



TECHNICAL SPECIFICATION NO
CE/Testing /MSC-I/FPI/2018

**NON COMMUNICABLE FAULT PASSAGE DETECTION
SYSTEM FOR 33kV, 22kV AND 11kV OVERHEAD
NETWORKS**

**FOR
DISTRIBUTION SYSTEM**

IN

MSEDCL

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**TECHNICAL SPECIFICATIONS OF NON COMMUNICABLE FAULT
PASSAGE DETECTION SYSTEM FOR 11 kV, 22 kV and 33 kV OVERHEAD
NETWORKS**

1.0 SCOPE:

1.1) This specification covers design, engineering, manufacturing, testing at manufacturer’s works, supply, delivery, erection, testing and commissioning of Non communicable type (as per the scope of tender) Fault passage Indicator (FPI) on the selected feeders.

1.2) It is not the intent to specify completely herein all the details of design and construction of the Fault passage Indicator (FPI). However, the equipment shall conform, in all respects to high standards of engineering, design and workmanship with recent editions. It shall be capable of performing in continuous commercial operation up to the supplier's guaranteed life of equipment in a manner acceptable to the purchaser who will interpret the meanings of drawings and specifications and shall have power to reject any work or material which, in his judgment, is not in accordance therewith. The Fault passage Indicator (FPI) offered shall be complete with all components necessary for its effective and trouble free operations. Such components shall be deemed to be within the scope of supplier's supply, irrespective of whether those are specifically brought out in this specification and/or in the commercial order or not.

1.3) The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

2.0 FAULT DETECTION SYSTEM MAINFUNCTIONS:

- a) To monitor, and record the line data for the following : Load current, electric field, line temperature, ambient temperature, fault current (max. 1200 A), Line status(On/Off)
- b) To indicate occurrence of permanent fault and restoration after manual resetting by MSEDCL staff.
- c) For transient faults, indication should be automatically resetted.

3.0 SYSTEM PARAMETERS:

- a. Nominal system voltage ... 33 KV 22KV11KV
- b. Corresponding highest system voltage... 36 KV 24KV12KV
- c. Frequency ... 50 Hz ± 3%
- d. Number of phases ... 3
- e. Neutral earthing ... Solidly earthed
- f. Short ckt. Current Rating ... 25 kA for 3sec
- g. Conductor Diameter ... 5 to 35 mm

3.1 SERVICECONDITIONS

Max. ambient temperature	: 50 Deg.C
Min. ambient temperature	: -5 °C
Max. relative humidity	: 100 %
Max. annual rainfall	: 1450 mm
Max. wind pressure	: 150 kg/sq.m.
Max. altitude above mean sea level	: 1000 mtrs.
Isoceraunic level	50
Seismic level(Horizontal acceleration)	: 0.3 g.
Climatic Condition:	Moderately hot (exposed to sun) and humid tropical climate conducive to rust and fungus growth
Wind speed:	: Wind speed 150 km /Hour

The climatic conditions are prone to wide variations in ambient conditions and hence equipment shall be of suitable design to work satisfactorily under these conditions.

4.0 REFERENCE STANDARDS:

The Fault passage Indicator (FPI) including the operating devices, accessories and auxiliary equipment forming integral part thereof, shall be designed, manufactured, assembled and tested in accordance with the relevant standards, specification and codes of practices, referred to herein and shall be the latest editions including all applicable official amendments and revisions.

The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes.

Unless otherwise specified, the equipment offered shall conform to the latest applicable Indian, IEC, British or U.S.A Standards and in particular, to the following:-

IEC 60068	Environmental testing
IEC 61010	Standard for safety requirements for electrical equipment for measurement, control, and laboratory use
IEC 61000	Standards for Electromagnetic compatibility
IS 11353/1985	Guide for Uniform System of Marking and Identification of Conductors and Apparatus Terminals
IS 1248/2003	Indicating instruments.
EN 60-950	Product Safety testing standard for "Information Technology Equipment" (known as ITE)
IEC 60529	Protection against accidental contact, foreign Objects and water
IEEE 495:2007	Guide for testing faulted circuit indicators

The components and devices which are not covered by the above standards shall conform to and comply with the applicable standards, rules, codes, and regulations of the internationally

recognized standardizing bodies and professional societies as may be approved by the Employer and the manufacturer shall list all such applicable standards, codes etc.

