lifting eye at the hinge end (lower) of the fuse carrier when it is in the dropped-out position. An operating lever eye shall be provided at the top of the carrier to facilitate a downward pull by the operating rod to release the latch incorporated in the stationary upper contact. The design of the fuse carrier shall be such that the insulating tubing could be replaced in the event the same is damaged or burned.

7.1.5 Corrosion protection

Ferrous parts, unless of stainless steel, shall be hot dip galvanized. The minimum weight of zinc deposited generally shall be 610 g/mm², which is equivalent to a minimum average thickness of coating of 85 microns (µm) with a preference for 1,005 g/mm², which is equivalent to a minimum average thickness of coating of 140 microns (µm).

7.2 Load break cut-out

For Load break cut out:

- The insulating support (incoming) shall be equipped with an arc chute device made of UV resisting component.
- The fuse carrier shall be fitted with a fast-switching blade installed with a spring in order to allow operator independent breaking of load.
- The breaking load of the assembly (base, arc chute device blade and shall be at least equal to the maximum current fuse so 200 A.

7.2.1 Marking

The ratings and data of the Expulsion Cut-out Fuse shall be provided in the rating plate, which shall be weather and corrosion proof. The main rating plate near the supporting bracket of the insulator base shall carry the following information:

- Reference and year of the Standard adopted.
- Rated voltage/Rated maximum current.
- Class designation/Manufacturer's name or trademark.
- Asymmetrical current rating / Symmetrical current rating / X/R Ratio.
- Year of manufacture.

The following information shall be marked on the fuse carrier:

- Manufacturer's name or trademark.
- Rated Voltage / Rated frequency.

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- Rated maximum current.
- Rated breaking capacity (Asymmetrical/Symmetrical current rating &X/R Ratio.
- Operation number during life time

7.3 Fuse link

To be compatible with the Cut Out quoted (for being accommodated appropriately in the fuse holders)

7.3.1 Ratings

The fuse link shall have current characteristics, generally in accordance with NEMA SG2 Class K - Fast fuse link type.

Their time current (total clearing time) characteristics shall be in accordance with the following Table 8 – Melting currents for K type (fast[a]) fuse links[b] accordance to standard IEEE Std C37.42-2009 : *IEEE Standard Specification 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*.

The Supplier shall provide time-current characteristics of all the distribution fuse links of the offer. The performance characteristics of the fuse links shall include:

- Melting time-current characteristics

  The Supplier shall state the minimum and maximum melting currents required to melt the fuse links at the three appropriate time points used in table 6 of ANSI C37.42.1 or equivalent standard.
- Total clearing time-current characteristics

7.3.2 Mounting arrangement and fabrication

The fuse link shall be capable of accepting IEC/NEMA fuse elements from 1 A up to a maximum continuous current rating of 100 A.

The fuse link cap shall preferably be of the non-expandable type. The diameter of the button head cap on fuse links shall be 19.1 mm.

The arc shortening rod, if provided, shall be permanently attached to the fuse link cap. Fuse link material shall preferably include fiberglass.

All current carrying parts of the fuse links shall be of nonferrous material, the main requirement being resistance to atmospheric corrosion.

7.3.3 Rated currents

Rated current	Rated voltage
1 A	35 kV
2 A	35 kV
3A	35 kV
6 A	35 kV

10 A	35 kV
15 A	35 kV
And up to 200 A	35 kV
1 A	22 kV
2 A	22 kV
3 A	22 kV
6 A	22 kV
8 A	22 kV
15 A	22 kV
30 A	22 kV
And up to 200 A	22 kV

8 Delivery

Fuse cut out shall be delivered in car box containing 1 complete set.

Fuse links shall be delivered in bags containing 10 pieces.

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9 Technical Particulars

9.1 35 kV Cut-Out

	Description	Unit	Requirement	Supplier's Offer
	35 kV Cut-out			
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		to be specified	
5	Type/reference		to be specified	
6	Operating voltage	kV	35	
7	Rated max voltage	kV	38	
8	Rated continuous current	A	200	
9	Impulse withstand voltage 1.2/50μs Terminal to earth Across insulating distance	kV peak	≥170 ≥210	
10	Power frequency withstand voltage - 1 min dry- 50Hz Terminal to earth Across insulating distance	kV rms	≥70 ≥80	
11	Insulator		Porcelain or polymer	
12	Asymmetrical Interrupt Current	kA	≥12	
13	Minimum creepage distance Pollution level II area (medium): 20 mm/kV Pollution level III area (heavy): 25 mm/kV	mm	760 mm ☐ 950 mm ☐	
14	Termination and brackets, bolts, washers, nuts		To be described	

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.

