BHUTAN POWER CORPORATION LIMITED
THIMPHU: BHUTAN

BIDDING DOCUMENT

FOR

SUPPLY, CONSTRUCTION, TESTING AND COMMISSIONING OF A 132 kV TRANSMISSION LINE FROM WOBTHANG SOLAR PROJECT AT BUMTHANG TO GARPANG, BHUTAN.

(TENDER NO. BPC/C&PD/CMS/TENDER-2026/10)

FUNDED BY ADB

LOAN NO: 58265-001-BHU

APRIL 2026

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Bhutan Power Corporation Limited
(An ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 Certified Company)
Registered Office, Thimphu
Construction & Procurement Department
Construction Division
Thimphu : Bhutan

Invitation for Bids

Date : 16 April 2026.
Loan/Grant No. and Title: 58265-001-BHU- Solar Farm Expansion Project.
Contract No : BPC/C&PD/CMS/TENDER-2026/10
Contract Title : Supply, Construction, Testing & Commissioning of a 132kV transmission line from Wobthang Solar Project at Bumthang to Garpang.
Deadline for Submission of Bids: 28 May 2026 at 14:00 Hrs. (Bhutan Local Time).

1. The Kingdom of Bhutan has applied for financing from the Asian Development Bank (ADB) toward the cost of Solar Farm Expansion Project. Part of this financing will be used for payments under the Contract named above. Bidding is open to Bidders from eligible source countries of ADB.

2. The Bhutan Power Corporation Ltd. (BPC) (the Employer) invites sealed bids from eligible Bidders for the construction and completion of t Supply, Construction, Testing & Commissioning of a 132kV transmission line from Wobthang Solar Project at Bumthang to Garpang (‘the Facilities”).

3. Open competitive bidding (International Advertisement) will be conducted in accordance with ADB’s Single-Stage: Two-Envelope procedure and is open to all Bidders from eligible countries as described in the Bidding Document.

4. Only eligible Bidders with the key qualifications defined in Section 3 (Evaluation and Qualification Criteria) of the Bidding Document may participate in this bidding.

5. To obtain further information and inspect the Bidding Document, Bidders should contact:
   Sangay Lungten
   Chief Manager, Contract Management Section, Construction Division,
   Bhutan Power Corporation Limited,
   Yarden Lam, Chubachu,
   PO Box 580, Thimphu, Bhutan.
   Tel: +975 02 325095/17756471 E-mail: sangay.lungten@bpc.bt

6. The Bidding Document may be downloaded free of charge from the BPC website: www.bpc.bt.

7. Deliver your bid:

   - To the address above in para 5
   - On or before the deadline: **28 May 2026 at 14:00 Hrs. (Bhutan Local Time)**
   - Together with a **Bid Security** as described in the Bidding Document.

   Bids will be opened promptly after the deadline for bid submission in the presence of Bidder’s representatives who choose to attend at the offices as specified in the bidding document.

   BPC will not be responsible for any costs or expenses incurred by bidders in connection with the preparation or delivery of bids including costs and expenses related to participation in pre-bid meeting and site visits.

This Bidding Document for the Procurement of Works has been prepared by Bhutan Power Corporation Limited (BPC) and is based on the Standard Bidding Document for the Procurement of Works (SBD Works) issued by the Asian Development Bank dated December 2024.

Section 1: Instructions to Bidders

This section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, evaluation of bids, and award of contract.

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A. General

1. Scope of Bid

1.1 In connection with the Invitation for Bids (IFB) indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section 6 (Works' Requirements). The name, identification, and number of contracts of the open competitive bidding (OCB) are provided in the BDS.

1.2 Throughout this Bidding Document,

(a) the term "in writing" means communicated in written form and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and

(c) "day" means calendar day.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called "Borrower") indicated in the BDS has applied for or received financing (hereinafter called "funds") from the Asian Development Bank (hereinafter called "ADB") toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.

2.2 Payments by ADB will be made only at the request of the Borrower and upon approval by ADB in accordance with the terms and conditions of the Financing Agreement between the Borrower and ADB (hereinafter called "Financing Agreement"), and will be subject in all respects to the terms and conditions of that Financing Agreement. No party other than the Borrower shall derive any rights from the Financing Agreement or have any claim to the funds.

