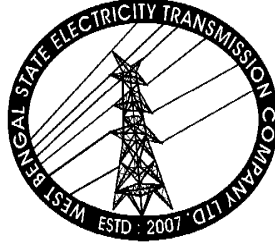


ACSR CONDUCTOR



September 2017

Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

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TECHNICAL SPECIFICATION FOR ACSR CONDUCTOR

1. **SCOPE :**

This specification covers design, manufacture, testing at manufacturer's works of ACSR 'MOOSE', ACSR 'PANTHER' & ACSR 'ZEBRA' Conductor for use in new as well as for existing Sub-Station.

2. **STANDARD :**

The ACSR Conductor shall conform to the latest edition of the following Indian Standards unless otherwise specified hereinafter and as per latest relevant IEC's.

Sl. No.	Indian Standards	Title
1.	IS 1778	Reels and drums for bare conductor
2.	IS 2629	Recommended practice for hot dip Galvanising on iron and steel.
3.	IS 2633	Method for testing uniformity of coating of Zinc-coated articles.
4.	IS 209	Specification for Zinc Ingot.
5.	IS 4826	Hot-dip Galvanised coatings on Round Steel Wires.
6.	IS 1521	Methods for Tensile testing of Steel Wires.
7.	IS 398	Aluminium Conductors for O.H. transmission purposes (Aluminium conductors galvanised steel reinforced).
8.	IS 6745	Method of Determination of weight of zinc coating of zinc coated Iron & Steel articles.

3. **I) DEVIATION :**

Normally the offer should be as per Technical Specification without any deviation.

II) MODIFICATION :

If any modification felt necessary to improve performance, efficiency and utility of equipment, the same must be mentioned in the 'Modification schedule' with reasons duly supported by documentary evidences and advantages. Such modifications suggested may or may not be accepted, but the same must be submitted along with Pre-Bid Queries. The modifications not mentioned in Schedule will not be considered.

4. DESIGN CRITERIA & CONSTRUCTION :

4.1. MATERIALS (Materials for ACSR Conductor) :

i) ALUMINIUM :

The aluminium strands of the steel coredaluminium conductor shall be hard drawn electrolytic aluminium rods of E.C. Grade having purity not less than 99.5%.

ii) STEEL :

The steel wire strand shall be drawn from High carbon steel wire rods produced by either the acid or the basic open hearth process, or, the electric furnace process of the basic oxygen process and shall conform to the following requirements as to the chemical composition.

Element	% Composition
Manganese	0.40 to 1.10
Carbon	0.50 to 0.85
Phosphorus	0.05 max.
Sulphur	0.05 max.
Silicon	0.15 to 0.35

iii) ZINC :

The zinc used for galvanizing shall be electrolytic High Grade (HG) quality of 99.95% purity. It shall conform to the requirements of IS: 209.

4.2. WORKMANSHIP :

- i) All the Aluminium and Steel strands shall be smooth, uniform and free from all imperfections, such as spills & splits, die marks, scratches, abrasions etc. after drawing and also after stranding.
- ii) The composite conductor surface shall be smooth without any cuts, abrasions scuff marks and shall be free from dirt, grease etc.
- iii) The steel strand shall be hot dip galvanised and shall have a zinc coating of minimum 260 gms /sqm on uncoated wire surface. The zinc coating shall be smooth continuous and of uniform thickness and shall withstand minimum three dips of one minute duration.
- iv) The wire used in construction of a steel coredaluminium conductor, before stranding shall satisfy the requirements for solid wires given in Tables 1 & 2 of IS:398 (Part-V), values given in this specification will hold good in case of any difference.

4.3. JOINTS IN WIRES (for ACSR) :

i) ALUMINIUM WIRES :

No joints shall be permitted in the individual wires in the outermost layer of the finished conductor. Joints in the individual wires in the layers are permitted in addition to those made in the base rod or wire before final drawing but no two such joints shall be less than 15 m. apart in the complete stranded conductor. Such joints shall be made by the cold pressure butt welding.

ii) STEEL WIRES :

There shall be no joint in the finished wire entering into the construction of the strand. There shall also be no strand joints or strand splice in any length of the completed stranded steel core of the conductor.

4.4. STANDARD LENGTH :

- i) The standard length of the conductor has been specified under Specific Technical Parameters. The tolerance on this length shall be +/- 5%.
- ii) Not less than 95% of the total quantity of the conductor shall be supplied in standard lengths. Conductor length in respect to balance 5% (maximum) supply shall be in random length of not less than 67% of a standard length and shall be supplied in individual drum.