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Full technical information shall be supplied within the bid.

Bidder signature:

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9.2 35kV Load Break Cut-Out

	Description	Unit	Requirement	Supplier's Offer
	35 kV Cut-out			
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		to be specified	
5	Type/reference		to be specified	
6	Operating voltage	kV	35	
7	Rated max voltage	kV	38	
8	Rated continuous current	A	200	
8a	Breaking current	A	200	
9	Impulse withstand voltage 1.2/50µs Terminal to earth Across insulating distance	kV peak	≥170 ≥210	
10	Power frequency withstand voltage - 1 min dry- 50Hz Terminal to earth Across insulating distance	kV rms	≥70 ≥80	
11	Insulator		Porcelain or polymer	
12	Asymmetrical Interrupt Current	kA	≥12	
13	Minimum creepage distance Pollution level II area (medium): 20 mm/kV Pollution level III area (heavy): 25 mm/kV	mm	760 mm ☐ 950 mm ☐	
14	Termination and brackets, bolts, washers, nuts		To be described	

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9.3 22 kV Cut-Out

	Description	Unit	Requirement	Supplier's Offer
	22 kV Cut-out			
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		to be specified	
5	Type and reference		to be specified	
6	Operating voltage	kV	22	
7	Rated max voltage	kV	24	
8	Rated continuous current	A	200	
9	Impulse withstand voltage 1.2/50µs Terminal to earth Across insulating distance	kV peak	≥125 ≥145	
10	Power frequency withstand voltage - 1 min dry- 50Hz Terminal to earth Across insulating distance	kV rms	≥50 ≥60	
11	Insulator		Porcelain or polymer	
12	Asymmetrical Interrupt Current	kA	≥12	
13	Minimum creepage distance Pollution level II area (medium): 20 mm/kV Pollution level III area (heavy): 25 mm/kV	mm	480 ☐ 600 ☐	
14	Termination and brackets, bolts, washers, nuts		To be described	

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

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Bidder signature:

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9.4 22kV Load Break Cut-Out

	Description	Unit	Requirement	Supplier's Offer
	22 kV Cut-out			
1	Country		to be specified	
2	Manufacturer		to be specified	
3	Manufacturer's reference		to be specified	
4	Standard		to be specified	
5	Type and reference		to be specified	
6	Operating voltage	kV	22	
7	Rated max voltage	kV	24	
8	Rated continuous current	A	200	
8a	Breaking current	A	200	
9	Impulse withstand voltage 1.2/50µs Terminal to earth Across insulating distance	kV peak	≥125 ≥145	
10	Power frequency withstand voltage - 1 min dry- 50Hz Terminal to earth Across insulating distance	kV rms	≥50 ≥60	
11	Insulator		Porcelain or polymer	
12	Asymmetrical Interrupt Current	kA	≥12	
13	Minimum creepage distance Pollution level II area (medium): 20 mm/kV Pollution level III area (heavy): 25 mm/kV	mm	480 ☐ 600 ☐	
14	Termination and brackets, bolts, washers, nuts		To be described	

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9.5 Fuse Link 35 kV

Fuse link				
1	Manufacturer		to be specified	
2	Manufacturing Country		to be specified	
3	Type		K	
4	Standard		to be specified	
5	Rated Voltage		35(38) kV	
6	Rated current	A	1 2 3 6 8 10 15 30 40 50 60 65 75 80 100 125 140 150 175 200	
7	Continuous current		1.5xI-rated	
8	Maximum clearing time at 5xI-rated		to be specified	
9	Maximum clearing time at 10xI-rated		to be specified	
10	Maximum clearing time at 30xI-rated		to be specified	
11	Maximum clearing time at 50xI-rated		to be specified	
12	Time-Current characteristics		to be specified	

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

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Full technical information shall be supplied within the bid.

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9.6 Fuse Link 22 kV

Fuse link				
1	Manufacturer		to be specified	
2	Manufacturing Country		to be specified	
3	Type		K	
4	Standard		to be specified	
5	Rated Voltage		22(24) kV	
6	Rated current	A	1 2 3 6 8 10 15 30 40 50 60 65 75 80 100 125 140 150 175 200	
7	Continuous current		1.5xI-rated	
8	Maximum clearing time at 5xI-rated		to be specified	
9	Maximum clearing time at 10xI-rated		to be specified	
10	Maximum clearing time at 30xI-rated		to be specified	
11	Maximum clearing time at 50xI-rated		to be specified	
12	Time-Current characteristics		to be specified	

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

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