



TATA POWER

TECHNICAL SPECIFICATION COVER SHEET

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1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store and performance of **AAAC Conductors** trouble free & efficient performance.

2. APPLICABLE STANDARDS:

AAAC Conductors covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest revisions of relevant Indian Standards/ IEC and shall conform to the regulations of local statutory authorities.

Sl. No	IEC/IS	Description
1	IEC :1089	Round wire concentric lay overhead electrical standard Conductor
2	IS 398:4	Aluminum Alloy Stranded Conductors
3	IS 9997	Aluminum Alloy redraw rods for electrical purposes
4	IEC 502: 1994	Extruded solid dielectric insulated power cables for rated voltages 1.0 kV up to 30 kV
5	IEC 104	Aluminum Magnesium Silicon alloy wire for overhead line conductors
6	IS 1778	Reels and drums of bare conductor.

3. CLIMATIC CONDITIONS:

SL.NO.	CONDITONS	VALUES
1	Max. altitude above sea level	1200m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	35 °C
4	Min Ambient Temp	0 °C
5	Max temperature attainable by an object exposed to sun	60 °C
6	Maximum Humidity	95%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	150 cm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.

Environmentally, some of the regions, where the work will take place include 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 atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces corresponding to an acceleration of 0.1 g.

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4. GENERAL TECHNICAL REQUIREMENTS:

SL/N	TECHNICAL PARTICULARS	UNIT	REQUIREMENT				
1	Make		Aluminium Alloy rod		HINDALCO / BALCO / VEDANTA / NALCO		
			Conductor		To be furnished by the bidder		
2	Particulars of Raw material Note – The Aluminum conductor strands shall be drawn from 99.5% pure electrolytic EC grade Aluminum rods	%	Material Particles		Percentage		
			Si		0.50 - 0.90		
			Mg		0.60-0.90		
			FE		0.50 max		
			Cu		0.10 max		
			Mn		0.03 max		
			Cr.		0.03 max		
			Zn		0.10 max		
			B		0.06 max		
			Other Elements (Each)		0.03 max		
			Other Elements (Total)		0.10 max		
			Aluminium		Remainder		
Aluminium alloy Stranded conductor, (IS 398 Part 4, table 2)							
3	Actual Sectional area of the conductor	Mm ²	Size of conductor		Area of conductor		
			WEASEL		34		
			RABBIT		55		
			RACCOON		80		
			DOG		100		
			COYOTE		148		
			PANTHER		232		
4	Stranding & wire dia of the conductor	No/mm	Size of conductor	Area of conductor	No of strands	Dia of strands	
			WEASEL	34	7	2.50	
			RABBIT	55	7	3.15	
			RACCOON	80	7	3.81	
			DOG	100	7	4.26	
			COYOTE	148	19	3.15	
			PANTHER	232	19	3.94	
5	Approx. overall dia of the conductor	mm	Size of conductor		Area of conductor		Overall diameter
			WEASEL		34		7.50
			RABBIT		55		9.45
			RACCOON		80		11.43
			DOG		100		12.78
			COYOTE		148		15.75
			PANTHER		232		19.70
6	Approx. mass of the conductor	Kg/km	Size of conductor		Area of conductor		Mass
			WEASEL		34		94.00
			RABBIT		55		149.20
			RACCOON		80		218.26

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			DOG	100	272.86
			COYOTE	148	406.91
			PANTHER	232	636.67
7	Calculated max resistance of 200 C of the conductor	Ohm/km	Size of conductor	Area of conductor	Max Conductor resistance
			WEASEL	34	0.9900
			RABBIT	55	0.6210
			RACCOON	80	0.4250
			DOG	100	0.3390
			COYOTE	148	0.2290
			PANTHER	232	0.1471
8	Approx. calculated breaking load of the conductor	KN	Size of conductor	Area of conductor	Breaking load
			WEASEL	34	10.11
			RABBIT	55	16.03
			RACCOON	80	23.41
			DOG	100	29.26
			COYOTE	148	43.50
			PANTHER	232	68.05

Aluminium Alloy wire used in the construction of stranded Aluminium Alloy Conductors, (IS 398 Part 4, table 1)

