GALVANISED STEEL STRANDED EARTH WIRE

(for Overhead Transmission Line)

September 2021

Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

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(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

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TECHNICAL SPECIFICATION FOR GALVANISED STEEL STRANDED EARTH-WIRE

1. SCOPE:

This specification covers the design, manufacture, testing at manufacturer's work before dispatch and delivery of 7/3.15mm and 7/3.66mm Galvanised Steel Stranded earth wire for use in 132 KV & 220 KV and 400 KV transmission lines.

2. STANDARD:

The galvanised earth wire shall conform to the latest edition of the following Indian Standards as amended up-to-date unless otherwise specified hereinafter. Corresponding standards of IEC or other reputed international standards which ensure equivalent or better quality are acceptable. In such case English version of the standards followed shall be furnished. In case of any discrepancy between stated parameters in this specification and related standards, the specification would prevail.

Sl.No.	Indian Standards	Equivalent International Standards	T i t l e
1	IS 2141 – 1992		Hot-dip galvanised stay strand.
2	IS 1778 – 1980	BS 1559 -1949	Reels and drums for bare conductor.
3	IS 2629 – 1985		Recommended practice for hot dip Galvanising on iron and steel.
4	IS 12776 - 1989		Galvanised strand for earthing.
5	IS 2633 – 1986		Method for testing uniformity of coating of Zinc-coated articles.
6	IS 209 – 1992	BS 3436 - 1986	Specification for Zinc Ingot.
7	IS 4826 – 1979	IEC 888 – 1987 BS 443 - 1969	Hot-dip Galvanised coatings on Round Steel wires.
8	IS 1521 - 1972	ISO 6892 - 1984	Methods for tensile testing of Steel wire.

3. DEVIATIONS:

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the *Deviation Schedule* with reasons of such deviation. Such deviation suggested may or may not be accepted. Deviation not mentioned in 'Deviation Schedule' will not be considered afterwards.

4. DESIGN CRITERIA & CONSTRUCTION:

4.1. MATERIALS:

4.1.1. STEEL:

The steel strands shall be drawn from high carbon steel rods produced by either the acid or basic open-hearth process, the electric furnace process or the basic oxygen process and shall conform to the following requirements as to their chemical composition.

Sl.No.	Element	% Composition
1.	Carbon	0.55 max.
2.	Phosphorus	0.05 max.
3.	Manganese	0.4 to 1.10
4.	Sulphur	0.05 max.
5.	Silicon	0.15 to 0.35

4.1.2. ZINC:

The Zinc used for Galvanising shall be electrolytic High Grade (HG) zinc of 99.95% purity. It shall conform to the requirements of IS:209 – 1968

4.2. WORKMANSHIP:

4.2.1. The earthwire size, physical properties etc. of the stranded wire is given under Specific Technical Parameter of this specification.

4.2.2. The steel strands should be smooth and free from all imperfections. Such as spills and splits, die marks, scratches, abrasions and kinks after drawing and also after stranding.

4.2.3. The finished ground wire shall have minimum brittleness as it will be subjected to appreciable vibration while in use.

4.2.4. The steel strands shall be hot dip galvanised and shall have a zinc coating of 275 gm/sqm for 3.66 mm dia. of the uncoated wire surface. The zinc coating shall be smooth and uniform thickness.

4.2.5. To avoid susceptibility towards storage stains (white rust) the stranded earthwire shall be provided with a protective coating of boiled linseed oil.

4.3. JOINT IN WIRES:

There shall be no joint of any kind in the finished strand wire for construction of earthwire. There shall also be no strand joints or strand splices in any length of the completed earthwire.

4.4. STANDARD LENGTH:

The standard length of the earthwire shall be 1500 mtrs to 2000 mtrs. Tolerances on this length shall be +/-5%. This however does not include any special length of earthwire (if required).

Random lengths may be accepted provided no length is less than half of the standard length and the total quantity of random lengths is not more than 5% of the total ordered quantity of individual weight. However no random length will be accepted for special lengths (if required).

4.5. SAG TENSION CHART:

The contractor shall be required to submit six (6) sets of stringing chart showing initial and final sags and tensions for various temperature and spans. One setoff stringing chart shall be in ink on tracing cloth. The contractor shall also prepare sag template in celluloid. This stringing chart and sag template shall be subjected to approval by WBSETCL and without involving any extra cost.