3. Fraud and Corruption

3.1 ADB requires Borrowers (including beneficiaries of ADB-financed activity) and their personnel, as well as firms and individuals participating in an ADB-financed activity, including but not limited to, Bidders, Suppliers, and Contractors, agents, subcontractors, subconsultants, service providers, subsuppliers, manufacturers (including their respective officers, directors, employees, and personnel) under ADB-financed contracts to observe the highest standard of ethics during the procurement and execution of such contracts in accordance with ADB's Anticorruption Policy (1998, as amended from time to time). In pursuance of this policy, ADB

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

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(iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;

(v) "abuse" means theft, waste, or improper use of assets related to ADB-related activity, either committed intentionally or through reckless disregard; and

(vi) "integrity violation" means any act, as defined under ADB's Investigation and Enforcement Framework (as amended from time to time), which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: failure to disclose and manage conflict of interest,[1] obstructive practice, violations of debarment, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standards.

(b) will reject a proposal for award if it determines that the Bidder recommended for award or any of its officers, directors, employees, personnel, subconsultants, subcontractors, service providers, suppliers, or manufacturers has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;

(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation, including by failing to inform ADB in a timely manner at the time they knew of the integrity violations;

(d) will impose enforcement and remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Investigation and Enforcement Framework, including declaring ineligible, either indefinitely or for a stated period of time, to participate[2] in ADB-financed, -administered, or -supported activities or to benefit from an ADB-financed, -administered, or -supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and

(e) will have the right to require that a provision be included in the Bidding Document and in contracts financed, administered, or

[1] "Conflict of interest" means any situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations; and

[2] Whether as a Contractor, Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

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supported by ADB, requiring Bidders, suppliers and contractors, consultants, manufacturers, service providers, and other third parties engaged or involved in ADB-related activities, and their respective officers, directors, employees, and personnel, to permit ADB or its representative to inspect the site and their assets, accounts and records, and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

3.2 All Bidders, consultants, contractors, suppliers, manufacturers, service providers, and other third parties engaged or involved in ADB-related activities, and their respective officers, directors, employees and personnel, are required to cooperate fully in any investigation when requested by ADB to do so. As determined on a case-by-case basis by ADB, such cooperation is set out in detail in the Investigation and Enforcement Framework.

3.3 All Bidders, consultants, contractors, and suppliers shall require their officers, directors, employees, personnel, and agents to ensure that, in its contracts with its subconsultants, Subcontractors, and other third parties engaged or involved in ADB-related activities, such subconsultants, Subcontractors, and other third parties similarly are required to cooperate fully in any investigation when requested by ADB to do so.

3.4 The Employer hereby puts the Bidder on notice that the Bidder or any Joint Venture partner of the Bidder (if any) may not be able to receive any payments under the Contract if the Bidder or any of its Joint Venture partners, as appropriate, is, or is owned (in whole or in part) by a person or entity subject to applicable sanctions.

3.5 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 1.17 and Part C *[Corrupt and Fraudulent Practices]* of the Particular Conditions of Contract.

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, or government-owned enterprise subject to ITB 4.5-or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture. In the case of a Joint Venture,

(a) all partners shall be jointly and severally liable; and

(b) the Joint Venture shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the Joint Venture during the bidding process and, in the event the Joint Venture is awarded the Contract, during contract execution.

4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of

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proposed Subcontractors or Suppliers for any part of the Contract including related services.

4.3 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in the bidding process if any of, including but not limited to, the following apply:

(a) they have controlling shareholders in common; or

(b) they receive or have received any direct or indirect subsidy from any of them; or

(c) they have the same legal representative for purposes of this bid; or

(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or

(e) a Bidder participates in more than one bid in this bidding process, either individually or as a partner in a Joint Venture, except for alternative offers permitted under ITB 13 of the Bidding Document. This will result in the disqualification of all Bids in which it is involved. However, subject to any finding of a conflict of interest in terms of ITB 4.3(a)-(d) above, this does not limit the participation of a Bidder as a Subcontractor in another Bid or of a firm as a Subcontractor in more than one Bid; or

(f) a Bidder, Joint Venture partner, associate, parent company, or any affiliated entity, participated as a Consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or

(g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Engineer for the contract; or

(h) a Bidder would be providing goods, works, or nonconsulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(i) A Bidder that has a financial or familial relationship with Employer's personnel including personnel of project implementing/executing agency, or of a recipient of a part of the loan who: (i) are directly or indirectly involved in the preparation of the Bidding Document or specifications of the contract, and/or the bid evaluation process of such contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to ADB throughout the procurement process and execution of the contract.

4.4 A firm will not be eligible to participate in any procurement activities under an ADB-financed, -administered, or -supported project while under suspension or debarment by ADB pursuant to its Anticorruption

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Policy (see ITB 3), whether such debarment was directly imposed by ADB, or enforced by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a suspended or debarred firm will be rejected and such bid may be in breach of debarment conditions, thereby subject to further ADB's investigation.

