BUFF- SHEET

U.O.I No- 162
CE(P&E) 141/2026
Date- 18/11/2026

Chief Engineer(Project-II) BSPTCL, Patna

Sub:- Regarding submission of Revised Technical Specification of HTLS Conductor.

Ref.:- 1. Your mail, dated-05.11.26

Sir,

With reference to your email dated 05.11.2026 regarding revision of the Technical Specification of HTLS Conductor for wider participation of bidders and cost optimization, the revised Technical Specification, incorporating necessary modifications in light of the relevant CEA guidelines/advisories, is enclosed herewith for your needful and necessary action.

Encl: As above

18/11/26

(A.K.Chaudhary)
Chief Engineer (P&E)

CC: DGM(IT),BSPTCL for uploading the same on BSPTCL website.

HTLS CARBON COMPOSITE & *MULTISTRAND COMPOSITE* CORE ALUMINIUM (equivalent to Panther/Zebra) conductor except GAP conductor

High Temperature Low Sag (HTLS)conductor Annealed Aluminium except GAP conductor

Specification

The work involves dismantling of existing ACSR Panther/*Zebra* Conductor, supply of HTLS CARBON COMPOSITE CORE ALUMINIUM (equivalent to Panther/*Zebra*) **conductor of minimum 1050 A/*1593 A* capacity corresponding to maximum allowable operating temperature*(180 deg C)* & with unit weight equal to or less than that of ACSR Panther/**Zebra conductor and associated conductor hardware fittings, clamps & vibration dampers and stringing of the HTLS conductor on existing 132KV transmission line structure after survey of the lines. ROW if any for execution of work & approach to worksite shall be resolved by contractor at his cost. However, BSPTCL will provide necessary assistance.

Submission of complete technical details of the proposed HTLS conductor with relevant calculation along with the bid to adjudge the sufficiency of existing towers for carrying out the up-rating works. This shall be carried out in compliances / adherence to all safety and standard requirements as per Indian Electricity Rules 1956. Design parameters and submission of detailed drawings of conductor hardware and accessories and preparation of sag tension chart, stringing chart, of the conductor used showing, sag& tension at various temperatures are included in the scope of the Contractor as per las IS/IEC/ASTM.

The entire stringing work of HTLS (equivalent to Panther) conductor shall be carried out by tension stringing technique except where geographical / topographical or other site constraints do not permit use of tension stringing equipment. In such cases manual stringing along with other appropriate tools and equipment may be employed with the approval of engineer in charge. The contractor shall indicate in their offer, the sets of tension stringing equipment he is having in his possession and the sets of stringing equipment he would deploy exclusively for this package. The contractor shall also engage sufficient manpower so that stringing of the conductor can be completed within the allowed shut down period.

In 132KV D/C Transmission lines, road crossings and lines passing over civilstructures will have double insulator strings. Vibration dampers are to be provided in all suspension & tension locations.

The rollers which will be used during stringing should be so designed that the line can be charged with the roller.

One conductor manufacturing engineer with master instructor should remain present on the site during erection process.

Conductor Type:

The actual conductor type is to be suggested by contractor having physical, mechanical and electrical characteristics such as,

i) Outer diameter in mm--- not exceeding 21/28.62 mm as applicable

ii) Outer diameter of core in mm---not exceeding diameter of core of existing ACSR conductor

iii) Weight in kg/km--- < OR =that of ACSR Panther/*Zebra*

iv) Tension at every day condition (32°C, no wind) Not exceeding 25% of UTS of offered conductor

v) Current carrying capacity---not less than1050/*1593* AMP

vi) Tension at 32°C, full wind (52 kg/m2)≤ 2763 Kg (for ruling span of 233 meters)

≤ 2896 Kg (for ruling span of 305 meters)

≤ 2986 Kg (for ruling span of 365 meters)

vii) The net expansion of the HTLS Panther equivalent conductor / unit length at maximum operating temperature should be less than the net expansion of ACSR panther conductor /unit length at (75°C)

viii) Sag (in meters) -- ≤ 3.37 metres (for ruling span of 233 meters)

