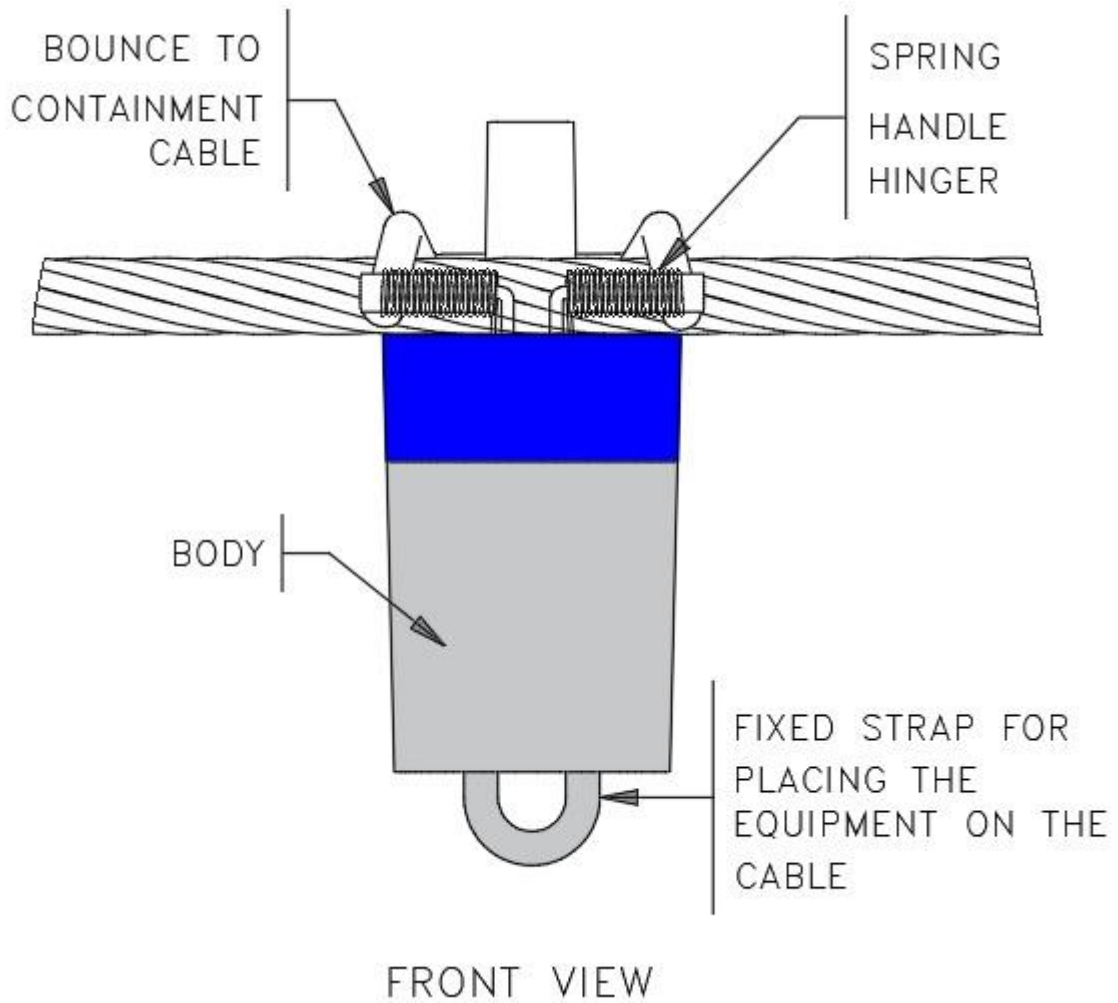


Figure 1 – MV Fault Current Indicator



NOTE: Illustrative picture

Table1 – Features and Codes

Item	Voltage range F-N (kV)	Current (A)		Supportability the failure (kA)/10 cycles	Frequency (Hz)	Outer diameter cable application (mm)	Code ENEL CE, GO and RJ
		Icc Failure	Current range				
1	7.867 - 19.92	50 - 1200	0-200	25	60	4 - 38	160194

1. Material

All components must resist UV rays, saline atmosphere and pollution;

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2. Constructive characteristics

- a) Indicate transient and permanent faults through the determined trip value, through the emission of luminous and indication through a high luminosity LED, the device must be easy to install.
- b) Signaling of high luminosity LED indicators is related to the color specifications according to the manufacturer's manual;
- c) The high luminosity LED indicators must point downwards for correct visualization and indication;
- d) Fixing/installation/removal: Exclusively through a distance maneuver stick, through an eyelet suitable for this purpose, developed in the body of the equipment;
- e) It's use can be carried out in aerial installations, with the cable being bare or covered;
- f) Mechanical impacts resistance , as indicated in 5.1 h)
- g) Auto adjustment of trip value;
- h) Device must be sealed with IP65 degree of protection, according to ABNT NBR IEC 60529;
- i) All components must be designed to withstand vibrations caused by short circuits in feeders and caused by winds;
- j) Power: Through lithium batteries with a useful life of at least 10 years (1,200 h) or self-powered, without the need for external sources;
- k) Low Pass Filter: Have a low pass filter in order to decrease the sensitivity to fault current waveforms with high harmonic content in order to reduce the number of false/incorrect activations.

2.1 Conditions of Service

The failure indicators covered by this technical specification must be designed and manufactured to operate at any level of contamination, in tropical climate, saline atmosphere, exposure to the direct action of the sun's rays, heavy rain, and must receive adequate treatment to resist environmental conditions indicated in the **Table 2**.