4.5 Government-owned enterprises in the Employer's country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not a dependent agency of the Employer.

4.6 A Bidder shall not be under suspension from bidding by the Employer as the result of the execution of a Bid–Securing Declaration.

4.7 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.8 Bidders shall be excluded if, by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods from, or payments to, a particular country, person or entity in respect of goods or services originating in that country. Where the Borrower's country prohibits payments to a particular person or entity or for particular goods or services by such an act of compliance, that firm shall be excluded.

4.9 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2, and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment, and services.

5.2 For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced, or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The Bidding Document consists of Parts I, II, and III, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITB 8.

PART I Bidding Procedures

Section 1: Instructions to Bidders (ITB)

Section 2: Bid Data Sheet (BDS)

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Section 3: Evaluation and Qualification Criteria (EQC)

Section 4: Bidding Forms (BDF)

Section 5: Eligible Countries (ELC)

PART II Requirements

Section 6: Works' Requirements (WRQ)

PART III Conditions of Contract and Contract Forms

Section 7: General Conditions of Contract (GCC)

Section 8: Particular Conditions of Contract (PCC)

Section 9: Contract Forms (COF)

6.2 The IFB issued by the Employer is not part of the Bidding Document.

6.3 The Employer is not responsible for the completeness of the Bidding Document and their addenda, if they were not obtained directly from the source stated by the Employer in the IFB.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Bidder requiring any clarification on the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS or raise his inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than 21 days prior to the deadline for submission of bids. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry, but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 23.2.

7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a contract for the construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be

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to clarify issues and to answer questions on any matter that may be raised at that stage.

7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than 1 week before the meeting.

7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.

7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the Bidding Document by issuing addenda.

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 23.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope.

11.2 The Technical Bid shall comprise the following:

(a) Letter of Technical Bid;

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(b) Bid Security or Bid-Securing Declaration, in accordance with ITB 20;

(c) alternative Bids, if permissible, in accordance with ITB 13;

(d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.2;

(e) documentary evidence in accordance with ITB 15, establishing the Bidder's qualifications to perform the contract if its Bid is accepted;

(f) Technical Proposal in accordance with ITB 14; and

(g) any other document required in the BDS.

11.3 The Price Bid shall comprise the following:

(a) Letter of Price Bid;

(b) completed Price Schedules, in accordance with ITB 12 and ITB 17;

(c) alternative price Bids, at Bidder's option and if permissible, in accordance with ITB 13; and

(d) any other document required in the BDS.

11.4 In addition to the requirements under ITB 11.2, Bids submitted by a Joint Venture shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement.

12. Letters of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, including the Bill of Quantities, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested and as required in the BDS.

13. Alternative Bids

13.1 Unless otherwise indicated in the BDS, alternative Bids shall not be considered. If permitted, the evaluation method will be as specified in Section 3 (Evaluation and Qualification Criteria).

13.2 Unless otherwise indicated in the BDS, alternative times for completion shall not be considered. If permitted, the evaluation method will be as specified in Section 3 (Evaluation and Qualification Criteria).

13.3 Unless otherwise indicated in the BDS, alternative technical solutions shall not be considered. If permitted to submit alternative technical solutions for specified parts of the Works, such parts will be identified in the BDS and described in Section 6 (Employer's Requirements). The method for their evaluation will be stipulated in Section 3 (Evaluation and Qualification Criteria).

13.4 Except as provided under ITB 13.3 above, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price based on the Employer's conceptual design as described in the Bidding Document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer,

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including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the first-ranked Bidder conforming to the basic technical requirements shall be considered by the Employer.

14. Subcontractors

14.1 Unless otherwise stated in the BDS, the Employer does not intend for the contractor to execute any specific elements of the Works through nominated subcontractors.

14.2 If subcontractors are proposed for any of the key activities listed in Section 3 (Evaluation and Qualification Criteria) 1.4.2 (b), they shall be considered as "Specialist Subcontractors" and shall meet qualification requirements for the relevant key activities.

15. Documents Establishing the Qualifications of the Bidder

15.1 To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).

15.2 Domestic Bidders, individually or in Joint Ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 36.

16. Document Comprising the Technical Proposal

16.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, and schedule as well as environmental, health, and safety management plan (EHSMP) commensurate with the proposed scope of works, EHS Code of Conduct; and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.