Equipment conforming to any other internationally accepted standards will also be considered if they ensure performance and constructional features equivalent or superior to the standards listed above. In such case, two copies of such standards in authentic English translation, if the language of the standard is other than English shall be provided. In case of dispute, the stipulations in the English translation, submitted by the manufacturer, shall prevail. Further, in the event of conflict between the stipulations of standard adopted by the manufacturer and the corresponding IEC/Indian Standard Specification, the stipulation of Indian Standard Specification shall prevail.

5.0 NON COMMUNICABLE (FPI) GENERAL REQUIREMENTS:

5.1) Fault Passage detection and Indication systems to be installed on 33kV, 22kV & 11kV Overhead Electric networks for fault and data communications by audio visual communication. The Non communicable Fault passage Indicator (FPI) shall be designed, manufactured and tested in accordance with the best international engineering practices under strict quality control to meet the requirement stipulated in the technical specification. Adequate safety margin with respect to thermal, mechanical, dielectric stress, dynamic short circuit fault and insulation coordination is to be maintained during design, selection of raw material, manufacturing process etc. so that the Fault passage Indicator (FPI) provides long life with least maintenance.

5.2) The Non communicable Fault passage Indicator (FPI) shall be designed to manage the risks associated with it such that there shall not be any safety hazard to the employees in normal service and during inspection and maintenance.

5.3) The workmanship shall be of the highest quality and shall conform to the latest modern practices for the manufacture of high technology machinery and electrical equipment.

5.4) The Non communicable Fault passage Indicator (FPI) shall be totally safe against inadvertent touch (by human/animal) of any of its constituent live parts.

5.5) All necessary equipment required for Non communicable Fault passage Indicator (FPI) handling at site (if any), shall be arranged by the supplier at their own cost during commissioning and further servicing in Guarantee Period(GP).

5.6) The Non communicable Fault passage Indicator (FPI) shall be cooled by natural airflow.

5.7) Bidder shall supply, install and commission FPI as per clause no. 6 of this specification in the selected feeders of the Utility. There shall be suitable clamping mechanism in such a way that FPI can be easily mounted and removed from live conductors. Line mounting and removing shall be easily and rapidly done with a hot-stick. Suitable Hot stick, >60KV insulated, preferably 12 meter long and Magnet for Manual reset shall be part of the supply. One hot-stick for every 30 FPI and part thereof shall be provided by the bidder.

5.8) Non Communicable FPI shall be used in the selected feeders to optimize the system. Bidder has to design the system to optimize the quantity of FPI to get the desired benefit out of the proposed system.

5.9) All the components of fault detection system shall be antirust, corrosion resistant and UV resistant hence suitable for long time outdoor exposure ensuring long life.

6.0 MAJOR PARTS OF FAULT DETECTION SYSTEM:

The detection system shall comprise (under the scope of bidder) three fault passage indicators mounted on three phases.

Fault Passage Indicators

6.1) 3 Fault Passage Indicators shall be clipped on one line, one on each phase so that to measure current and voltage presence in that phase and compute fault detection algorithm accordingly.

6.2) The Fault Passage Indicators shall be suitable for mounting on live line conductors and suitable clamps shall have to be designed so that the Fault Passage Indicator can withstand wind pressure as specified without falling from the line. The components used in the Fault Passage Indicators shall be suitably protected from direct sunlight to prevent malfunctioning due to solar radiation.

6.3) The Fault Passage Indicator shall be fully self-contained type without any external connection, indicator or sensors. The Fault Passage Indicators shall be suitable for use on multiple lines supported by the same pole.

6.4) In case of either vertical or horizontal configuration of line, efficiency of FPI should not be degraded.

6.5) The Fault Passage Indicator (FPI) shall be self-supplied from a non-rechargeable (lithium) battery of a minimum life time 10 years or minimum 800 hours flashing for fault indication in the temperature conditions (avg. ambient 40 deg C),

6.6) Battery shall be replaceable type in case battery failure.

7.0 WORKING/ OPERATIONAL DETAILS:

Fault detection:

7.1.1) Phase-to-phase and phase to earth Faults shall be detected by the Fault Passage Indicator. The fault sensed on measured current and Voltage and based on the electromagnetic field and its variations.

7.1.2) The Fault Passage Indicator shall be of the programmable type and suitable for sensing Short-circuit and Low earth leakage faults down to 5A.

