



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

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**Technical Specifications
For MV Dropout Fuse Cutouts
12 & 24 kV (D.O.F)**



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CONTENTS

1- Scope.....	3
2- Applicable codes and standards.....	3
3- Environmental conditions.....	3
4- System parameters.....	4
5- Technical specifications for 11 &22 kV fuses.....	4
6- Basic features.....	5
6-a General.....	5
6-b Design, Construction.....	5
6-c Terminals.....	6
6-d Fuse holder and tube.....	6
6-e Fuse link.....	7
6-f Contacts.....	8
6-g Fuse base.....	8
6-h Insulators.....	8
6-i Load break hook.....	9
6-j Galvanizing.....	9
6-k Interchangeability.....	10
6-l Mounting arrangement.....	10
6-m Fuse tube assembly.....	10
7- Inspection and testing.....	11
7-a Type tests.....	11
7-b Sample and acceptance tests.....	12
8- Packing....	12
9- Marking and information.....	13
9-a Identifying marking.....	13
9-b Information to be given by manufacturer.....	13
9-c Information to be supplied with the offer.....	14
10- Catalogues, Drawings and samples.....	14
11- Rated current of fuse link.....	14
12- Warranty	14
13- Guarantee.....	15



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

1. Scope:

This specification covers the minimum technical requirements of the design, material, engineering, manufacturing, testing, inspection, packing, marking and performance for MV Dropout Fuse Cutouts (12 & 24 KV-50 Hz), intended to be used for the protection of the branches, pole-mounted transformers and capacitor banks for power-factor correction against short circuit and overcurrent at distribution networks.

2. Applicable codes and standards:

The equipment/material covered in this specification should comply with the latest edition/amendment of the following codes and standards.

* Where any provision of this specification differs from those of the standards listed below, the provisions of this specification should apply.

S.N.	Standard No	Description
1.	IEC 60282-2	High voltage fuses part2: Expulsion and similar insulators.
2.	IEC 60060-1	High voltage test techniques (Part 1).
3.	IEC 60168	Test on indoor and outdoor post insulators of ceramic material or glass for system with nominal voltages greater than 1000 V
4.	IEC 60815	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions system
5.	ANSI C 37.42	Specification for distribution cut outs and fuse links
6.	IEC 60071	Insulation co-ordination part1&part2
7.	DIN50976	Protection against Corrosion - Coatings on iron and steel components applied by hot dip zinc coating - Requirements and testing
8.	IEC 60549	H.V fuses for external protection of shunt power capacitors.

3. Environmental conditions:

Maximum daily mean temperature	45 °c
Maximum outdoor ambient shade temperature	50 °c
Minimum outdoor ambient shade temperature	-10 °c
Maximum relative humidity	95 %



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

Environmental conditions	Humid tropical climate Heavily polluted atmosphere
Service dust storm	Dusty atmosphere
Maximum Rainfall	250 mm
Altitude	1000 m

4. System Parameters

Nominal Voltage, kV	11	22
Rated voltage, kV	12	24
System frequency, Hz	50	50
Number of phases	3	3
System fault current (3 sec)	25 kA	20 kA

5. Technical Specifications for 11 & 22 kV Fuses:

The fuse should have the following technical specification:

Table (1)

No.	Specification item		
1	Nominal operating voltage kV	11	22
2	Maximum operating voltage kV	12	24
3	Type	Single pole, manually hook, stick operating, drop out, pole mounted.	
4	Rated continuous current of fuse link at 40 °C (I_r) A	6.3,10,16,20,25,40,50,63,80,100	
5	The fuse – base should carry current of (A) at 40 °C	50-100-200 A	
6	One – second thermal withstand current for fuse-link contacts and fuse-carrier contacts kA	25	20
7	Symmetrical interrupting rating (minimum) rms. kA	8	8
8	Rated insulation levels (of fuse or fuse-base):		



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

One-minute power frequency withstand voltage (dry and wet)		
To earth between poles and across the base, kV	28	50
Across isolating distance of fuse base, kV	32	60
Lightning impulse withstand voltage		
To earth between poles and across the base, kV	75	125
Across isolating distance of fuse base, kV	85	145
9	Leakage path of fuse base insulator	4 cm/kV

