

POWER GRID CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

**TECHNICAL SPECIFICATION
FOR
RE-CONDUCTORING PACKAGE OH01
FOR RECONDUCTORING OF EXISTING
LARA-I – RAIGARH (KOTRA) 400KV D/C
LINE WITH TWIN HTLS CONDUCTOR
WITH MINIMUM CAPACITY OF
2100MVA PER CKT AT NOMINAL
VOLTAGE
VOLUME-II**

(This document is meant for the exclusive purpose of bidding against this specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued).

TECHNICAL SPECIFICATION
(VOLUME-II)
CONTENTS

SECTION-I A	SCOPE
SECTION-I B	GENERAL INFORMATION
SECTION-II	GENERAL TECHNICAL CONDITIONS
SECTION-III	SURVEY AND SOIL INVESTIGATION
SECTION-IV A	TOWER DESIGN
SECTION-IV B	TOWER TESTING
SECTION-IV C	FABRICATION, ERECTION AND STRINGING
SECTION-IV D	FOUNDATION (CONTRACTOR DESIGN)
SECTION-IV E	FOUNDATION (EMPLOYER DESIGN)
SECTION-IV F	POLE STRUCTURE, FOUNDATION AND ERECTION
SECTION-V	GALVANISED STEEL EARTHWIRE
SECTION-VI A	HARDWARE FITTINGS & ACCESSORIES
SECTION-VI B	CLAMP FITTINGS AND ACCESSORIES FOR HTLS CONDUCTOR
SECTION-VII A	CONDUCTOR
SECTION-VII B	HTLS CONDUCTOR
SECTION-VIII	COMPOSITE LONGROD INSULATOR
SECTION-IX A	PILE FOUNDATION
SECTION-IX B	STONE COLUMN
SECTION-X	OPGW
SECTION-XI	DRAWINGS
SECTION-XII	FAQ
SECTION-XIII	TOWER SCHEDULE OF EXISTING LINE

SECTION-I A

SCOPE

TECHNICAL SPECIFICATIONS

SECTION-I A

SCOPE

Revision History

Revision No.	Date	Clause Ref	Description
Rev-0	June'2021		First Release
Rev-1	Sept'2021		First Revision
Rev-2	Oct'2021		Second Revision
Rev-3	Jan'2022		Third Revision
Rev-4	Apr'2022		Fourth Revision
Rev-5	July'2022		Fifth Revision
Rev-6	Feb'2023		Sixth Revision
Rev-7	Sept'2023		Seventh Revision
Rev-8	Dec'2023		Eighth Revision
Rev-9	March'2024		Ninth Revision
Rev-10	Jan'2025		Tenth Revision
Rev-11	Jan'2025		Eleventh Revision
Rev-12	Jan'2025		Twelfth Revision
Rev-13	May'2025		Thirteen Revision
Rev-14	June'2025		Fourteenth Revision
Rev-15	Sept'2025		Fifteenth Revision
Rev-16	Oct'2025		Sixteenth Revision
Rev-17	Jan'2026		Seventeenth Revision
Rev-18	Feb'2026		Eighteenth Revision
Rev-19	March'2026		Nineteenth Revision

TECHNICAL SPECIFICATIONS

SECTION-I A

SCOPE

CONTENTS

Clause No.	Description	Page No.
1.0	Scope	1
2.0	Transmission towers & line data	9
3.0	Different Sections to Technical Specification	11
4.0	Service Condition	12

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 – OH01

1. Re-conductoring of existing Lara-I – Raigarh (Kotra) 400kV D/c line with twin HTLS conductor with minimum capacity of 2100MVA per ckt at nominal voltage

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) 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) Destraining & dismantling of existing 765/400/220/132/66kV Transmission line. (whenever applicable & covered under BPS)
- (xiv) Stringing of Power line crossing section under Live Line Condition (where ever applicable & covered under BPS);
- (xv) Cable bypass arrangement of 11KV/33KV/LT Powerline crossing. (wherever applicable & covered under BPS)
- (xvi) Stringing of transmission line through Drones (wherever applicable & covered under BPS).
- (xvii) Testing and commissioning of the erected transmission lines and
- (xviii) 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.
- (xix) 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).
- (xx) 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.