≤ 5.56 metres (for ruling span of 305 meters)

≤7.71metres(forrulingspanof 365meters)

ix) Sag of offered HTLS Conductor at maximum continuous operating temperature < sag ofACSR Conductor at 75 Deg Cconsidering same span length

x) DC resistance at 20°C and AC resistance at 75°C should be at least 15% less thanACSR Panther conductor.

xi) The conductivity at 20 Deg C (corresponding to % IACS) of aluminum or aluminum alloy used in the offered HTLS conductor should not be less than the % IACS Conductivity of Aluminum used in ACSR type conductor (IACS: International Annealed Copper Standard

Note: Current carrying capacity of the offered conductor shall be calculated corresponding to following ambient conditions:

1. Ambient temperature (°C) = 45
2. Solar Absorption coefficient = 0.8
3. Solar Radiation (w/sqm) = 1045
4. Emissivity constant = 0.45
5. Wind Velocity = 0.56 m/sec.

During execution, if there be any constraint regarding tension, sag, span, weight/mtr, diameter, ampacity and modulus of elasticity of the conductor, then the contractor shall formulate and submit these data in favour of BSPTCL after detailed engineering and the revised data shall be implemented after written approval of the buyer/BSPTCL.

Current Carrying capacity / Ampacity of offered Conductor

The Contractor in his bid shall furnish calculations for the ampacity based on IEEE-738 standard for the offered HTLS conductor. The design of conductor shall be suitable for operation at steady state conductor temperature at flow of minimum **1050/*1593* Amperes AC.** The Contractor shall also indicate the maximum permissible conductor temperature for continuous operation at maximum ampacity quoted at still air & at 45ambient without any deterioration of its electrical, mechanical & metallurgical properties.

The contractor shall indicate the technical particulars and details of the construction of the conductor in the relevant schedule of GTP. The contractor shall also guarantee the DC resistance and AC resistance at temperature corresponding to the continuous operating current of 1050 under normal condition. The contractor shall submit the supporting calculations for the AC resistance indicating details & justification of values of temperature coefficient of resistance & DC to AC resistance conversion factor with due reference to construction & geometry of the conductor. The Contractor shall submit the type test reports in support of DC resistance and the calculations for AC resistance.

Sag-Tension calculations of the existing ACSR Panther conductor and offered HTLS (EQUIVALENT TO PANTHER/*ZEBRA*) conductor are to be submitted along with bid under following conditions.

i) 32°C, No wind
ii) 32°C, Full wind
iii)05°C, 2/3rd wind
iv) 65°C, No wind
v) 180°C, No wind
vi) Emergency temperature no wind.

Contractor shall also furnish details of creep characteristics based on laboratory investigations/experimentations conducted on the HTLS conductor as per IEEE 1138 and shall indicate creep strain values corresponding to 1 month, 6month, 1year creep at tensions corresponding to the above conditions.

Calculations for Sag & tension shall be as described below:-

Design of Hardware & accessories should be compatible with the supplied HTLS (EQUIVALENT TO PANTHER) conductor and existing insulators & structures.

Major Qualifying Projects (MQP) for offered Conductor and hardware/accessories manufacturing is to be submitted with technical bid.

Workmanship

i) All the conductor strands shall be smooth, uniform and free from all imperfections, such as spills and splits, cracks, die marks, scratches, abrasions, rust etc.

ii) The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protrusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and / or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc),dirt, grit etc.

Joints in wires

a) Aluminum OR Aluminum Alloy Wires

During stranding no Aluminum/ aluminium Alloy welds shall be made for the purpose of achieving the required conductor length

b) Core Wires

There shall be no joint of any kind in the finished wire entering into the manufacture of the strand. There shall also be no joints or splices in any length of the completed stranded core. However, for composite core wires, splicing of the galvanic protection barrier is allowed, provided diameter specifications are maintained adhering to ASTM B987-17 and its upgradation (if any)

Tolerances

Manufacturing tolerances on the dimensions to the extent of one percent shall be permitted for individual strands and the complete conductor. However, For composite cores, the manufacturing tolerance shall be +/- 0.05 mm of the stated nominal value adhering to ASTM B987-17 and its upgradation (if any)

Materials

The materials used for construction of the conductor shall be such that the conductor meets the specified technical and the performance requirements.

