West Bengal State Electricity Distribution Company Limited
(A Govt. Of West Bengal Enterprise)

TECHNICAL SPECIFICATION FOR ACSR CONDUCTORS

August'2025

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1. **SCOPE:**
This specification provides for the manufacture, testing, supply and delivery of Aluminium Conductors with Steel Re-inforced.

2. **STANDARDS:**
The conductors shall comply with the Indian Standard Specification IS: 398 (Part I & II) of 1996 with latest amendments.

3. **MATERIAL:**
The material shall be of best quality and workmanship. The stranded steel re-inforced conductors shall be manufactured from hard-drawn aluminium wires and galvanized steel wires, which have the mechanical and electrical properties specified in Schedule –B. The coating of the galvanized steel wires shall be applied by the hot process or electrolysis process in accordance with IS: 4826–1968 or latest amendment thereof. The wires shall be smooth and free from all imperfections such as soils and splits.

4. **SIZE AND PROPERTIES:**

The sizes of stranded steel re-inforced aluminium conductors shall be as given in Schedule –B which also indicate the values of resistance and strengths etc.

5. **TOLERANCES:**

The following tolerances shall be permitted:

i. Tolerance on nominal diameter of aluminium wires: ±1(one)percent.
ii. Tolerance on nominal diameter of galvanized steel wires: ±2(two)percent.

6. **MODULUS OF ELASTICITY & CO-EFFICIENT OF LINEAR EXPANSION:**

The values of the final modulus of elasticity and Co-efficient of linear expansion for ACSR shall be as given hereunder.

No. of Wires	Final Modulus of Elasticity GN/m^2(Practical)	Co-efficient of linear expansion/^{0}c.
ACSR6/1	79	19.1×10^{-6}
ACSR6/7	75	19.8×10^{-6}
ACSR30/7	80	17.8×10^{-6}

7. **JOINTS IN WIRES:**

Aluminium Conductor Steel Re-inforced: No two joints shall occur in the aluminium wires closer than 15 meters. No joints shall be permitted in galvanized steel wire unless the core consists of seven or more steel wires. In the later case, joints in individual wires are permitted, but no two such adjacent joints shall be less than 15 meters.

8. **STRANDING:**

i. The wires used in manufacturing of stranded conductors shall satisfy all requirements of IS: 398/1996(Part-I& II)before stranding. For ACSR, the lay ratio of the different layers shall be within the limit given under clause No. 9 below.

ii. In all constructions, the successive layers shall have opposite directions of lay and the outer most layers being right handed. The wires in each layer shall be evenly and closely stranded.

iii. In conductor having multiple layers of aluminium wires, the lay ratio of any aluminium layers shall be not greater than the lay ratio of the aluminium layer immediately beneath it.

9. LAY RATIO:

The lay ratio (Ratio of the axial length of a complete turn of the helix formed by an individual wire in a stranded conductor to the external diameter of the helix) shall be within the limits given below:

a) Aluminium conductor steel re-inforced.

No. of Wires		Lay ratio for Steel core		Lay ratio for outside layer		Aluminium Wire inner most layer	
Al.	Steel	Max.	Min	Max.	Min.	Max.	Min
6	1	-	-	14	10	-	-
6	7	28	13	14	10	-	-
30	7	28	13	14	10	16	10

10. GROSS WEIGHT:

The gross weight of each wooden drum containing conductor of all sizes shall not exceed 900 kg with a tolerance limit of ±10 %.
Drums containing conductor having gross weight above 990kg.will not be accepted in any case. Also more than two lengths in one conductor drum will not be accepted.

11. STANDARD LENGTH:

Minimum length of ACSR Squirrel & ACSR Weasel Conductors should be 2(two) km. & in case of ACSR Rabbit, DOG and Wolf, it should be 1(one) Km. Longer lengths are also acceptable provided they are within gross weight limit. The conductor shall be supplied in standard lengths of not less than 95% of the total quantity. The quantity of the conductor in lengths shorter than standard ones shall not exceed 5% of the total quantity to be supplied.

Further, single conductor length in respect of such 5 % (maximum) shall be supplied in random length of not less than 50% of the standard length and shall be supplied in individual drum. Such random length shall be acceptable to the maximum extent of 5% of the offered quantity.

12. SELECTION OF TEST SAMPLE

Selection of test sample shall be done as per relevant I.S.

13. TESTS:

13.1 The conductors shall be subjected to routine and acceptance test in accordance with the relevant I.S with latest amendments if any.

13.2 CHECKING OF CONDUCTOR SURFACE, DECLARED LENGTH AND WEIGHT

13.2.1 Out of each lot offered for testing, maximum number of drums to the extent of 10% will be rewound for checking the surface of conductor, declared length and weight of conductor in drum.