17. Bid Prices and Discounts

17.1 The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Bill of Quantities shall conform to the requirements specified below.

17.2 The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities. Unit rates and prices for all items of the Works described in the Bill of Quantities shall be expressed in positive values. If unit rates and prices are expressed in negative values, the bid will be rejected.

17.3 The price to be quoted in the Letter of Price Bid, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the Bid.

17.4 The Bidder shall quote any discounts and the methodology for their application in the Letter of Price Bid, in accordance with ITB 12.1.

17.5 The prices shall be either fixed or adjustable as specified in the BDS.

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(a) In the case of Fixed Price, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A Bid submitted with an adjustable price will be treated as nonresponsive and rejected.

(b) In the case of Adjustable Price, prices quoted by the Bidder shall be subject to adjustment during the performance of the contract to reflect changes in the cost elements such as labor, material, transport, and contractor's equipment in accordance with the provisions of the Conditions of Contract. A Bid submitted with a fixed price will be treated as nonresponsive and be rejected. The Bidder shall furnish the indexes and weightings for the price adjustment formulas in the Tables of Adjustment Data included in Section 4 (Bidding Forms) and the Employer may require the Bidder to justify its proposed indexes and weightings. Any bid that omits indexes and weightings shall be subject to clarification with the Bidder.

17.6 If so indicated in ITB 1.1, bids are being invited for individual contracts or for any combination of contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 17.4, provided the Bids for all contracts are submitted and opened at the same time.

17.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.

18. Currencies of Bid and Payment

18.1 The unit rates and the prices shall be quoted by the Bidder entirely in the currency specified in the BDS.

18.2 Bidders shall indicate the portion of the bid price that corresponds to expenditures incurred in the currency of the Employer's country in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).

18.3 Bidders expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country and wishing to be paid accordingly may indicate the other currencies in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).

18.4 The rates of exchange to be used by the Bidder for currency conversion during bid preparation shall be the selling rates for similar transactions prevailing on the date 28 days prior to the deadline for submission of bids published by the source specified in the BDS. If exchange rates are not so published for certain currencies, the Bidder shall state the rates used and the source. Bidders should note that for the purpose of payments, the exchange rates confirmed by the source specified in the BDS as the selling rates prevailing 28 days prior to the deadline for submission of Bids shall apply for the duration of the Contract so that no currency exchange risk is borne by the Bidder.

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18.5 Foreign currency requirements indicated by the Bidders in the Schedule of Payment Currencies shall include, but not be limited to the specific requirements for

(a) expatriate staff and labor employed directly on the Works;

(b) social, insurance, medical, and other charges relating to such expatriate staff and labor, and foreign travel expenses;

(c) imported materials, both temporary and permanent, including fuels, oil, and lubricants required for the Works;

(d) depreciation and usage of imported Plant and Contractor's Equipment, including spare parts, required for the Works;

(e) foreign insurance and freight charges for imported materials, Plant and Contractor's Equipment, including spare parts; and

(f) overhead expenses, fees, profit, and financial charges arising outside the Employer's country in connection with the Works.

18.6 Bidders may be required by the Employer to clarify their foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Payment Currencies are reasonable and responsive to ITB 18.3 above, in which case a detailed breakdown of its foreign currency requirements shall be provided by the Bidder.

18.7 Bidders should note that during the progress of the Works, the foreign currency requirements of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor to reflect any changes in foreign currency requirements for the Contract, in accordance with Sub-Clause 14.15 of the Conditions of Contract. Any such adjustment shall be effected by comparing the percentages quoted in the bid with the amounts already used in the Works and the Contractor's future needs for imported items.

19. Period of Validity of Bids

19.1 Bids shall remain valid for the bid validity period specified in the BDS. The bid validity period starts from the date fixed for the bid submission deadline date prescribed by the Employer in accordance with ITB 23.1. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.

19.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 20, it shall also be extended 28 days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.

20. Bid Security/Bid-Securing Declaration

20.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its Bid, in original form, either a Bid-Securing Declaration or a bid security as specified in the BDS. In the case of a bid security, the amount and currency shall be as specified in the BDS.

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20.2 If a Bid-Securing Declaration is required pursuant to ITB 20.1, it shall use the form included in Section 4 (Bidding Forms). The Employer will declare a Bidder ineligible to be awarded a Contract for a specified period of time, as indicated in the BDS, if the Bid-Securing Declaration is executed.