9	Diameter (mm)	mm	Size of conductor	Nominal	Maximum	Minimum
			WEASEL	2.5	2.53	2.47
			RABBIT	3.15	3.18	3.12
			RACCOON	3.81	3.77	3.85
			DOG	4.26	4.30	4.22
			COYOTE	3.15	3.18	3.12
			PANTHER	3.94	3.98	3.90
10	Cross Section Area of Nominal dia. wire	mm ²	Size of conductor	Nominal dia	Cross sectional area	
			WEASEL	2.5	4.909	
			RABBIT	3.15	7.793	
			RACCOON	3.81	11.40	
			DOG	4.26	14.25	
			COYOTE	3.15	7.793	
			PANTHER	3.94	12.19	
11	Mass of individual wire	Kg/km	Size of conductor	Nominal dia	Mass	
			WEASEL	2.5	13.25	
			RABBIT	3.15	21.04	
			RACCOON	3.81	30.78	
			DOG	4.26	38.48	
			COYOTE	3.15	21.04	
			PANTHER	3.94	32.92	
12	Minimum Breaking Load of each strand after stranding	KN	Size of conductor	Nominal dia	Breaking load	
			WEASEL	2.5	1.44	
			RABBIT	3.15	2.29	
			RACCOON	3.81	3.34	
			DOG	4.26	4.18	

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			COYOTE	3.15	2.29		
			PANTHER	3.94	3.58		
13	Max Resistance at 20°C	Ohm/km	Size of conductor	Nominal dia	Max Resistance		
			WEASEL	2.5	6.845		
			RABBIT	3.15	4.290		
			RACCOON	3.81	2.938		
			DOG	4.26	2.345		
			COYOTE	3.15	4.290		
			PANTHER	3.94	2.746		
Other Requirement							
14	Minimum elongation % on gauge length of 200 mm (After Strand)	%	4 (As per IS 398 Part 4, Clause no 12.3)				
15	Lay ratio of conductor (Min. / Max.) Note – As per IS 398 part 4, table 3		Size of conductor	No of strands	Min	Max	
			WEASEL	7	10	14	
			RABBIT	7	10	14	
			RACCOON	7	10	14	
			DOG	7	10	14	
			COYOTE	19	10	16	
			PANTHER	19	10	16	
16	Direction of lay for outside layer		Right Hand				
17	Standard length of conductor (meter) Note – Tolerance on standard length of Conductor is ±5 %	Mtr.	Size of conductor		Length of the conductor		
			WEASEL		2000		
			RABBIT		2000		
			RACCOON		2000		
			DOG		2000		
			COYOTE		2000		
			PANTHER		2000		
18	Modulus of Elasticity Note – As per IS 398 Part 4 ANNEX A	Kg/cm ²	Size of conductor		No of strands		Modulus of elasticity
			WEASEL		7		0.6324 X 10 ⁶
			RABBIT		7		0.6324 X 10 ⁶
			RACCOON		7		0.6324 X 10 ⁶
			DOG		7		0.6324 X 10 ⁶
			COYOTE		19		0.612 X 10 ⁶
			PANTHER		19		0.612 X 10 ⁶
19	Co – efficient of liner expansion per deg. C Note – As per IS 398 Part 4 ANNEX A		Size of conductor		Co-efficient of liner expansion per deg. C		
			WEASEL		23 X 10 ⁻⁶		
			RABBIT		23 X 10 ⁻⁶		
			RACCOON		23 X 10 ⁻⁶		
			DOG		23 X 10 ⁻⁶		
			COYOTE		23 X 10 ⁻⁶		
			PANTHER		23 X 10 ⁻⁶		
20	Density of Material	Kg/ cm ³	2.7 (As per IS 398 Part 4, Clause 4.2)				
21	Freedom of defects		The wire shall be smooth and free from all imperfections not				

