	<b>SPECIFICATION FOR DESIGN OF TRANSMISSION LINE TOWER</b>	<b>PROJECT: 4x100 MW KOTESHWAR HEP - 400KV SWITCHYARD</b>
	DOC. No. : TB-224-316-051      REV No. 00	

## SECTION-1

### SCOPE SPECIFIC TECHNICAL REQUIREMENTS AND QUANTITIES

#### 1.0 SCOPE:

The scope of work includes **ROUTE SURVEY, DESIGN (Including foundation design), SUPPLY, PROTO TESTING, SUPPLY AND ERECTION TESTING COMMISSIONING OF** the transmission line and Intermediate Towers between GT Yard and 400 kV Switchyard as per enclosed drawings for the following Project:

Name of customer : **THDC**  
Name of the project: **4x100MW Koteswar Hydro Electric Project, 400 kV Switchyard**

The scope for **DESIGN(Including foundation design), SUPPLY, ERECTION, TESTING & COMMISSIONING** of Transmission Lines covers but not limited to the following activities:


1. Detailed survey, Check Survey, preparation of line chart, route map etc. as required for design of transmission lines.
2. Structure design of double circuit double ACSR Moose conductor 400kV transmission line towers between GT Yard and 400kV Switchyard and suitable extensions as required.
3. Fabrication of proto assembly and type testing, including destructive tests, under THDC/BHEL witness for double conductor, double circuit transmission line tower of each type.
4. Preparation of fabrication drawings and detailed BOQ for tower structures.
5. Technical support and revision of documents including resurvey as and when required during the execution of the transmission line contract till completion of work.
6. Preparation for design documents, reports, drawings, specifications, BOQ etc. for the transmission line / Intermediate Towers and getting approval of customer /BHEL for design drawings / documents.
7. Providing stringing charts and other details as required for stringing of all lines.
8. Technical support and revision of documents including recheck-survey as and when required during the execution of the transmission line contract till completion of work.
9. Getting approval from THDC / BHEL for Drawings and documents required for the above work prior to the execution of work.
10. Supply and Erection of Intermediate Transmission Line Towers.
11. Providing estimated BOQ and specifications for all stringing material required i.e. string hardware, clamps, jumpers, mid-span compressions, repair sleeves, spacers, vibration dampers, conductors, ground wire etc.
12. Complete Erection of Transmission Line and stringing of ACSR conductor, ground wire from GT Yard to Switchyard.
13. Earthing of Transmission Line Towers.

#### 1.1 Introduction and Specific Technical Requirement:

The inter-connection between the GT yard gantry (Generating Station) and the outdoor switchyard, located at distance of approximately 300 m, shall be by overhead ACSR Moose conductors. Due to relative position of transformers and switchyard and the distances between these two it shall be necessary to have conductor supports between these terminal points.

The clearances between phase and earth, between phases and ground shall have to be maintained as per IE Rules/CBIP guidelines.

The Contractor shall offer the arrangement as proposed here covering all aspects of interconnection.

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Refer enclosed **Annexure-A** for input data required for the design work and **Section-2** for customer specification Structural work. ETC and Earthing work of Transmission Line shall be in accordance of Relevant standards of IS/ IEC/ CBIP Manual/ IEEE.

## 2.0 Bill of Quantity:

S. No.	Item / Work description	Quantity
1.	Detailed survey, Check Survey, Tower Profile, route map and Tower Spotting etc. as required for design of transmission lines.	L/S
2.	Structural design of double circuit Double ACSR Moose conductor 400kV transmission line towers and suitable extensions as required and Providing BOQ of Tower Structures.	2 Nos.
3.	Providing estimated BOQ of all Stringing Material required i.e. String Hardware, String Insulators, Clamps, Jumpers, mid-span compressions, repair sleeves, vibration dampers, conductors, ground wires etc. Providing Stringing Charts and other details as required for stringing of all lines.	L/S
4.	Fabrication of proto assembly and type testing, including destruction tests, under THDC / BHEL witness for double conductor, double circuit transmission line tower of each type.	1 No. (for Each Type of Tower)
5.	Design ( <b>Including foundation design</b> ), Supply of Transmission Line Towers, Erection, testing & Commissioning of 400kV Double Circuit Transmission Line between GT Yard and 400kV Switchyard. Including Stringing of ACSR Conductor & Ground wire, Earthing of Transmission Line and supply of Earthing material.	1 lot, 02nos of Towers


Note: Any other item / work not mentioned in this specification but required for completion of work and commissioning of Transmission line and Towers shall be covered in scope of contractor.

BHEL scope will comprise of conductor, line hardware and insulator. Civil work shall be carried out by THDC. Supply of foundation bolt will be in contractor scope.

The make of structure steel, reinforcement steel, grade of concreting will be subject to THDC / BHEL approval.