4.5. STRANDING :

The wire used in the construction of a stranded conductor shall before stranding, satisfy all the relevant requirement of the standard. The lay ratio of different layers shall be within the limit as specified.

In all constructions, **the successive layers shall have opposite directions of lay, the outermost layer must be right handed.** The wires in each layer shall be eventual and closely stranded,

5. TESTS & INSPECTION :

5.1. WBSETCL RESERVE THE RIGHT FOR TESTING AND INSPECTION OF THE CONDUCTOR AND STEEL WIRE AND VERIFY ITS COMPONENT.

i) ACCEPTANCE TESTS :

All acceptance tests shall be conducted on every lot offered for inspection at the manufacturer's works as per relevant IS in presence of Engineers of WBSETCL. Bidder shall have adequate testing facilities at their works to conduct all relevant routine and acceptance test as stipulated in the relevant IS in presence of engineers of WBSETCL. The entire cost of carrying out all routine as well as all acceptance test on all offered lot as per stipulation of IS shall be treated as included in the quoted unit price of conductors. Contractor shall give at least 15 (fifteen) days advance notice intimating actual date of inspection and details of all tests that are to be carried out. Selection of sample for acceptance test as well as rejection and re-testing shall be guided by relevant IS. All routine tests at manufacturer's works i.r.o conductor of each drum shall be carried out and Test Report are to be submitted.

FOR ACSR CONDUCTOR :

- a) Visual checks for joints etc.
Two / three drums from each lot shall be rewound in presence of the purchaser's representative to facilitate visual checks for joints, scratches etc. and to see that the conductor generally conforms to the requirement of the specification.
In the process declared length and weight shall also be verified.
- b) Dimensional check on aluminium and steel strands.
- c) Checking of lay ratio of each layer of conductor and lay direction.

- d) Breaking load test on individual wires.
- e) Elongation test on steel wire.
- f) Wrap test on steel and aluminium wire.
- g) D.C. resistance test on Aluminium strands.
- h) Galvanising test on steel strands.
- i) Visual check on drums.
- j) Ductility test on galvanized steel wires.

ii) ROUTINE TEST :

To ensure quality of conductor to be supplied under this contract, the suppliers have to carry out all the routing tests as described in IS:398 and maintain a record. Routine Test reports are to be submitted to WBSETCL.

Moreover in course of production, the contractor shall ensure the following:

- a) Check that the joints are as per specifications.
- b) Check that there are no cuts, fins etc. on the strands.
- c) Check that correctness of stranding.
- d) Check that the drums are as per specification.

For quality assurance of the materials used in the production he will also check the following:

- i) Chemical analysis of aluminium used or making aluminium strands.
- ii) Chemical analysis of steel used for making steel strands.
- iii) Chemical analysis of zinc used for Galvanising.

5.2. GUARANTEE:

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

5.3. CONTRACT DRAWINGS & DOCUMENT :

In the event of placement of Letter of Award (LOA) the contractor shall submit six (6) copies of relevant drawings, leaflets, G.T.P. and other particulars to the Chief Engineer, Engg. Dept. for approval.

After approval four (4) sets of approved GTP & relevant documents both in soft and hard format, for each sub-station shall be submitted by the contractor for our record and distribution to site.

5.4. TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES :

- i) Each type of conductor shall comply with the requirements of routine tests as per relevant IS.
- ii) All routine and acceptance tests shall be carried out at the manufacturer's works on every lot of offered different type of conductor as per relevant IS. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. Three (3) copies of test reports shall be submitted for approval and distribution to site. The contractor shall give at least 15 (fifteen) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

5.5. TESTS REPORTS AND TYPE TESTS :

Only type tested ACSR Conductor are to be offered conforming to our technical specification, and relevant IS and IEC. ACSR Conductor offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively alongwith submission of drawings during detailed Engineering. Successful bidder may require to produce original copies of type test reports at the time of detail Engineering if asked by WBSETCL.

6. PACKING AND FORWARDING :

6.1. GENERAL:

- i) The conductor shall be wound on returnable wooden drum strong enough and provided with tagging of adequate strength, constructed to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The drums shall generally conform to IS:1778 – 1980 as amended up to date and the dimensions shall be as per requirement of conductor length.
- ii) Only one conductor length shall be packed on such drum.
- iii) The drum shall be suitable for wheel mounting.

6.2. CONSTRUCTION OF DRUMS:

All wooden component shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment shall be applied to the entire drum with preservatives of such a quality which is not harmful to the conductor.