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			consistent with good commercial practices, for example spills, spilts, scratches. (As per IS 398 Part 4, Clause 6)															
	Joints in the wires (As per IS 398 Part 4, Clause no – 8)		<p>Conductors Containing Up to Seven Wires – No joints are permitted in any wire of a stranded conductor containing up to seven wires, except those made in the base rod or wire before final drawing.</p> <p>Conductors Containing More Than Seven Wires –</p> <ul style="list-style-type: none">• Joints in individual wires are allowed in any layer except the outermost layer, in addition to those made in the base rod or wire before final drawing.• Spacing – No two such joints should be less than 15 meters apart in the complete stranded conductor.• Method – Joints must be made by resistance or cold-pressure butt welding.• Mechanical Requirements – These joints are not required to meet the mechanical requirements for unjointed wires.• Annealing – Joints made by resistance butt welding should be annealed over a distance of at least 200 mm on each side of the joint.															
22	Continuous max current carrying capacity in still air at 40°C ambient temperature	Amp	<table><tr><th>Size of conductor</th><th>Current Charring Capacity (min)</th></tr><tr><td>WEASEL</td><td>155</td></tr><tr><td>RABBIT</td><td>230</td></tr><tr><td>RACCOON</td><td>295</td></tr><tr><td>DOG</td><td>345</td></tr><tr><td>COYOTE</td><td>447</td></tr><tr><td>PANTHER</td><td>593</td></tr></table>	Size of conductor	Current Charring Capacity (min)	WEASEL	155	RABBIT	230	RACCOON	295	DOG	345	COYOTE	447	PANTHER	593	
Size of conductor	Current Charring Capacity (min)																	
WEASEL	155																	
RABBIT	230																	
RACCOON	295																	
DOG	345																	
COYOTE	447																	
PANTHER	593																	

5. GENERAL CONSTRUCTION:

Freedom of defects – The wire shall be smooth and free from all imperfections not consistent with good commercial practices, for example spills, splits & scratches. (As per clause 6.1 IS 398 part 4)

Joints in the wire – As per Clause no 8 IS 398 part 4

6. MARKING:

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- Contract/Award letter number
- Name and address of consignee.
- Manufacture's name and address.
- Drum and lot number
- Size and type of conductor
- Length of conductor in meters
- Arrow marking for unwinding

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- Position of the conductor ends
- Number of turns in the outer most layer.
- Gross weight of the drum after putting lagging.
- Average weight of the drum without lagging. ISI mark Manufacturer Name/ Trade Mark
- “TPNODL/ TPCODL/ TPSODL/ TPWODL, TPDDL, TPADL, TPC – Mumbai”
- P.O No and Date.

7. TESTS:

All Routine, Acceptance & Type tests shall be carried out in accordance with the Relevant IS/IEC/ ENA TS 09-13. All the components shall also be type tested as per the relevant standards mentioned below. Following tests shall be necessarily conducted on the conductors in additions to others specified in the IS standards:

*In case of any conflict on any technical particular in the specification, the stricter requirement mentioned in the relevant standard shall be valid

A. ACCEPTANCE TESTS:

S/NO	Test	Clause No.	Reference Standard
1	Tensile strength of wire	Cl. 12.2	IS 398 Part 4
2	Elongation of wire	Cl. 12.3	IS 398 Part 4
3	Electrical resistivity	Cl. 12.4	IS 398 Part 4
4	Dimensional check (Dis of overall conductor, wires & mass of wire & conductor)	As per specification	As per specification
5	Surface condition	Cl. 6	IS 398 Part 4
6	Conductor lay verification	Table 3	IS 398 Part 4
7	Raw material TC verification	As per specification	As per specification

B. ROUTINE TESTS

The routine tests shall be done same as acceptance tests and shall be carried out before and after stranding.

S/NO	Test	Clause No.	Reference Standard
1	Visual inspection	Cl. 12.1	No surface defects, proper stranding
2	Dimensional check	Cl. 6 & 9	As per conductor & wire design
3	Lay ratio verification	Table 3	IS 398 Part 4
4	Electrical resistivity (sample wire)	Cl. 12.4	IS 398 Part 4
5	Marking and packing inspection	Cl. 11	As per specification

C. TYPE TESTS:

S/NO	Test	Clause No.	Reference Standard
1	Tensile strength of individual wire	Cl. 12.2	IS 398 Part 4
2	Elongation of individual wire	Cl. 12.3	IS 398 Part 4
3	Electrical resistivity of wire	Cl. 12.4	IS 398 Part 4
4	Surface condition	Cl. 6	IS 398 Part 4

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5	Dimensional check	-	IS 398 Part 4
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8. TYPE TEST CERTIFICATES:

The bidder shall furnish the type test certificates of the cable for the tests as mentioned as above as per the corresponding standards. All the tests shall be conducted by CPRI / ERDA / Third Party NABL as per the relevant standards. Type test 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 or any/all type tests (including additional type tests, if any) not carried out, same shall be carried out without any cost implication to TPNODL / TPWODL / TPCODL/ TPSODL / TPDDL / TPADL / Tata power Mumbai.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power mumbai. 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 TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power mumbai representatives at all times when the work is in progress. Inspection by the 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 TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power mumbai.

