

KHANDUKHAL-RAMPURA TRANSMISSION Limited

TECHNICAL SPECIFICATIONFOR

***Construction of “400kV Khandukhal (Srinagar)-
Rampura (Kashipur) D/c line” – 194 Km with Twin
HTLS conductor along with associated 400kV AIS
S/S Extension Package SS01 for (i) Extn. of 400kV
Rampura (Kashipur) S/S including 400kV class
Line Reactor and (ii) Extn. of 400kV Khandukhal
(Srinagar) S/S” under Turnkey basis – Bids invited
by M/s. Khandukhal –Rampura Transmission
Limited (hereafter referred as KRTL)***

VOLUME-II

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TECHNICAL SPECIFICATION

(VOLUME-II)

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Specification No. :KRTL/TBCB/400kV/ Khandhukhal & Rampura/G1
Dated:-----

SECTION-I A

SCOPE

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TECHNICAL SPECIFICATIONS

SECTION-I A

SCOPE

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TECHNICAL SPECIFICATIONS

SECTION-I A

SCOPE

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TECHNICAL SPECIFICATIONS

SECTION- I A

SCOPE

1.0 Scope :

Construction of “400kV Khandukhal (Srinagar)- Rampura (Kashipur) D/c line” – 194 Km with Twin HTLS conductor along with associated 400kV AIS S/S Extension Package SS01 for (i) Extn. of 400kV Rampura (Kashipur) S/S including 400kV class Line Reactor and (ii) Extn. of 400kV Khandukhal (Srinagar) S/S” under Turnkey basis – Bids invited by M/s. Khandukhal –Rampura Transmission Limited (hereafter referred as KRTL

1.1 This Specification covers the following scope of works:

- (i) Detailed survey including route alignment, profiling, tower, soil resistivity measurement & geotechnical investigation (including special foundation locations viz. pile/well foundation locations, whenever applicable & covered under BPS);
- (ii) Check survey;
- (iii) Design and Proto type testing of transmission line towers
- (iv) Fabrication and supply of all type of transmission line Towers as per Contractor’s design/drawings (including River crossing towers (wherever applicable) as per Employer’s design/ drawings) including fasteners, step bolts, hangers, D-shackles etc.;
- (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) Supply of
 - a) Earth wire
 - b) Hardware Fittings and accessories for Conductor/Earth wire
 - c) Insulators (Composite Longrod)
 - d) OPGW & associated fittings & accessories.
- (vii) Design, manufacturing, testing & supply of High Temperature Low Sag (HTLS) conductor along with associated clamp fittings and accessories suitable for the offered HTLS conductor.
- (viii) Design of foundations for different soil conditions for different type of towers

- (ix) Classification of foundations for different type of towers and Casting of Foundations for tower structure footings as per Contractor's foundation design/ drawing;
- (x) Supply & Installation of Tower structure 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) For transmission lines, to promote mechanization and safe working conditions, use of crane is being promoted. Erection of towers structures 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. 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 structure erection.;
- (xiv) Destraining & 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) Painting of towers structures & supply and erection of span markers, obstruction lights (wherever applicable) for aviation requirements (as required)
- (xvii) Testing and commissioning of the erected transmission lines and
- (xviii) Scope also includes design, foundation, Supply, Erection, testing, commissioning of Bay extension works at Khandukhal & Rampura
- (xix) 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.
- (xx) 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).
- (xxi) The casting of special pile/well foundations, wherever required, shall be in the scope of the Bidder. The design shall be provided by KRTL. If the bidder

does not have necessary experience and is not meeting the qualifying requirements specified herein, some other agencies meeting the qualifying requirements may be engaged by the bidder for the casting of pile/well foundations.

- (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 KRTL. Charges for supervision (including supervision by core manufacturer, if required) shall be deemed to be included in the total quoted price. This shall also include supply of one set of all the special tools & tackles required for stringing of the offered HTLS conductor. 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.

1.2 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	1516 A

	design continuous operating temperature(A)	
2	Maximum DC Resistance at 20 ⁰ C (Ohm/km)	0.05552
B)	Physical Dimension Requirements	
1	Overall diameter of complete conductor	
a)	Minimum (mm)	28.62
2	Maximum Nominal mass of complete conductor (kg/km)	Less than or equal to 2004 kg/km
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 22% of UTS of proposed conductor
3	Tension at designed maximum temperature and no wind condition (Kg)	Not exceeding 22% of UTS at designed maximum temperature
4	Sag-Tensions	
i)	Tension at 32°C and full wind condition	
a)	80.84 X Gust Factor Kg/m ² wind pressure	≤11420 kg & not exceeding 70% of UTS of proposed conductor
ii)	Tension at designed maximum temperature and Full wind condition	
a)	80.84 X Gust Factor Kg/m ² wind pressure	≤ 11420 kg & not exceeding 70% of UTS at designed maximum temperature of proposed conductor
iii)	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.

1.3 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.