Necessary arrangements shall be made in the works of the manufacturer for transferring the conductor from the sample drum to another empty drum after weighing the sample drum along with the conductor and at the same time measuring the length of the conductor so transferred by means of meters. Thereafter, the original sample drum without the conductor shall be weighed and the value shall be checked with the packing list. In case, any excess length that mentioned in offered packing list is found in drum during length checking, no benefit will be given to the manufacturer for the same. However, in case any shortage of conductor is found in one or more drums, the maximum value of each shortage, in percent(s) shall be deducted from all the drums offered for inspection.

13.2.2 The inspecting officer will carry out 100% checking of all the drums for inspection by Weight.

13.2.3 The drum for length measurement shall be selected either by keeping in view the maximum difference in weight as recorded on the drums packing list and actually measured or at random.

13.2.4 The inspecting officer will check the Outer diameter and Surface of conductor during re- winding of the drum for length measurements.

13.2.5 For sealing of both ends of conductor, the position of conductor ends should be marked clearly on the body of wooden drum to avoid opening of all wooden planks of the conductor drum.

13.2.6 Necessary care should be taken by the supplier to ensure that Seals provided by the inspection officer remains intact during transportation and receipt of the drum by stores wing.

13.3 REJECTION AND RE-TESTING

13.3.1 As per relevant IS with latest amendment if any.

13.3.2 WBSEDCL also reserves the right to check length of the conductor at Store/Site.

13.3.3 The entire cost of testing for acceptance & routine tests and checking of length etc shall be borne by the supplier.

14.0 INSPECTION

The purchaser's representative shall be entitled to have access to the works and all places of manufacturer. The said representative shall have full facilities for un-restricted inspection of supplier's works, raw materials, manufacture of conductor and conducting necessary tests. The supplier shall keep the purchaser informed well in advance of the time of starting and process of manufacture of conductor in its various stages. The acceptance of any quantity of materials shall in no way relieve the supplier of his responsibility for meeting all requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

15.0 TEST REPORTS:

15.1 TYPETEST:

All the tests mentioned below shall be conducted on ACSR Conductor as per IS: 398 (Part-II) 1996 with latest Amendment.

TYPE TEST OF ACSR CONDUCTOR UPTO "RABBIT"

Sl. No	Particulars of Test	Clause No.
1.	Measurement of diameter of individual Aluminium and Steel Wires	13.2ofIS-398(Part-II)
2.	Measurement of Lay Ratio/Direction of Lay	13.8
3.	Breaking load of individual wire	13.3.1
4.	Ductility Test(Torsion/Elongation)	13.4
5.	Wrapping Test(Aluminum and Steel)	13.5
6.	Resistance Test	13.6
7.	Galvanizing Test (Uniformity of Galvanizing and Mass of coating	13.7

TYPE TEST OF ACSR "DOG" AND "WOLF" CONDUCTOR

Sl. No	Particulars of Test	Clause No.
1.	Measurement of diameter of individual Aluminium and Steel Wires	13.2ofIS-398 (Part-II)
2.	Measurement of Lay Ratio/Direction of Lay	13.8
3.	Breaking load of individual wire	13.3.1
4.	Ductility Test(Torsion/Elongation)	13.4
5.	Wrapping Test(Aluminum and Steel)	13.5
6.	Resistance Test	13.6
7.	Galvanizing Test (Uniformity of Galvanizing and Mass of coating	13.7
8.	Surface Condition Test	13.9
9.	Test for Ultimate Breaking Load on Stranded Conductor	13.10
10.	Stress Strain Test	13.11

The Type Tests are to carried out within last 5 (five) years from the due date of submission of tender and the reports of Type Test successfully carried out for the respective item from Govt. approved/ NABL accredited laboratory shall be furnished by the bidder along with their offer. The Type Test Reports shall bear Logo of NABL accreditation.

15.2 The test reports of Routine/ Acceptance tests and checking of length etc. as specified in Clause no 13 shall be signed jointly by the supplier's representative and WBSEDCL'S representative.

16.0 PACKING & MARKING

16.1 GENERAL

i) The conductor shall be wound on non-returnable drum strong enough and provided within lagging of adequate strength, constructed to protect the conductor against all displacement during transit, storage and subsequent handling and stringing operation in the field. The drum shall conform to IS: 1778-1980 as amended upto date and the dimensions shall be as per drum under column 9 of Table- 2 of the IS.

ii) The drum shall be suitable for wheel mounting.

iii) The general construction of drum shall be as shown in IS: 1778-1980. However, the drum shall be suitable for letting off the conductor under controlled tension of the order of 300 kg minimum.

iv) After application of bituminized and plastic paper protective lagging or circumferential batten of minimum 50mm. thickness shall be provided suitably, in order to protect conductor from damage during transit in the event of breakage/detachment of the external protective lagging. The thickness of the external protective lagging or circumferential batten shall be sufficient to nail across grains as far as possible to the flange edges with at least one nail per end. The length of the nails shall be not less than twice the thickness of the battens. The nails shall not protrude above general surface and shall not expose sharp edges or allow the battens to be released due to correction.

v) Outside the protective lagging, there shall be minimum two binders consisting of hoop iron or galvanized steel wire. Each protective lagging shall have recesses to accommodate hoop binders.

vi) The conductor ends shall be properly sealed and secured with the hoop of "B" nails or bolts on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.