6. BASIC FEATURES

a. General

The Dropout Fuse Cutouts should be of Class A as per IEC 60282-2-clause 12.3.4. It should be suitable for use in outdoor circuits under tropical conditions stipulated in Clause 3.0 above. The Dropout Fuse Cutouts should be complying with the minimum technical requirements stipulated in Clause 5.0 above.

b. Design, construction

- 1- The Dropout Fuse Cutouts should consist of a fuse element inside a tube that has an open end, and when the fuse element melts, the electric arc extends between the two ends of the fuse, and as a result of the high temperature of this arc the tube material evaporates, which leads to the emission of a huge amount of gases that raise the pressure inside, which works To extinguish the electric arc and prevent its re-ignition. The gases are strongly expelled into the atmosphere from the upper end of the tube, where the intensity of the gas rush is used to bring down the entire fuse downward, so that it gives a visual evidence of its melting.
- 2- The Dropout Fuse Cutouts should be designed with a solid core, bird proof, and should be robust enough to withstand shocks due to frequent operations. The fuse carrier should drop-out immediately follow the blowing of the fuse.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

- 3- Dropout Fuse Cutouts within the same voltage class should be so designed that fuse carrier together with mounting assembly should be dimensionally compatible to facilitate the interchange of fuse carriers of the cutouts of the corresponding rating.
- 4- The fuse should be composed of fuse base, fuse holder with rewired fuse link, terminal, cross arm mounting bracket, completed with fitting bolt set and other necessary parts to form one cut-out fuse.
- 5- The installation and removal of the fuse carrier should 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 should 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
- 6- All castings such as upper and lower moving and fixed contacts, clamp type terminals, toggle mechanism should be of phosphor bronze, silicon bronze, aluminum bronze or Silver-plated brass.

c. Terminals

- Terminals should be of (bar has two holes) type and accommodated with Copper/Aluminum conductors of suitable sizes.
- The terminal should be made of copper alloy and tin painted.
- The upper terminal should be positioned to receive the conductor from either side or upward direction while the lower terminal should be able to receive the conductor from either side or downward direction.
- The maximum temperature rise for terminals and contacts (movable and stationary) should be according to table 12-IEC60282-2

d. Fuse holder and tube

- Fuse carrier (tube) should be made of high strength fiberglass – epoxy outer tube or suitable insulating material and it should be protected from the weather and environment by a UV resistant coating. The inside liner of the fuse tube should be constructed of an arc quenching material.
- The tube should have high bursting strength to sustain high pressure of the gases during fault interruption
- The fuse holder should be capable of attaching to and detaching from the hanger by hook stick.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

- The pulling eye-lifting eye inner diameters should be not less than 26mm.
- The fuse holder should be provided with a spring-loaded flipper which gives fuse link tension and wiping action.
- The flipper should also make the fuse link free from contact pressure and any opening and closing shocks.
- The inside diameter of the fuse tube should be 17.5mm.
- The solid cap on the single vent fuse holder is made of silver-plated brass, which provides efficient current transfer.

e. Fuse link

- The drop out fuse cut outs should be suitable in all respects for fuse links within the range as defined in IEC 60282-2. It should be K- type, high speed fuse links with pre arcing time current characteristics in accordance with table 10 – IEC60282-2.
- Typical dimensions for fuse-links having an inner arc-quenching tube and used in distribution fuse-cutouts and open-link cutouts and removable head (Annexe B – IEC60282-2).
- The rewired fuse links should be according table (1) &...EDC requirements and suitable for transformer ratings and branches.
- Dropout Fuse link is a fuse link to be mounted in a fuse holder installed in an outdoor overhead cutout.
- Easy to install and service.
- Fusible element should be designed to melt when a current of a large enough magnitude and duration passes through the element.
- The fuse link will consist of button head made of tinned copper, fuse element inside auxiliary vent tube and fuse tail of tinned copper strands that having ample length that can be mounted in different types of fuse holder.
- The clearing operation of the Dropout Fuse Cutouts should be with minimum noise, gas emission, burning debris and expelling by products.
- The rated current should be marked clearly and indelibly marked on the fuse body.
- Time - current characteristics should be in compliance with IEC 60282-2 standards and should be offered with tender together with detailed technical catalogue.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

- The values of cut – off current corresponding to each value of prospective breaking current should not exceed the values corresponding to the cut – off characteristics given by the manufacturer.