Outer Layer

i) The material of outer layer of HTLS (EQUIVALENT TO PANTHER/ZEBRA) conductor shall be of high temperature resistant aluminum/ aluminum alloy/Annealed Aluminium added with any suitable elements to electrolytic aluminum having purity not less than 99.5% and a copper content not exceeding 0.04%. Contractor shall guarantee the chemical composition in the schedule GTP and also furnish description of the manufacturing process in the bid.

Core

The core wire strands may be of any composite materials/ *multistrand composite* or special steel and shall have properties conforming to the technical performance requirements of the finished conductor. Contractor shall furnish properties and composition of the core wire strands in the GTP schedule. The composite material for core shall be of such proven quality that its properties are not deteriorated by the normal operating conditions of 132KV transmission line in tropical environment conditions as experienced by the existing lines. The Contractor shall provide adequate details including specifications / test reports / operating experience details / performance Certificates etc. in support of the suitability of the offered materials. Care to be taken for internal friction due to different material having different thermal co efficient of expansion.

Please note that if multi-strand core conductor is offered, which is adhering to ASTM B987-25 and meeting the minimum requirements shown in Table 1 (Physical Properties) of ASTM B987-25, should perform all design validation tests as per Table 2 (Design Validation and Routine Test Classifications) of ASTM B987-25 and submit test report at the time of bidding. This confirms that the offered core design is validated as per ASTM B987-25.

The design, testing and qualification of carbon fibre composite (CFC) cores for HTLS conductors shall also comply with the applicable provisions of CEA advisories issued on dated 21.05.2024 regarding testing of carbon fibre composite (CFC) cores of HTLS conductors and dated 30.10.2025 regarding technical clarification/advisory on carbon fibre composite cores used in overhead HTLS conductors, as per the latest revision of ASTM B987/B987M-25.

Conductor Length

The Contractor after his survey of the existing line shall determine the most appropriate individual conductor lengths to be manufactured & supplied keeping in view of the tower schedules, section lengths, special crossings etc. The drum drawing as per IS 1778 or any international standard shall be submitted to purchaser for review and approval. The Contractor shall also indicate the maximum single length of conductor that they can manufacture, in the GTP. Contractor has to do survey, route, profile & engineering etc.of the existing line.

STANDARDS

The conductors & accessories shall comply in all respects to the clauses of this specification as indicated above & with the standards noted in Appendix-I, Appendix-II.

STRANDING

8.4.1 For all, constructions, each alternate layer shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the under laying wire or wires. The final layer of wires shall have a right hand lay.

PACKING AND MARKING

The conductor shall be wound in non-returnable reels or drums conforming to Indian Standard 1978-1961 specification for Reels and Drums for Bare Wire, or any other authoritative better standard and marked with the following: -

a) Trade name, if any b) Contract/Award letter Number

c) Name of manufacturer d) Name & Address of Consignee

e) Drum Number f) Length of conductor

g) Size of conductor h) Gross Weight of drum with conductor

i) Weight of empty drum j) Net and gross weight of conductor with lagging.

k) Arrow marking for un-winding

The reel shall be of such construction as to assure delivery of conductor in the field free from displacement & damage and should be able to withstand all stresses due to handling and the stringing operations so that conductor surface is not dented, scratched or damaged in any way during manufacture, transport and erection. The conductor shall be properly lagged on the drums and the method of lagging to be employed may be clearly stated in the offer. It should be stacked to suit the reel and held in place by steel strapping. Lagging shall not be nailed or bolted in place.

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 conductor, the exposed surfaces should be wrapped with suitable soft material to prevent the conductor from dirt and grit. Any space betweendrum lagging and conductor should be suitably filled with soft filler material compactly packed.