16.2 TOLERANCE IN QUANTITY:

A manufacturing tolerance upto **(-)5%** subject to maximum one standard drum length against each item of the order, for the last offered lot, will be allowed.

16.3 MARKING:

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

a) 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.
g) Gross weight of the drum.
h) Weight of empty drum with protective lagging.
i) Net weight of the conductor
j) Arrow marking for unwinding
k) Position of the conductor end.
l) Lot number.

Before despatch, property identification mark 'WBSEDCL' shall be engraved in each drum.

16.4 CONSTRUCTION OF DRUMS

(a) All wooden components 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 preservative of such a quality which is not harmful to the conductor.

(b) FLANGES

(i) The flanges shall be of two ply construction with such ply at right angle of the other and nailed together. The nails shall be driven from the inside face of flanges, punched and then cleaned on the outer face. There shall be at least 3 nail per plank of ply with maximum nail spacing 70- 75 mm.

(ii) There will be a slot in the flange to receive the inner end of the conductor; the entrance shall be in line with the periphery of the barrel.

(c) Spindle hole shall be provided at the center of the middle planks of the plies and spindle planets with 100 mm diameter holes shall be fitted on either side of both the flanges.

(d) DRUM AND SUPPORTS:

The end supports shall be securely fixed by nailing and may be disc or segmental type. The middle barrel support of the two ply construction of disc type with a 100 mm diameter concentric with the holes in flanges shall be provided at the centers of the barrel supports.

(e) DRUM:

The wooden batons used for making the barrel of the conductor shall be segmental type. These shall be nailed to the barrel supports with at least two nails. The batons shall be closely butted and shall provide a round barrel with smooth surface. The edges of the batons shall be rounded or compared to avoid damage to the conductor.

(f) DRUM STUDS:

Barrel studs shall be used for the construction of drum. The flanges shall be holed and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end sufficient to accommodate washers, spindle plates and nuts for fixing at the required spacing.

(g) IRON COMPONENTS

Normally, the nuts on the studs shall stand pound of the flange. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk at least 5 mm. deep. The ends of barrel shall generally be flushed with the top of the nuts.

16.5 PROTECTIVE ARRANGEMENT

i) The inner side of the flanges and drum barrel surfaces shall be painted with bitumen based paint.

ii) Before reeling, cardboard of double corrugated or thick bituminised water proof bamboo paper shall be secured to the drum barrel and inside the flanges of drum by means of suitable adhesive materials. These protective wrappings and the adhesive material used shall be of a quality which is not harmful to the conductor.

iii) After reeling the conductor, the exposed surface of the outer layer of the conductor shall be wrapped with water proof, thick, bituminised bamboo paper and also with thick plastic sheet to prevent the conductor from dirt, grit and damage during transport and handling.

17. **Weights of Aluminum and Steel per Km. length of respective Conductors are given below:**

Weight in Kg. per Km.				
Item No.	**Description of materials**	**Aluminium**	**Steel**	**Total**
01.	**ACSR:20mm^2(Squirrel)**	**57.73**	**27.27**	**85.00**
02.	**ACSR:30mm^2(Weasel)**	**86.60**	**41.10**	**127.70**
03.	**ACSR:50mm^2(Rabbit)**	**144.80**	**68.80**	**213.60**
04.	**ACSR:100mm^2(DOG)**	**287.46**	**105.71**	**393.17**
05.	**ACSR:150mm^2(WOLF)**	**437.00**	**289.00**	**726.00**

18. Documents to be submitted at the time of physical delivery at Consignee Stores:

The following documents are to be submitted by the vendors to the Consignee Stores at the time of dispatch to stores:-

a) Copy of Purchase order
b) Copy of Despatch Instruction
c) Inspection Test Certificate
d) Guarantee Certificate
e) Proforma Invoice
f) Calculation Sheet for Price Variation on the basis of Terms and condition of NIT.
g) Seal list and packing list
h) Challan in triplicate
i) Way bill, if applicable

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SCHEDULE-A

TECHNICAL SPECIFICATION

Guaranteed Technical Particulars of Conductor (To be filled in by the Tenderer)

