**SPECIFICATION NUMBER: TI/SPC/OHE/ ROCSRRCS/XXXX**

सत्यमेव जयते

**भारत सरकार GOVERNMENT OF INDIA**
**रेल मंत्रालय Ministry of Railways**

# DRAFT FUNCTIONAL REQUIREMENT SPECIFICATION (FRS) FOR Rigid Catenary Overhead Conductor System for use in Tunnels and Retractable Rigid Overhead Conductor System in Sidings/Depots

**(For official use only)**



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**PERFORMANCE SPECIFICATION**
**FOR**
**Rigid Catenary Overhead Conductor System for use in Tunnels and Retractable Rigid Overhead Conductor System in Sidings/Depots**

## 1.0 SCOPE:

1.1 A Rigid Overhead Conductor-rail System (ROCS) should be generally used in following cases:

i) Normally in tunnels of length more than 750m or where the provision of ATD is difficult.
ii) Where the head room/height of the tunnel is not sufficient for conventional OHE,
iii) Stations/Any other location for improved electrical clearances.

Rigid Overhead Conductor Systems (ROCS) that meet the following functional and operational characteristics shall be accepted:

**a)** Absence of Catenary System and Reduced Overhead Space Requirements
**b)** Elimination of Tensioning Devices and Increased Space Efficiency
**c)** Stagger Adjustment Without Push-Off/Pull-Off Components
**d)** High Current Carrying Capacity
**e)** Simplified Operation and Maintenance
**f)** Reduced Tunnel Clearance Requirements and Lower Civil Construction Costs.

iv) The Aluminium conductor rail cross section should be minimum 2214mm.
v) The design speed potential shall be 180 kmph for ROCS and 60 kmph for RRCS.

1.2 **RETRACTABLE RIGID CATENARY SYSTEM (RRCS):**
Retractable Rigid Catenary System (RRCS) is required for loading of Coal, Iron Ore under SILO, covered maint shed,etc .

a. To provide a solution for facilitating overhead loading under SILO at freight terminals in electrified territory.
b. To minimize the rake loading time thereby improving wagon turnaround and optimum utilization of crew / assets.
c. Minimize damage to OHE during loading in wharf system.
d. Compliance of National Green Tribunal (NGT) guidelines for minimizing pollution during loading.

1.3 This specification covers the requirement of "Rigid Catenary Overhead Conductor System for use in Tunnels and Retractable Rigid Overhead Conductor System" in Sidings/Depots/washing lines to suit the existing system on Indian Railway's 25kV AC traction network.

1.4 The continuous current rating of the conductor rail, without the contact wire, shall be 2900 A at a temperature rise of 50 K above ambient

**2.0 GOVERNING SPECIFICATIONS:** In preparation of this specification, reference has been made to the following specification:

| | | |
|---|---|---|
| 1. | IS : 285-2002 | Specification for wrought aluminium and aluminium alloys, extruded round tube and hollow sections (of general engineering purposes) |
| 2. | IS : 2673-2002 | Specification for Dimensions for wrought aluminium and aluminium alloys , extruded tube (round) . |
| 3. | IS:4711-2008 | Methods for sampling of pipes, tubes and fittings |