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

- 1.4.1 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:

KHANDUKHAL RAMPURA TRANSMISSION LIMITED

Vikash nagar ,Gadi Ghat near Children Accedmy

V/P -kotdwar district Pouri Garhwal ,Uttarakhand 246149;

Mr. B Kishore Singh C/O Binod Ray Mob- 8210714832/9165589898

1.4 Location Details and Terminal Points

- 1.5.1 Transmission line of 400 kV D/C Khandukhal (Srinagar) – Rampura (Kashipur) under Transmission line shall emanate from the Khandukhal (Srinagar)-Rampura(Kashipur) in the State of Uttarpradesh & Uttarakhand and terminate at one end of substation Khandukhal (Srinagar) & other end at Rampura (Kashipur) in the State of Uttarakhand.

The transmission line is passing through Plain & Hilly area.

- 1.5.2 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 Qualification Requirements

2.1 Qualification Requirement for Pile foundation

2.1.1 Qualifying Requirements

The bidder shall have experience of its own or should engage the services of an agency (ies) meeting the following experience, for carrying out pile foundations covered under the scope of the work of the package. The details in support of the contractor/agencies meeting the stipulated requirement shall be submitted by the Contractor within one month of NOA, to Site-In-charge for approval: -

2.1.1.1 Technical Experience

The bidder/agency shall have successfully completed# execution of pile foundation work (s) within the last seven (7) years as on date of NOA. In the above work(s), the bidder's experience should include the following:

- (i) The bidder/agency should have installed cast-in-situ vertical bored pile foundation experience executed at least 1000mm dia of having depth of 25meters below ground level:-
- (ii) The monthly average rate of pile boring for best three months achieved by the bidder/agency in any one contract executed during last 5 years should be at least **140m** for **Package TL02**.
- (iii) The monthly average rate of Concreting for pile cap, pedestal, tie beams etc. for best three months achieved by the bidder/agency in any one contract executed during last 5 years should be at least **80cum** for **each Package**.
- (iv) In case bidder is a holding company, the technical experience referred to in clause 2.1.1.1 above shall be of that holding company only (i.e. excluding its subsidiary/group companies). In case bidder is a subsidiary of a holding company, the technical experience referred to in clause 2.1.1.1 above shall be of that subsidiary company only (i.e. excluding its holding companies).

2.1.1.2 Equipment capabilities

The bidder/agency should own or have access to at least 1 (one) no. Hydraulically operated drilling machine against each package capable of boring following minimum diameter and depth upto 40 m below ground level with necessary tools/accessories for boring in all kinds of soil including bed rock:

In case bidder is proposing above facilities from other agencies, they shall furnish the details of such agencies along with their consent letters.

2.1.1.3 In case the bidder engages the services of subcontractor for carrying out pile foundations covered under the scope of the work of the package, the subcontractor shall also meet the criteria in addition to cl 2.46 in Sec-IBof technical specification and an undertaking (as per format enclosed at *Annexure-A*) shall be submitted from the agency(ies) along with the bid.

3.0 Transmission towers and Line data

3.1 General Description of the Tower

3.1.1 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.

3.1.2 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.

3.1.3 The towers are of the following types:

A) Double Circuit

3.2 Classification of Towers

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

Type of Tower	Deviation Limit	Typical Use
DA	0 – 2 deg.	To be used as Tangent tower.
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.

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.
DD45	30 - 45 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.
DD60	45 - 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.
3. DD45 towers (which shall not be designed for dead end conditions) shall not be used for 400 kV & above voltage level Power line crossings, Railway crossings and National Highway crossings.
4. For DB & DC type towers, separate foundation quantities (wherever applicable) are indicated in BPS for following categories based on angle of line deviation: DB1- 0 to 7 deg, DB2- 7 to 15 deg, DC1- 15 to 22 deg, DC2- 22 to 30 deg. Further, foundations shall be designed separately for different categories of towers based on applicable design loads. The bidder shall quote prices for various items of towers & foundations on per number basis as per BPS.

3.2.2 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 . 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, DC type towers designed for upto 30 deg deviation angle with modifications shall be used as Section towers 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. However, foundation designed for tower type of DC1 (15 to 22 deg.) shall be adopted.

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.

Quantities of DC towers indicated in BPS include quantities of Transposition Towers. The payments for additional weight of Transposition Tower over DC tower weight, its Design, fabrication, supply, transportation, erection, etc. are deemed to be included in DC type towers.

3.2.3 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.

3.3 Electrical Clearances

3.3.1 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.

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
1	Section-IA	Scope
2	Section-IB	General Information
3	Section-II	General Technical Conditions
4	Section-III	Survey and Soil Investigation
5	Section-IVA	Tower Design
6	Section-IVB	Tower Testing
7	Section-IVC	Fabrication, Erection and Stringing
8	Section-IVD	Foundation (Contractor Design)
9	Section-V	Galvanised Steel Earthwire
10	Section-VIA	Hardware Fittings and Accessories for Conductor & Earthwire
11	Section-VIB	Clamp Fittings and Accessories for HTLS Conductor
12	Section-VII B	HTLS Conductor
13	Section-VIII	Composite Longrod Insulators
14	Section-IX	Pile foundation
15	Section-X	OPGW
16	Section-XI	Drawings
17	Section-XII	FAQ

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 (°C)	50
Minimum ambient temperature (°C)	0
Relative humidity (% range)	10-100
Wind zone (as per NBC)	5
Terrain Category	2
Maximum wind velocity (m/sec.)	50
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.