## ENCLOSURES:

1. Annexure-A, Input Design Data.
2. Drg. No. TB-0-224-507-030A Rev 00, Title- Overall Layout of GT Yard and Switchyard.

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## SECTION-2

### SPECIFICATION FOR CIVIL DESIGN AND STRUCTURAL STEEL WORK

#### 10.7.8 Civil Works

Civil work is excluded from scope. However, civil foundation design and installation of the structures shall be executed by the contractor.

#### 10.7.9 Structural Steel Works

The structural steel works shall be done in accordance with requirements stipulated under relevant specifications.

#### 10.8: STEEL STRUCTURES FOR TRANSMISSION LINE:


##### 10.8.1: Scope

- (a) The galvanised steel structures for towers as mentioned hereunder shall conform to relevant standards.
  - (i) Towers structures, supports, etc. for interconnecting GT Yard and outdoor switchyard through a 400 kV overhead Transmission Line.
- (b) All types of bolts, nuts, hangers, shackles, clamps anti-climbing devices, bird guards, step bolts, inserts in concrete templates, gusset, plates, structure earthing bob, foundation bolts, splicing bolts spring washers, fixing plates , angles and bolts for structure and other item as required to complete the job shall be in accordance with the relevant standards 1 requirement of specification.

##### 10.8.2 Standards

All materials shall be of best quality conforming to the relevant IS standards. Any material, not specified therein and for which there is no IS shall conform to the latest British Standards (B.S.). The materials for which no Indian or British Standards exists shall be new and the best of its kind and subject to the approval of the purchaser. Other internationally acceptable standards which ensure equal or higher performance than those specified shall also be accepted.

IS: 800	Code of practice for, use of structural steel in general construction in steel.
IS: 4759	Specification for hot dip zinc: coatings on structural steel and other allied products.
IS: 5358	Specification for hot dip galvanized coatings on fasteners
IS: 6639	Specification for hexagon bolts for steel structures.
IS: 2633	Method for testing uniformity of coating on zinc coated articles.
IS: 1893	Criterion for earthquake resistance design of structures.
IS: 2016	Plain washer.
IS: 6610	Specification for heavy washers for steel structures.

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IS: 6745      Methods for determination of weight of zinc coating of zinc coated iron and steel articles.

IS: 814      Specification for covered electrodes for metal and welding of mild steel.

All steel section shall be straight, sound, free from twists, cracks, flaws, laminations, rough, jagged and imperfect edges and all other defects.

All steel sections including nuts, bolts etc. shall be of relevant standards stipulated in the specification.

#### 10.8.5 Weights

The weight shall mean the weight calculated by using the black sectional (i.e. ungalvanised) weight of steel members of the size indicated in the approved fabrication drawings and Bill of Materials without taking into consideration the reduction weights due to holes, notches and bevel cuts etc.

#### 10.8.6 Test at Works


- a) The Contractor shall arrange for all materials procured by him to be tested as and when required and in the presence of the representative of the Purchaser, if so desired.
- b) When steel is procured from a merchant's stock, the purchaser shall:
  - I) Satisfy himself by means of identification marks on the steel combined with a manufacturer's certificate that such steel has been tested and found to comply with the requirements herein container: or
  - II) Arrange for samples to be prepared and tested under this contract to prove the requisite quality. Only after satisfying himself about its quality the Purchaser shall allow such steel to be used in the work
- c) For structural steel test samples shall be cut out of the materials from the locations indicated by the Purchaser and samples shall be prepared in accordance with the requirement of Indian Standards Specifications for conducting such test. For each set of tests three samples shall be taken for tensile strength test and bend test. One set of tests will include test of three individual pieces of samples for the purpose of measurement fit and payment.

#### 10.8.7 Inspection before dispatch

All structures being supplied shall be subjected to routine tests in accordance with relevant standards.

Each part of the fabricated steel work shall be inspected and certified by the Purchaser or his authorised representative,, as satisfactory before it is dispatched to the erection site. Such certification shall not relieve the Contractor of his responsibility regarding adequacy and completeness of fabrication.

The following standard, (latest revisions) are applicable in general:-

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IS: 226	Specification for structural steel (Standard quality).
IS: 802	Code of practice for use of structure steel in overhead.
Part-I	Loads and permissible stresses.
Part-II	Fabrication, galvanising, inspection and packing.
Part-III	Testing.
IS:808	Specification for Rolled steel Beam Channel and Angle Sections,
IS:816	Code of practice for, use of material arc welding for general grade C.
IS: 1364	Specification for hexagon head bolts, screws and nuts of product grade A and 8.
IS: 1363	Specification for hexagon head screws bolts and nuts off product grade C.
IS: 1367	Specification for Technical supply condition for threaded steel fasteners.
IS: 1573	Specification for Electroplated coatings of zinc on iron and steel.
IS: 2062	Specification for weldable structure steel.
IS: 2629	Specification for Recommended practice for hot dip galvanising of iron and steel.
IS: 1978	Specification for line pipe.
IS: 3063	Specification for single coil rectangular section spring washers for bolts, nuts and screws.
IS: 806	Code of practice for use of tubes in general building construction.
IS. 116	Specification for steel tubes for structural purpose
IS:823	Code of practice for manual metal arc welding of mild steel.
IS:209	Specification for zinc.
IS:406	Specification for method of chemical analysts for slab zinc.