1. Code Word
2. Maker's name and address

   a. Aluminium Rods
   b. Steel Rods
   c. Complete Conductor
3. Stranding and Wire diameter
   a. Aluminium
      i) Nominal ii)Minimum iii) Maximum
   b. Steel
      i) Nominal ii)Minimum iii) Maximum
4. Nominal Aluminium Area in sq.mm
5. Sectional Area of Aluminium in Sq.mm.
6. Total Sectional Area in Sq.mm.
7. Cross Sectional area of Nominal Diameter wire in sq.mm.
   a) Aluminium b)Steel c)Overall diameter of conductor in mm.
8. Breaking load of conductor in KN.
9. Minimum breaking load for
   a. Aluminium Wire ---i)Before stranding ii)After stranding
   b. Steel Wire ---i)Before stranding ii)After stranding
10. Zinc Coating of steel wire
    a. Uniformity of coating, number & duration of dips process test, withstood
       i) Before stranding ii)After stranding
       1Min x nos.
       ½Min x nos
    b. Minimum Weight of coating gm/sq.m
       i) Before stranding ii)After stranding
11. Mass in kg. per Km.
    a. Aluminium
    b. Steel
    c. Conductor
12. Resistance in ohm per Km at 20^0C i)Aluminium ii)Conductor
13. Continuous maximum current rating of conductor (Amps. in still air at 45^0 C ambient temperatures).
14. Modulus of elasticity of conductor
15. Co-efficient of linear expansion per degree centigrade of:
    a. Aluminium wire
    b. Steel Wire
    c. Conductor
16. Standard length of each piece in Km.
17. Approximate dimensions of the drum in mm.
18. Weight of the conductor in one drum in Kg.
19. Weight of the drum in Kg.
20. Gross weight of the drum including weight of the conductor.
21. Standard according to which the conductor will be manufactured and tested.
22. Other particulars if any.

(Signature of the Tenderer)

SCHEDULE-B

SIZES & PROPERTIES OF ALUMINIUM CONDUCTOR GALVANISED STEEL REINFORCED

NOMINAL ALUMINIUM AREA(mm2)	STRANDING AND WIRE DIAMETER (mm)		SECTIONAL AREA OF ALUMINIUM (mm2)	TOTAL SECTIONAL AREA(mm2)	APPROXIMATE OVER-ALL DIAMETER(mm)	APPROXIMATE MASS(KG/KM)	CALCULATED RESISTANCE AT 20°c MAX (OHM/KM)	APPROXIMATE CALCULATED BREAKING LOAD (KN)
	ALUMINIUM	STEEL						
20	6/2.11	1/2.11	20.98	24.48	6.33	85	1.394	7.61
30	6/2.59	1/2.59	31.61	36.88	7.77	128	0.9289	11.12
50	6/3.35	1/3.35	52.88	61.70	10.05	214	0.5524	18.25
100	6/4.72	7/1.57	105.00	118.5	14.15	394	0.2792	32.41
150	30/2.59	7/2.59	158.1	194.9	18.13	726	0.1871	67.34

PROPERTIES OF ALUMINIUM WIRES USED IN THE CONSTRUCTION OF ALUMINIUM CONDUCTORS GALVANISED STEEL REINFORCED

DIAMETER(mm)			CROSS SECTIONAL AREA OF NOMINAL DIAMETER WIRE(mm^2)	MASS(KG/KM)	RESISTANCE AT 20°C(MAX)(OHM/KM)	BREAKINGLOAD(MIN) (KN)	BREAKING LOAD AFTER STRANDING (KN)
NOMINAL	MIN	MAX					
2.59	2.56	2.62	5.269	14.24	5.490	0.89	0.85
2.11	2.09	2.13	3.497	9.45	8.237	0.63	0.60
3.00	2.97	3.03	7.069	19.11	4.079	1.17	1.11
3.35	3.32	3.38	8.814	23.82	3.265	1.43	1.36
4.72	4.67	4.77	17.50	47.30	1.650	2.78	2.64

PROPERTIES OF STEEL WIRES USED IN THE CONSTRUCTION OF ALUMINIUM CONDUCTOR STEEL REINFORCED.

DIAMETER(mm)			CROSSSECTIONAL AREA OF NOMINAL DIAMETER WIRE(mm2)	MASS KG/KM	BREAKING LOAD(MIN) (in KN)	
NOMINAL	MIN	MAX			BEFORE STRANDING	AFTER STRANDING
1.57	1.54	1.60	1.936	15.10	2.70	2.57
2.11	2.07	2.15	3.497	27.27	4.60	4.37
2.59	2.54	2.64	5.269	41.09	6.92	6.57
3.00	2.94	3.06	7.069	55.13	9.29	8.83
3.35	3.28	3.42	8.814	68.75	11.58	11.00