| | | |
|---|---|---|
| 4. | IS :504-1963 | Methods of Chemical Analysis and its alloy |
| 5. | IS:1608-2005 | Mechanical Testing of Metals-Tensile Testing |
| 6. | IS:5052-1993 | Aluminium & its Alloy - Temper Designation |
| 7. | IS: 6051-1970 | Code for Designation of Aluminium & its Alloy |
| 8. | ASTM B221M | Standard Specification for Aluminum-Alloy Extruded Bar, Rod, wire, Profiles and Tube (Metric) |
| 9. | ASTM B317/B317M | Rod, Tube, Pipe, Structural Profiles, and Profiles for Electrical Purposes (Bus Conductor |
| 10. | ASTM B557 | Tension testing of wrought and cast aluminum & magnesium alloy products |
| 11. | ASTM E-155-00 | Reference for Radiographs for inspection of Aluminum & Magnesium castings |
| 12. | TI/SPC/OHE/INS /0070 | Specification for solid core porcelain insulators for 25kV, a.c. 50Hz Over head traction lines |
| 13. | TI/SPC/OHE/INS COM/1071 | Specification for solid core porcelain insulators for 25kV, a.c. 50Hz Over head traction lines |
| 14. | TI/SPC/OHE/FA STNERS/0120(Rev.01) | Specification for Steel Fasteners & Stainless Steel |
| 15. | TI/SPC/OHE/ FITTINGS/0130 | Technical specification for 25 kV AC OHE Fittings |
| 16. | EN 12165/ ASTM B124 | Specification for Copper and Copper Alloy Forging Rod, Bar & Shapes |
| 17. | EN 1706/ASTM B 85 | Specification for Aluminium Alloy Die Castings |
| 18. | Instruction No. TI/IN/0041 | Guidelines for Rigid Catenary Overhead Conductor System for use in Tunnels and Retractable Rigid Overhead Conductor System in Sidings/Depots |
| 19 | EN1301 | Aluminium and Aluminium Alloys |
| 20 | EN50110-1(11.04) | Operation of electrical installations |
| 21 | EN50110-2(03.10) | Operation of electrical installations (national annexes) |
| 22 | EN50119-(09.09) | Railway applications Fixed installations -Electric traction-overhead contact lines |
| 23 | EN50122-1(06.97) | Railway applications - Fixed installations Part 1Protective provisions relating to electrical safety and earthing |
| 24 | EN50124-1(03.01) | Railway applications - Insulation coordination- Part 1: Basic requirements Clearances and creepage distances for all electrical and electronic equipment |
| 25 | EN50149(03.01) | Railway applications - Fixed installations; Electric traction Copper and copper alloy grooved contact wires |
| 26 | EN50152-1(12.07) | Railway applications; Fixed installations Particular requirements for AC switchgear- Part 1: Single-phase circuit-breakers with Um above 1 kV |
| 27 | EN50155 | Railway applications- Electronic equipment used on rolling stock |
| 28 | EN50163(11.04) | Railway applications - Supply voltages of traction systems |
| 29 | EN60383-1(11.96) | Insulators for overhead contact lines with a nominal voltage above 1 kV - Part 1: Ceramic or glass insulator units for A.C. systems; definitions, test methods and acceptance criteria |
| 30 | ENV50121-5 | Railway Application Electromagnetic Compatibility Part 5: Fixed Power Supply Installations |
| 31 | IS398 (Part1) | Aluminium Conductors for overhead transmission purposes-Specification- Aluminium stranded conductors |
| 32 | IS398 (Part2) | Aluminium Conductors for overhead transmission purposes- |

| | | |
|---|---|---|
| | | Specification-Aluminium conductors, Galvanized steel-reinforced |
| 33 | DIN VDE 0101 (01.00) | Power installations exceeding 1 kV |
| 34 | DIN VDE 0115 Part 1 (06.02 | Railway applications; General construction and protection regulations, additional requirements |
| 35 | DIN VDE 0141 (02.86) | Earthing system for special power installations with nominal voltages above 1 kV |
| 36 | DIN VDE 0216 (02.86) | Fittings for overhead and conductor rail equipment; static mechanical behaviour; requirements and testing |
| 37 | DIN VDE 0446 Part2 (03.71) | Regulations for insulators for overhead power lines, overhead equipment, and telecommunication lines; part 2: Regulations for insulators for high-tension overhead lines and overhead equipment up to 1000 V as well as telecommunication overhead lines |
| 38 | DIN VDE 0446 Part3 (05.73) | Regulations for insulators for overhead power lines, overhead equipment, and telecommunication lines; Part 3: Regulations for fittings permanently connected to the insulators |
| 39 | DIN 43138(09.08) | Flexible wires for overhead equipment and return current Electric Traction; Conductor Rail; Characteristics |
| 40 | DIN 43156(03.78) | Electric Traction , Conductor Rail, Dimensions and Charateristics |

2.1 The latest version of the above-mentioned Specifications shall be available with the firm.

2.2 Any special requirements given in the relevant drawings submitted by manufacturer & approved by RDSO will override the specification. Final drawings of ROCS and RRCS is treated as the RDSO property.