20.3 If a bid security is specified pursuant to ITB 20.1, the bid security shall be, at the Bidder's option, in any of the following forms:

(a) an unconditional bank guarantee (hard copy of the bank guarantee or in the form of SWIFT message MT760), or

(b) an irrevocable letter of credit, or

(c) a cashier's or certified check

all from a reputable source from an eligible country as described in Section 5 (Eligible Countries). In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included in Section 4 (Bidding Forms) or another form acceptable to the Employer. The form must include the complete name of the Bidder. The bid security shall be valid for 28 days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 19.2.

20.4 Unless otherwise specified in the BDS, any Bid not accompanied by a substantially compliant bid security or Bid-Securing Declaration, if one is required in accordance with ITB 20.1, shall be rejected by the Employer as nonresponsive.

20.5 If a bid security is specified pursuant to ITB 20.1, the bid security of substantially nonresponsive Technical Bids shall be returned before opening the Price Bids. The bid security of unsuccessful Bidders at Price Bid evaluation shall be returned promptly upon the successful Bidder's furnishing of the Performance Security pursuant to ITB 47.

20.6 If a bid security is specified pursuant to ITB 20.1, the bid security of the successful Bidder shall be returned promptly once the successful Bidder has signed the Contract and furnished the required Performance Security.

20.7 The bid security may be forfeited or the Bid Securing Declaration executed, if

(a) notwithstanding ITB 25.3, a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, except as provided in ITB 19.2; or

(b) the successful Bidder fails to

(i) sign the Contract in accordance with ITB 46;

(ii) furnish a Performance Security in accordance with ITB 47;

(iii) accept the arithmetical correction of its Bid in accordance with ITB 35; or

(iv) furnish a domestic preference security, if so required.

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20.8 If the bid security is required as per ITB 20.1, the bid security of a Joint Venture shall be in the name of the Joint Venture that submits the Bid. If the Joint Venture has not been legally constituted at the time of bidding, the bid security shall be in the name of any or all of the Joint Venture partners. If the Bid-Securing Declaration is required as per ITB 20.1, the Bid-Securing Declaration of a Joint Venture shall be in the name of the Joint Venture that submits the Bid. If the Joint Venture has not been legally constituted at the time of bidding, the Bid-Securing Declaration shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.

21. Format and Signing of Bid

21.1 The Bidder shall prepare one original set of the Technical Bid and one original set of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - PRICE BID." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE." In addition, the Bidder shall submit copies of the Technical and Price Bids, in the number specified in the BDS**,** and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

21.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. If a Bidder submits a deficient authorization, the Bid shall not be rejected in the first instance. The Employer shall request the Bidder to submit an acceptable authorization within the number of days as specified in the BDS. Failure to provide an acceptable authorization within the period as stated in the Employer's request shall cause the rejection of the Bid. If either the Letter of Technical Bid or Letter of Price Bid or Bid-Securing Declaration (if applicable) is not signed, the Bid shall be rejected.

21.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

22. Sealing and Marking of Bids

22.1 Bidders shall submit their Bids as specified in the BDS. Procedures for submission, sealing, and marking are as follows:

(a) Bidders submitting Bids by mail or by hand shall enclose the original of the Technical Bid, the original of the Price Bid, and each copy of the Technical Bid and each copy of the Price Bid, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL - TECHNICAL BID," "ORIGINAL - PRICE BID," and "COPY NO… - TECHNICAL BID" and "COPY NO…. - PRICE BID." These envelopes, the first containing the originals and the others containing copies, shall then be enclosed in one single envelope per set. If permitted in accordance with ITB 13, alternative Bids shall be similarly sealed, marked and included in the sets. The rest of the procedure shall be in accordance with ITB 22.2 and ITB 22.5.

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(b) Bidders submitting Bids electronically shall follow the electronic bid submission procedures specified in the BDS.

22.2 The inner and outer envelopes shall

(a) bear the name and address of the Bidder;

(b) be addressed to the Employer in accordance with BDS 22.1; and

(c) bear the specific identification of this bidding process indicated in the BDS 1.1.

22.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB 25.1.

22.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 26.7.

22.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

23. Deadline for Submission of Bids

23.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.

23.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

24. Late Bids

24.1 The Employer shall not consider any Bid that arrives after the deadline for submission of bids, in accordance with ITB 23. Any bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

25. Withdrawal, Substitution, and Modification of Bids

25.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 21.2 (except for withdrawal notices, which do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be

(a) prepared and submitted in accordance with ITB 21 and ITB 22 (except for withdrawal notices, which do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” “MODIFICATION”; and

(b) received by the Employer no later than the deadline prescribed for submission of Bids, in accordance with ITB 23.

