



GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

SPECIFICATION
FOR

SECTION INSULATOR ASSEMBLY WITHOUT SECTION INSULATOR

June 2020

ISSUED BY

TRACTION INSTALLATION DIRECTORATE RESEARCH DESIGN AND STANDARDS ORGANISATION
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SPECIFICATIONS FOR SECTION INSULATOR ASSEMBLY WITHOUT SECTIONING INSULATOR

- 0.0 FOREWORD: The specification for Section Insulator Assembly was first issued by erstwhile Railway Electrification Organization in 1968. This was last revised by RDSO in 1971 and then in 1984. The Earlier revision which has been made to update all the material specifications referred herein, excludes the use of aluminum-bronze fasteners and incorporates routine and acceptance tests. The present revision has been made to update reference of standard specifications and guidelines for procurement of Fasteners.
- 1.0 SCOPE :This specification covers requirements of section insulator assembly for use on Conventional 25 kv ac single phase traction overhead equipment with single 107 sq. mm hard drawn grooved copper contact wire conforming to RDSO specification No. **ETI/OHE/76(06/99)(latest)**.
- 1.1 The section insulator provides electrical isolation between two elementary sections of Traction overhead equipment. It is required to provide a smooth passage to pantographs of electric rolling stock for current collection without any perceptible arcing in either direction up to a speed of 60 km/h when installed in any position in a span of overhead equipment.
- 2.0 STANDARD SPECIFICATIONS:
- 2.1 Following Indian Standard and RDSO Specifications **or its latest version** are applicable for various materials and processes used in the section insulator assembly.
- (i) **TI/SPC/OHE/INS/0070(04/2007) with A & C 1 & 2**: Solid core porcelain insulators for 25 kv ac traction Overhead equipment.
- (ii) **IS: 3091-1999** : Aluminum bronze ingots and castings for overhead fittings.
- (iii) **TI/SPC/OHE/Fittings/0130: Specification for fittings for 25 kv traction. With A & C Slips 1&2.**
- (iv) **IS: 1897-2008** : Specification for copper strip for electrical purpose.
- (v) **ETI/OHE/76(06/97)** : Specification for hard drawn grooved contact wire For electric traction.
- (vi) **ETI/OHE/13(4/84)** : Specification for galvanizing of mast, tubes, fittings etc. With A & C slips 1 to4.
- (viii) **IS: 3658-1999** : Code of Practice for liquid Penetrant flaw detection.
- (ix) **IS: 6745-1972** : Specification for determination of mass of zinc coating and zinc coated iron and steel articles.
- (x) **IS: 2633-1986** : Specification for method of testing, uniformity of coating on zinc coated articles.
- (xi) **EN-10090-1998** : Schedule for wrought steel.
- (xii) **TI/SPC/OHE/Fasteners/0120(rev.1) with A &C slips 1: Specification for galvanized steel & stainless steel Fasteners.**
- (xiii) **IS: 2629-1985: Recommended practice for hot dip galvanizing of Iron and steel.**
- 2.2 In case of a difference between this specification and above specifications, This specification will be referred to.
- 3.0 SERVICE CONDITIONS: The section insulator Assembly may be used in area of medium marine or /and industrial pollution. These are also subjected to vibrations caused by wind and the passage of trains under them or nearby track. The section insulator assembly shall be designed for satisfactory performance under the following atmospheric conditions:
- (i) Maximum temperature of air in the shade = 45⁰ C
- (ii) Minimum temperature of air in the shade = 0⁰ C

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DATE			
DESIGNATION	JE/TI	DTI-2	EDTI

- (iii) Maximum temperature of on object exposed to sun = 65⁰ C
- (iv) Daily average ambient temperature = 35⁰ C
- (v) Maximum relative humidity = 100 %
- (vi) Maximum wind pressure = 216 kgf/m²
- (vii) Altitude

a. For Normal Area -not exceeding 1000 m

b. For Mountainous area -2500 m from sea level

4.0 GENERAL CONSTRUCTION:

4.1 The section insulator assembly consists of a solid core porcelain insulator (Ref. RDSO Specification No. TI/SPC/OHE/INS/0070) designed to secure a contact wire through a link at one end. At the other end the insulator shall be connected to a cross beam supported on two runners made of hard drawn copper through articulated links. The other contact wire shall be clamped directly at one end of the runners joined together, so that the runners take the full tension of the contact wire and ensure a rigid assembly.