7.1.3) The Fault Passage Indicators shall detect faults based on two simultaneous tripping criteria such as

- On phase-to-phase faults, it shall operate when the phase current exceeds an absolute threshold followed by interruption of voltage longer than 100 ms. This absolute threshold must be user configurable to different values preferably between 75A to 1200A based on nominal currents.
- On phase-to-earth faults, it shall operate when the phase current exceeds an absolute threshold followed by interruption of voltage longer than 100 ms. This threshold must be

configurable to at least 6 different values between 5A to 160A.

It shall be possible to disable this second tripping criterion. Further it may be noted that depending on site conditions, the bidder has to do proper FPI settings.

7.1.4)The Fault Passage Indicator which is detecting the variation of the electromagnetic field due to fault current (Fault Passage Indicators installed between the circuit breaker and fault point) shall provide a fault indication, while Fault Passage Indicators downstream the fault or on non-faulty branches shall not provide any indication.

7.2) Fault indication:

7.2.1)The fault indication shall be a flashing light with good contrast against sunshine (red colour) and an MTBF light emitting at least 45000 Hours (LEDs for instance). It shall provide a very high visibility of an intensity of 40 Lumens (minimum) and give a 360° visibility angle from at least 50 meter in sunny day conditions, and at least 300 m at night. Total flash duration shall not be less than 800 Hours. Flashing period for both permanent faults and transient faults shall be distinct and configurable. Say 1 flash in every 6 seconds. The duration of flash indication shall be adjustable from 2 to 16 hours.

7.2.2)The Fault indication shall remain until:

- a. time-out, configurable to at least 4 possible values between 2 and 16 hours, has expired,
- b. the medium voltage is back,
- c. the Fault Passage Indicator is reset manually,
- d. Whatever condition comes first

Caution: since the load current might be very low upon MV return, load current reset is not acceptable.

7.3 Fault indication resetting:

7.3.1)Local light indication flashing stopped.

7.3.2)The Fault Passage Indicator shall include some self-test possibility usable when it is on the line (powered or not).

7.3.3)The Fault Passage Indicator shall be selective in action as indicated below:

- a. It shall not respond to any sudden variation (increases/decrease) in load current,
- b. It shall not respond to an over current not due to a fault,
- c. It shall not respond to high magnetizing inrush currents, created upon line energizing.

7.4 Measurements :

The Fault Passage Indicator shall continuously measure the current passing through the conductor on which it is clipped.

8.0 TYPETESTS:

The product shall be fully type tested as per relevant latest IEC or other standards. Following type test reports shall be submitted with the technical bid. These tests must have been conducted on the offered items in the NABL or internationally accredited laboratory within last **Five years** prior to date of validity of the offer.

All the equipment's offered shall be fully type tested as per the relevant standards, amended up-to-date. The supplier shall furnish the type test reports and certificate of accreditation issued by

the testing authority along with the offer. These tests must not have been conducted earlier than **Five** years from the date of opening of bids.

In case these type tests are conducted earlier than **Five** years, all the type tests as per the relevant standards shall be carried out by the successful bidder in the presence of purchaser's representative at free of cost before commencement of supply. The undertaking to this effect should be furnished along with the offer without which the offer shall be liable for rejection.

The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of his representative. For this purpose the supplier may quote unit rates for carrying out each type test.

For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of tests without any extra cost before commencement of supply. In this case the bidder shall bring out in his offer all such changes made in components, materials, design etc. as the case may be.

The company shall have the option to carry out various tests including type tests as per specification on the samples selected at random from the supplies effected, to ensure that the supplies conform in quality and workmanship to the relevant specification. The testing shall be done at an independent laboratory at company's cost. Due notice shall be given to supplier for such sample selection and such testing thereof to enable him to be present for the same if so desired by him. If the supplier or his authorized representative fails to attend the sample selection and testing, the same shall be carried out unilaterally by the company and the result thereof shall be binding upon the supplier. In case the sample selected from the supplies fails to withstand the required tests, then:-

- a. For first time failure of sample, supplier shall have to replace the full quantity of the respective inspected lot supplied to various Stores and lying unused at Stores.
- b. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
- c. In respect of further supplies made against the order, if failure of samples is noticed (i.e., second time failure against the order) then the quantity lying unused at various Stores shall be rejected.
- d. For the quantity already accepted against the order and used, deduction in price of 10% of the value of material supplied shall be made.
- e. Balance quantity against the order including the rejected qty. shall be cancelled without any liability on either side.
- f. The firm will be debarred from dealing with the company up to a period of three years from the date of rejection.

