POWER GRID CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

TECHNICAL SPECIFICATION

FOR

RECONDUCTORING PACKAGE OH01 FOR RE-CONDUCTORING OF GOOTY – TUMKUR(PAVGADA) 400 KV D/C LINE WITH TWIN HTLS CONDUCTOR (CAPACITY 2100 MVA)

VOLUME-II

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TECHNICAL SPECIFICATION

(VOLUME-II)

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SECTION-I A

SCOPE

Revision History

Revision No.	Date	Clause Ref	Description
Rev-0	June'2021		First Release
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Rev-22	June’2026		twenty-second Revision
Rev-23	August'2026		twenty-third Revision
Rev-24	August'2026		twenty-four Revision
Rev-25	Sept'2026		Twenty-fifth Revision

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TECHNICAL SPECIFICATIONS

SECTION- I A

SCOPE

1.0 Scope

1.1 The following transmission lines are included in the scope of the Contractor under various packages:

Package –

1. **Reconductoring package OH01 for Re-conductoring of Gooty-Tumkur (Pavgada) 400 KV D/C line with TWIN HTLS conductor. (Capacity 2100 MVA)**

1.2 This Specification covers the following scope of works:

(i) Survey & profiling of existing line route using Total stations, verification of availability of statutory electrical clearances using PLS-CADD software

(ii) Fabrication, supply and erection of assorted tower members for transmission line Towers as per Employer's design/drawings including River crossing towers (wherever applicable) including fasteners, step bolts, hangers, D-shackles etc.;

(iii) De-stringing the existing conductor and EW/OPGW (wherever applicable) including inspection of insulator strings, hardware fittings, dismantling and replacement of the same (if required), dismantling of accessories for conductor, dismantling of existing insulators (if required) etc.

(iv) Installation of necessary hardware, hoisting of insulator strings and stringing of each circuit with HTLS conductor and EW/OPGW (wherever applicable) along with all necessary line accessories with the other circuit under live condition

(v) Supply of all types of tower accessories like phase plate, circuit plate (where ever applicable), number plate, pole plate (where ever applicable), danger plate, anti-climbing device, Bird guard, (where ever applicable);

(vi) Buy-back of dismantled material (if required & covered under BPS)

(vii) Supply of

a) Hardware Fittings and accessories for Conductor

b) HTLS Conductor

c) Insulators

(viii) Design, manufacturing, testing & supply of High Temperature Low Sag (HTLS) conductor along with associated clamp fittings and accessories suitable for the offered HTLS conductor.

(ix) Supply of one set of all the special tools & tackles required for stringing of the offered HTLS conductor. (where ever applicable & covered under BPS);. List of Special tools & tackles required for stringing of HTLS conductor is enclosed as Appendix-IV of Section IVC.

(x) Supply & Installation of Tower Earthing.

(xi) Supply & installation of Insulated Conductor sleeve, (if required & covered under BPS);

(xii) Supply & installation of Bird Diverter, (if required & covered under BPS);

(xiii) Erection of towers by using crane (wherever feasible), tack welding of bolts and nuts including supply and application of zinc rich paint, fixing of insulator strings, stringing of conductors and earth wires/OPGW* along with all necessary line accessories. For transmission lines, to promote mechanization and safe working conditions, use of crane is being promoted. However, where usage of crane is not possible, erection of towers has to be carried out by conventional method i.e using Gin pole, Derrick, Centre mast etc. through usage of Power Operated Winch Machines. No tractor shall be allowed for tower erection.;

(xiv) Destringing & dismantling of existing 765/400/220/132/66kV Transmission line. (whenever applicable & covered under BPS)

(xv) Stringing of Power line crossing section under Live Line Condition (where ever applicable & covered under BPS);

(xvi) Cable bypass arrangement of 11KV/33KV/LT Powerline crossing. (wherever applicable & covered under BPS)

(xvii) Stringing of transmission line through Drones (wherever applicable & covered under BPS).

(xviii) Painting of towers & supply and erection of span markers, obstruction lights (wherever applicable) for aviation requirements (as required)

(xix) Testing and commissioning of the erected transmission lines and

(xx) Other items not specifically mentioned in this Specification and/or BPS but are required for the successful commissioning of the transmission line, unless specifically excluded in the Specification.

(xxi) The installation/stringing of OPGW cable along with associated fittings & accessories shall be carried out by the contractor. The scope of installation/stringing shall include splicing, termination, testing, demonstration for acceptance & commissioning as well as documentation. Splicing is preferred to be carried out at Tension towers locations. However, it shall be permitted at Suspension Tower locations also as required due to site conditions. The installation/stringing and splicing shall be carried out as per owner guidelines (provided as part of TS). The FODP & Approach cable shall also be installed by the Contractor (where ever applicable as per BPS).

