Date:23.09.2013

TECHNICAL SPECIFICATION FOR

34Sqmm, 55Sqmm & 100Sqmm AAA Conductor

1. SCOPE :

1.1 This specification provides for the manufacture, testing before dispatch, supply and delivery of (ISI Marked) All Aluminium Alloy (Aluminium + magnesium + Silicon) Stranded conductors at destination stores for overhead Power Transmission purposes.

1.2 The tenderer shall furnish a copy of valid BIS license for ISI marking together with their offer, without which the offer shall be treated as non-responsive

2. STANDARD :

The conductors shall comply in all respects with the latest versions of IS given below with latest amendments if any.

SR.No.	Indian Standards	Title
1	IS: 398 (Part VI) /1994	Specification for Aluminium conductors for overhead transmission purpose
2	IS:1778/1980	Reels and drums for bare conductors
3	IS 9997 : 1991	Aluminium Alloy Redraw Rods For Electrical Purposes.

2.1 CONFLICT OF STANDARDS

Equipment conforming to other internationally accepted standards, which ensure equal or higher quality than the standards mentioned above, would also be acceptable. In case the Bidder who wish to offer material conforming to the other standards, salient points of difference between the standards adopted and the specific standards shall be clearly brought out in relevant schedule. Four copies of such standards with authentic English Translations shall be furnished along with the offer. In case of conflict the order of precedence shall be (i) IS (ii) IEC (iii) Other standards. In case of any difference between provisions of these standards and the provisions contained in this specification shall prevail.

3. CLIMATIC CONDITIONS:

i)	Peak ambient temperature in shade	50 deg. C
ii)	Maximum average ambient temperature over a 24 hours period in shade	40 deg. C
iii)	Maximum temperature attainable by **an object exposed to sun**	70 deg. C

iv)	Minimum ambient temperature	7.5 deg. C
v)	Maximum relative humidity	100%
vi)	Average number of thunderstorm days per annum	50
vii)	Average number of dust storms	10
viii)	Average number of rainy days per annum	90
ix)	Average rainfall per annum	925 mm
x)	Number of months of tropical monsoon conditions	4 months
xi)	Maximum wind pressure	260 Kg/Sq.mm
xii)	Altitude not exceeding	1000 Mtrs. above MSL

4. MATERIALS:

a) The materials offered shall be of best quality and workmanship. The conductors shall be constructed of heat treated Aluminium-Magnesium Silicon alloy wires with chemical composition as per IS 9997:1991 and having the mechanical and electrical properties specified in appendix –I enclosed. The wires shall be smooth and free from all imperfections such as spills and splits. The surface of conductor shall be free from points, sharp edges, abrasions or other departures from smoothness or uniformity of surface contour that would increase radio interference and corona losses. When subject to tension upto 50% of the ultimate strength of the conductor. The surface shall not be depart from the cylindrical form nor any part of the component parts or standards relative to each other in such a way as to get out of place and disturb the longitudinal smoothness of the conductor.

b) **Raw materials:** The supplier shall make their own arrangement to procure the necessary raw materials required for the manufacture of the conductors ordered. The Aluminium Alloy rod used for manufacture of conductor shall be bought from the following primary producers.

1) M/s.Vedanta
2) M/s.Hindustan Aluminium Corporation Ltd.,
3) M/s.Madras Aluminium Company,
4) M/s.Nalco,
5) M/s.Indal

The EC grade Aluminium Metal Ingots used for the manufacture of conductor shall be bought from the following primary producers viz., M/s.Nalco, M/s.Malco, M/s.Hindalco, M/s.Indal and M/s.Vedanta.

Invoices for the procurement of raw materials from the above primary producers shall be furnished for each consignment of conductor to be supplied along with the manufacturers test report for verification.

Aluminium Alloy Rod/EC Grade Aluminium Metal Ingots procured from open market or consignee agents shall not be used for manufacture of AAA Conductors.

5. Size and Properties :

The size and properties of Aluminium Alloy Conductor shall be as given in the Appendix-I & II enclosed which also indicate the values of resistance and weights.

6. Tolerance :

The following tolerance shall be permitted on nominal diameter.

Tolerance on nominal diameter of Aluminium alloy Wires } Plus or Minus one percent (±1%)

7. a) The Co-efficient of linear expansion per deg. C shall be $23.0X10^{-b}$ (E)

b) Final modulus of Elasticity (Practical) $0.6324 X 10^{-6}$ Kg/Sq.mm.