5. TESTS & INSPECTION:

WBSETCL reserves the right for testing and inspection of the earthwire and verify its component at any stage of manufacturing.

5.1. TESTS:

Type, acceptance and routine tests shall be carried out on the earthwire as stated below. Type tests and acceptance tests are to be carried out in presence of the representative of WBSETCL.

5.1.1. TYPE TESTS:

Type tests are to be conducted once on sample of earthwire to be supplied under this contract.

Type Tests are to be conducted in accordance with the procedures laid down in relevant IS/IEC and standards referred to therein.

Test procedure for respective tests will be discussed during technical evaluations or at contract negotiation stage. However, type tests reports from proposed sub-vendor are to be submitted along with the technical offer of the bid. Without submission of type test reports, sub-vendors will not be approved. Validity of Type tests shall be in line with latest CEA guidelines.

5.1.2. ACCEPTANCE TESTS:

Acceptance test shall be conducted on every Lot offered for inspection.

a) Visual checks for joints etc.

One or two drum from each lot shall be rewound in presence of the WBSETCL's representative to facilitate visual checking for joints; scratches etc. and see that the earthwire generally conforms to the requirement of the specification.

In the process declared length and weight shall also be verified.

b) Dimensional check on steel strands.

c) Check for lay ratio of various layers.

d) Breaking load test on individual wires& composite earthwire.

e) Elongation test on steel wire.

f) Wrap test on steel wire.

g) D.C. resistance test on steel strands.

h) Galvanising test on steel strands.

i) Chemical analysis test of steel.

5.1.3. ROUTINE TEST:

To ensure quality of earthwire to be supplied under this contract, the supplier has to carryout routine tests as per approved standard manufacturing quality described below and maintain a record for periodic inspection of the same by the representative of the 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 the correctness of stranding.

d) Check that the drums are as per specification.

e) Check the application of linseed oil.

f) Chemical analysis of steel used for making steel strands.

g) Chemical analysis of zinc used for Galvanising.

5.1.4. SELECTION OF SAMPLES – As per related IS.

5.2. TESTING EXPENSES:

The entire cost of testing for the acceptance & routine tests specified herein shall be treated as included in the quoted unit price of earthwire.

5.3. ADDITIONAL TESTS:

The purchaser may at his option, asks the supplier to carry out additional tests at the purchaser's cost in the supplier's premises, or at site or in any place to satisfy himself that the materials comply with the specification.

5.4. REJECTION & RETEST:

Rejection & retesting of the material shall be guided by the relevant clause of IS / IEC.

5.5. CONTRACT DOCUMENT:

The Contractor shall submit 6 (six) copies of the following to the Chief Engineer, Engineering, 9th Floor, BidyutBhavan, Salt Lake – 700091 for approval.

Guaranteed Technical Particulars filled up in the format enclosed with the Bid Documents.

Complete Test Reports of all tests (including type test) as stipulated in the relevant IS and IEC carried out in a Govt. recognized test house or NABL accredited laboratory on earth wire of similar design.

Only type-tested materials are to be offered conforming to our technical specification. They should be identical with the earth wire on which type tests have been carried out as per relevant IS and IEC.

5.6. TEST REPORTS:

- The Contractor shall submit all type tests results (6 copies) to WBSETCL.
- Test at manufacturer's works and Test Certificates:

  Acceptance test reports shall be furnished in six (6) copies. After approval of the same by WBSETCL, dispatch clearance will be issued. An advance notice of 15 (fifteen) days shall be given before the date when the tests will be carried out.

- Record of routine test reports shall be maintained by the manufacturer at his works for periodic inspection of the same by the WBSETCL's representative.

5.7. INSPECTION:

i) The representative of WBSETCL shall have full facilities for unrestricted inspection of manufacturer's works, raw materials, manufacturer of Earthwire and for conducting necessary tests as detailed herein before. The supplier shall keep Purchaser informed well in advance of the time of starting and progress of manufacture of earthwire in its various stages so that arrangement can be made for inspection.

ii) No earthwire shall be dispatched before it has been satisfactorily inspected, tested and clearance issued by WBSETCL for dispatch unless the inspections is waived by WBSETCL in writing.

iii) The acceptance of any quantity of material shall in no way relieve the contractor of any of its responsibility for meeting all requirements of the Specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

6. PACKING & FORWARDING:

a) The earth wire shall be wound on non-returnable drums strong enough and provided with tagging of adequate strength, constructed to protect the earthwire 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.

b) Two lengths of earthwire will be packed on each drum.

c) The drums shall be suitable for wheel mounting.