Evaluation of Ohmic Losses and Differential Price Loading

Based on the conductor parameters guaranteed by the bidders, average ohmic losses for different type of conductors offered by the bidders shall be calculated as per the following formula:

Average Ohmic loss (kW) = Loss Load Factor X conductor length X (Continuous operating current under normal conditions) 2 X AC Resistance corresponding to continuous operating current

For total conductor requirement of_kms, loss load factor = 0.50, continuous operating current of 1050Amp;

Average Ohmic loss (kW) =__x 0.50x (1050)2 x Rac/1000

=_____X Rac

Where Rac is the AC resistance per km guaranteed by the bidder at temperature corresponding to the continuous operating current of 1050A under normal condition.

Differential price evaluation for the conductors offered by the bidders shall be carried out considering the average ohmic losses calculated as above and considering Rs. 1,52,600per kW.

The best parameter of loss (lowest ohmic loss for conductor) corresponding to lowest AC resistance quoted among bidders by any technically responsive and qualified bidder shall be taken as basis and that quoted by the particular bidder shall be used to arrive at differential price to be applied for each bid.

TESTS AND TEST CERTIFICATES 1.7.1Type Tests on Conductor

The following type valid test certificates are to be furnished along with the bid.

i) Breaking Load Test on Stranded conductor

The test is to be carried out as per IS 398 Part V or as per IEC 61089 and the resultsshould conform to the guaranteed values furnished by the contractor.

ii) D.C Resistance Test on stranded conductor
The tests is to be carried out as per IS 398 Part V or as per IEC 61089 and the results should conform to the guaranteed values furnished by the contractor.

iii) Test on Composite Carbon Core
The offered conductor is acceptable only if the conductor passes the tests on Composite Carbon Core as per relevant IS/IES/ASTM.

Note: - Apart from above if any test is desired to be done by BSPTCL, agency should do the same and arrange it on discretion of BSPTCL. Price implication for the same shall be borne by BSPTCL.

Acceptance tests on conductor
The following acceptance tests will be made in the presence of the representatives of the owner. However, these tests are subject to change as per the technical discussion between the owner & contractor.

i) Breaking load test on conductor strands and D.C resistance test on conductor strand
The conductor strands and DC resistance should meet the requirements of ASTM B.

ii) Aluminium Area measurement on complete conductor
The test is to be carried out as per ASTM B 263. The aluminium area should conform to the guaranteed values furnished by the contractor.

iii) Check for Lay ratios of various layers
The lay- ratios of various layers shall be checked to ensure that they conform to the guaranteed values furnished by the contractor.

iv) Visual and Dimensional check on drums
The drums shall be visually and dimensionally checked to ensure that they conform to the approved drawings.

In case of composite core type conductors, composite Core manufacturer must have successfully performed design validation tests prior to bid submission as per ASTMB987 on the class of core being offered and it must be witnessed by the representative
(s) of Utility or witnessed by representative of a Laboratory which is accredited to ISO/IEC 17025 (different than that of laboratory where tests were performed).

8.7.4 Tests on Accessories
8.6.3.1 Dead end strength, high temperature endurance, current cycling, sustained ampacity, aeolian vibration, & corrosion tests will be conducted on the accessories according to the standards specified at appendix-IV.

1.7.4 Additional Information

i) Contractor should have experience of stringing of HTLS/ High Ampacity Conductors of same technology as offered in the bid.
ii) Laying of HT cable/stringing of HTLS / High Ampacity Conductor shall be carried out in presence of OEM/authorized representative of OEM.

GUARANTEED TECHNICAL PARTICULARS
The contractor shall fill in the guaranteed technical particulars in the Performa below and submit the same with his tender, without which bid will not be considered.