(xxii) The scope of the package shall inter-alia include supervision of stringing works at site as per the approved procedure during the entire period of

stringing. The stringing works including installation of HTLS conductor & its fittings & accessories shall be supervised by a team of supplier's engineers/ supervisory staff/ workmen already experienced in stringing work associated with the type of HTLS conductor being supplied. The bidder shall furnish experience details of the engineers/ supervisory staff proposed to be deployed. The supplier shall coordinate with the line contractor and train their workers. Site visit for supervision shall be carried out as per instructions of POWERGRID. Charges for supervision (including supervision by core manufacturer, if required) shall be deemed to be included in the total quoted price. The HTLS Conductor and associated Clamps & accessories covered in this package shall be supplied complete in all respects, including all components, fittings and accessories which are necessary or are usual for their efficient performance and satisfactory maintenance under the various operating and atmospheric conditions. The supplier shall be responsible for ensuring compatibility with associated fittings and accessories and satisfactory performance of complete conductor system (alongwith associated fittings and accessories) for continuous operation at the designed continuous operating temperature of the offered HTLS conductor. Such parts shall be deemed to be within the scope of the Contract, whether specifically included or not in the Specification or in the Contract Schedules. The Supplier shall not be eligible for any extra charges for any additional fittings/ associated parts, components, if required based on site conditions & for satisfactory performance of complete conductor system.

(xxiii) The use of suitable Heavy-Duty Composite Mats (HDCM) for making temporary access road, equipment staging area, movement of heavy machineries like JCBs, Pokelane, earthmovers, Tension Stringing Equipment's, Cranes, Concrete Mixers, etc. in paddy fields, Swampy, Marshy, Muddy, Sandy and Partially submerged area, etc. shall also be in the scope of contractor. The Provisional quantities of locations where Heavy-Duty Composite Mats required to be used are indicated in the relevant Price Schedules of BPS.

1.3 Provisions pertaining to Reconductoring packages

1.3.1 The Insulators along with hardware fittings (except suspension clamps at suspension tower and dead-end clamps at tension tower) of the existing line shall be used for reconductoring of line with HTLS conductor. The existing insulators and hardware fittings shall be inspected by the contractor for any defects and those found defective shall be replaced after approval of engineer-in-charge with fresh items to be supplied by Employer (if not covered under the scope of works).

1.3.2 The conductor/earthwire (if required & covered under BPS) & associated clamps/accessories removed from the existing line shall be retained & bought -

back by the contractor in “as is, where is” condition. The contractor shall quote the buyback price for the dismantled conductor/earthwire (along with associated clamps/accessories) in the buyback schedule enclosed with the bidding documents. Further, in case scope of works also includes replacement of old hardware Fittings (except clamps) & Insulators, the same shall also be required to be bought back by the contractor in “as is, where is” condition as per the quoted price in the buyback schedule.

All the expenses incurred by the contractor towards handling/loading/transportation or any other activities related to bought-back material shall be borne by the contractor without any financial implication to POWERGRID.

The quantities of Conductors, Earthwire, Clamps, Accessories, Hardware Fittings, and Insulators specified in the Buyback Schedule shall be deemed definitive and final. No further measurement of the actual quantities of items bought back shall be required for the purpose of invoicing the Contractor by POWERGRID for payment. Invoices may be issued on a progressive basis, corresponding to the completed sections of the line length where de-stringing/re-stringing has been successfully completed.

1.3.3 In case of partial replacement of Hardware Fittings/Insulators etc. whose buyback is not covered in the scope, the contractor shall return the dismantled material to the Employer. The contractor shall be responsible for the safety of the dismantled material from damage during handling and transportation to the designated stores of employer. The Contractor shall be responsible for proper reconciliation, accounting and safe storage of the materials at site and further transportation to Employer’s stores. No payment shall be admissible for any expenses incurred towards handling, loading/unloading, transportation to Employer’s stores etc.

If the Contractor fails to return the same, beyond the permitted wastage (i.e. 2% of total dismantled quantity), the Contractor shall compensate the Employer suitably for the material which he is unable to return at rates corresponding to the prevailing 'cost of procurement'.

1.3.4 The contractor shall return to the Employer, other Employer supplied materials if any, not incorporated in the works, except those quantities permitted as extra consumption by the Employer as indicated under Section-IVC. If the Contractor fails to return the same, he shall either replenish the same or compensate the Employer suitably for the material which he is unable to return at rates corresponding to the prevailing 'cost of procurement' plus 15%.