#### 10.8.8 **Test Certificate**

Copies of all test certificates relating to material procured by the Contractor for the works shall be forwarded to Purchaser.

#### 10.8.9 **Standards for Testing**

For testing of materials, the following standards shall be adopted:


- Methods of Tensile Testing of Steel Products other than sheets, strip, wire and tube IS: 1608.

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- b) Methods of Bend Tests for steel products other than sheet, wire and tube IS: 1599.
- c) Methods of Chemical Analysis of Pig Iron, Cast iron and plain carbon and low alloy steel IS: 228.
- d) Code of Practice for Radiographic Testing IS: 2595.
- e) Recommended Practice for Radiographic Examination of fusion welded butt joints in Steel Plates IS: 1182.
- f) Code of Practice for Ultrasonic Testing by Pul seecho method IS: 3664.

#### 10.8.10 **Design, drawings and documents**

- a) Manufacturer's drawings, instructions and recommendations shall be followed by the Contractor for handling, setting and testing of all structures. Care has to be exercised in handling to avoid distortions to stationary structures, the marring of finish, damage of parts. Adjustments if required to be stationary structures for plumb and level, for the sake of appearance or to avoid twisting of frame or bending of hinged member shall have to be carried out by the Contractor.
- b) The Contractor shall furnish a list of drawings with the tender which he intends to submit after award of the contract. The Contractor shall necessarily submit all these drawings, unless a drawing is waived. However, Contractor shall have to prepare, and submit any other drawings and reference in addition to the drawings contained in the list furnished by Contractor if so required during design and engineering stage etc. in case any drawing, is to be modified even after its approval, Contractor shall the modify drawings arid resubmit the drawing as required in the specification and no extra payment shall be made on this account.
- c) The fabrication drawings to be prepared arid furnished by the, Contractor shall as per the design approved. These fabrications drawings shall indicate complete detail of fabrication and erection including all erection splicing details and typical fabrication splicing details, facing details, weld sizes and lengths, bolt details and all customary details in accordance with standard structural engineering practice. He shall furnish along with the fabrication drawings necessary calculations regarding design of joints viz., size and length of welds diameter and number of bolts and calculations justifying other fabrication details like size and spacing of tack plates, batten plates, lacings, etc. as well as design of erection and fabrication splices in accordance with IS: 800, IS: 823/IS: 802 and IS: 816.
- d) The fabrication drawings submitted by the Contractor shall indicate the size of section shown in the. design drawings/sections submitted for the approval and their black steel weights with reference to Indian Standard Hand Book for structural engineers. The fabrication drawings shall also indicate identification erection marks for purpose of dispatch and erection etc.
- e) Six copies of the detailed fabrications drawings including bolt arid nut schedule shall be submitted by the Contractor for approval in the first instance, in case the approval to the fabrication drawings is subject to any modification, additions and alternations, the Contractor shall submit six sets of the revised drawings for final approval after incorporating these changes.

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- f) The approved fabrication drawings may require revision either before or after preparation and approval of shop drawings. Such revisions shall be duly incorporated in the shop drawings. Contractors are expected to make their own assumption regarding the quantum of such revision involving preparation revisions of shop drawings.
  - g) The fabrication works shall start only after the final approval to the fabrication drawings.
  - h) Such approval shall, however, not relieve the Contractor of his responsibility for the safety of the structure and good connections and any loss or damage occurring due to defective fabrication, design of joints or workmanship shall be borne entirely by the Contractor.
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### Annexure-A

#### Input data for Design:

##### **A      Conductor Data**

No. of conductor per phase	2
Type of conductor	ACSR Moose
Dia of conductor	3.177 mm
Weight of conductor per meter	2.004 kg/m
UTS of conductor	161 kN

##### **B      Shield wire data**

No. of shield wire	1
Type of shield wire	GI Wire
Dia of shield wire	10.98 mm
Weight per meter	0.583 kg/m
UTS of shield wire	68.4 kN

##### **C      Disc Insulator data**

Dia of insulator	280 mm
EMS of disc	120 kN

##### **C-i      400kV Insulator string**

No. of discs per tension string	= 2x25
No. of discs per suspension string	= 1x25
Weight of tension string with hardware in kg	450
Length of tension string	4638 mm
Dia of tension string in mm	280
Weight of suspension string with hardware in kg	250
Length of suspension string	4249 mm
Dia of suspension string in mm	255