8. Joint in Wires:

There shall be no joint in any wire of a stranded conductor containing seven wires.

9. STRANDING:

9.1 The wires used in construction of a stranded all Aluminium Alloy conductor (AAAC) shall, before stranding, satisfy all requirements of IS 398 (Part –IV) 1994 with latest amendments thereof. The lay ratio shall be within the limits given under Col.10.

9.2 The lay of the stranding shall be right handed. The wires shall be evenly and closely stranded.

10. LAY RATIO:

The lay ratio of different layers shall be within the limits given below:-

No.of Wires in Conductors	6 Wire layer	
	Min	Max
7	10	14

11. PACKING AND MARKING

11.1 The conductor shall be wound in non-returnable reels or drums conforming to **IS 1778 of 1980** "Specification for reels and drums for bare conductor or the latest versions thereof. The drums shall be marked with the following :

a) Manufacturer's Name
b) Trade Mark, if any.
c) Drum number or Identification number
d) Size of Conductor
e) Number and lengths of piece of conductor in each drum (No/Meters)
f) Gross mass of the packing(Kg)
g) Net mass of Conductor (Kg)
h) ISI Specification Mark, in addition the drum shall be marked with purchase order number, identification mark and letter **("AP PDCL")**

11.2 The drums shall be of such construction as to ensure delivery of conductor in the field free from displacement and damage and shall withstand all stresses of handling and stringing operation, so that the conductor surface is not cut, dented, scratched or damaged in any way during manufacture, Transport & Stringing. The conductor shall properly lagged on drums and shall be notched to suit the drum and held in place of Steel strapping. Method of lagging to be employed may be clearly stated in the tender. The lagging shall not be nailed or bolted in place.

11.3 The conductor drum should be suitable for wheel mounting, before reeling, the cardboard or other suitable material shall be secured to the drum and inside flanges of the drums. After reeling, the exposed surface area of conductor shall be nearly wrapped with suitable soft material to protect the conductor from dirt and grit.

11.4 The gross weight of each package shall not exceed the following limits, subject to a tolerance of +10%

Sl.No.	Conductor size	Gross mass in Kgs.
1	34 Sq.mm (7/2.50mm)	1100 Kg
2	55 Sq.mm (7/3.15mm)	1500 Kg
3	100 Sq.mm (7/4.26mm)	2000 Kg

11.5 The minimum standard length of following sizes of AAAC shall not be less than as indicated below. Much longer lengths are preferred. Short lengths (not less than 50% of the standard length) shall be acceptable only to the maximum extent of 10% of the quantity ordered for each size.

1	34 Sq.mm (7/2.50mm)	Aluminium Alloy Conductor	2.0KM
2	55 Sq.mm (7/3.15mm)	Aluminium Alloy Conductor	1.7KM
3	100 Sq.mm (7/4.26mm)	Aluminium Alloy Conductor	1.1KM

12. TESTS:

The following tests shall be carried out on wires used for AAAC as per detailed procedures and test samples given in the IS 398 Part-IV/1994 **with latest amendments thereof**.

i) Breaking Load Test.
ii) Elongation test.
iii) Resistance.

12.1. The rejection and retest procedure shall be followed as stipulated in IS:398/Part-IV of 1994, or any other latest amendments thereof.

The type tests as specified in the IS should be carried out not later than 5 years from the date of opening of bid.

13. INSPECTION:

All tests and inspections shall be made at the place of manufacturer unless otherwise specifically agreed upon by the purchaser. The manufacturers shall afford the Inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification.

The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever in dispute regarding the quality of supply.

13.1 The supplier shall furnish the following documents as proof of purchase of RAW material along with each inspection offer.

a) Invoice of the supplier
b) Supplier Test Certificate
c) Packing List
d) Bill of Landing
e) Bill of Entry Certificate by Custom
f) Description of material, electrical analysis, physical inspection, certificate of
surface defects, thickness and width of material wherever applicable.

14. CHECKING AND VERIFICATION OF LENGTH OF CONDUCTORS:

The Supplier /manufacturer of conductor should arrange for the inspection by the representative of the purchaser specially authorized for this purpose. Atleast 10% of the total number of drums of conductors taken at random should be checked to ascertain the length of conductor adopting the following method.

Transfer the AAAC from one reel to the other while at the same time measuring the AAAC so transferred by means of a meter. Arrangements should be made available in the works of the manufacturer for transferring the conductor from one reel to another at the same time measuring the length of conductor so transferred by means of a meter.