**3.0 ENVIRONMENTAL REQUIREMENTS:** The ROCS and RRCS shall be used in varying atmospheric and climatic conditions as tabulated below.

| | | |
|---|---|---|
| i. | Ambient air temperature | -10°C to (+)65°C |
| ii. | Maximum conductor temperature | 90°C |
| iii. | Minimum Temperature | (-) 25°C |
| iv. | Maximum relative humidity | 100% |
| v. | Annual rainfall | Dry Arid regions and also heavy monsoon affected regions with rainfall ranging from 1750 to 6250 mm |
| vi. | Maximum number of Thunder storm days per annum | 85 |
| vii. | Maximum number of Dust storm days per annum | 35 |
| viii. | Number of Rainy days per annum. | 120 |
| ix. | Altitude | For altitude above 2000m and up to 2500m, the altitude correction factor 1.07 is be applied as per IEC 62497-1(with latest revision). |
| x. | Corrosion Heavy corrosion prone areas, saline | Heavy corrosion prone areas, saline environment |

## 4.0 GENERAL & TECHNICAL REQUIREMENTS:

### 4.1 ROCS SYSTEM:

4.1.1 The manufacturer is invited to submit a comprehensive proposal for the development of the Rigid Overhead Conductor System (ROCS) through this Expression of Interest (EOI). The proposal must include Technical Compliance as given below**:**

i. **Conductor Rail**:

- The conductor rail shall be manufactured using a high-conductivity aluminium alloy, typically conforming to EN AW-6101 or equivalent..
- The aluminium conductor rails shall be produced by hot extrusion through precision dies to maintain dimensional accuracy and surface finish.
- The conductor rail shall be designed with a sealed or water-draining profile to prevent moisture accumulation.
- The aluminium rail shall include an internal ribbed groove or slot designed to firmly hold a copper contact insert.
- This insert ensures high conductivity and wear resistance where the pantograph slides. The ribbed design ensures a secure mechanical bond and improves heat dissipation and electrical contact quality

ii. **Cantilever support Bracket**:

- Design of **drop tube**, **rear bracket**, **standoff bracket**, **swivel head**, and **number plate support**.
- Compliance with **IRSOD(BG)-Revised 2022** for mechanical and electrical clearances.
- Swivel head allowing ±25mm vertical adjustment and ±200mm stagger.
- Details of materials (galvanized steel, aluminium, insulators).
- Provision for temperature-induced longitudinal movement.

iii. **Insulator:** The material/testing of Insulators shall meet the requirement of RDSO specification No. TI/SPC/OHE/INS/0071 for porcelain insulator with minimum creepage distance 1050m and specification No. TI/SPC/OHE/INSCOM/1072 for Composite Insulators with minimum CD 1600 mm.

**iv. Joints and Overlaps:**

- Conductor rail sections shall be connected using interlocking joints designed to ensure both mechanical strength and electrical continuity.
- Joint plates (inner or outer type) shall be made of compatible conductive materials to ensure low electrical resistance and structural integrity.
- Expansion overlaps should accommodate the thermal expansion and contraction of the conductor rails.
- For high-speed operations (over 120 km/h), special expansion joints are provided. These are designed to absorb longitudinal expansion while maintaining mechanical alignment, continuous current collection, and safe pantograph interaction at high speeds. Expansion Joints for >120 km/h

v. **Contact Wire:**

- The contact wire shall be of hard-drawn grooved copper with a round bottom to ensure efficient current collection and wear resistance. It is to be inserted into the conductor rail (CR) in a **non-tensioned manner**, meaning the wire is laid without applying mechanical tension. This design facilitates easier installation and accommodates thermal expansion without inducing stress on the contact wire or conductor rail assembly.