Table 2: Environmental service conditions

Feature	Enel Ceará	Enel Goiás	Enel Rio	Enel São Paulo
Maximum Altitude (m)	1,000			
Minimum Temperature (°C)	0			
Maximum Temperature (°C)	+40			
Average Relative Humidity (%)	> 80			
Maximum Wind Pressure (N/m ²)	700			
Contamination Level (ABNT IEC/TR 60815)	and (Very Heavy)	c (Average)	and (Very Heavy)	c (Average)
Salinity Level (mg/cm ² day)	>0.3502	-		
Maximum Solar Radiation (wb/m ²)	1,000			

3. Functional Features

Sensor must have a microprocessor to determine the system current by measuring the output of an open core current transformer inductively coupled to an overhead conductor. The sensor must be placed in the upper conductor part



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by a provision that guarantees the fixation on the conductors according to the range of external diameter determined in the Table1, it will be energized for the conductor's line potential.

The MV fault current indicator microprocessor shall have the self-adjusting function allowing it to automatically select the best trip level in relation to the currently measured current.

3.1 Perform automatic reset/reset:

- a) Manual by magnetic device approximation;
- b) By time (determined 8 to 16 hours);
- c) Load current (line current restoration);
- d) Line voltage (line re-energization);

Note: The equipment must indicate/signal transients even when re-establishing through items c) and d);

3.2 Trip:

- a) Logical: The circuit based on a microcontroller should automatically select the trip limit based on the load current sampling. The sensor must have a fault trip limit/set ranging from 50 to 1200 A.
- b) Response time: maximum trigger response time of 50 ms

3.3 Inrush restriction

The indicator shall have an inrush restraint feature activated by loss of current and / or loss of voltage to prevent false activation of inrush currents resulting from transformer energizing during automatic reclosing operations and when energizing the system.

3.4 Reliability

The proponent in a technical proposal must inform the Mean Time Between Failures (MTBF).

3.2 Test operation


The indicator must have a light sequence activated by magnetic toll in order to indicates that all operation are normal.

4. Identification

The indicator body must contain at least the following information, on an appropriate label that resists all the conditions provided for in the item 0:

- a) Manufacturer name;
- b) Product trade name;
- c) Lot number and date of manufacture;
- d) Model;
- e) Frequency and nominal voltage;
- f) Maximum mass of equipment, in kg.

5. Essay

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5.1 - Type Tests

The type tests must comply with ANSI/IEEE 495:

- a) Visual and dimensional inspection;
- b) Functional tests of actuation and signaling and reset (reset), according to ANSI/IEEE 495 (4.2.2);
 - Actuation current, current reset;
 - Automatic reset by current and time;
 - Manual reset;
 - Indicator signaling (LED);
- c) Temperature cycle as per ANSI/IEEE 495 (4.4.1);
- d) Water submersion, according to ANSI/IEEE 495 (4.4.2);
- e) External weathering of plastics, according to ANSI/IEEE 495 (4.4.3);
- f) Salt Spray, per ANSI/IEEE 495 (4.4.4);
- g) Traction test (electrical conductor), according to ANSI/IEEE 495 (4.4.5);
- h) Mechanical test according to ABNT NBR IEC 60068-2-32 and prescribed according to:
 - Surface: Concrete;
 - Height of free fall: 12 m;
 - Fall conditions: Shock produced by field installation (free fall);
 - Number of falls: 2;
 - Sample rejection criterion: Do not perform the operation cycle (operation)
- i) Short Duration Current Test, according to ANSI/IEEE 495 (4.4.7);
- j) Effect of currents (adjacent conductors), according to ANSI/IEEE 495 (4.4.8);
- k) Actuation Characteristic (trip test), according to ANSI/IEEE 495 (4.4.9);
- l) Reset test, according to ANSI/IEEE 495 (4.4.10);
- m) Overcurrent response test, according to ANSI/IEEE 495 (4.4.11) and requirements indicated in Table1;

5.2 Receipt tests

The receiving tests are the tests mentioned in the paragraphs **a) and b)** of item 5.1 of this document.

6. Sampling

Sampling plans according to ABNT NBR 5426:

- n) Dimensional verification: double sampling, level II, EQS 1.0%;
- o) Mechanical tests: double sampling, level S4, EQS 1.0%.

7. Transport, Packaging and Packaging

- a) The tapes must be packed in suitable packaging that allows for their handling, storage and transport, from the factory to the installation site, without causing damage to them;



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- b) The tapes must be packed in a sealed plastic bag that prevents the penetration of moisture;
- c) Plastic packaging must be packed in palletized cardboard boxes, with a maximum mass of 23 kg;
- d) Provide packaging that contributes to the circular economy and the environment.

8. Supply

To supply Enel Distribuição Ceará, Enel Distribuição Goiás, Enel Distribuição Rio and Enel Distribuição São Paulo, a prototype must be previously approved.

The bidder must provide, together with the failure indicators, the special tools necessary for operation, assembly and maintenance.

All necessary spare parts must be specified in the technical proposals, as well as the information for each component.

8.1 Field Testing

- a) Installation tests, light sequence and correct fixation on conductors, according to the interval established in **Table1**;

9. Warranty

18 months from the date of entry into operation or 24 months from the delivery, whichever occurs first, against any manufacturing, material and packaging defect.

10. Standards and Complementary Documents

ABNT NBR 5426, Sampling plans and procedures in inspection by attributes;

IEEE 495-2007, IEEE Guide for Testing Faulted Circuit Indicators;

ABNT IEC/TR60815, Guide for selection of insulators under polluted conditions;

ABNT NBR IEC 60529; Degrees of protection provided by enclosures (IP Codes);



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