f. Contacts

- All contacts should be designed to give continuous rated current carrying capacity after exposure to marine and desert climates for the service life.
- Contacts should be silver plated to minimize the contact resistance.
- Top and bottom contacts, sub-assemblies and mounting fitting should be potted into the insulators.
- The upper fixed contacts assembly should not be corroded when exposed to atmosphere.
- Upper contacts should positively latch in the closed position to prevent the fuse carrier from dropping due to vibration and the upper contacts should be protected from any airborne contaminants
- The lower contacts should be with stainless steel backup springs to prevent arcing that may occur as the fuse tube rises slightly in the hinge during operation.
- The Asymmetrical breaking current ratings should be permanently marked on the upper metal part. (marking)
- All of current carrying contact parts should be given sufficient contact pressure to contact area by adequate back-up spring, with contact resistance not more than $100\mu\Omega$.
- The fuse-link contact, fuse – carrier contact should be made of high-grade silver – plated copper not less than 5 microns.

g. Fuse base

The fuse base should be bird-proof. The top and bottom assemblies as also the middle clamping hard wares should be either embedded in the insulator or suitably clamped in position. For insulators, the minimum breaking load should not be less than 900 Kg. (i.e. Mechanical failing load). or two unit's post insulators.

h. Insulators

- The insulators should be suitable material and bird proof. There should be no steel bands around the insulator. In case of stand- off insulator, the insulators should be rigidly connected to the channel base where provided so that the deflection of the



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

insulators under short circuit conditions is kept to a minimum and there is no tendency for them to work loose from the base.

- The insulator should be of solid core, providing high strength.
- It should have no moisture absorption and also be entirely free from deterioration.
- High uniformity in its quality should be assured by the mass production process under strict quality control.
- Insulator surface should be brown glazed to give a luster and smooth finish of uniform color.
- The Creepage distance over the insulator should be 4 cm / kV of line voltage.
- The insulator should be made of best quality glazed free from flaws, cracks, voids, uniform smooth, brown smooth, and color

i. Load break hook:

- The dropout fuse cutouts should be provided with a load break hooks to facilitate the use of portable load break tools. The attachment hooks should be made of galvanized steel.
- Hook stick is first attached to a universal pole at least 8 meter length. It is then positioned across the front of the type fuse cutout with the hook stick anchor hung on the attachment hook on the far side of the cutout. The pull ring of the fuse tube or is connect blade is engaged with hook stick's pull-ring hook and held fast with it.

j. Galvanizing

- All ferrous parts should be hot-dip galvanized. The supplier /vendor should state the weight/thickness of the coating layer (zinc) on the attached technical data schedule.
- All iron and steel parts such as mounting and support brackets, bolts, and nuts, washers, etc. should be galvanized after processes such as sawing, shearing, drilling, punching, filing, bending and machining is completed.
- The average thickness of steel 85 microns for the bolts and nuts is thickness equal to 43 microns.
- The galvanization is done in accordance with German specification No (DIN50976) or other approved specifications.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

k. Interchangeability of fuse link

- The fuse holder and tube of a dropout fuse cutout should be dimensionally compatible with a universal type IEC fuse link of corresponding rating. The cutout and fuse links should meet the interchangeability requirements of ANSI C 37.42.
- Compatibility of dimensions and pre-arcing time-current characteristics between different manufacturer's Dropout Fuse-links, permitting use of such fuse-links in fuse-carriers of alternative manufacturers, without significant alteration of the pre-arcing time-current characteristics.

l. Mounting arrangement

- The dropout fuse cutouts should be suitable for vertical mounting. The brackets including bolts, nuts, lock washers etc. should be in accordance with ANSI C 37.42 to prevent swiveling.
- Fuses should be mounted in the position specified by the manufacturer. For multiple arrangements of fuses, when the distance between poles is not fixed by the construction, the poles should be mounted with clearances not less than those specified by the manufacturer.
- Precautions should be taken concerning the selection of the site of installation of Dropout type fuses, due to the high level of noise and emission of hot gases during operation which are inherent in some types.
- Mounting arrangement should be made of high strength galvanized steel flat and should be robust enough to sustain the various stresses encountered during all operating condition of the cutout.