**vi. Anchor Bolts**

- Anchor bolts used for securing the conductor rail support system may be of mechanical or hot-dip galvanized type, with the option to use chemical anchors as per site requirements. All anchor bolts must demonstrate adequate **mechanical strength** and **corrosion resistance**, ensuring long-

term durability and structural stability under operational and environmental loads.

**vii. Jumpers and Feeders**

- Copper jumpers of 150 mm² or 130 mm² cross-section shall be used at turnouts and uninsulated overlaps to ensure reliable current transfer. The feeder system shall comprise **2×240 mm², 25 kV armoured copper cables**, designed for high-voltage applications. Feeder clamps and jumper connections shall be arranged to **accommodate thermal expansion** and prevent mechanical stress. All feeder cables must comply with **IEC 60840** standards for high-voltage power cables with extruded insulation..

**viii. Overhead Protection Conductor (OPC)**

- A 70 mm² continuous bare copper conductor, or equivalent aluminium conductor, shall be used as the Overhead Protection Conductor. It shall be clamped to each bracket along the conductor rail system **and** earthed at regular intervals using traction earthing wires (TEW) to ensure effective protection against lightning and fault currents.

**ix. Anti-Creep Anchor (Midpoint Anchor)**

- Demonstrate capacity to stabilize expansion forces within tension length (~500m).

**x. Transition Element**

- Provide sample design of **transition bar** with 6 progressive depth cut-outs.
- Description of anchoring mechanism and end point anchor.

**xi. Section Insulators**

- Section insulators shall be made of PTFE-coated fiberglass material, ensuring high electrical insulation and mechanical strength. These insulators are to be used at sectioning points and crossovers to maintain electrical separation while allowing smooth passage of pantographs.

**xii. End Sections**

- One metre bent-up conductor rail segment for pantograph smooth transition.

**xiii. CR Protection Cover**

- Water ingress from nearby water bodies may pose a risk in tunnels. To prevent this, conductor rails at tunnel entrances and moisture-prone areas shall be enclosed with a transparent, halogen-free (V-0 grade) polycarbonate cover with IP68 protection. All joints and terminations shall be sealed with IP68-rated covers; the lightweight design ensures no impact on rail sag..

**xiv. Earthing Clamps**

- Fixing design for discharge rod.
- Safety compliance documentation.

## 4.2 RETRACTABLE RIGID CATENARY SYSTEM(RRCS):

4.2.1 **Technical Compliance:** The manufacturer is invited to submit a comprehensive proposal for the development of the RETRACTABLE RIGID CATENARY SYSTEM (RRCS) through this Expression of Interest (EOI). The proposal must include Technical Compliance as give below:

4.2.2 **Retractable Rigid OHE Assembly**

- Conductor rail with hard-drawn copper contact wire.
- Swivelling-type bracket assembly with insulators and jumper connections.
- Motor gear unit specification for controlled swivelling.
- Design drawings, BOM, and detailed mechanical arrangement of complete assembly.

4.2.3 **Control System**

- Integrated control panel for motor operation, isolators, and audio-visual alert systems.
- System logic and safety interlocks (interlocking with loading equipment, audio-visual signalling before energisation, etc.).

4.2.4 **Earthing & Bonding**

- Compliance with ETI/OHE/71 (11/90) or latest.
- All structures and isolators to be earthed and bonded with documented layout and connection details.

4.2.5 **Aerial Protection Cable (APC)**

- Design and connection details for APC to ensure equipotentiality across all swing arms.
- Terminal connections to Silo earth grid or buried rail.

