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1. **SCOPE:**

This specification covers the technical requirements of design, manufacture, test at manufacturer's works, packing & forwarding, supply and unloading at store/ site of 33 KV Pin polymer insulator 10 KN used in 33 KV Overhead Transmission lines.

2. **APPLICABLE STANDARDS**:

Insulator shall comply with the requirements stated in the latest editions of the following standards-

- IEC: 61109: Definition, test methods and acceptance criteria for composite insulators for A.C. overhead lines above 1000V.
- IEC: 61952: Insulators for overhead lines – Composite line post insulators for alternative current.
- IS: 2071/ IEC: 60060-1: Methods of High Voltage Testing.
- IS: 2486/ IEC: 60120: Specification for Insulator fittings for Overhead power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices.
- IEC: 60575: Thermal Mechanical Performance test and mechanical performance test on string insulator units.
- IS: 13134/ IEC: 60815: Guide for the selection of insulators in respect of polluted condition.
- STRI guide 1.92/1: Hydrophobicity Classification Guide.
- IEC: 60437: Methods of RI Test of HV insulators.
- IS: 4759: Hot dip zinc coatings on structural steel & other allied products.
- IS: 2629: Recommended Practice for Hot, Dip Galvanization for iron and steel.
- IS: 6745: Determination of Weight of Zinc Coating on Zinc coated iron and steel articles.
- IS: 2633: Testing of Uniformity of Coating of zinc coated articles.
- ASTM D 578-05: Standard specification for glass fiber strands.

3. **CLIMATIC CONDITIONS**:

The service conditions shall be as follows:

1. Maximum altitude above sea level 1,000m
2. Maximum ambient air temperature 50°C
3. Maximum daily average ambient air temperature 35°C
4. Minimum ambient air temperature 0°C
5. Maximum relative humidity 95%
6. Average number of thunderstorm days per annum (isokeraunic level) 70
7. Average number of rainy days per annum 120
8. Average annual rainfall 150cm
9. Earthquakes of an intensity in horizontal direction - equivalent to seismic acceleration of 0.3g
10. Earthquakes of an intensity in vertical direction - equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

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11. Wind velocity: 300 km/hr, 200 km/hr and 160 km/hr.

Environmentally, some of the regions, where the work will take place includes coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas.

Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere

The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

4. GENERAL TECHNICAL REQUIREMENTS:

Sr.No.	Description	Unit	Requirements
1.	Type of Insulator		Polymeric Pin Insulator
2.	Standard according to which the Insulators manufacturedand tested.		IEC 61952 & IEC 61109
3.	Material of Housing and Weather Sheds		high voltage grade Silicone rubber
(a)	Material of core(FRP rod)		ECR BORRON FREE
(b)	Material of end fittings		SGI Cast/Forged steel
(c)	Sealing compound for end fittings		Silicone Sealent
4.	Colour of housing		Grey
5.	Electrical characteristics		
(a)	Nominal system voltage	KV	33 KV
(b)	Highest system voltage	KV	36 KV
(c)	Wet Power frequency withstand voltage	KV	75 KV
(d)	Dry lighting impulse withstand voltage	KV	170 KV
(e)	Visible Discharge Test Voltage	KV(rms)	27
(f)	Creepage distance (Min.)	mm	900 MM
(g)	Inclined plane Tracking and Erosion Resistance of Housing		4.5 kV for 360 minutes
(h)	FRP rod leakage Current at 175 V/mm		< 0.05 mA
6.	Other Physical & Dimensional characteristics:		
(a)	FRP Rod Dia (Min)	mm	24

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(b)	Dia of Weather Sheds	mm	110
(c)	Number of Weather Sheds	No.	8 (Min)
(d)	Creepage distance in heavily polluted atmosphere	Mm	900 (Min)
(e)	Minimum failing loads	kN	10

5. GENERAL CONSTRUCTION

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

Polymeric Insulators shall consist of THREE parts, at least two of which are insulating parts:- (a) Core- the internal insulating part (b)Housing- the external insulating part (c)Metal end fittings.

5.1 CORE

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber and shall exhibit both high electrical integrity and high resistance to acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP rod shall be manufactured through Pultrusion process. The FRP rod shall be void free. All rods must pass electric leakage current test of 170V/mm. The leakage current shall not exceed 0.05mA.

5.2 POLYMER HOUSING:

The FRP rod shall be covered by a seamless sheath of high voltage grade Silicone rubber housing of thickness 3mm minimum. It shall be one- piece housing using only Injection Molding process to cover the core. Primer should be used to bond the housing with FRP rod. The housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 60815 with latest amendments.

The high voltage grade Silicone rubber polymer material should be as per requirement specified in clause 8.2.2

5.3 WEATHERSHEDS

The composite polymer weathersheds made of high voltage grade Silicone rubber polymer shall be molded as part of the sheath and shall be free from imperfections. It should protect the FRP rod against environmental influences, external pollution and humidity. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

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Housing and weather shed material shall have tensile strength of 3 MPa with 400% elongation minimum and tear strength of 16N/mm.

The high voltage grade Silicone rubber polymer material should be as per requirement specified in clause 8.2.2

5.4 METAL END FITTINGS:

End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminum alloy. Metal end fitting shall be suitable for pin type hardware support of respective specified mechanical load and shall be hot dip galvanized in accordance with IS 2629. They shall be connected to the rod by means of a controlled compression technique. The OD of end fittings should be machined to make the surface uniform round to ensure effective sealing when housing is molded over it. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IEC: 60120/ IS: 2486 - Part-II /1989. Outer portion of Pin should be Zinc sleeved with minimum 99.95% purity of Electrolytic high grade zinc. Bottom end metal fitting (Shank) of Pin insulator should be forged steel as per IS 2002/92. Bottom end fitting should be single unit without any joints.
Nuts as per IS 1363 (P-III) and spring washer shall be as per IS 3063 with Latest amendments if any, Nuts and spring washer shall be hot dip galvanized.