7. DRUM:

As per specification IS : 1778 – 1980

8. MARKING:

Each drum shall have following information stenciled on it in indelible ink along with other essential data, before offering the same for inspection.

LOA number .....

Name & address of the consignee .....

Maker's name and address .....

Drum number .....

Size of the earth wire .....

Length of the earth wire in meters .....

Gross weight of the drum with earth wire in Kg .....

Net weight of the earth wire in Kg .....

Arrow marking for unwinding .....

Position of the earth wire ends .....

Lot number .....

Date of manufacture .....

Before dispatch, property identification mark "WBSETCL" is engraved in each drum

SPECIFIC TECHNICAL PARAMETERS FOR EARTHWIRE

		7/3.15 (for 132 & 220 KV)	**7/3.66 (for 400 KV)**
1.	Material	Galvanised stranded Steel wire	
2.	Stranding and wire diameter(mm)	+/- 0.05	+/- 0.08
3.	No. of strand: i) Steel Core ii) Outer Steel Core	1 6	
4.	Ultimate tensile strength (Kgf)	5710	6969
5.	Approx nominal diameter (mm)	9.45	10.98
6.	Co-efficient of linear expansion per ^{o}C	11.50×10^{-6}	
7.	Zinc Coating: i) No. of one minute dip ii) Weight of Zinc coating(gm/sqm) iii) Purity of Zinc (%)	 3 260 99.95	 3 275 99.9
8.	Maximum DC resistance per Km of wire at 20^{O}C (Ohm/Km)	3.375	2.5
9.	Strand lay	Outer layer Right Hand Lay Length: 165 to 198	
10.	Weight per KM of strand (Kg) (Approx)	428	583

GUARANTEED TECHNICAL PARTICULARS OF GS EARTH WIRE

(To be filled in and signed by the bidder)

1. Maker's Name and Country :

2. i) Material :

   ii) Percentage of different contents of steel wire and zinc :

	Steel		**Zinc**
a)	Carbon	a)	Zinc, Minimum
b)	Sulphur	b)	Lead, Maximum
c)	Manganese	c)	Cadmium, Maximum
d)	Phosphorous	d)	Iron, Maximum
e)	Silicon	e)	Tin, Maximum
		f)	Copper, Maximum

3. Particular of steel strands :
   a) No. of strands :
   b) Diameter(mm) :
   i) Standard (mm) :
   ii) Minimum(mm) :
   iii) Maximum(mm) :
   c) Standard sectional area (mm^2) :
   d) Minimum ultimate tensile strength(Kgf) :
   e) Minimum breaking load (Kgf) :

4. Zinc coating of steel strands (after stranding)
   a) Uniformity of Zn coating number of durations of Dips (No. of dips/minute) :
   b) Minimum weight of coating (g/m^2) :

5. Overall diameter of earth wire (mm) :

6. Area of cross-section of earth wire (mm^2) :

7. Guaranteed ultimate tensile strength (Kgf) :

8. Resistance in Ohm/Km at 20°C (Ohm/Km) :

9. Standard length of earthwire without joint / weld :

10. Tolerance (if any) on standard length :

11. Minimum breaking load of earthwire (Kgf) :

12. Modulus of elasticity of earthwire (Kg/Cm^2) :

13. Co-efficient of linear expansion for eathwire (/ ^oC) :

14. Overall weight of earthwire (Kg/km) :

15. Length of lay of stranded wire

    i) Maximum(mm) :

    ii) Minimum :

16. Standard length of earthwire on the drum (KM) :

17. Standard weight of earthwire on the drum (Kg) :

18. Weight of the drum (Kg) :

19. Gross weight of the drum (Kg) :

20. Initial & final sag tension & stringing chart whether furnished :

21. Standard according to which the earthwire will be manufactured :

22. Quality of zinc used in Galvanising :

23. Other particulars (if any) :

24. Standard to which galvanizing conforms :