4.2.6 **Safety Features**

- Interlocking system to prevent loco entry during OHE operation.
- Auto-locking of motor post-operation.
- Fail-safes for incorrect isolator operation.
- Measures to avoid foreign material falling on OHE.
- OHE swivelling away from track as default ‘OFF’ position.

4.2.7 **Operation Protocol**

- Sequential operation plan including:
- OHE movement,
- Isolator control,
- Energisation/de-energisation,
- Earthing procedure with optional discharge rod.
- Control logic for automatic chute retraction after loading.

4.2.8 **Clearances & Insulators**

- Compliance with IRSOD (BG) 2022 (Revised) for vertical and lateral clearances.
- Use of insulators per:
  TI/SPC/OHE/INSCOM/1071 Rev-01 (composite),
  TI/SPC/OHE/INS/0070 with A&C Slip 1 & 2 (porcelain),
  1050 mm creepage (1600 mm for ESDD > 0.3 mg/cm²).

4.2.9 The manufacturer shall provide, as part of its EOI submission for RRCS development, documentary evidence demonstrating that all components and sub-assemblies (e.g., transition elements, drop arms, motors, brackets) have been proven in service in India or abroad..

## 5 TECHNICAL DOCUMENTATION:

**5.1** The technical documentation which is submitted by the manufacturer in the context of the qualification process must contain at least the following elements:

**5.2** Detailed system description, design and drawings of the ROCS/RRCS system and its components as given below:

5.2.1 Relevant international /National standard followed for Basic design data, Inspection& acceptance criteria.

5.2.2 Details of General Arrangement of ROCS/RRCS like Material, size, permissible continuous current carrying capacity, short time rating, thermal time constant of conductors, permissible maximum temperature for continuous & short time rating, relevant standard references, permissible tensile stress, Breaking load & factor of safety for conductors & fittings, allowable wear of contact wire, permissible condemning diameter of the contact wire etc.

5.2.3 Design details of Tension length, Spans, Stagger, Height of Contact Wires, Wind Load & Electrical Clearances (Longitudinal/ Lateral & Vertical - Static & Dynamic).

5.2.4 Electrical clearances of pantograph from adjacent structures, in dynamic condition of train under design wind conditions.

5.2.5 Design details of Temperature rise in all type of bare conductors, insulated conductors (Cables), for continuous and short time intervals.

5.2.6 Tolerances and limit of construction, operation and maintenance.

5.2.7 Any other Details

**5.3 General Arrangement and Part Drawings of following:** Manufacturer should submit the following part drawings along with BOM, as applicable:

5.3.1 Contact wire, Conductor Rails

5.3.2 Drop arms, Insulators, Jumpers, Expansion joints

5.3.3 Insulated Overlaps, Un-insulated Overlaps.

5.3.4 Turnouts & Crossover arrangements.

5.3.5 Anti-Creep Arrangement

5.3.6 Termination Arrangement

5.3.7 Anchoring Arrangement

5.3.8 Neutral Section and Section Insulator

5.3.9 Transition section Arrangement.

5.3.10 Earthing and Bonding Arrangement.

5.3.11 Any other relevant drawing.

**5.4 Creepage lengths/Air Gap of the various insulators.**

**5.5 Manufacturer should submit the FEA reports and design calculations for:**

5.5.1 Supporting structures with approved partial factors (support structures, fastening bolts

5.5.2 Catenary – Conductor rail transitions

5.5.3 Sagging

5.5.4 Support point distances (creepage distance)

5.5.5 OHE-Pantograph study for the design speed

**5.6** List of systems implemented in India and foreign countries with details of the approved speeds for the route

**5.7** Installation and maintenance instruction

**5.8** Statement of times for the replacement of components.

**5.9** Any other Information

**5.10** Following details other than general requirements shall be submitted by manufacturer to the concerned Railway Authority for approval for Rigid OHE arrangement in tunnels:

5.10.1 Layout Plan of the ROCS in tunnels.

5.10.2 Drawing of transition arrangement from Flexible OHE to Rigid OHE.

5.10.3 Drawings of Components of ROCS.

5.10.4 Earthing and bonding requirement of components of the system duly considering Railway directives.

5.10.5 Cable routing/Installation Plan/drawing

5.10.6 Electrical clearances from the live ROCS system and pantograph to the structure

5.10.7 Protection system for safety of operation and personnel.

5.10.8 Design details and drawings of the Structure and Foundations of the ROCS system.
5.10.9 Schedule of type tests for the components and Assembly to be specified.