25.2 Bids requested to be withdrawn in accordance with ITB 25.1 shall be returned unopened to the Bidders.

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25.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid or any extension thereof.

26. Bid Opening

26.1 The Employer shall open the Technical Bids in public at the address, on the date and time specified in the BDS in the presence of Bidders` designated representatives and anyone who chooses to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 22.1, shall be as specified in the BDS. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and the Price Bid are submitted together in one envelope, the Employer may reject the entire Bid. Alternatively, the Price Bid may be immediately resealed for later evaluation.

26.2 First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening.

26.3 Second, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened, read out, and recorded. Substitution Price Bid will remain unopened in accordance with ITB 26.1. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

26.4 Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original as well as Modification, will remain unopened in accordance with ITB 26.1.

26.5 All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:

(a) the name of the Bidder;

(b) whether there is a modification or substitution;

(c) the presence of a bid security or Bid-Securing Declaration, if required; and

(d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Technical Bid are to be initialed by at least three representatives of the Employer

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attending bid opening. No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with ITB 23.1.

26.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum, the name of the Bidder and whether there is a withdrawal, substitution, or modification; alternative proposals; and the presence or absence of a bid security or Bid-Securing Declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

26.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Price Bids.

26.8 The Employer will notify in writing Bidders who have been rejected for submitting nonresponsive Technical Bids and return their Price Bids unopened together with their bid securities, before opening the Price Bids of the substantially responsive Bidders.

26.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders` representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.

26.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:

(a) the name of the Bidder;

(b) whether there is a modification or substitution;

(c) the Bid Prices, including any discounts and alternative offers; and

(d) any other details as the Employer may consider appropriate.

Only Price Bids discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Price Bid and Bill of Quantities are to be initialed by at least three representatives of the Employer attending bid opening. No Bid shall be rejected at the opening of Price Bids.

The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum, the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be

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distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

E. Evaluation and Comparison of Bids

27. Confidentiality

27.1 Information relating to the examination, evaluation, comparison, and post-qualification of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on the Contract award is communicated to all Bidders.

27.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.

27.3 Notwithstanding ITB 27.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.

28. Clarification of Bids

28.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 35.

28.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.

29. Deviations, Reservations, and Omissions

29.1 During the evaluation of Bids, the following definitions apply:

(a) "Deviation" is a departure from the requirements specified in the Bidding Document;

(b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and

(c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.

30. Examination of Technical Bids

30.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted.

30.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.

(a) Letter of Technical Bid;

(b) written confirmation of authorization to commit the Bidder;

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(c) Bid Security or Bid-Securing Declaration, if applicable; and

(d) Technical Proposal in accordance with ITB 16.

31. Qualification of the Bidder

31.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether a Bidder meets the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).

31.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15.1. Unless permitted in the BDS, the determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, or affiliates.

31.3 An affirmative determination shall be a prerequisite for proceeding the next step of the evaluation process under ITB 32. The Employer reserves the right to reject the bid of any Bidder found to be in circumstances described in Sub-Clause GCC 15.2.1 (g) or Sub-Clause PCC 15.2.1 (h). A negative determination shall result in disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

32. Responsiveness of Technical Bid

32.1 The Employer's determination of a Bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB11.

32.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,

(a) if accepted, would:

(i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or

(ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

32.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section 6 (Works' Requirements) have been met without any material deviation, reservation, or omission.

32.4 If a Bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

33. Nonmaterial Nonconformities

33.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation, or omission.

33.2 Provided that a Technical Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or

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documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

33.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section 3 (Evaluation and Qualification Criteria).

34. Technical Scoring

34.1 Provided that a Technical Bid is substantially responsive in accordance with ITB 32.3, the Employer will proceed with the technical scoring of the Bids. The scores to be given to technical factors and sub-factors are specified in Section 3 (Evaluation and Qualification Criteria).

35. Correction of Arithmetical Errors

35.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:

(a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer, there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.

(b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.

(c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Price Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected.

(d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a), (b), and (c) above.

35.2 If the Bidder that submitted the first-ranked Bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited or its Bid-Securing Declaration executed.

36. Conversion to Single Currency

36.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified in the BDS.

37. Domestic Preference

37.1 Unless otherwise specified in the BDS, domestic preference shall not apply.

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38. Financial Evaluation

38.1 Provided that a Bid is substantially responsive with the technical evaluation in accordance with Section 3 (Evaluation and Qualification Criteria), the Employer will proceed with the detailed evaluation of financial aspects. The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.