- (xxi) 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 Destraining/ Dismantling

- 1.3.1 The scope of works includes destraining of conductor, earthwire & OPGW, removal of hardware fittings, insulators, conductor, earthwire & OPGW accessories, etc. and dismantling of tower from some sections of existing 400kV line and transporting of dismantled materials to designated POWERGRID stores. The Employer shall arrange shut down of charged sections of existing transmission lines, if required, before carrying out destraining & dismantling works as per program finalized in co-ordination with site. Appropriate safety measures along with necessary safety tools and equipments to carry out destraining and stringing operations under the above conditions including mechanical/ structural safety of the towers shall be the responsibility of the contractor. The entire quantity of dismantled line materials viz. tower parts, conductor, earthwire, OPGW, hardware fittings, insulators and conductor, earthwire & OPGW accessories removed from the existing line shall be transported to the designated POWERGRID stores by the contractor at his own cost. The Bidder shall submit his offer taking into consideration transportation cost of the dismantled material.
- 1.3.2 The contractor shall inspect the affected stretch of transmission lines and shall accordingly devise appropriate methodology/procedure of carrying out the destraining/restringing works during detailed engineering & execution stage in consultation with the site-in-charge.

1.4 Provisions pertaining to Reconductoring packages

1.4.1 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).

1.4.2 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.

1.4.3 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'.

- 1.4.4 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%.
- 1.4.5 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.
- 1.4.6 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.
- 1.4.7 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.
- 1.4.8 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.
- 1.4.9 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.

1.4.10 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.

1.5 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% 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/m ² wind pressure	≤ 6333.22 kg & not exceeding 70% of UTS of proposed conductor
iv)	Tension at designed maximum temperature and Full wind condition	
a)	110 Kg/m ² wind pressure	≤ 6333.22 kg & not exceeding 70% of UTS at designed maximum temperature of proposed conductor
v)	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.

1.6 Details of Transmission Line Routes and Terrain

The detailed survey shall be carried out using Total stations along the approved route alignment. As an alternative, the contractor may also use ALTM (Airborne Laser Terrain Modeling) techniques of equal or better accuracy for the detailed survey.

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.

Quantity of detailed survey including route alignment, profiling, tower spotting, optimization of tower locations, soil resistivity measurement & geotechnical investigation etc. of lines have been indicated in the BPS.

- 1.6.1 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.
Western Region Transmission System-I
Regional Head Quarter
SAMPRITI NAGAR, NARI RING ROAD,
PO: UPPALWADI, NAGPUR-440026
(MAHARASHTRA)**

1.7 Location Details and Terminal Points

- 1.7.1 Reconductoring of existing Lara-I – Raigarh (Kotra) 400kV D/c line with twin HTLS conductor

The existing Lara-I – Raigarh (Kotra) 400kV D/c transmission line shall emanate from existing Lara-I substation/switchyard in the State of Chhattisgarh and terminate at Raigarh (Kotra) substation in the State of Chhattisgarh.

The existing Lara-I – Raigarh (Kotra) 400kV D/c transmission lines are passing through Plain area.

- 1.7.2 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 400kV Double Circuit Lines shall be of Vertical Configuration and are classified as given below:

SI 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.

2.3 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.

2.4 Electrical Clearances

2.4.1 Ground Clearance

The minimum ground clearance from the bottom conductor shall not be less than 8840 mm for 400KV lines 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) Conductor creep shall be compensated by over tensioning the conductor at a temperature as mentioned in section IV of this specification-
- c) 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.

2.5 Special Requirements

i) Details of Line Materials shall be following: -

a) Hardware Fittings (except clamps) for Twin HTLS conductor:

Type tests, test procedures and technical particulars specified for hardware fittings for 400KV TL with TWIN ACSR MOOSE conductor under Section-VIA shall be applicable for hardware fittings (except clamps) for TWIN HTLS conductor under re-conductoring packages OH01.

3.0 Different Sections to Technical Specification

3.1 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-19(March'2026)
2	Section-IB	General Information	Rev-14 (Sept'2025)
3	Section-II	General Technical Conditions	Rev-4 (Jan'2026)
4	Section-III	Survey and Soil Investigation	Rev-8 (Sept'2025)
5	Section-IVC	Fabrication, Erection and Stringing	Rev-11 (Feb'2026)
6	Section-VIA	Hardware Fittings and Accessories for Conductor & Earthwire	Rev-4 (March'26)
7	Section-VIB	Clamp Fittings and Accessories for HTLS Conductor	Rev-3 (March'26)
8	Section-VII B	HTLS Conductor	Rev-8 (March'26)
9	Section-VIII	Composite Longrod Insulators	Rev-5 (March'26)
10	Section-XI	Drawings	Rev-2 (Jan'2025)
11	Section-XII	FAQ	Rev 0 (June'2021)
12	Section-XIII	Tower Schedule of Existing Line	

3.2 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.

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

4.0 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 (°C)	50
Minimum ambient temperature (°C)	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.