Following documents shall be sent along with material.

- Test reports
- MDCC issued by TPCODL/TPWODL/TPNODL/TPSODL/TPC mumbai/ TPDDL/ TPADL
- TPCODL/TPWODL/TPNODL/TPSODL/TPC mumbai/ TPDDL/ TPADL Invoice in duplicate
- Packing list
- Drawings & catalogue
- Guarantee / Warrantee card
- Delivery Challan
- Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORE:

The material received at TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power mumbai 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 Project Engineering department.

11. GUARANTEE:

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 earlier, (the time scale of 12/24 months could be enhanced subject to mutual agreements).

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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.

12. PACKING AND TRANSPORT:

- A. The conductor shall be wound on non-returnable wooden reels or drums conforming to IS 1778:1981 Conductor drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/ unevenness/ sharp edges that can damage the conductor or hands of the operator during rotation of drums. Material preservation shall be applied to the entire drum.
- B. The conductor shall be supplied in the standard length of 2.00km. Not less than 95% of the conductor shall be supplied in standard lengths and the remaining 5% required to be supplied in one drum only and length of pieces shall not be less than 500 meters. The number of pieces if in the drum shall be indicated on the conductor drum.
- C. No. of standard length @ 2000 mtrs \pm 5% per Drum.
- D. Conductor wound on wooden drum shall be covered by recyclable polyethylene sheets.

13. TENDER SAMPLE:

NA

1. TRAINING:

NA

2. 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.

Rejection and Retest – During inspection if any one of the test pieces first selected fail to pass the tests, three further samples from the same batch shall be selected as per IS, one of which shall be from the length from which the original test sample was taken, unless that length has been withdrawn by the supplier. If all of the three test pieces from these additional samples satisfy the requirements of the tests, the batch represented by these samples shall be deemed to comply with the standard. In case, the test pieces from any of the three additional samples fail, the batch represented shall be deemed not to comply with the standard.

3. TESTING FACILITIES:

Supplier/ Manufacturer shall have adequate in-house testing facilities for carrying out all routine tests &

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acceptance tests as per relevant Indian/International standards.

4. MANUFACTURING FACILITIES:

The successful bidder will have to submit (after placement of RC) technical compliance document as per RC line items for getting approval before mass manufacturing. Bidder shall start manufacturing of mass quantity only after getting Cat – A approved specification / GTP/ drawings as per intimation from TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power mumbai.

5. SPARES, ACCESSORIES AND TOOLS

NA

6. DRAWINGS AND DOCUMENTS:

Following drawings and documents shall be prepared based on TPCODL/ TPWODL/ TPNODL/ TPSODL/ TPDDL/ TPADL /Tata power Mumbai. Specifications and statutory requirements and shall be submitted with the bid:

- Completely filled in Technical Particulars.
- Type test Certificates

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

Sl/No	Description	For approval	For Review Information	Final submission
1	Technical Parameters	√		√
2	Technical details and test certificates of conductor.		√	√
3	Cross sectional Drawing of the conductor		√	√
4	QA & QC Plan	√	√	√

All the Documents and Drawings shall be in English Language

7. SCHEDULE- “A” GUARANTEED TECHNICAL PARTICULARS:

All clauses and points in the Specification to be complied.

8. SCHEDULE “B” DEVIATIONS:

(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:

SL. No	Clause No.	Details of deviation with justifications

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

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Seal of the Company:

Signature
Designation

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Annexure 1

Inspection Test Plan

S/NO	Test	Clause No.	Reference Standard
1	Tensile strength of wire	Cl. 12.2	IS 398 Part 4
2	Elongation of wire	Cl. 12.3	IS 398 Part 4
3	Electrical resistivity	Cl. 12.4	IS 398 Part 4
4	Dimensional check (Dis of overall conductor, wires & mass of wire & conductor)	As per specification	As per specification
5	Surface condition	Cl. 6	IS 398 Part 4
6	Conductor lay verification	Table 3	IS 398 Part 4
7	Raw material TC verification	As per specification	As per specification