9.0 TRANSPORTATION:

The bidder shall be responsible for the loading, transport, handling and off-loading of all equipment and materials from the place of manufacture to site. The bidder shall be responsible for any type of damage during transportation.

10.0 MARKING ON FAULT PASSAGE INDICATORS:

Each Fault Passage Indicator shall carry a weather and corrosion proof plate indicating the following particulars.

- a. Property of MSEDCL
- b. Manufacturer's identification.
- c. Model or type number (as per catalogue) & Sr.No.

- d. Month and Year of manufacture in characters big enough to allow reading from the ground so that to provide indication of battery age.
- e. PO number and date
- f. Guarantee period

11.0 INSPECTION:

- a. The inspection may be carried out by the purchaser at any stage of manufacture. The successful Tenderer shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.
- b. The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for stage inspection.
- c. The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall keep the purchaser informed, in advance, about such testing program.

12.0 FACTORY ACCEPTANCE & ROUTINE TESTS:

All acceptance and routine tests of fault passage indicator unit and interface unit as per relevant IS/IEC/IEEE standards shall be carried out by the supplier in the presence of purchaser's representative without any extra cost to the purchaser.

(Note: - All measuring/testing equipment's shall be of appropriate class of accuracy and shall have valid calibration certificates which shall be produced to the Inspecting Officer for verification.)

After finalization of the program of type/acceptance/routine testing, the supplier shall give three weeks advance intimation to the purchaser, to enable him to depute his representatives for witnessing the tests.

13.0 QUALITY ASSURANCE PLAN:

The Bidder shall supply documentary proof that the manufacturer possesses ISO 9001 certification, from an independent internationally recognized body, for the design, manufacture and testing of Fault passage Indicators for medium voltage lines.

The tenderer shall invariably furnish information along with his offer, failing which his offer shall be liable for rejection.

Information and copies of test certificates in respect of bought out accessories.

List of areas in manufacturing process, where joint stage inspections are normally carried out by the tenderer/purchaser for quality control and details of such tests and inspections.

Special features provided in the equipment to make it maintenance free.

List of testing equipment available with the tenderer for final testing of equipment such as type, special, acceptance and routine test specified herewith. The successful tenderer shall, within 30 days of placement of order, submit following information to the purchaser. The List of bought out accessories and name of sub-suppliers selected from those furnished along with the offer.

- a) Type test certificates of bought out accessories
- b) Quality assurance plan with holds points for purchaser's inspection.

13.6. The quality assurance plan and purchaser's hold points shall be discussed between the purchaser and supplier, before it is finalized.

The successful tenderer shall submit the routine test certificates of bought out accessories at the time of routine testing of the fully assembled for the goods manufactured within purchaser's country.

14.0 PERFORMANCE GUARANTEE:

The equipment's offered shall be guaranteed for satisfactory performance for a period of 60 months from the date of satisfactory commissioning of equipment. The equipment's found defective/failed within the above guarantee period shall be replaced/repared by the supplier free of cost within one month of receipt of intimation. If the defective/failed equipment's are not replaced/repared as per the above guarantee clause, the company shall recover an equivalent amount plus 15 % supervision charges from any of the

The bidder shall furnish an assurance that the necessary spare parts and after sales service will be provided to the fullest satisfaction of MSEDCL, for at least ten (10) years. A list of free spare parts and tools supplied shall be furnished with the offer.

15.0 DRAWINGS AND DOCUMENTATION:

Each device shall be supplied with a user manual for installation, maintenance and commissioning at site. General arrangement drawings and technical literature for FPI unit shall be submitted along with the bid.

16.0 PACKING AND FORWARDING:

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable materials shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper lifting arrangement such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information:

- a. Name of the consignee.
- b. Details of consignment.
- c. Destination.
- d. Total weight of consignment.
- e. Sign showing upper/lower side of the crate.
- f. Handling and unpacking instructions.
- g. Bill of materials indicating contents of each package and spare materials

The supplier shall ensure that the packing list and bill of materials are approved by the purchaser before dispatch.