GUARANTEED TECHNICAL PARTICULARS OF "HTLS CARBON COMPOSITE CORE ALUMINIUM

(EQUIVALENT TO PANTHER) " CONDUCTOR

Sl. Description Unit Value guaranteed by the Contractor

1. Name of Manufacturer
2. Address of Manufacturer
3. Name of the conductor
4. Construction of conductor/
Designation of conductor as per IEC:61089
5. Particulars of Raw Material

Outer Layers

a) Type of conductor strand.

b) Chemical composition of Conductor strand .

i) .....%
ii) .....%
iii).....%
iv) .....%
v) .....%

Inner Core

a) Material of core

b) Chemical composition of core

i) .....%
ii) .....%
iii).....%
iv) .....%
v) .....%
vi) .....%

6. Outer Aluminium Alloy Strand after Stranding

Number of outer layers Nos.

Diameter mm

a) Nominal mm
b) Maximum mm
c) Minimum mm

Minimum Breaking load of strand

a) Before stranding KN
b) After stranding KN

Resistance of 1m length of strand at 20 deg. C. Ohm

7. Inner core strands/inner core after stranding

Number of layers in inner core No.

Diameter mm

a) Nominal mm
b) Maximum mm
c) Minimum mm

Minimum Breaking load of strand/Core

a) Before stranding KN
b) After stranding KN

Min. no. of twists which a
single strand shall withstand
during torsion testfor a length
equal to 100times dia of wire
after stranding. Nos
8. Complete conductor
UTS of Conductor KN
Lay ratio of conductor Maximum Minimum
a) 1st layer (outer most layer)
b) 2nd Layer
c) 3rd Layer
d) 4th Layer
Maximum permissible
conductor temperature for
continuous operationDeg C
Maximum permissible conductor
temperature for shortterm
operationDeg C
Permissible duration of above
short term operationMinutes
Maximum length of conductor
that can be offered as single length KM
DC resistance of conductor at 20°C Ohm/km
AC resistance at maximum
continuous operating temperature
corresponding to specified
maximum operating current
(minimum 1050 A under
maximum ambient conditions
and zero wind
as per Technical Specification) Ohm/km
Details of Creep characteristicfor
conductor enclosed (as per Technical
Specification) Yes/No
Sag Tension Calculation
Sag Tension Calculation enclosed Yes/No 8.10.2Sag &
tension at 32 deg. C & no wind Meters & KN8.10.3Sag
& tension at 32 deg. C & full wind Meters
& KN 103
8.10.4Sag & tension at 05 deg. C & 2/3rd wind Meters & KN
8.10.5Sag & tension at 65 deg. C & no wind Meters & KN
8.10.6Sag & tension at 150 deg. C & no wind Meters & KN
8.10.7Sag & tension at maximum operating temperature & no wing
Meters & KN

8.10.8Sag & tension at emergency temperature & nowind
Meters & KN

Tolerance on standard length of conductor %

Direction of lay for outside layer

Linear mass of the Conductor

a) Standard Kg/Km

b) Minimum Kg/Km

c) Maximum Kg/Km

Standard length of conductor KM

9.0 Drum is as per specification Yes/No

10.0 Accessories as per specification/standards Yes/No

SAG TENSION CHARTS AND SAG TEMPLATES

The contractor shall supply six copies of sag tension charts and sag templates each in respect of the conductor. The contractor shall also supply sag template in celluloid, which shall be subject to the approval by the owner and without involving any extra charges. The sag template will be used for changing the tower positions in future.

ACCESSORIES

The Contractor after his survey of the existing line shall determine the quantity and type of the accessories required for the turnkey job, which are to be supplied by them. These accessories should be suitable for the supplied conductor for its entire operating range without degradation of mechanical, metallurgical and electrical properties. The steady state temperature of hardware and accessories must not exceed 90°C during no wind and 50°C ambient temperature at minimum 800Amp load. The contractor shall be responsible for satisfactory performance of complete conductor, hardware and accessories, offered by him, for continuous operation at temperatures corresponding to various conditions stipulated at 2.4 of this technical specification.