15. GUARANTEED TECHNICAL PARTICULARS:

The Bidder shall furnish the guaranteed technical particulars as per Appendix-III enclosed and submit the same with his tender.

16. The prices shall be variable and would be based on the price variation clause attached at Annexure-I.

APPENDIX – I

SIZE AND PROPERTIES OF ALUMINUM ALLOY WIRES USED IN THE CONSTRUCTION OF STRANDED ALL ALUMINUM ALLOY CONDUCTOR

Nominal Size mm	Diameter		Cross sectional area of Nominal diameter Sq.mm	Mass Kg/Km	Minimum braking load after stranding KN	Resistance at 20 deg.C Maximum Ohm/KM
	Min mm	Max. mm				
2	3	4	5	6	7	8
2.50	2.47	2.53	4.909	13.25	1.44	**6.845**
3.15	3.12	3.18	7.793	21.04	2.29	4.290
4.26	4.22	4.30	14.25	38.48	4.18	2.345

APPENDIX – II

PROPERTIES OF ALUMINUM ALLOY STRANDED CONDUCTOR

Nominal aluminium area Sq.mm	Stranding and wire dia mm	Sectional area Sq.mm	Approximate over all dia mm	Approximate mass Kg/Km	Calculate max resistance 20 deg. C Ohm/Km	Approximate calculated breaking load KN	Current rating Amps
1	2	3	4	5	6	7	8
34	7/2.50	34.36	7.50	94.00	0.9900	10.11	129
55	7/3.15	54.55	9.45	149.20	0.6210	16.03	173
100	7/4.26	99.77	12.78	272.86	0.3390	29.26	254

APPENDIX – III

GUARANTEED TECHNICAL PARTICULARS
FOR ALL ALUNINIUM ALLOY CONDUCTORS

Description	AP PDCL requirement			Details furnished by the bidder
	34 Sq.mm	55 Sq.mm	100 Sq.mm	
1. Stranding and diameter of Aluminum Alloy Strand	7/2.50 mm	7/3.15 mm	7/4.26 mm	
2. Over all diameter of conductor in mm	7.50	9.45	12.78	
3. Standard nominal Aluminium Alloy area in Sq.mm	34	55	100	
4. Calculated Aluminium alloy area in Sq.mm	34.36	54.55	99.77	
5. Minimum ultimate tensile strength of Aluminium Wire strand in Kg/mm^2	31.57	31.57 Kgs./Sq.mm	31.57 Kgs./Sq.mm	
6. Guaranteed ultimate tensile strength of conductor in Kg/mm^2	1019.7	1634 Kgs	2982 Kgs	
7. Minimum breaking load in Kg. For a) AluminiumAlloy Strand b)Aluminium Alloy Conductor	 156 (1.44 K.N) 1085 (10.11 K.N)	 2.29 KN 16.03 KN	 4.18KN 29.26KN	
8. Maximum working tension of conductor	50% of 1019.7	70% of UTS	70% of UTS	
9. Weight in Kg. Per KM of Aluminium Alloy conductor	94.0 Kgs approx.	149.20 Kgs approx.	272.86 Kgs. Approx.	
10. Resistance in Ohm per KM at 20^0C	0.9900 max.	0.621 max.	0.339 max.	
11. a) Continuous maximum current rating of conductor in still air at 45^0C ambient temperature (A) b) Temperature rise for the above current (deg.C)	129 Amps 30^0C	173 Amps 30^0C	254 Amps 30^0C	
12. Modulus of Elasticity of Aluminium Alloy conductor Kg/Sq.mm	$0.6320X10^6$	$0.6320X10^6$	$0.6320X10^6$	
13. Co-efficient of linear expansion per degree centigrade for a) Aluminium Alloy Strand/^0C b) Alloy conductor/^0C	 $23X10^{-6/0}C$ $23X10^{-6/0}C$	 $23X10^{-6}$ $23X10^{-6}$	 $23X10^{-6}$ $23X10^{-6}$	
14. Standard length of each piece in KM	2Kms & above	1.70 and above	1.10 and above	
15. Dimension of the reel in Cms.	127X50.8X66.04	135X50X71	145X55X81	
16. Gross weight of the reel including weight of the conductor Kg.	Max. 1100	Max. 1500	Max. 2000	
17. Standard according to which the conductor will be manufactured and tested	IS : 398 (Part-4) – 1994	IS : 398 (Part-4) – 1994	IS : 398 (Part-4) – 1994	
18. Other particulars				

Signature of the bidder :

Name :

Date :

Seal :