1.3.5 In respect of hardware fittings (Except Clamps) of existing line, which shall be used/ retained for the reconductoring with HTLS conductor, no wastage shall be

permitted. In case of any damage/wastage of these hardware, the contractor shall either replenish the same or compensate the Employer suitably for the material which he is unable to return at rates corresponding to the prevailing 'cost of procurement' plus 15%. However required quantities to replace the defective items, if any found during inspection, shall be supplied by the Employer.

1.3.6 In case, the dismantled insulators are required to be returned to the Employer, the same shall be packed in wooden crates. The cost of wooden crates shall be deemed to be included in the total quoted price.

1.3.7 Contractor shall be responsible for regulating the supplies of contractor supplied materials based on actual requirements. The Employer shall have right not to take any surplus contractor supplied materials.

1.3.8 The contractor shall give complete details of the stringing methods he proposes to follow. Prior to stringing, the contractor shall submit the stringing charts for the conductor (Initial & Final) and Earthwire/OPGW (Final) (if applicable) showing the initial & final sag & tension for various temperatures (min. temp. to designed max. temp.) and spans alongwith equivalent spans in the lines for the approval of the employer. Conductor creep are to be compensated by over tensioning the conductor at an appropriate temperature lower than the ambient temperature based on the creep calculations to be furnished by the contractor or by using initial sag & tension indicated in the approved Initial sag-tension chart.

1.3.9 The Employer shall arrange shut down of one circuit at a time and the other circuit shall be kept under charged condition. The contractor shall de-string the existing conductor and restring the circuit with the HTLS conductor section by section and restore the line in original conditions as per program finalized in coordination with site. Appropriate safety measures along with necessary safety tools and equipment to carry out de-stringing and stringing operations under the above conditions, including mechanical/ structural safety of the towers, shall be the responsibility of the contractor. This shall include inspecting the tower to ascertain quantity of missing members and bolts & nuts and erection of assorted tower members to be supplied under the scope of the package. The contractor shall ensure that by replacing the existing conductor with the HTLS conductor offered, the loadings on the towers due to conductor tensions as well as loads on account of the reconductoring activities shall be within specified limits.

1.3.10 The materials covered here under this specification shall be supplied complete in all respects, including all components, fittings and accessories which are necessary or are usual for their efficient performance and satisfactory maintenance under the various operating and atmospheric conditions. The Supplier of HTLS conductor shall be responsible for ensuring compatibility with associated fittings and accessories and satisfactory performance of complete conductor system (along with associated fittings and accessories) for continuous operation at the designed maximum continuous operating temperature of the offered HTLS conductor. Such parts shall be deemed to be within the scope of the Contract, whether specifically included or not in the Specification or in the Contract Schedules. The Supplier shall not be eligible for any extra charges for such fittings, etc.

1.4 Technical Requirements of High Temperature Low Sag (HTLS) Conductor

The offered HTLS conductor shall meets the following technical requirement

Sl. No.	**Parameters**	**Requirement**
A)	**Electrical Requirements**	
1	Minimum Current carrying capacity/Ampacity at maximum design continuous operating temperature(A)	1516
2	Maximum DC Resistance at 20^0 C (Ohm/km)	0.05552
B)	**Physical Dimension Requirements**	
1	Overall diameter of complete conductor	
a)	Maximum (mm)	31.77
b)	Minimum (mm)	28.62
2	Maximum Nominal mass of complete conductor (kg/km)	2004
3	Direction of lay of outer layer	Right Hand
C)	**Sag Tension Requirements**	
1	**Ruling span(m)**	400
2	Tension at every day condition (32°C, no wind) (Kg)	Not exceeding 25% (as applicable*)* of UTS of proposed conductor

3	Tension at designed maximum temperature and no wind condition (Kg)	Not exceeding 25% of UTS at designed maximum temperature
4	**Sag-Tensions**	
i)	Sag for ruling span at designed maximum temperature & no wind condition (m)	≤ 13.26
ii)	Sag for ruling span at minimum temp (*0 deg C*) and no wind condition (m)	≥ 9.67
iii)	Tension at 32°C and full wind condition	
a)	110 Kg/m2 wind pressure	≤ 6333 kg & not exceeding 70% of UTS of proposed conductor
iv)	Tension at 0°C and 36% full wind condition	
a)	39.6 Kg/m2 wind pressure	≤ 4699 kg & not exceeding 70% of UTS of proposed conductor
v)	Tension at designed maximum temperature and Full wind condition	
a)	110Kg/m2 wind pressure	≤ 6333 kg & not exceeding 70% of UTS at designed maximum temperature of proposed conductor
vi)	Tension at knee point temperature & no wind condition (Kg)	Not exceeding 40% of UTS of core@ of proposed conductor

Note:

1. In case more than one sag tension conditions are specified in the above table, Bidder shall offer only one design of HTLS conductor, which shall comply with all the above sag-tension requirements.
2. @UTS of core shall be equal to the Breaking strength of individual core wires before stranding X no. of wires in the core of offered conductor.