EXECUTION OF WORK

The erection works consist of

(a) dismantling of existing ACSR Panther Conductor, Construction of new Transmission line on narrow base tower having pile foundation, supply of HTLS CARBON COMPOSITE CORE ALUMINIUM (EQUIVALENT TO PANTHER) conductor of minimumapprox 1050 A capacity corresponding to maximum allowable operating temperature & with unit weight equal to or less than that of ACSR Panther conductor and associated conductor hard ware fittings, clamps & vibration dampers and stringing of the HTLS conductor on existing 132KV transmission line structure. ROW if any for execution of work & approach to worksite shall be resolved by contractor at his cost. However, BSPTCL will provide necessary assistance. In case, Tower strengthening is required where there is missing tower members, agency will install the missing members of tower (if required) and the payment shall be done on actual consumption.. The summary of the work is as follow-

a. Insurance of materials during storage-cum-erection.

b. Distribution of materials at erection site.

c. Stringing of conductor up to both ends of the lines, with the help of tensioner andpuller machine and if required, manually with the approval of the owner.

d. Guarantee of all the activities carried out from (a) to (e) and submission of FQP for carrying out of all above activities.

All works shall be carried out in accordance with the revised and latest provisions under Indian Electricity Act and Rules made there under.

All the erection tools required during erection of lines shall be arranged by the Contractor at his own cost. The Contractor shall also be responsible for any damage to and / or loss of his erection tools.

In case of any deviation in quantities from the tendered quantity, payment will be made with the approval from the corporate office of the owner.

It will be the Contractor's sole responsibility to take the materials up to the location. Anypathway, temporary road, temporary bridge required for the work, same will be provided by the contractor at his cost. If, for any reasons the above is not feasible, the contractorat his own cost shall have to arrange transportation by head loads.

STRINGING

The stringing work shall be carried with the help of tensioner and puller machines. Wherever it is not possible to install the tensioner, it can be done manually with the approval of site engineer of the owner. Stringing shall mean, the activities of paying, jointing, tensioning, clamping with armor-rod, providing dampers and fixing the conductorat tension hardware and jumpering etc.

Stringing of conductor shall be done up to gantry at both ends of the individual lines.

1.12.2Installation tension is not allowed to exceed beyond maximum allowable tension of existing ACSR

The stringing work should be planned in such a manner in consultation with the Engineer in charge of the Owner that minimum shut down of power line crossings are required. Revenue loss due to any undue shut down due to contractor's irresponsibility shall be recoverablefrom the contractor.

Before commencing of stringing work, Contractor shall obtain approval of sag tension charts showing final sag and tension for various temperature and spans.

The Contractor shall be responsible and will take care of proper handling of conductor drums. Sufficient numbers of aluminum snatch blocks shall be used for paying out the Conductors. Necessary precautions shall be taken to avoid conductor rubbing on the ground by providing adequate ground roller, rollers on supports. Additional rollers shall also be provided to cross thorny hedges, tower footing and other obstructions to avoid scratching of conductor. The conductor shall be made to sag correctly as per stringing charts, before they are finally transferred to the hardware and clamps . No mid span joint shall be made at less than 30 meters from the tower end and no mid span joint shall be permitted in road and other important crossings spans.

There shall not be more than one joint in the same span of individual conductor. The sagshall be adjusted to suit the sag indicated against actual temperature. The thermometer shall be provided at the conductor point during the stringing work. Dynamo meters shall be used in tensioning the conductors. All conductors shall be stressed to their load at thetime of stringing, as per approved stringing charts.

The minimum clearance between the lowest point of conductor and ground shall not be less than as specified in the chart. All compression joints should be carefully made and a record of initial and final lengths of the joints, jointly signed by contractor and BSPTCL representatives shall be maintained. Check for sag should also be made atintervals when conductors are drawn up. Over stressing, causing damage to towers must be avoided. Care should be exercised not to over tension the conductor.

To avoid contact with the ground or any object above ground level the conductors shall be pulled by the controlled tension methods using neoprene lined double pulled wheel type tension stringing equipments. The equipment shall be capable of maintaining continuous tension of not less than of 3000 kg. per conductor.

When the conductor is on the stringing rollers before sagging-in, it shall be ensured that the conductor is not damaged due to wind, vibration, vehicles or other causes. Scaffolding should be used to cross the important road crossings for minimum interruption to traffic.