The ending clamps for the contact wire at the runner and insulator ends shall be of the toothed type, designed to grip the contact wire firmly. The entire assembly shall to such that it provides means of easy adjustment during erection and permits smooth passage of pantograph. The complete section insulator assembly shall be suspended from the stranded 65 mm² cadmium-copper catenary wire and maintained in proper level by means of 5 mm diameter droppers made of hard drawn copper wire attached to lugs , provided at the two ends of the runner cross beam. Suitable lugs are also provided on the cross beam and the contact wire link to permit suspension of the section insulator from the cross span wire(s).

4.2 The air gap between the runners and the metallic parts of the insulator or the contact wire belonging to a different electrical section shall not be less than 160 mm.

4.3 The distance between the axis of the runners shall not exceed 466 mm.

5.0 MATERIAL SPECIFICATIONS:

5.1 The cross beam, the contact-wire-end-link and the end-clamps of the runner-end and insulator-end shall be die-cast aluminium-bronze conforming to IS: 3091. The clamps shall comply with TI/SPC/OHE/Fittings/0130.

5.2 The runners shall be made of 40mm x 8 mm hard drawn copper strip (Grade FRHC) to IS: 1897.

5.3 All the fasteners including bolts, screws, nuts, locknuts, and pins shall be made of stainless steel and conform to RDSO specification No. TI/SPC/OHE/Fasteners/0120 (rev.1). It shall be outsourced from CORE approved source only.

5.4 Hot dip galvanized parts shall conform to RDSO specification No.ETI/OHE/13 (4/84) (latest). The coating of zinc shall not be less than 610 g/m².

6.0 MANUFACTURE AND QUALITY CONTROL

6.1 RDSO's drawings for components and the assembly of the section insulator are for guidance only. The manufacturer shall prepare his own manufacturing drawings incorporating the closest tolerances attainable by him consistently on all dimensions. Closer tolerances are required on holes, hole Centres, wall thickness etc. ~~the drawings shall be prepared in accordance with RDSO specification No. RE/OHE/25(03/66).~~

6.2 The section insulator assemblies shall be manufactured strictly in accordance with the manufacturer's drawings approved by RDSO/CORE.

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SIGNATURE			
DATE			
DESIGNATION	JE/TI	DTI-2	EDTI

- 6.3 All components shall fully interchangeable between different assemblies.
- 6.4 The Aluminium bronze components shall be produced by die casting process, i.e. by gravity or pressure die casting.
- 6.5 The galvanizing of ferrous parts shall be carried out in accordance with IS: 2629-1985 (R 2016).
- 6.6 The manufacturer shall provide identification mark indicating his name or trade make, railways part number, melt and year on each of Aluminium bronze casting. From one melt, only one type of castings shall be made. Three test bars shall also be cast from each melt. The fittings shall be used in assembly only if the test bar meets the requirements of IS: 3091-1999 in respect of physical properties and chemical composition, otherwise the entire lot shall be re-melted. Record of the tests carried out shall be maintained and offered to the Inspector at the time of inspection for each type of fitting. The remaining two test bar of each lot shall be carefully preserved.
- 6.7 The manufacturer shall prepare a Quality Assurance Standard to ensure that all Component and assemblies provided conform to the specification. The Quality Assurance Standard shall be got approved from RDSO/CORE.
- 7.0 TESTS: The manufacturer shall arrange for tests at his works. The test, for which facilities do not exist with the manufacturer, may be carried out at any reputed laboratory after specific approval by RDSO/CORE.
- 7.1 Type Tests
- 7.1.1 Type tests shall be carried out to assess capability of the manufacturer to produce the section insulator assembly to this specification and approved drawings. These tests may be repeated any time on any of the sample by RDSO/CORE or the inspector of purchaser.
- 7.1.2 The manufacturer shall first manufacture prototype sample conduct type tests and send test reports to RDSO/CORE. The Type test than shall be witnessed by representative of RDSO. The manufacturer shall manufacture minimum three assemblies in presence of RDSO representative for the type tests.
- 7.1.3 The following test shall be made on the components/assemblies manufactured as per clause-7.2.2:

SN	Tests	Type Test	Routine tests	Acceptance test	Refer Clause
1.	Visual examination of components	Yes	Yes	Yes	8.1
2.	Dimensional verification of components	Yes	No	Yes	8.2
3.	Examination of assembly	Yes	No	Yes	8.3
4.	Inter-changeability of components	Yes	No	Yes	8.4
5.	Physical and chemical tests on aluminum-bronze test bars	Yes	Yes	Yes	8.5
6.	Tests-on fasteners	Yes	No	Yes	8.6
7.	Radiographic examination of casting	Yes	No	No	8.8
8.	Liquid dye penetration test on castings.	Yes	Yes	Yes	8.7
9.	Galvanizing test	Yes	No	Yes	8.10
10.	Test on runner strips	Yes	No	Yes	8.9
11.	Proof load test	Yes	Yes	Yes	8.11

- 7.1 7.1.4 In the event of the tests not being carried through to completion at one

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SIGNATURE			
DATE			
DESIGNATION	JE/TI	DTI-2	EDTI

stretch for any reason attributable to the successful manufacturer and it is required for the representative of Director General (Traction Installations), Research Designs and Standards Organisation, Manak Nagar, Lucknow, to go again or more number of times to the works of the manufacturer or other place(s) for continuing and/or completing the tests on the prototype (s) of the equipment. The guide line of ISO documents No. ISO9001:2008 Document No: QO-D-8.1-10 Version No: 1.0 Date Effective: 12/09/2018 (latest) for Vendor sample type testing and ISO9001:2008 Document No: QO-D-8.1-14 Version No: 1.3 Date Effective 17/03/2020 (latest) for Vendor registration schedule of charges shall be followed.

7.3 Acceptance Tests:

7.3.1 The manufacturer shall offer section insulator assemblies in lots of not more than 50 assemblies. Only those assemblies and their components which have already been subjected to routine tests, as per clause-7.4, shall be offered for inspection. The results of routine tests shall be presented to the inspector, who will record these in the inspection certificate.

7.3.2 Components of two assemblies shall be selected at random for acceptance tests.

7.3.3 Acceptance Criteria:

Provided routine tests results are satisfactory and the samples selected in accordance with 7.3.2 are found conforming to the specification when tested as per clause-7.1.3, the lot may be accepted. If any component fails in any test four more samples, taken at random, shall be subjected to the test. If, there is no failure in the retest, that lot of the component may be accepted otherwise not. If a component fails in more than one test, lot of the component may be rejected.

The assemblies shall be accepted only if all the components are acceptable and interchangeable and the assemblies pass proof load test.

~~All accepted fittings and components shall be punched with the inspectors seal giving the initials of inspector and date of inspection. Alternatively, a label carrying the initials of inspections and date of inspection may be fixed indelibly on the each fittings/components.~~

"All accepted fittings/components/assembly shall be affixed with hologram and sealed by the Inspector" as per the directive of inspection agencies.

7.4 Routine Tests: The manufacturer shall carry out routine tests on all components and assembly. Records of the tests shall be examined by the Inspector.

8.0 TEST METHODS:

8.1 Visual examination of components:

8.1.1 All the components shall be examined for visible defects, deformation, flaws and surface finish. Particular attention shall be paid to smooth surface finish of contact surfaces of the runners. The galvanizing of ferrous parts shall be examined for a visible defect as defined in IS: 2629.

8.1.2 As a routine test this test shall be carried out on all the components. The components not found satisfactory shall not be utilised and offered for acceptance tests.

8.2 Dimensional verification of components:

8.2.1 The manufacturer shall check dimensions of all the components using gauges, approved by the Inspector, on the entire lot before offering for inspection.

8.2.2 The Inspector shall check dimensions of the components of two assemblies selected in accordance with Clause 7.3.2 for acceptance of the lot and for the purpose of type tests. In type tests, all dimensions shall be checked. In acceptance test, important dimensions such as wall thickness, hole diameters, hole centers, and runner profile and runner thickness only

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SIGNATURE			
DATE			
DESIGNATION	JE/TI	DTI-2	EDTI

may be checked. The inspector, at his sole discretion, may check all dimensions. The dimensions shall be within the tolerance indicated on the approved drawings.

8.3 Examination of assembly

Two assemblies shall be made and clearance as specified in 4.2 and 4.3 shall be checked. It shall be possible to adjust the assembly so as to obtain proper level. The level of an assembly shall be checked by moving a straight flat copper strip of approximately 500mm length below the assembly in a manner similar to movement of pantograph. Alternatively, arrangement can be made to suspend the assembly over a plain table to check the level. The sectioning insulator for the test shall be provided by the manufacturer.