**5.11** Following details other than general requirements shall be submitted by manufacturer to the concerned Railway Authority for approval for Retractable Rigid OHE arrangement at sidings/Depots:

5.11.1 Layout Plan of the RRCS at sidings /Depots.
5.11.2 Drawing of transition arrangement from Flexible OHE to Rigid OHE.
5.11.3 Specification and Drawings of Components of RRCS.
5.11.4 Power Supply arrangements
5.11.5 Standby power supply for the control system &Standby arrangement for Motor failure.
5.11.6 Pollution Degree for components, Fire Retardant Class for Cables, sleeves, MCB, connectors etc.
5.11.7 Earthing and bonding requirement of components of the system duly considering Railway directives
5.11.8 Cable routing/Installation drawings.
5.11.9 Electrical clearances from the live RRCS system and pantograph to the earthed structure
5.11.10 Schedule of type tests for the components and Assembly to be specified.
5.11.11 Protection system for safety of operation and personnel.
5.11.12 Design details and drawings of the Structure and Foundations of the ROCS system.

## 6 INSPECTION & TESTING:

**6.1** ROCS and RRCS shall be inspected and tested by the Director General/TI [DG/TI]/RDSO, Lucknow or his authorized representative at the firm's work. All the proto type tests specified in clause 7 shall be carried out at the manufacturer's works. The firm shall arrange, without making any claim or charges, all the necessary machinery, apparatus, labour and assistance required to get the specified tests conducted in the presence of purchaser's representative. If certain facilities are not available for the tests, manufacturer may arrange these tests outside at Government approved Laboratories. The charges for these tests shall be borne by the manufacturer. After successful prototype Inspection & Testing, ROCS and RRCS shall be subjected to Field Trial as per clause 1.4

**6.2** Before giving call to RDSO for prototype testing of ROCS and RRCS, the manufacturer shall submit a detailed test schedule consisting of the details of each test and nature of the test, venue of the test and the duration of each test and the total number of days required to complete the test at one stretch. Once the test schedule is approved, the test shall invariably be done accordingly.

**6.3** In case, any dispute or disagreement arises between the manufacturer and RDSO/Purchaser during the process of testing, as regards to the type test and /or the interpretation and acceptability of the type test results, it shall be brought to the notice of DG/TI/RDSO, whose decision shall be final and binding.

## 7 TESTS:

**7.1** The following type tests shall be conducted

| Sr. | TEST | TYPE TEST | ACCEPTENCE TEST | ROUTINE TEST | CLAUSE No./Standard/Drawings |
|---|---|---|---|---|---|
| 1.0 | Visual examination (Conductor Rail and its fittings) | Y | Y | Y | Cl.8.1 |
| 2.0 | Verification of dimensions (Conductor Rail and | Y | N | Y | Cl.8.2 |

| | | | | | |
|---|---|---|---|---|---|
| | its fittings) | | | | |
| 3.0 | Chemical composition test (Conductor Rail and its fittings) | Y | Y | Y | Cl.8.3 |
| 4.0 | Radiography Testing on casting fittings | Y | Y | Y | Cl.8.4 |
| 5.0 | Inter changeability test (Conductor Rail and its fittings) | Y | N | N | Cl.8.5 |
| 6.0 | Physical properties and failing load test for Conductor Rail and its fittings | Y | Y | Y | Cl.8.6 |
| 7.0 | Insulator Testing | Y | Y | Y | Cl.8.7 |
| 8.0 | Test on Fasteners | Y | N | Y | Cl.8.8 |
| 9.0 | Short circuit test for all component of ROCS and RRCS | Y | N | N | Cl.8.9 |