The conductor shall be pulled up to desired sag and left in serial stringing sheaves for at least one hour after which the sag shall be rechecked and adjusted, if necessary, before clipping in and transferring the conductors from the serial stringing sheaves to the suspension clamps.

The stringing rollers, when suspended on the transmission structure for supporting conductors, shall be so adjusted that the conductor will be on the rollers at the same height as the suspension clamp to which it is to be secured.

Armour rods and vibration dampers shall be fitted at each suspension and tension tower before final clamping of conductor with Insulator strings. Vibration dampers are to be fixed with clamping bolt and in correct vertical position in relation to conductor.

Compression type joints are to be used for jointing of conductors. Each part connected with joints shall be perfectly cleaned & precautionary measures taken before final compression. All the joints of conductors shall be made with the best workmanship and shall be perfectly straight and having maximum possible strength.

Proper guys shall be provided to counter balance the paying out tension of conductor at the tension locations, to avoid damage to towers and/or accident.

FIELD QUALITY PLAN (FQP)

Contractor shall invariably submit the FQP along with Technical Bid for erection of line, including all the activities such as dismantling, stringing, construction etc. with detailed checklist to be referred.

WASTAGE

The maximum permitted ceiling for wastages for conductor permitted is 0.5% (maximum) which takes into account the additional length for sag & jumpers.

No wastage is allowed for any material except the percentage limit mentioned for Conductor here in above in Clause No. 13.1

LOSSES

In the event of any material used for transmission line found broken or damaged or received short during transit or failed during the erection / testing at site before commissioning of line, the contractor shall replace the same free of cost.

COMMISSIONING

The contractor shall ensure that at the end of each sub-activity the surplus material is immediately removed from the work-site to avoid loss and injury to the public.

The contractor has to make reconciliation of material account and to settle final bill including signature in all relevant papers required for passing of final bill within three months from the date of charging / commissioning of line.

APPENDIX- I

Sl. no	Title	International Standard
1.	Specification for aluminium conductors for overhead transmission purposes	IEC:1089-1991, BS:215-1970
2	Breaking Strength –Epoxy Ends	Aluminum Association
3	Stress-strain Curves – Epoxy Ends	Aluminum Association or IEC 61089
4	Electrical Resistance	ASTM B193, IEC:468
5	Creep (25 C)	Aluminum Association, IEC 61395, IEEE:1138
6	Sheave Test	IEEE:1138, IEC:61396
7	Core Creep	Aluminum Association
8	Fault Current	IEEE 1138, IEC 61396
9	Aeolian Vibration	IEEE 1138, – use mechanical set-up
10	Galloping	IEEE 1138, – use mechanical set-up
11	Axial Impact, Radial Crush	IEEE 1138, EIA/TIA 455-25A /41A
12	Lightning Strike	IEC 61396
13	Torsional Ductility	IEC 60794-1-2 /ASTM
14	Corrosion & salt spray	ISO 9227:1990 or ASTM B117
15	Outer wire layer	ASTM B941-05/ASTM B609
16	Stranding, workmanship, finish and appearance	ASTM B232/B232M
17	Elongation & strength	ASTM B557
18	Corona	IEEE 4

19	Sustained ampacity test at ambient & elevated temperature	ANSI C119.4, IEEE:738
20	Reels and drums for bare conductors	IS:1778-1980, BS:1559-1949
21	Method of radio interference tests	IS:8263-1990, IEC:437-1973, NEMA:107-1964

APPENDIX- II

Sl. no	Title	Standards	Modifications
1.	Dead-end, Joint Strengths	Aluminum Association, ANSI C119.4	
2	Current Cycling	ANSI C119.4 –ANSI C119.7	
3	Sustained Load (room temperature)	ANSI C119.4	
4	Sustained Load (high temperature)	ANSI C119.4	
5	Aeolian Vibration	IEEE 1138, – use mechanical setup	None
6	Galloping	IEEE 1138, – use mechanical setup	8% RBS
7	Corrosion	ASTM B117	None
8	Corona Testing	IEEE539/656	None
9	Damper Efficiency	IEEE 664	None