

TPSODL	TP SOUTHERN ODISHA DISTRIBUTION LIMITED, BERHAMPUR		
	TECHNICAL SPECIFICATION		
Doc. Title	Technical Specification for 11KV Pin Polymer Insulator		
Doc. No	ENG-HV-39	Eff. Date: 01/03/2021	
Rev. No	01	Page 1 of 10	
Prepared by:	Reviewed by:	Approved By:	Issued By:

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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 11 KV Pin polymer insulator used in 11 KV Overhead Transmission lines.
2	APPLICABLE STANDARDS:	<p>Insulator shall comply with the requirements stated in the latest editions of the following standards-</p> <ul style="list-style-type: none"> a) IEC: 61109: Definition, test methods and acceptance criteria for composite insulators for A.C. overhead lines above 1000V. b) IEC: 61952: Insulators for overhead lines – Composite line post insulators for alternative current. c) IS: 2071/ IEC: 60060-1: Methods of High Voltage Testing. d) 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. e) IEC: 60575: Thermal Mechanical Performance test and mechanical performance test on string insulator units. f) IS: 13134/ IEC: 60815: Guide for the selection of insulators in respect of polluted condition. g) STRI guide 1.92/1: Hydrophobicity Classification Guide. h) IEC: 60437: Methods of RI Test of HV insulators. i) IS: 4759: Hot dip zinc coatings on structural steel & other allied products. j) IS: 2629: Recommended Practice for Hot, Dip Galvanization for iron and steel. k) IS: 6745: Determination of Weight of Zinc Coating on Zinc coated iron and steel articles. l) IS: 2633: Testing of Uniformity of Coating of zinc coated articles. m) ASTM D 578-05: Standard specification for glass fiber strands.
3	CLIMATIC CONDITIONS OF THE INSTALLATION	<p>The service conditions shall be as follows:</p> <ol style="list-style-type: none"> 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) 11 .Wind velocity: 300 km/hr, 200 km/hr and 160 km/hr. <p>Environmentally, some of the regions, where the work will take place includes</p>

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		<p>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.</p> <p>Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere</p> <p>The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.</p>
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4.0 GENERAL TECHNICAL REQUIREMENTS			
Sl No.	Description	Unit	Requirements
1	Type of Insulator		Polymeric Pin Insulator
2	Material of housing and weather sheds		High voltage grade
(a)	Material of Core (FRP rod)	kV	ECR BORON FREE
(b)	Material of end fittings	Hz	SGI Cast/Forged Steel
(c)	Sealing compound for end fittings		Silicone Sealent
3	Colour of housing		Grey
4	Electrical characteristics		
(a)	Type		B
(b)	Rated Voltage	kV	12
(c)	Service Voltage	kV	11
(d)	Rated Frequency	Hz	50
(e)	Visible discharge test voltage	kV	9
(f)	Wet power frequency withstand voltage	kV (rms)	35
(g)	Dry power frequency withstand voltage	kV (rms)	55
(h)	Impulse withstand voltage	kV (peak)	75
(i)	Power frequency puncture withstand voltage	kV (rms)	105
(j)	RIV at 1MHZ when energized at 10KV	Microvolt	<50Micro volt
5	Other Physical & Dimensional requirements		
(a)	FRP Rod Dia (Min)	mm	24
(b)	Dia of Weather Sheds	mm	110
(c)	Number of Weather	No.	3 (Min)


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	Sheds		
(d)	Creepage distance in heavily polluted atmosphere	Mm	320 (Min)
(e)	Minimum failing loads	kN	5


5	GENERAL CONSTRUCTIONS	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	Core 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.
5.2	POLYMER HOUSING	The FRP rod shall be covered by a seamless sheath of high voltage grade Silicone rubber housing. 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. All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.
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. Housing and weather shed material shall have tensile strength of 3 MPa with 400% elongation minimum and tear strength of 16N/mm.
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