**7.2 Sampling for type test:**

a) Three set of each fitting & CR used in ROCS and RRCS shall be produced by the manufacturer, on which test as per clause 7.1 shall be carried out for ascertaining their conformity to the requirements of this specification.
b) The lot which has been found satisfactory in visual examination shall be tested for dimensional characteristics. Any items failing to meet one or more dimensional requirements shall be considered been found unsatisfactory, all the samples in the lot may be inspected for dimensional characteristics and the defective ones be removed, if agreed by the purchaser. The lot shall then be tested for the remaining tests. Any item failing to meet the requirement of tests, shall be considered as defective.

**7.3 ACCEPTANCE & ROUTINE TESTS:**

The manufacturer shall carry out the specified tests, during production, on the samples taken at regular intervals, to ensure conformity to relevant specifications as also to maintain proper control over the process of manufacture. The manufacturer shall maintain the frequency of the various tests and shall produce a certificate at the time of inspection, showing the frequencies of various inspections/tests which have been exercised during production.

## 8 TEST METHODS:

**8.1 Visual examination:** All fittings & conductor rail of ROCS and RRCS shall be visually examined as per RDSO's Specification. Components made by casting process shall have clean finish and free from cracks, surface flaws, harmful inclusions, blow holes etc. No repair shall be done to the castings to hide defects. ROCS and RRCS shall also be checked for identification nos. and firms monogram, as mentioned in the relevant drawings.

**8.2 Verification of dimensions:** The dimensions of the castings, and other components of the ROCS and RRCS shall conform to the drawings approved by RDSO.

**8.3 Chemical composition test:** NABL approved lab's test certificate for Chemical composition of the different components shall be obtained from the supplier and submitted at the time of testing.. The purchaser shall be at liberty to analyze chemical composition of any component. in addition to test bars.

Note : Inspecting official shall check & verify the traceability of submitted Test Certificate with supplied raw material.

**8.4** **Radiographic Test:** All cast components shall subjected to radiography as per ASTM E-155-00(2005)/DIN EN VDE 0216 and shall satisfy the RDSO Specification.

**8.5** **Inter changeability test:** If the components (fittings/Conductor Rail) of one ROCS and RRCS are able to fit in place of components of other ROCS and RRCS, randomly selected, without any further modifications for inter changeability and ease in erection & maintenance and ROCS and RRCS/ so made meet the requirements of clause 8.3, the requirement of this test shall be deemed to have been complied with.

**8.6** **Physical properties and failing load test:** The tensile strength, yield stress and percentage elongation shall be determined in accordance with methods specified in ASTM B-557 and shall not be less than the values specified for the Grades given in RDSO approved drawing. Bending test shall be conducted in accordance with ASTM B 317. Calculation for permissible stresses along with the copy of relevant standard shall be submitted.

**8.7** **Insulator Testing:** Insulator Testing uses in ROCS and RRCS should be as per RDSO specification of Insulators.

**8.8** **Test on Fasteners:** The fasteners used in regulating equipment shall be tested for visual examination, dimensional measurements, gauging of threads, tensile &elongation test, head sound test, proof load test and hardness tests for their conformity to Specification No TI/SPC/OHE/ FASTNERS/0120 or latest.

**8.9** **Short circuit test for all component of ROCS and RRCS:** Short circuit test for all component of ROCS and RRCS should be as per DIN EN 50119 (VDE0115-601):2010, IEC 62271-1:2007.

**Note:**

- **Stage Inspection:** During prototype testing, RDSO shall carry out stage inspections of the conductor rail extrusion for both ROCS and RRCS.

- **Simulation Study Report:** The firm shall submit, as part of prototype testing, a simulation study report on the interaction between the pantograph and the ROCS/RRCS at maximum design speed.

