POWER GRID CORPORATION OF INDIA LTD.

(A Government of India Enterprise)

TECHNICAL SPECIFICATION

FOR

LILO OF VEMAGIRI-SRIKAKULAM 765 KV D/C LINE AT KAKINADA SUB-STATION(PKG TL01) ASSOCIATED WITH TRANSMISSION SYSTEM FOR PROPOSED GREEN HYDROGEN / GREEN AMMONIA PROJECTS IN KAKINADA AREA, ANDHRA PRADESH

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 (only applicable for Re-conductoring packages)

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
Rev-20	April'2026		twentieth Revision

Rev-21	May’2026		twenty-first Revision
Rev-22	June’2026		twenty-second Revision
Rev-23	August'2026		twenty-third Revision
Rev-24	August'2026		twenty-four Revision

TECHNICAL SPECIFICATIONS

SECTION-I A

SCOPE

CONTENTS

Clause No.	Description	Page No.
1.0	Scope	1
2.0	Transmission towers & line data	4
3.0	Different Sections to Technical Specification	7
4.0	Service Condition	8

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 – TL01

1. **LILO of Vemagiri – Srikakulam 765 kV D/C line at Kakinada substation.**

1.2 This Specification covers the following scope of works:

(i) Detailed survey including route alignment, profiling, tower spotting, optimization of tower locations, works related to forest proposal clearances, soil resistivity measurement & geotechnical investigation (including special foundation locations viz. pile/well foundation locations, whenever applicable & covered under BPS);

(ii) Check survey.

(iii) Fabrication and supply of all type of transmission line Towers as per Employer's design/drawings including River crossing towers (wherever applicable) including fasteners, step bolts, hangers, D-shackles etc.;

(iv) 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);

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

(vi) Supply of

a) Earth wire

b) Hardware Fittings and accessories for Conductor/Earth wire

c) AL59 Zebra Conductor

d) Composite Long Rod Insulators

e) OPGW & associated fittings & accessories.

(vii) Classification of foundations for different type of towers and Casting of Foundations for tower footings as per Employer's foundation design/ drawing;

(viii) Supply & Installation of Tower Earthing.

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

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

(xi) 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/OPGWalong 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.;

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

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

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

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

(xvi) Painting of towers & 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) 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 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 Destringing/ Dismantling

1.3.1 The scope of works includes destringing of conductor, earthwire & OPGW, removal of hardware fittings, insulators, conductor, earthwire & OPGW accessories, etc. and dismantling of tower from some sections of existing 400kV/ 765 kV/ +/-500kV HVDC/ +/-800kV HVDC 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 destringing & dismantling works as per program finalized in co-ordination with site. Appropriate safety measures along with necessary safety tools and equipments to carry out destringing 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 destringing/restringing works during detailed engineering & execution stage in consultation with the site-in-charge.

1.4 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 spotting, optimization of tower 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:

POWER GRID CORPORATION OF INDIA LTD.

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

1.5 Location Details and Terminal Points

1.5.1 The transmission lines (LOOP IN & LOOP OUT) shall emanate from the LILO point of 765 KV D/C Vemagiri-Srikakulam line in the State of Andhra Pradesh and terminate at the proposed 765/400 KV Kakinada substation in the State of Andhra Pradesh.

The LILO of 765 KV D/C Vemagiri-Srikakulam line at Kakinada sub-station covered under package TL01 is passing through Coastal 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 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 765 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	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.
5	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 and Railway crossings.

4. The contractor is permitted to offer tower/foundation design of higher tower loading / higher Wind Zone / higher deviation angle than the details specified for the transmission lines in this section/BPS. However, payment for supply , erection & installation of the offered tower/foundation shall be restricted to the price quoted by the bidder against the required tower type specified in BPS.

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 18000 mm for 765 KV 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.

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-24(August'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-IV E	Foundation (Employer Design)	Rev-8 (Sept'2025)
7	Section-V	Galvanised Steel Earthwire	Rev-2 (March'26)
8	Section-VIA	Hardware Fittings and Accessories for Conductor & Earthwire	Rev-4 (March'26)
9	Section-VIIA	Conductor	Rev-4 (March'26)
10	Section-VIII	Composite Longrod Insulators	Rev-6 (June'26)
11	Section-X	OPGW	Revision-2 (April'2026)
12	Section-XI	Drawings	Rev-2 (Jan'2025)
13	Section-XII	FAQ	Rev 0 (June'2021)

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 (^oC)	50
Minimum ambient temperature (^oC)	0
Relative humidity (% range)	10-100
Wind zone (as per NBC)	5 Coastal
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.