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		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.
6.0	MARKING:	Each insulator shall be legibly and indelibly marked with "PO no. with date, "Property of TPSODL, BERHAMPUR", "CODE NUMBER", along with following: <ul style="list-style-type: none"> a. Manufacturer's name b. Type designation or serial no. c. Minimum failing load in kN d. No. of relevant standard e. Month and year of manufacture f. Country of manufacture
7.0	TESTS:	All routine/acceptance tests shall be witnessed by the purchaser/his authorized representative. Following tests for 11kV Pin Polymer insulator should be done as per relevant standards: <p>Tests on Silicone Rubber:</p> <ul style="list-style-type: none"> • Tensile Strength & Elongation • Tear Strength • Inclined Plane Tracking & Erosion • Volume resistivity • Dielectric Strength • Dielectric Constant • Density • Hardness • Arc Resistance • Silicone content • Flammability • Resistance to weathering & UV. • Limiting oxygen index test. • Specific gravity. <p>Tests on FRP Rods:</p> <ul style="list-style-type: none"> • Verification of dimensions. • Specific Gravity • Glass Content • Water Diffusion Test • Hardness • Dye Penetration Test. • Flexural strength. • Water absorption. • Brittle fracture resistance test.

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		<ul style="list-style-type: none"> • Visible discharge test. • Dry lightning impulse withstand voltage test. • Wet power frequency withstand voltage test. • Power Arc test. • Accelerated weathering test. • Tracking & erosion test. <p>Tests on End Fittings:</p> <ul style="list-style-type: none"> • Thickness of Zinc Coating • Uniformity of Zinc Coating • Micro-structural of metal fitting. <p>Test of Complete polymer insulators:</p> <ul style="list-style-type: none"> • Dry lightning impulse withstand voltage test. • Wet power frequency test. • Mechanical failing load test. • Radio interference test. • Mechanical performance test <p>U.V Resistance as per ASTM G 53: 1000 Hrs - UV Light for 8 Hours and condensation for 4 hours in a continuous cycle. Elongation to be limited to 20% (% Elongation to break before and after the test).</p> <ul style="list-style-type: none"> • Salt Fog test: On insulators for 1000 hours as per IEC. • Galvanisation test. • Visual examination. • Verification of dimensions. • Bending test. • Verification of the locking system or the tightness of the interface between end fitting and insulator housing. • Assembled core load time test. • Determination of the average failing load of the core of the assembled insulator. <p>Design Tests:</p> <p>For composite insulators it is essential to carry out design test as per clause 4.1 of IEC 61109 / 92-93 with latest amendments. The design tests are intended to verify the suitability of the design, materials and method of manufacture (technology). When a composite insulator is submitted to the design tests, the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics:</p> <ul style="list-style-type: none"> • The materials for the core, and sheds and same manufacturing method; • The material of the fittings, the same design, the same method of attachment; • Polymer insulator should have greater layer thickness of the shed material over the core (including a sheath where used); • Polymer insulator should have smaller ratio of the highest system voltage to insulation length; • Polymer insulator should have smaller ratio of all mechanical loads to the smallest core diameter between fittings • Polymer insulator should have greater diameter of the core.
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		<p>The tested composite insulators shall be identified by a drawing giving all the dimensions with the manufacturing tolerances. Manufacturer should submit test reports for Design Tests as per IEC – 61109 (clause – 5) along with the bid. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract: UV test: the test shall be carried out in line with clause 7.2 of ANSI C29.13. In addition, chemical composition test for silicon content would also be added in the testing list.</p> <p>Acceptance Tests For Composite Insulators</p> <ul style="list-style-type: none"> • Verification of dimensions • Visual examination • Verification of the locking system or the tightness of the interface between end fitting and insulator housing • Galvanizing test • Verification of the specified mechanical load • Bending load test • Dry power frequency withstand voltage test • Analysis of material properties of housing material • Analysis of material properties of core material <p>Routine Tests</p> <ul style="list-style-type: none"> • Visual Examination • Mechanical load test as per IEC 61109 & IEC 62231
8.0	TYPE TEST CERTIFICATES:	<p>The Bidder shall furnish the type test certificates of the 11 KV Pin polymer Insulators for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI/ERDA/International Laboratory 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.</p>
9.0	PRE DISPATCH INSPECTION:	<p>The material shall be subject to inspection by a duly authorized representative of the TPSODL. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder 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 its authorized representatives shall not relieve the bidder 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.</p> <p>Following documents shall be sent along with material</p> <ol style="list-style-type: none"> a) Test reports b) MDCC issued by TPSODL c) TPSODL Invoice in duplicate d) Packing list e) Drawings & catalogue