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## 9 CRITERIA FOR ACCEPTANCE OF FINISHED PRODUCT:

a) Lot: The lot size for ROCS and RRCS is 50 units each for 12 m, 8 m, and 6 m rigid conductors.
b) Lot shall be made from the same production batch. Three ROCS and RRCS assemblies from each batch shall be selected at random from the offered lot (not more than 50 units.) for tests. Samples from three selected units shall be subjected to the tests as specified above.
c) If any sample fails to comply with any test(s) specified in this specification, test(s) shall be repeated on three samples, taken from the same batch but limited to the test(s) in which failure occurred. If in the retest(s) any sample fails, the batch represented by the sample shall be deemed not to comply with specification and the complete batch shall be rejected.
d) Only after clear written approval of the results of tests on the prototype is communicated by the DG/TI/RDSO to the manufacturer, he shall take up bulk manufacture of ROCS and RRCS which shall be strictly with the same material and process as adopted for the prototype.

**10** **PACKING AND MARKING:** Part identification No., Manufacturers monogram and month/year of manufacture shall be marked on each part of the ROCS and RRCS. The ROCS and RRCS complying with this specification shall be properly packed, duly assembled, in

strong wooden boxes so as to avoid damage during transit. The box shall carry on its outer face the following information

| | | | |
|---|---|---|---|
| a. | Manufacturer' s name | e. | Content details (Part Name, Part no. & quantity |
| b. | Net and gross weight | f. | Production batch number |
| c. | Contract number and consignee | g. | Any other particulars specified by the purchaser |
| d. | Inspector's stamp and seal on components and box | h. | Date of inspection |

**11 INSTALLATION, COMMISSIONING & TRIAL:** The manufacturer shall be responsible for installation, commissioning and to carry out trials of the ROCS and RRCS on the line to the satisfaction of DG/TI/RDSO. Necessary assistance in this regard shall be provided by the purchaser.

**12 RELIABILITY:**

a) ROCS and RRCS assembly as a unit is expected to provide reliable service for at least 40 years irrespective of polluting & corrosive atmosphere such as in the coastal areas, in the vicinity of chemical plants and diesel loco sheds etc.
b) The manufacture shall, therefore, ensure that the Assembly supplied including all parts and components etc. used are free from manufacturing defect. ROCS and RRCS shall be of highest quality and in conformity with the specification.
c) The manufacturer shall submit the schedule of guaranteed performance for ROCS and RRCS

**13 MAINTAINABILITY:**

a) Manufacturer will submit to RDSO the requirements of maintenance.
b) The manufacturer shall provide the services of competent engineers at own expense during the warranty period for any manufacturing and design defects and also to impart instructions for regular service and maintenance.
c) The manufacturer shall furnish list of recommended spares, tool & plants for proper upkeep and trouble-free service of ROCS and RRCS.
d) An undertaking that spares shall be made available during the service life (40years) of ROCS and RRCS shall be furnished along with the offer.

**14 WARRANTEE:** The manufacturer shall provide warrantee for satisfactory performance of ROCS and RRCS for a period of 30 months from date of supply & 24 months from the date of commissioning, whichever is earlier.

**15 FIELD TRIAL:** After successful type testing of prototype, minimum one tension length is required to be commissioned against order in Indian Railways for field trial for a period of three months. If field trial is not satisfactory, the prototype shall be treated as failed and further action shall be taken as per applicable RDSO ISO document of vendor approval. Any modifications found necessary during prototype testing and field trial shall be carried out by the manufacturer at his own cost Field trial shall be applicable for fresh vendor registration cases. After the satisfactory performance of the field trials, the firm may be considered for approval.

**16** All the provisions contained in RDSO's ISO procedures laid down in document No.- QO-D-8.1-11 dated 18.03.2025 (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"

**17** ROCS and RRCS should be compatible with Pantographs used in India Railways.

**18** The "Make in India" policy of Government of India shall be applicable.