m. Fuse tube assembly

- The assembly should be designed in such a way that the fuse tube can be pushed-in into the slot even without taking due care even when the closing force is applied from angle.
- The toggle mechanism should provide locking action to protect the fuse link from shock. A spring assisted flipper should assist arc interruption by the withdrawal of the fuse tail.
- The fuse tube cap should preferably be of the non- expandable type.
- A lifting eye should be provided on the fuse tube and designed for use with a hook-stick from the ground level to pullout or close in the fuse carrier by manual operation.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

7. Inspection and testing

- Electricity Distribution Company (...EDC) reserves its right to carry out inspection during fabrication stages and witnessed the testing of fuses
 - The methods of carrying out the tests, selection of samples used for tests, and rejection of fuses should be accordance with all relevant applicable IEC standards.
 - All tests should be carried out by the manufacturer and on his expense under control and supervision of (...EDC) inspection engineer (s)
 - One-copy for both type and sample test certificates should be delivered to (...EDC)
 - Attendance of (...EDC) representative (s) during fabrication stages and testing should not release the manufacture of his responsibility for furnishing the fuses in accordance with the requirements of this specification and should not give him the right to invalidate any claim that (...EDC) may make because of defective or unsatisfactory material or faulty workmanship
 - Type tests certificates should be offered with tender.
 - Tests should be made in accordance with IEC 60282-2 and its amendments and may be witnessed by (...EDC) representative.
- a. Type tests.
- The dropout fuse cutouts offered should meet the type test requirements of the standards given below.
 - Conditions for performing the tests according to IEC60282-2 Clause (8.1)
 - The type tests to be conducted upon completion of a design or following a change that affects the performance are the following:
- 1- Dielectric tests.
 - Power frequency withstand (1minute dry and wet).
 - Impulse with stand (1.2 x50 μ sec).
 - 2- Temperature rise tests.
 - 3- Breaking tests.
 - 4- Test for time - current characteristics.
 - 5- Mechanical tests (for fuse-bases and fuse-links).
 - 6- Artificial pollution tests- IEC 60815.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

b. Sample / Acceptance tests:

- The following Sample / Acceptance tests as per IEC 60282-2 should be witnessed by the Representative of the Purchaser.
- If acceptance tests are agreed between user and manufacturer, they should be selected from the type tests. In addition, further tests or verifications may be requested, for example:
 - 1- Visual inspection.
 - 2- Dimensional verification.
 - 3- Measurement of resistance of fuse-links.
 - 4- Mechanical tests-(for fuse-bases and fuse-links)- (type test).
 - 5- Dielectric tests (type test).
 - 6- Test on fiber glass tube.

One sample of fiber glass tube will be selected from the lot under inspection and also for the type test and tested for the following tests as per BS-3953/105.

- 1- Electric strength of 25 KV when tested edgewise in oil at 90 °c
- 2- Insulation resistance of 10 meg.Ω (minimum) after emersion in water at 500 V DC.

8. PACKING

- Each dropout fuse cutout should be packed individually in a strong non-returnable wooden crate / card board box in such manner to prevent damage to components during transportation and handling up to installation site. Packing should be designed to prevent entry of dust, ingress of moisture and other foreign materials. The mounting bracket, where required, should be packed separately.
- Dropout fuse cutouts should not be packed in any organic material
- Each container should have the following information stenciled on it in English and /or Arabic.
 1. Manufacture's name.
 2. Country of origin.
 3. ...EDC purchase order number.
 4. Weight in kilogram.
 5. Handling instruction.
 6. Voltage and current rating.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

9. Markings and information

a. Identifying markings

- The minimum identifying markings on fuse-links, fuse-carriers, and fuse-bases are given below according to IEC 60282-2-clause 11.
- The identifying markings should be legible and durable for the service conditions. In case of doubt, a test according to 8.3 of IEC 60898 may be used.
- The figures representing ratings should in all cases be followed by the symbol of the unit in which they are expressed.

i) On the fuse-base:

- Manufacturer's name or trademark.
- Manufacturer's type designation (if any).
- Rated insulation level.
- Rated voltage (Ur).
- Rated current (Ir).

ii) On the fuse-carrier:

- Manufacturer's name or trademark.
- Rated voltage (Ur).
- Rated current (Ir).
- Rated breaking capacity and TRV class.
- Rated frequency.