8.4 Interchangeability of components

All components shall be freely interchangeable. If the components selected in a random manner permit assembly without any further machining of forming operation and the assemblies so made meet the requirement of 8.3, the requirement of this test shall be deemed to have been complied.

8.5 physical & chemical tests on aluminum bronze test bars.

8.5.1 The manufacturer shall test one of the three test bars cast for each melt for physical properties and chemical composition. Only if the test results are found conforming to IS: 3091 the lot of the components cast from the melt shall be utilised and offered to the Inspector. Otherwise the lot shall be re-melted.

8.5.2 one second test bar shall be tested by the Inspector for the each lot of components from each melt for physical properties only. If the requirements of physical properties are not met, the particular lot shall be rejected and components broken or re-melted by the Inspector in his presence.

8.5.3 The third test bars of each lot shall be preserved for five years for testing in future if need arises.

8.6 Test on fasteners

8.6.1 The fasteners shall be tested in accordance with RDSO's specification No. ~~TI/SPC/OHE/Fasteners/0120 (Rev.1) both for type and acceptance tests.~~

8.6.2 The stainless steel pins shall be tested for chemical composition and Inter crystalline corrosion bend test as per ~~BS: 970 (Part 4) EN-10090-1998~~ .The tests shall be made on one sample only for both type test and acceptance tests.

8.7 Liquid dye-penetration test on castings: All castings shall be tested for cracks, blow holes porosity etc. by liquid dye penetrate flaw detection method in accordance with ~~IS: 3658-1999~~ . The defective fittings shall be rejected. The test shall be carried out as routine test by the manufacturer and as acceptance test by the purchaser's Inspector. Records of routines tests shall also be examined by the inspector.

8.8 Radiographic examination of castings: Radiographs of three samples of each casting shall be taken. These will be evaluated by the Purchaser for inclusions, blow holes, cavities, cracks porosity etc. the accepted radiographs shall be retained by manufacturer and RDSO for reference and record. Manufacturer shall subject castings to radiographic tests from time to time to ensure that the accepted standards are maintained.

8.9 Tests on runner stripes

	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE			
DATE			
DESIGNATION	JE/TI	DTI-2	EDTI

- 8.9.1 For the purpose of type tests, chemical analysis, mechanical test and electrical resistivity tests shall be made on three samples. The test results shall conform to IS: 1897.
- 8.9.2 For acceptance tests, only physical properties and electrical resistivity shall be tested.
- 8.10 Galvanising tests on ferrous parts:
 - 8.10.1 The galvanized ferrous parts shall be tested in accordance with IS: 2629 for visible defects and adherence; IS: 2633 for uniformity of Zinc coating; and IS: 6745 for weight of zinc coating. The samples shall meet the requirements of respective specifications. The uniformity of zinc coating shall be ascertained by seven one minute dips in the Preece Test.
 - 8.10.2 For acceptance test only weight of zinc coating shall be checked by magnetic method or by stripping method.
- 8.11 Proof load test
 - 8.11.1 The complete section insulator together with end links will be tested for a proof load of 3 tonne for one minute for type test and 2 tonne for one minute for acceptance and routine tests. The position of contact wire shall be marked suitably prior to the test. There shall not be any slipping of neither contact wires nor any deformation to any component of the assembly.
 - 8.11.2 A suitable dummy steel plate with ends shaped exactly as the tongues of sectioning insulator may be use in lieu of the sectioning insulator for proof load test.
- 9. PACKING AND MARKING:
 - 9.1 The components and fittings of section insulator assembly shall be packed either in fully assembled conditions or in knocked down condition in strong wooden boxes/ **any other hard packing (suitable for transporting the material safely)**. Every, box/**hard packing** shall contain a list of components giving quantity of each component packed in the box.
 - 9.2 Every box shall carry, in legible and indelible lettering, the following information:
 - i Manufacturers trade name and brand mark.
 - ii Number of assemblies/component packed.
 - iii Contract/ Order number.
 - iv Consignees address.
 - v Date of Inspection and Inspecting Authority.
 - vi Any other particulars specified by the Purchaser.
- 10.0 **All the provisions contained in RDSO's ISO procedures laid down in document No.- QO-D-7.1-11 dated 19.07.2016 (Titled " Vendor- change in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways".**

	PREPARED BY	CHECKED BY	APPROVED BY
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DATE			
DESIGNATION	JE/TI	DTI-2	EDTI