The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulators shall not lead to deterioration. The Pin insulator shall not engage directly with hard metal.

6. **MARKING:**

Each insulator shall be legibly and indelibly marked as-

(a) Name & Trade mark of the manufacturer
(b) Month and year of manufacture
(c) Minimum failing load in KN
(d) “TPSODL” Name should be mentioned on each insulator.

7. **TESTS:**

Type Tests

- Dry lightning impulse withstand voltage test.
- Wet power frequency test.
- Mechanical load-time test.
- Radio interference test.
- Recovery of Hydrophobicity test.
- Brittle fracture resistance test.
- Cantilever Load withstand test for Pin Insulators.

Tests on the high voltage grade Silicone rubber material used in manufacture of the insulator housing and weathersheds:

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The bidder shall furnish following type test reports conducted on High voltage Silicone rubber material used for Polymer housing confirming following properties along with their bid.

Sl. No	Property	Requirement	Standard
1	Tensile Strength (MPa)	4 Mpa min	ASTM D 412-06a
2	Elongation (%)	300%	ASTM D 412-06a
3	Tear Strength	15 N/mm min	ASTMD 624
4	Inclined plane Tracking & Erosion resistance test	(4.5KV 360 min)	ASTM D2303
5	Volume Resistivity (Ohm –cm)	$1*10^{13}$ Ohm-cm min	ASTM D257
6	Dielectric constant	4	ASTM D150
7	Dielectric Strength (kv/mm)	26 kV /mm min	ASTM D149
8	Density	1.5 min	ASTM D792
9	Hardness (shore A)	62 nominal	ASTM D 2240
10	Arc Resistance	> 220 Seconds	ASTM D 495-99
11	Silicone Content	> 40%	BS: 2782-Pt10
12	Flammability	V0	UL 94

Acceptance Tests

- Verification of dimensions.
- Verification of the specified Cantilever load test.
- Galvanizing test.

Routine Test-

- Visual Inspection.
- Tensile Load Test (As per clause 13.2 of IEC-61952)
- Identification of marking.

8. **TYPE TEST CERTIFICATES:**

The Bidder shall furnish the type test certificates of the 33 KV Pin polymer Insulators for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA as per the relevant standards. Type tests should have been conducted in certified Test laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable, same shall be carried out without any cost implication to TPSODL.

9. **PRE-DISPATCH INSPECTION:**

Equipment shall be subject to inspection by a duly authorized representative of the TPSODL Inspection may be made at any stage of manufacture at the option of the purchaser and the equipment if found unsatisfactory as to workmanship or material is liable to rejection. Supplier shall grant free access to the places of manufacture to TPSODL's representatives at all times when the work is in progress. Inspection by the TPSODL or it's authorized representatives shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPSODL.

Following documents shall be sent along with material

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- Test reports
- MDCC issued by TPSODL
- Invoice in duplicate
- Packing list
- Drawings & catalogue
- Guarantee / Warrantee card
- Delivery Challan
- Other Documents (as applicable)

10. **INSPECTION AFTER RECEIPT AT STORE:**
TPSODL Inspectors will inspect the material received at TPSODL Store and shall have right to reject if found different from the reports of the pre-dispatch inspection.

11. **GUARANTEE:**
Supplier shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under the contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the Company up to a period of 12 months from the date of commissioning or 24 months from the date of last supplies made under the contract, whichever is earlier, supplier shall be liable to undertake to replace/rectify such defects at his own costs. within mutually agreed timeframe, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at supplier's risks and costs and recover all such expenses plus the Company's own charges(@ 20% of expenses incurred), from the supplier or from the" Security cum Performance Deposit" as the case may be. Supplier shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the Company.

12. **PACKING AND TRANSPORT:**
Supplier shall ensure that all equipment covered by this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.

13. **TENDER SAMPLE:**
As and when required.

14. **QUALITY CONTROL:**
The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections.

15. **TESTING FACILITIES:**
Supplier / Manufacturer shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16. **DRAWINGS AND DOCUMENTS:**
Following drawings and documents shall be prepared based on TPSODL specifications and

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statutory requirements and shall be submitted with the bid:

a) Completely filled in Technical Particulars
b) General description of the equipment and all components including brochures.
c) Experience List
d) Type test certificates.

Drawings / documents to be submitted after the award of the contract are as under:

S No.	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	General Arrangement Drawing	√		√
3	Mounting and fixing arrangement		√	√
4	Instruction for use		√	√
5	QA & QC Plan & Type test certificates	√	√	√

17. GUARANTEED TECHNICAL PARTICULARS:

The Bidder shall submit GTP as per the requirements of technical specification for approval.

18. SCHEDULES OF DEVIATIONS:

The Bidders shall set out all deviations from this specification, Clause by Clause in this schedule. Unless specifically mentioned in this schedule, the bidder shall be deemed to confirm the purchaser's specifications. (Format is attached).

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the Purchaser's specifications:

S.No.	Clause No.	Details of deviation with justifications

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We confirm that there are no deviations apart from those detailed above.

Seal of the Company. Designation:

Signature:

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