6.3. PROTECTIVE ARRANGEMENT:

- i) The inner side of the flanges and drum barrel surfaces shall be painted with a bitumen based paint/aluminium paint.
- ii) Before reeling, cardboard or double corrugated or thick bituminised waterproof paper shall be secured to the drum barrel and inside of flanges of the drums by means of suitable adhesive material. These protective wrappings and the adhesive material used, shall be of a quality which is not harmful to the conductor. The bituminous water proof paper shall also be provided between each layer of conductor.
- iii) After reeling the conductor, the exposed surface of the outer layer of the conductor shall be wrapped with waterproof, thick, bituminised paper and also with thick plastic sheet to prevent the conductor from dirt, grit and damage during transport and handling.
- iv) After application of bituminised and plastic paper, protective tagging of circumferential batten of suitable thickness shall be provided, in order to protect conductor from damage during transit in the event of breakage/detachment of the external protective tagging.
- v) The thickness of the external protective tagging or circumferential batten shall be sufficient to withstand transit hazards.
- vi) Outside the protective tagging, there shall be minimum of two binders' consisting of hoop iron or galvanised steel wire. Each protective tagging shall have two recesses to accommodate hoop binders.
- vii) The conductor ends shall be properly sealed and secured with the help of 'U' clamps on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.

6.4. MARKING :

Each drum shall have following information stenciled on it in indelible ink along with other essential details.

- (a) Contract/Purchase order number
- (b) Name and address of the consignee
- (c) Manufacturer's name or trademark
- (d) Drum number
- (e) Code name and size of the conductor
- (f) Length of the conductor in meters
- (g) Gross weight of the drum with protective tagging including conductor
- (h) Net weight of the conductor
- (i) Arrow marking for unwinding
- (j) Position of the conductor end
- (k) Lot number
- (l) Name of the destination
- (m) Date of Manufacture.

Before dispatch, property identification mark 'WBSETCL' shall be engraved in each drum.

SPECIFIC TECHNICAL PARAMETERS

Sl. No.	Description	For ACSR Conductor		
1.	Code Name	MOOSE	ZEBRA	PANTHER
2.	Equivalent area of Aluminium (sq.mm.)	520	418.6	207.0
3.	Wire Strand (Al./Steel)	54/7	54/7	30/7
4.	Nominal diameter of strand (Al./Steel)(mm.)	3.53/3.53	3.18/3.18	3.00/3.00
5.	Weight (Kg/Km)	2004	1621	976
6.	Co-eff. of linear expansion per °C	19.30×10^{-6}	19.30×10^{-6}	17.80×10^{-6}
7.	Ultimate Tensile Strength (kgf.)	16250	13316	9127
8.	Maxm. DC resistance at 20°C (Ω /Km) (Calculated from maxm. Value of resistivity and min. Cross-sectional area)	0.05552	0.0680	0.1375
9.	Zinc coating of steel :			
	i) No. of one minute dip	3	3	3
	ii) Min. wt. of zinc.(gm.m ²)	260	260	260
	iii) Purity of zinc (%)	99.95	99.95	99.95
10.	Diameter of conductor (mm)	31.77	28.62	21.00
11.	Standard Length (meter)	1100	1100	1000 to 1250

GUARANTEED TECHNICAL PARTICULARS FOR ACSR CONDUCTOR

(To be filled in and signed by the Bidder)

Sl. No.	Description	MOOSE	ZEBRA	PANTHER
1.	Material Designation	:		
2.	Particulars of Raw Material			
	i) Aluminium			
	a) Minimum purity of aluminium	:		
	b) Maximum Copper content	:		
	ii) Steel Wire/Rods			
	a) Carbon	:		
	b) Manganese content	:		
	c) Phosphorous content	:		
	d) Sulphur content	:		
	e) Silicon content	:		
	iii) Zinc			
	a) Minimum purity of Zinc	:		
3.	Name of the Manufacturer and Address	:		
4.	Nominal diameter of Aluminium / Steel wire (mm)	:		
5.	Minimum and Maximum diameter of Aluminium and Steel wire	:		
6.	Number of Aluminium wires (No.)	:		
7.	Number of Steel wires (No)	:		
8.	Overall diameter of the conductor (mm)	:		
9.	DC resistance at 20°C (Max.) (Ohm/Km)	:		
10.	Approx. calculated breaking load (KN)	:		
11.	Nominal current carrying capacity at 45°C ambient (Amps.)	:		
12.	Approx. weight of conductor (Kg/Km)	:		
13.	Approximate ultimate tensile strength of conductor (Kgf)	:		
14.	Conforming Standard	:		
15.	Modules of Elasticity (kg/sq. cm):			
16.	Standard Length (in Mtr.)	:		