1.5 Details of Transmission Line Routes and Terrain

The tower schedule of the transmission line prepared during its construction is enclosed for reference in Section-Tower Schedule of this Volume. During execution, Profiling of existing line route (quantity indicated in the BPS) covering ground profile, locating towers, verification of Sag profile of HTLS conductor at designed maximum temperature & verification of clearances etc. employing Total Stations & PLSS CAD software shall be carried out by the contractor.

1.5.1 Bidders may visit the line route to acquaint themselves with terrain conditions and associated details of the proposed transmission lines. For this purpose they are requested to contact the following address:

POWER GRID CORPORATION OF INDIA LTD.
Southern Region Transmission System-I

NO.6-6-8/32&39S/E, Kavadiguda Main Road,
Secunderabad-500080 (Telangana)

1.6 Location Details and Terminal Points

1.6.1 The 400kV D/C Gooty – Tumkur (Pavagada) transmission line shall emanate from Gooty substation/switchyard in the State of Andhra Pradesh and terminate at Tumkur (Pavagada) substation in the State of Karnataka.

The 400kV D/C Gooty – Tumkur (Pavagada) transmission line is passing through Plain area.

1.6.2 The Contractor shall have to construct the transmission line portions, covered under the tower package, completely up to dead end towers at either/substation end**.** Stringing shall also be carried out from dead end tower to terminal arrangements/terminal points.

2.0 Transmission towers and Line data

2.1 General Description of the Tower

2.1.1 The transmission towers covered under the package are of self-supporting hot dip galvanized lattice steel type, designed to carry the line conductors with necessary insulators, earth wire, OPGW (If applicable) and all fittings under all loading conditions. Outline diagram of towers are enclosed with the Specification.

2.1.2 The towers shall have mild steel or/and high tensile steel sections and shall be fully galvanized as specified in relevant clauses in section-IV. Bolts and nuts with spring washer are to be used for connections.

2.1.3 The towers are of the following types:

A) Double Circuit

2.2 Classification of Towers

2.2.1 The towers for 400 kV Double Circuit Lines shall be of Vertical Configuration and are classified as given below:

Sl No	Type of Tower	Deviation Limit	Typical Use
1	DA	0 – 2 deg.	To be used as Tangent tower.
2	DB	0 deg.	To be used as Section Tower.
		0 - 15 deg.	a) Angle towers with tension Insulator string.
			b) Also to be used for uplift force resulting from an uplift span up to 200m under broken wire conditions.
			c) Also to be used for Anti Cascading Condition.
3	DC	0 deg.	To be used as Section Tower.
		15-30 deg.	a) Angle tower with tension insulator string.
			b) Also to be used for uplift forces resulting from an uplift span up to 200m under broken wire condition.
			c) Also to be used for anti-cascading condition.
4	DD	30 - 60 deg.	a) Angle tower with tension insulator string.
			b) Also to be used for uplift forces resulting from an uplift span up to 300m under broken wire condition.
			Dead end with 0 deg to 15 deg deviation both on line side and sub-station side (slack span)
		0 deg.	a) Complete Dead end
			b) For river crossing anchoring with longer wind span.

Note:

1. The above towers can also be used for longer span with smaller angle of deviations without infringement of ground clearance.

2. The above table provides indicative classification of Towers. Tower spotting data for various towers to be used in the transmission lines under the specific package shall be given to the contractor during execution stage.

2.2.2 Transposition tower for Lines

Transposition is to be done generally for all transmission lines whose length is greater than 100 km.

Two numbers of transposition towers have been envisaged in the double circuit transmission line and three number of transposition towers have been envisaged in the single circuit transmission line having horizontal configuration of towers. Actual no. of transposition towers and Location of transposition towers shall be finalized during detailed survey in consultation with site in charge

For transposition of transmission line, Transposition tower/DC type towers designed for upto 30 deg deviation angle with modifications shall be used. The transposition tower shall be spotted at 0 deg. deviation for transposition of the line, maintaining all the required electrical clearances and shielding. Indicative sketches for single and double circuit transposition towers are enclosed in drawing section of this specification.

Alternatively, in case of 765 kV D/C transmission line or above, transposition shall be carried by using two auxiliary towers to carry jumper to achieve required electrical clearances for transposing the phases and erected along side any tension type tower i.e. DB/DC/DD as shown in the sketch enclosed in drawing section of this specification.