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		f) Guarantee / Warrantee card g) Delivery Challan h) Other Documents (as applicable).
10.0	INSPECTION AFTER RECEIPT AT STORES:	The material received at TPSODL store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Engineering & contracts department.
11.0	GUARANTEE:	<p>Bidder shall stand guarantee towards design, materials, workmanship & quality of process/ manufacturing of items under this 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 Purchaser up to a period of at least 12 months from the date of commissioning or 24 months from the date of last supplies made under the contract whichever is later, (the time scale of 12/24 months could be enhanced subject to mutual agreements). Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Purchaser, failing which the Purchaser will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Purchaser's own charges (@ 20% of expenses incurred), from the Bidder or from the "Security cum Performance Deposit" as the case may be.</p> <p>Bidder 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 Purchaser.</p>
12.0	PACKING:	Bidder shall ensure that all the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
13.0	TENDER SAMPLE:	As and when required
14.0	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.
15.0	MINIMUM TESTING FACILITIES:	The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to TPSODL Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender. The insulators shall be tested in accordance with the procedure detailed in IEC 61109 / 92-93 with latest amendments.

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16.0	MANUFACTURING ACTIVITIES:	The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.
17.0	SPARES, ACCESSORIES AND TOOLS:	Not Applicable.
18.0	DRAWINGS AND DOCUMENTS:	

Following documents shall be prepared based on TPSODL specifications and statutory requirements with complete BOM and shall be submitted with the bid:

- Completely filled in Technical Particulars
- General description of the equipment and all components including brochures
- Generalized drawing for Pin Insulator
- Bill of Material
- Type test Certificates
- Experience List.

After the after of the contract, four (4) copies of the drawings, drawn to scale, describing the equipment in detail shall be forwarded for approval and shall subsequently provide four (4) complete sets of final drawings, one of which shall be auto positive suitable for reproduction, before the dispatch of the equipment. Soft copy (Compact Disk CD) of all the drawing, GTP, test certificates shall be submitted after the final approval of the same to the purchaser.

Following Drawings/Documents shall be submitted after the award of the contract:

S. No	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	Manual/Catalogues/drawings for all components.		√	
3	Technical details and test certificates of the component.		√	√
4	Installation Instructions		√	√
5	Instructions for use		√	√
6	Transport/shipping dimension drawing		√	√
7	QA & QC Plan	√	√	√
8	Routine, Acceptance and Type test Certificates	√	√	√

All the Documents and Drawings shall be in English Language.

Instruction Manuals: Bidder shall furnish two (2) soft copies (CD) and four (4) hard copies of nicely bound manual (in English Language) covering erection and maintenance instructions and all relevant information pertaining to the main equipment as well as auxiliary devices.

19.0	GUARANTEED TECHNICAL PARTICULARS:	
The Bidder shall submit GTP as per the requirements of technical specification for approval.		

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20.0	SCHEDULE OF DEVIATIONS <u>(TO BE ENCLOSED WITH</u> <u>TECHNICAL BID)</u>							
<p>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:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="width: 10%;">S. No</th> <th style="width: 20%;">Clause No.</th> <th style="width: 70%;">Details of deviation with justifications</th> </tr> </thead> <tbody> <tr> <td style="height: 200px;"></td> <td></td> <td></td> </tr> </tbody> </table> <p>We confirm that there are no deviations apart from those detailed above.</p> <p>Seal of the Company:</p> <p style="text-align: center;">Signature</p> <p style="text-align: center;">Designation</p>			S. No	Clause No.	Details of deviation with justifications			
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