38.2 To evaluate the Price Bid, the Employer shall consider the following:

(a) the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Grand Summary, but including Daywork items, where priced competitively;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 35.1;

(c) price adjustment due to discounts offered in accordance with ITB 17.4;

(d) price adjustment for nonmaterial nonconformities in accordance with ITB 33.3;

(e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 36;

(f) assessment whether the bid is abnormally low in accordance with ITB 40; and

(g) application of all the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria).

38.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in the bid evaluation.

38.4 If this Bidding Document allows Bidders to quote separate prices for different contracts, and the award to a single Bidder of multiple contracts, the methodology to determine the first-ranked contract combinations, including any discounts offered in the Letter of Price Bid and Schedule, is specified in Section 3 (Evaluation and Qualification Criteria).

38.5 After the detailed financial evaluation, the Employer will determine the financial score of the Bids using the formula and methodology specified in Section 3 (Evaluation and Qualification Criteria).

39. Combined Technical and Financial Scores

39.1 The Employer will proceed with the evaluation for each substantially responsive bid by combining the technical and financial scores using the weights specified in the BDS and as per the formula specified in Section 3 (Evaluation and Qualification Criteria). The Bid with the highest combined technical and financial score will be determined as the first-ranked Bid.

40. Abnormally Low bids

40.1 An abnormally low bid is one where the bid price, in combination with other elements of the bid, appears to be so low that it raises concerns as to the capability of the Bidder to perform the contract for the offered bid price.

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40.2 When the offered bid price of the first-ranked Bid appears to be abnormally low, the Employer shall undertake a three-step review process as follows:

(a) identify abnormally low costs and unit rates by comparing them with the engineer's estimates, other substantially responsive bids, or recently awarded similar contracts;

(b) clarify and analyze the bidder's resource inputs and pricing, including overheads, contingencies, and profit margins; and

(c) decide whether to accept or reject the bid.

40.3 With regard to ITB 40.2 (b) above, the Employer will seek a written explanation from the bidder of the reasons for the offered bid price, including a detailed analysis of costs and unit prices, by reference to the scope, proposed methodology, schedule, and allocation of risks and responsibilities. This may also include information regarding the economy of the manufacturing process; the services to be provided, or the construction method to be used; the technical solutions to be adopted; and any exceptionally favorable conditions available to the bidder for the works, equipment, or services proposed.

40.4 After examining the explanation given and the detailed price analyses presented by the bidder, the Employer may:

(a) accept the bid, if the evidence provided satisfactorily accounts for the low bid price and costs, in which case the bid is not considered abnormally low;

(b) accept the bid, but require that the amount of the Performance Security be increased at the expense of the bidder to a level sufficient to protect the Employer against financial loss. The amount of the Performance Security shall generally be not more than 20% of the contract price; or

(c) reject the bid if the evidence provided does not satisfactorily account for the low bid price, and make a similar determination for the next ranked bid, if required.

41. Unbalanced or Front-Loaded Bids

41.1 If the Bid, which results in the first-ranked Bid, is seriously unbalanced or front-loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed, as well as the pricing and sources of materials, equipment, and labor.

41.2 After the evaluation of the information and detailed price analyses presented by the Bidder, the Employer may, as appropriate:

(a) accept the Bid; or

(b) accept the Bid, but require that the total amount of the Performance Security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract subject to ITB 47.2; or

(c) reject the Bid and make a similar determination for the next ranked bid.

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42. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

42.1 The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

43. Notice of Intention for Award of Contract

43.1 If standstill provisions apply as specified in the BDS, the standstill period shall be defined in the BDS to specify the duration subsequent to notification of intention for award of contract (before making the actual contract award) within which any unsuccessful bidder can challenge the proposed award.

F. Award of Contract

44. Award Criteria

44.1 The Employer shall award the Contract to the Bidder whose offer has been determined in line with ITB 38 to ITB 41 above to be the first-ranked Bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

45. Notification of Award

45.1 Prior to the expiration of the period of bid validity and upon expiry of the standstill period specified in ITB 43.1, or upon satisfactory resolution of a complaint filed within the standstill period, if applicable, the Employer shall transmit the Notification of Award through the issuance of a Letter of Acceptance using the form included in Section 9 (Contract Forms) to the successful Bidder, in writing, that its Bid has been accepted.

45.2 Unless the standstill period applies, upon notification of award through the issuance of a Letter of Acceptance, unsuccessful Bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their Bids were not selected. The Employer shall promptly respond in writing and/or in a debriefing meeting to any unsuccessful Bidder who, after publication of contract award, requests a debriefing.