In case of the 765 kV S/C transmission line having delta configuration of towers, no modification in the C type tower is required and transposition shall be carried by using three pairs of C type towers in the line as shown in the sketch enclosed in drawing section of this specification.

Single tension strings, Single suspension pilot strings and T-connectors/PG Clamp as indicated in the sketches shall be used for maintaining the requisite electrical clearances under normal and swing conditions.

2.2.3 Special Towers

The towers which will be specially designed for very long spans which cannot be crossed by normal tower with extensions as given in relevant clause like Major River crossings etc. shall be treated as special towers.

2.3 Electrical Clearances

2.3.1 Ground Clearance

The minimum ground clearance from the bottom conductor shall not be less than 8840 mm for 400KV line at the maximum sag conditions i.e. at max temperature as indicated in tower spotting data and still air.

a) An allowance of 150mm shall be provided to account for errors in stringing.

b) In case of HTLS conductor, Sag-Tension shall be carried out using PLSCADD considering Final values of modulus of elasticity, Coefficient of Linear Expansion, Stress-Strain coefficients & Creep coefficients of aluminium/ aluminium alloy / core in the cable data (.wir file) as mentioned at clause 1.5, Section -VIIB.

3.0 Special Requirements

Out of the total requirement of HTLS conductor and associated clamp fittings & accessories for lines covered under the Re-conductoring packages, Employer may provide some quantity of HTLS conductor and associated clamp fittings & accessories as Owner Supplied material (OSM). This HTLS conductor may be different from the HTLS conductor offered by the Contractor. The Contractor shall take delivery of this HTLS conductor and associated clamp fittings & accessories as Employer supplied materials at the stores established by the Contractor in consultation with the Employer and ensure their safe custody. Stringing of Employer supplied HTLS conductor and associated clamp fittings & accessories shall be in the scope of the Contractor and shall be done under supervision of the HTLS conductor supplier(s). For stringing of Employer supplied HTLS conductor and associated clamp fittings & accessories, Line sections shall be identified in advance in consultation with the site in-charge and record of the same shall be maintained.

Contractor shall ensure stringing of Employer supplied HTLS conductor and associated clamp fittings & accessories in accordance with approved stringing procedure submitted by the HTLS conductor supplier. Contractor along with HTLS conductor supplier shall be equally responsible for proper stringing of employer supplied HTLS conductor and associated clamp fittings & accessories.

4.0 Different Sections to Technical Specification

4.1 For the purpose of present scope of work, technical specification shall consist of following parts and they should be read in conjunction with each other: -

Sl. No.	Section Number	Name of Section	Rev No.
1	Section-IA	Scope	Rev-25(Sept'2026)
2	Section-IB	General Information	Rev-15 (May'2026)
3	Section-II	General Technical Conditions	Rev-4 (Jan'2026)
4	Section-III	Survey and Soil Investigation	Rev-9 (April'2026)
5	Section-IVC	Fabrication, Erection and Stringing	Rev-11 (Feb'2026)
6	Section-V	Galvanised Steel Earthwire	Rev-2 (March'26)
7	Section-VIA	Hardware Fittings and Accessories for Conductor & Earthwire	Rev-5 (Sept'26)
8	Section-VIB	Clamp Fittings and Accessories for HTLS Conductor	Rev-3 (March'26)
9	Section-VII B	HTLS Conductor	Rev-8 (March'26)
10	Section-VIII	Composite Longrod Insulators	Rev-6 (June'26)
11	Section-XI	Drawings	Rev-2 (Jan'2025)
12	Section-XII	FAQ	Rev 0 (June'2021)
13	Section-XIII	Tower Schedule of Existing Line	

4.2 In case of any discrepancy between Section-IA (Scope) and Section-IB (General Information) and other technical specifications on scope of works, Section-IA (Scope) shall prevail over all other sections.

4.3 In case of any discrepancy between Section-IB (General Information) and individual sections for various equipment, requirement of individual equipment section shall prevail.

5.0 Service Conditions:

Equipment/material to be supplied against this specification shall be suitable for satisfactory continuous operation under tropical conditions as specified below:

Maximum ambient temperature (^oC)	50
Minimum ambient temperature (^oC)	0
Relative humidity (% range)	10-100
Wind zone (as per NBC)	2
Terrain Category	2
Maximum wind velocity (m/sec.)	39
Maximum altitude above mean sea level (Meters)	Below 1000m
Isokeraunic level (days/years)	60

Moderately hot and humid tropical climate conducive to rust and fungus growth.