iii) On the fuse-links:

- Manufacturer's name or trademark;
- Manufacturer's type designation (if any);
- Rated current (Ir) and speed designation (if any) ;
- Rated voltage (Ur) .

b. Information to be given by the manufacturer

- The manufacturer should make available to the purchaser the following information:
 1. The time/current characteristics for fuse-links.
 2. Mounting angle of the fuse, if applicable.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

c. Information to be supplied with the offer

1. Catalogues describing the equipment and indicating the model number.
2. Literature describing the operational and constructional features of the equipment and materials used for components
3. Overall dimensional drawings and separate dimensional drawing of the mounting arrangement, movable and stationary contacts, clamping terminals, toggle/tongue mechanism and insulator support.
4. Drawing of nameplate to scale, incorporating the particulars called for.
5. Completed schedule of guaranteed technical particulars (Annex A).

10. Catalogues, Drawings and samples:

- The tendered should submit with his offer a complete copy of outline drawings, with all dimensions and a complete catalogue containing full technical data and time - current characteristics curves and cut – off characteristics curves of the fuses.
- The tendered should also submit quality control procedure and origin certificate and test certificates.
- One sample of the offered model of the Dropout Fuse Cutouts unit should be attached with the offer to facilitate analysis and evaluation for each voltage rating offered.

11. Rated current of fuse link:

VOLTAGE	The transformer rating KVA	25	50	63	100	160	200	300
12 kV	Fuse link rated current	6.3	6.3	10	16	20	25	40
24 kV		6.3	6.3	6.3	10	16	16	25

12. Warranty

- All equipment provided should be fully warranted by the manufacturer for defects in material and workmanship for a period of 18 months from the date of delivery and 12 months from the date installation, unless and otherwise specified in tender documents.
- The manufacturer should carry all direct costs of correction and replacement of the defective materials or workmanship during the guarantee period, including transportation costs.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

- If no exception/deviations are taken to this specification and no list of deviations is submitted, it should be deemed that, in every respect, the offered dropout fuse cutouts and their accessories conform to this specification.
- يلزم تقديم خطاب اعتماد الشركة القابضة لكهرباء مصر (ساري) رفق العرض المقدم.

13. Guarantee:

- The tenderer should be filled in all guarantee tables attached to these specifications accurately. The offer which will not be accompanied with a complete copy of drawings, catalogues and filling guarantee tables will not be considered.
- Any tender not accompanied with it clear and complete guarantee tables should be rejected.



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

**GUARANTEE TABLE
For 11&22 kV FUSES**

S.No	DESCRIPTION	UNIT	VENDOR PROPOSED VALUES
1	Type	--	
2	Manufacture's name	--	
3	Country of Origin	--	
4	Reference manufactured standard	--	
5	Class Designation	--	
6	Type, Size and Material of		
7	i) Upper Terminal	--	
8	ii) Lower Terminal	--	
9	iii) Moving Contacts	--	
10	iv) Fixed Contacts	--	
11	Material of button head and fuse tail	---	
12	Weight of fuse link	kg	
13	Total length of fuse link	mm	
14	System Operating Voltage	kV	
15	Max Design Voltage	kV	
16	Continuous current capacity	A	
17	Interrupting current (symmetrical).	kA	
18	Total creepage distance of insulator	mm	
19	Power frequency with stand 1 min dry and wet: a)-To earth and between poles. b)-Across the isolating distances.	kV	
20	Impulse (1.2 μ sec). a)-To earth and between poles. b)-Across the isolating distances.	kV	
21	Ambient temperature during temperature rise tests.	°C	
22	Temperature rise of contacts.	°C	
23	Temperature rise of terminals.	°C	



EEHC DISTRIBUTION MATERIALS SPECIFICATION

EDMS 19- 402 - 1

Date: 1-12-2020

24	Material of support insulators.	---	
25	Color of the insulator.	---	
26	Type of Mounting Bracket	---	
27	Galvanizing thickness of contact	micron	
28	Galvanizing thickness of steel	micron	
29	Galvanizing thickness of bolts and nuts	micron	
30	Minimum breaking load (failing load)	KG	
31	Hook – stick length	m	

I / We guarantee the technical data given above for the offered material/equipment.

Signature

Date