17.0 SUPERVISORY ERECTION AND COMMISSIONING:

The erection and commissioning of the FPI shall be supervised, if required by the Purchaser, through one work-trained Engineer/technician who shall direct the sequence of erection and make necessary adjustments to the apparatus and correct in the field any errors or omissions on the part of the tenderer in order to make the equipment and material properly perform in accordance with the intent of this specification. The representative shall also instruct the plant operators in the operation and maintenance of equipment furnished. Skilled workers, all the ordinary tools, equipment and cranes required for FPI erection, shall be provided by the purchaser. Apart from the above, the purchaser shall not be responsible for any other expenses incurred by the tenderer and expenses such as Erector's salary, insurance against personal injuries to the Erector etc., shall be to tenderer's account. Special tools, if required for erection and commissioning shall be arranged by the supplier at his cost. The supplier shall be responsible for any damage to the FPI on commissioning, if it results from faulty or improper assembly unless the erector can conclusively prove that the damage has occurred on account of intentional mistake on the part of the skilled workers provided by the purchaser. If any miscellaneous accessories are required for commissioning at site, then no additional cost will be paid.

18.0 TRAINING TO THE MSEDCL' STAFF:

Before Commissioning & after completion of Erection of the FPI, the successful bidder shall deliver installation, Operation & Maintenance Training including settings at different site to the personnel as deputed by the MSEDCL. The successful bidder shall submit the training schedule to the site authority for MSEDCL. The Training should be comprehensive to the satisfaction of the trainees. The Trainer should cover both theoretical & practical aspects of the modules, operation & maintenance requirements of the modules etc. The trainer shall also exhibit major components of the modules separately for visual clarity of the trainees with better understanding. The successful bidder shall bear every cost required for the Training.

19.0 TENDER SAMPLE:

The bidder shall have to submit one sample of offered make FPI along with bid documents. The sample submitted shall be tested at Govt. approved /NABL accredited laboratory/ MSEDCL testing Division as decided by the MSEDCL for the following test.

FPI outer case shall be wrapped with conductive foil and may be treated as earth terminal and jaw or fixing arrangement of FPI may be kept as live terminal where conductor is to be placed. There shall be min 2 cms distance between live terminal and earth terminal. Insulation resistance shall be measured with min. 500 Volts megger between live terminal and earth terminal of FPI. IR value shall be more than 100 Mega ohms.

20.0 GUARANTEED TECHNICAL PARTICULARS**Overhead Fault Passage Indicator (Communicable)**

Sr. No.	Description	Unit	To be specified by Bidder
A	Application		
1	Make and Model of FPI and country of origin		
3	Distribution Network Voltage (6 to 35 kV)	kV	
4	Power Frequency	Hz	
5	Short-Circuit withstand (31.5 kA/ 2 Sec)	kA/s	
6	Earthing system		
7	Conductor Diameter (5 to 35 mm)	mm	
8	Load current range	Amp.	
B	Fault detection Parameters		
9	Current setting Trigger value	Amp.	
10	Transient and permanent faults detection	Yes/ No	
11	Fault confirmation		
12	Minimum impulse time	msec	
13	Flash Indication Duration (user settable)		
14	Inrush transient restraint	Sec	
C	Reset(Permanent fault)		
15	Automatic Power Return		
16	Timer Reset	Min	
17	Manual Reset		
D	Fault Indication		
18	Indication		
19	Light Power	Lumens	
20	Visibility of LED indication at night and visibility Angle (300 mtr and 360 degree)	Meter and Degree	
21	Flash Period for permanent faults	Sec	
22	Flash Period for transient faults	Sec	
23	Standard total flash duration (800 hrs)	Hrs	
E	Power Supply		
24	Battery type		

25	Life of the Battery Years considering Avg. ambient 40 deg C (upto 10 years or 800 hours of LED indication)		
F	Environment		
26	Operational Temperature (-30 to 70 Deg C)	Deg C	
27	Storage Temperature	Deg C	
28	IP rating of FPI (IP 68)		
G	Mechanical		
29	Wind speed (up to 150 km / Hour)	km / Hour	
30	Weight	Kg	
31	Dimensions	mm	
H	Type test		
32	Whether type testing done in accordance with relevant specs and valid reports submitted	Yes/No	
33	Operational Temperature (-30 to 70 Deg C)	Deg C	
34	Operational humidity (100 %)		
35	Battery capacity	V and Ah	
36	Battery life (8 years)		

21.0 NON-COMPLIANCE SCHEDULE:

On this schedule the bidder shall provide the list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to relevant specification clause.

Clause No.	Non-compliance

Signature and seal of the manufacturer

Date:

I/ We certify that the above data are true and correct

Signature and seal of the bidder

Date: