

Group - V



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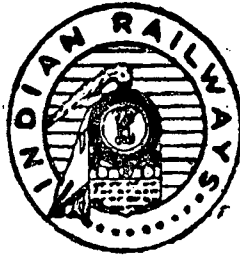
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**SPECIFICATION NO. ETI/PSI/14 (1/86) ✓**

**25 KV DROP OUT FUSE SWITCH AND OPERATING POLE**

127042

**RESEARCH DESIGNS & STANDARDS ORGANISATION  
MINISTRY OF RAILWAYS  
GOVERNMENT OF INDIA  
LUCKNOW-226011**



INDIAN RAILWAYS

SPECIFICATION NO. ETI/PSI/14 (1/86)

25 KV DROP OUT FUSE SWITCH AND OPERATING POLE

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APRIL-1987

ADDENDUM/CORRIGENDUM SLIP NO. 1 OF  
TRACTION INSTALLATION DIRECTORATE  
SPECIFICATION NO. ETI/PSI/14(1/86)  
FOR 25 KV DROP-OUT FUSE SWITCH AND  
OPERATING POLES.

The existing paras 8.2.2(vi) & (viii) at para 7 shall be re-read as under :-

8.2.2 (vi) Cantilever load test :

- (a) The complete assembly of operating pole shall be subjected to a cantilever load of 2 Kg. on the top end, the base being clamped horizontally at intervals of 300mm and 1000 mm from the bottom end. The deflection of the top end from the horizontal level shall be measured and recorded. The operating pole should withstand this test, without any permanent deformation.
- (b) Base remaining clamped, the load shall then be removed from the top end. The deflection at the top end measured from the horizontal level should not exceed 300 mm.

8.2.2(viii) Mechanical endurance test :

- (a) The operating pole assembly shall be tested for mechanical endurance by assembling and disassembling the operating pole 200 times each time pulling out and putting back the fuse carrier tube on to the DD fuse switch. After this test, there shall be no surface defects in the glass fibre tube. Also, no loosening of joints should take place.
- (b) The cantilever load test shall be repeated after the mechanical endurance test and it shall be verified that deflection do not exceed the values measured/ specified in para 8.2.2(vi) above.

127044

APRIL 1987

ADDENDUM/CORRIGENDUM SLIP NO.1 OF  
TRACTION INSTALLATION DIRECTORATE  
SPECIFICATION NO. ETL/PSI/14(1/86)  
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8.2.2.(viii) Mechanical endurance test:

- (a) The operating pole assembly shall be tested for mechanical endurance by assembling and disassembling the operating pole 200 times, each time pulling out and putting back the fuse carrier tube on to the DO fuse switch. After this test, there shall be no surface defects in the glass fibre tube. Also, no loosening of joints should take place.
- (b) The cantilever load test shall be repeated after the mechanical endurance test and it shall be verified that deflection do not exceed the values measured/specified in para 8.2.2(vi) above.

127045

GOVERNMENT OF INDIA  
MINISTRY OF TRANSPORT  
(DEPT. OF RAILWAYS)

RESEARCH DESIGNS AND STANDARDS ORGANISATION

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Specification No. ETI/PSI/14  
(1/86)

25 KV DROP OUT FUSE SWITCH AND OPERATING POLE

1.0 Scope

- 1.1 This specification applies to outdoor, expulsion, drop out type fuse switches for protection of 25KV/230V, 10KVA and 100KVA LT supply transformers at the various traction installations.
- 1.2 The specification also covers insulated operating poles for opening/Closing the fuse link from ground level under line condition of the fuse switch.
- 1.3 The fuse switches and operating poles shall be complete with all parts and accessories necessary for their efficient operation. All such parts and accessories shall be deemed to be within the scope of this specification, whether specifically mentioned or not.

2.0 Service conditions

- 2.1 The fuse switches are required to be used as isolating links-cum-fuses for protection of the 25KV/230V, 10KVA & 100 KVA, 50HZ single-phase LT supply transformers at traction substations, switching stations and way side railway stations. The transformer and fuse switch are mounted on the same mast, the line end or upper terminal of the fuse switch being connected to the substation/switching station busbar or traction overhead equipment as the case may be, and the outgoing end or lower terminal to the transformer.

2.2 Weather conditions

The weather conditions under which the drop out fuse switch and operating pole are used vary widely. The limiting conditions which have to be withstood in service are indicated below :

2.2 Weather conditions (Contd.)

-Maximum temperature of air in shade.	45°C
-Minimum temperature of air in shade.	0°C
-Maximum temperature attainable by an object exposed to sun.	65°C
-Maximum relative humidity	100%
-Average annual rainfall.	1750 to 6250 mm
-Number of thunderstorm days/annum.	85 days. Max.
-Average number of dust-storm days/annum	35 days Max.
-Number of rainy days/annum	120 days Max.
-Maximum wind pressure	200 Kg/m <sup>2</sup>
-Altitude	Not exceeding 1000 m.

2.3 In some area, the drop out fuse switch and operating pole are also subject to chemical pollution from the effluent gases of chemical/ fertilizer plants and to saline atmosphere on the lines near sea.

3.0 Governing specification

3.1 The fuse switches shall, unless otherwise specified conform to IS:9385(Part-II)-1980, which shall be applied in the manner altered, amended or supplemented by this specification and the latest Indian Electricity Rules, wherever applicable.

3.2 The synthetic resin banded glass fibre tube for operating pole shall conform to BS 3953-1976 (latest version.)

3.3 Any deviation from this specification, calculated to improve the performance, utility and efficiency of the equipment proposed by the tenderer, will be given due consideration, provide full particulars with justification there of, are furnished.

4.0 Rating and other particulars of the Fuse Switch

4.1 The fuse switches shall be designed for the following rating and other particulars :

- i)Type : Outdoor, expulsion rewirable dropout type.
- ii)Rated voltage : 25 kV subject to rise upto 27.5 kV.
- iii)Rated current : 1 Amp/ 5 Amp.
- iv)Rated breaking capacity : 5000A at a recovery voltage of 27.5 kV.
- v)Rated frequency : 50 Hz.
- vi)Number of poles : One

4.2 The fuse links shall be continuously rated for 1 Amp. in case of 10KVA transformer and 5 Amp in case of 100kVA transformer. The fuse link rated for 1 Amp. shall blow off within one second for a fault current of 10A and fuse link rated for 5 Amp. shall blow off within 0.5 sec. for a fault current of 75 Amp. The fuse link shall be of materials which effectively resist deterioration under normal climatic condition. The fuse link shall be mechanically robust to ensure that no damage results in from normal handling or operation of the associated equipment. A minimum tensile strength of 7 kg shall be ensured, for the fuse link . The fusing element shall be protected with a strong fibre sleeve so as to prevent damage to the fuse carrier tube at the time of operation. Suitable end terminals shall be crimped/coldered on fuse link to ensure its proper fixing in position. The length of fuse link shall be 650 mm.

5.0 Type construction and mounting of the fuse switch .

5.1 The fuse switch shall be of robust construction ensuring no damage from normal operation, handling and vibration and free operation at all times.

5.2 The fuse shall be of the rewirable, expulsion type in which the length of the break is increased by expulsion of part of or full fuse element and in which the arc quenching is assisted by the movement of gases from the fuse carrier. The mounting shall be such that in the event of the fuse blowing out, the fuse link or carrier drops down and hangs suspended from the lower contact.

- 5.3 The fuse link shall be designed for use as an isolator blade to be operated with a portable insulated operating pole from ground level. It shall also be possible to remove the fuse link bodily from the fuse-switch, when it is hanging from the lower contact, with the operating pole.
- 5.4 The fuse carrier shall be of synthetic resin bonded glass fibre tube conforming to BS:3953-1976. The tube shall be of 500 mm length having an inside dia. of 16 mm and an outside dia of 32 mm.
- 5.5 The fuse switch shall be complete with its mounting frame. Bolts, nuts and other fasteners of 12 mm dia. and less shall be of stainless steel. Higher size of fasteners may be made of galvanised steel.
- 5.6 All ferrous parts shall be hot dip galvanised and other parts including top and bottom contacts shall be made of tin bronze. The zinc coating shall satisfy the requirements of IS:2633-1972 and tin bronze of IS:306-1968.
- 5.7 The fuse switch shall be suitable for mounting on the vertical face of a structural steel support, with four 16 mm dia bolts spaced vertically 450 mm apart and horizontally 240 mm apart.
- 5.8 The fuse switch shall be provided with terminals suitable for connection to 19/2.10 mm (10.5 mm dia) cadmium copper wire on the line side. At the load side the terminals shall cater for connection to 2 SWG (7 mm dia) copper wire.
- 5.9 The fuse switch shall strictly conform to Drg. ETI/PSI/032 for general assembly and Drg.No.ETI/PSI/038 for part details. These drawings are enclosed with the specification. The workmanship shall be good and the castings of different component shall be free from any defects and shall have a good finish. The manufacturer's monogram shall be stamped on different components for an easy identification.
- 6.0 Support insulators
- 6.1 The support insulators shall be of solid core construction conforming to the provisions and requirements of IS:4318-196 as applicable to Post Insulators. The insulators shall be procured from the approved manufacturers only.



- 6.2 The porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The caps shall be made of black heart malleable cast iron conforming to grade BM 340 of IS:2108-1977, and the ferrous parts shall be hot dip galvanised.
- 7.0 Operating pole
- 7.1 The operating pole shall be designed for opening/closing as well as removal/refizing of the fuse carrier from ground level under live conditions of the fuse switch.
- 7.2 The operating pole shall have a total length of about 6 mm made of four pieces with necessary joints in brass metal caps, to facilitate quick assembly.
- 7.3 Suitable attachment made of aluminium alloy to engage the fuse link shall be provided at the top end of the pole.
- 7.4 The main insulation in the operating pole shall comprise glass fibre insulating piece of not less than 500 mm long at the top end, and rigidly fixed on to the supporting piece below. The remaining portion of the operating pole below the insulating piece shall be made of either Permali wood encased in PVC sleeving or synthetic resin bonded glass fibre tube coated with three coats of polyurethane. In case of Permali wood, the PVC sleeving shall maintain a firm bond with the wood base, the joint between the sleeve and the wooden pole being impervious to ingress of moisture.
- 7.5 The operating pole shall be robust in construction and light in wight. The complete assembly, which shall not be too flexible, shall be capable of taking a centilever load of 2 Kg without cracking or breaking.
- 7.6 The operating pole shall strictly conform to Dr.No.ETI/PSI/039 enclosed with the specification.
- 7.7 A suitable canvas carrying case, to hold the four pieces of the pole, with a strap for slinging, shall be provided with each operating pole for packing and transport.

## 8.0 Tests

8.1 All the tests on the drop out fuse switch and operating pole assembly shall be carried out at manufacturer's works. The electrical tests may be carried out at any reputed laboratory where testing facilities are available subject to prior approval of the purchaser. The manufacturer shall arrange with out making claim or charges, all the necessary apparatus, labour assistance etc. required to conduct the specified tests.

### 8.2 Type tests.

8.2.1 The following type tests shall be carried out on the prototype fuse switch :

- i) Visual examination and general observations.
- ii) Dimensional measurements.
- iii) One-minute dry and wet power frequency withstand voltage test.
  - a) To earth . . . 95 KV (rms)
  - b) Across isolating distance . . . 110 KV(rms)
- iv) Lightning impulse withstand voltage test (positive and negative polarity):
  - a) To earth . . . 190 KV(peak)
  - b) Across isplating distance. . . . 235 KV (peak)
- v) Braking capacity test at 5KA with a recovery voltage of 27.5 KV.

vi) Test for current/ time characteristics for fuse link

8.2.2 The following type tests shall be carried out on the prototype operating pole :

- i) Visual examination and general observation.
- ii) Dimensional measurements.

8.2.2 Contd.

- iii) One-minute dry and wet power frequency voltage withstand test at 105KV(rms) on main insulating piece in vertical position.
- iv) Lighting impulse withstand voltage test (positive and negative polarity) at 250 KV(P) on main insulating piece in vertical position.
- v) One-minute dry power frequency voltage withstand test on permali wood/glass fibre portion of operating pole at 40KV (rms) across ferrules clamped on pole at 300 mm apart.
- vi) Cantilever load test: the complete assembly of operating pole shall withstand a cantilever load of 2 Kg at the top and, the base being clamped horizontally at intervals of 300 mm and 1000 mm from the bottom end. The deflection of the top end from the horizontal level shall not exceed 150 mm. The operating pole should withstand the test successfully without any permanent deformation.
- vii) Impact test: With a load of 8 Kg tied at the top and, the completely assembled operating pole shall be lifted up and the top of the pole swung over an angle of  $45^{\circ}$  from vertical 20 times. There should be no sign of cracking, distortion or damage at the end of the test.
- viii) Mechanical endurance test: The operating pole assembly shall be tested for mechanical endurance by assembling and disassembling the operating pole 200 times with each time removing and fixing the fuse carrier tube on the DO fuse switch mounted in position. No surface defects in the glass fibre tube or loosening or joints should take place. The deflection shall also be measured after the endurance test and shall not exceed 150 mm.

8.2.2 Contd.

ix) Determination of weight of assembly.

8.2.3 If the prototype of the fuse-switch and operating pole conforming to this specification has already been approved in connection with previous supplies to Indian Railways, fresh prototype testing may be waived if the equipment had passed the prototype tests earlier and no changes in the design or material have been made.

8.3 Routine test :

All the fuse switches and operating poles shall be subjected to the routine tests detailed below at the manufacturer's works :

- i) Visual examination.
- ii) Dimensional measurements.
- iii) One minute dry power frequency withstand voltage test on fuse switch at 95 KV(rms).
- iv) One-minute dry power frequency withstand voltage test on the fibre glass insulating piece of the operating pole at 105 KV(rms).
- v) Cantilever load test on operating pole as per clause 8.2.2 (vi).

9.0 Technical data and drawings.

- 9.1 The tenderer shall furnish guaranteed performance, technical and other particulars for the equipment offered in the proforma attached as Annexure-A.
- 9.2 The tenderers shall indicate their compliance or otherwise against each clause and sub-clause of the Technical specification. The tenderers shall for this purpose enclose a separate statement, if necessary, indicating the annexure and clause reference and compliance or otherwise. Wherever the tenderer deviates from the provisions of the clause, he shall furnish his detailed remarks.

(This specification supersedes specification No. ETI/PSI/14(11/78) and No.ETI/PSI/14A(7/82).

Encl:-Annexure-A and  
Drawings No. ETI/PSI/032 Mod-D.  
ETI/PSI/038 Mod-B.  
ETI/PSI/039 Mod-B.

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Annexure-A

to Specification No. ETI/14(1/86)

SCHEDULE OF GUARANTEED PERFORMANCE, TECHNICAL AND OTHER PARTICULARS

S.No.	Description	Unit of measurement
1.	2.	3.
1.	Name of manufacturer	
2.	Country of origin.	
3.	Standard governing specification.	
4.	Manufacturer's type designation.	
5.	Rated Voltage.	KV
6.	Rated Current	A
7.	Rated breaking capacity	KA
8.	Total operating time at the rated breaking current.	ms
9.	Operating time :	
	a) at 10A for 1A fuse link	ms
	b) at 75A for 5A fuse link	ms
10.	Minimum fusing current for the fuse element :	
	a) 1A fuse link	A
	b) 5A fuse link	A
11.	Insulation level of fuse switch :	
	a) One- minute wet power frequency withstand:	KV(rms)
	i) To earth.	
	ii) Across isolating distance.	
	b) Impulse withstand.	KV(Peak)
	i) To earth.	
	ii) Across isolating distance.	
12.	Insulator Particulars :	
	a) Name of manufacturer.	
	b) Standard governing specification.	
	c) Manufacturer's type designation.	
	d) One-minute dry power frequency withstand.	KV(rms)
	e) One- minute wet power frequency withstand.	KV(rms)

- | 1.  | 2.   | 3.       |
|-----|--|----------|
| 12. | Insulator particulars (Conted.)                                      |          |
| f)  | Impulse withstand :  | KV(peak) |
|     | i) positive polarity.  |          |
|     | ii) Negative polarity.   |          |
| g)  | Minimum failing loads :  |          |
|     | i) In tension  | kgf.     |
|     | ii) In bending   | kgf.m    |
|     | iii) In torsion  | kgf.m    |
|     | iv) In compression.  | kgf.     |
| h)  | Weight of each insulator   | kg.      |
| 13. | Material of fuse switch contacts.                                    |          |
| 14. | Temperature rise of contacts at rated current above ambient.         |          |
| 15. | Minimum clearance in air :   |          |
|     | a) Across isolating distance.  |          |
|     | b) Live parts to earth.  |          |
| 16. | Type of terminal connectors.   |          |
| 17. | Type of fuse switch.<br>(whether outdoor/ drop out, expulsion type). |          |
| 18. | Fuse link particulars :  |          |
|     | i) Name of manufacturer.   |          |
|     | ii) Standard governing specification.                                |          |
|     | iii) Manufacturer's type designation.                                |          |
|     | iv) Rated current.   |          |
|     | v) Rated breaking capacity at a recovery voltage of 27.5KV. Kg.      |          |
|     | vi) Minimum tensile strength in Kg.                                  |          |
| 19. | Material of fuse carrier tube and the name of its manufacturer.      |          |

1.

2.

3.

20. Weight of fuse switch assembly. Kg.

21. Particulars of operating pole :

a) Name of manufacturer.

b) Manufacturer's type designation.

c) Material of insulating pieces :

i) Top piece.

ii) Other pieces.

d) Material of top attachment.

e) Insulation strength of insulating piece :

i) One minute wet power frequency withstand KV(rms)

ii) Impulse withstand KV  
(peak)

f) One-minute dry power frequency withstand across ferrules 30 cm apart on permali wood/glass fibre portion on the pole. KV(rms)

g) Weight of the operating pole assembly Kg.

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