45.3 Until a formal contract is prepared and executed, the notification of award through the issuance of a Letter of Acceptance shall constitute a binding Contract.

45.4 Within 2 weeks of the award of contract or expiry of the standstill period, where such period applies, or, if a complaint has been filed within the standstill period, upon receipt of ADB's confirmation of satisfactory resolution of the complaint, the Borrower shall publish in an English language newspaper or widely known and freely accessible website the results identifying the bid and lot or package numbers, as applicable, and the following information:

(a) name of each Bidder who submitted a Bid;

(b) bid prices as read out at bid opening;

(c) name and evaluated prices of each Bid that was evaluated;

(d) names of Bidders whose bids were rejected and the reasons for their rejection; and

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(e) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded.

46. Signing of Contract

46.1 The Employer shall send the successful Bidder the Contract Agreement together with or promptly after the issuance of Letter of Acceptance.

46.2 Within 35 days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

47. Performance Security

47.1 Within 28 days of the receipt of notification of award through issuance of Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the conditions of contract, subject to ITB 40 and ITB 41, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer. If the bank issuing Performance Security is located outside the Employer's country, it shall be counter-guaranteed or encashable by a bank in the Employer's country.

47.2 Failure of the successful Bidder to submit the abovementioned performance security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security or execution of the Bid-Securing Declaration. In that event, the Employer may award the Contract to the next ranked Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

47.3 The above provision shall also apply to the furnishing of a domestic preference security if so required.

48. Bidding-Related Complaints

48.1 The procedures for dealing with Bidding-Related Complaints arising out of this bidding process are specified in the BDS.

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BIDDING DATA SHEET (BDS)

A. General	
ITB 1.1	Clause 1 ITB 1.1. The number of the Invitation for Bids (IFB) is: BPC/C&PD/CMS/TENDER-2026/10 Clause 2 ITB 1.1 The Employer is: Bhutan Power Corporation Limited. Clause 3 ITB 1.1 The name of the open competitive bidding (OCB) is: Supply, Construction, Testing & Commissioning of a 132kV transmission line from Wobthang Solar Project at Bumthang to Garpang. The identification number of the OCB is: BPC/C&PD/CMS/TENDER-2026/10 The number and identification of lots comprising this OCB is: None
ITB 2.1	Borrower's name: **Royal Government of Bhutan.** The name of the Project is Solar Farm Expansion Project.
B. Contents of Bidding Document	
ITB 7.1	The Employer's address for clarification is: **Mr. Sangay Lungten** **Chief Manager** **Contracts Management Section** **Construction Division** **Construction & Procurement Department** **Bhutan Power Corporation Limited** **175 Yarden Lam SE, Thimphu, Bhutan** **Telephone: +975-2-322046;** **Email: sangay.lungten@bpc.bt / cmsection@bpc.bt**
ITB 7.4	A Pre-bid meeting will take place at the following date, time and place: **Date : May 04, 2026** **Time : 10:00 AM (Bhutan Standard Time)** **Place : BPC, Head Office, 175 Yarden Lam SE, Thimphu**

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	The pre-bid meeting will be held face to face; a Video Conference (VC) will be arranged for bidders unable to attend physically, subject to a request made at least one week in advance. A site visit conducted by the Employer will be organized. Date: April 30 to May 01, 2026 (two days). Time: 09:00 AM (Bhutan Standard Time) Place: Bumthang Bidders shall take care of their own transport, at their own cost.
ITB 7.5	The Employer will respond to any request for clarification, which it receives on or before **May 08, 2026.**
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: **English**
ITB 11.2 (h)	The Bidder shall submit the following additional documents in its Technical Bid: 1. Latest Tax Clearance Certificates (if applicable) 2. Certificate of Incorporation 3. Valid Business/Trade License and CDB registration certificate (for Bhutanese Bidders); and 4. Signed Integrity Pact form
ITB 13.1	Alternative Bids shall **not** be permitted.
ITB 13.2	Alternative times for completion shall **not** be permitted.
ITB 13.3	Alternative technical solutions shall **not** be permitted.
ITB 14.1	The Employer does not intend for the contractor to execute any specific elements of the Works through nominated Subcontractors.
ITB 17.5	The prices quoted by the Bidder shall be fixed.
ITB 18.1	The unit rates and the prices shall be quoted by the bidder separately in: Any freely convertible international currency for those inputs to the Works which the bidder expects to supply from outside the Purchaser's country (referred to as "the foreign currency requirements") and Currency of Purchaser's country for those inputs to the Works which the bidder expects to supply from within the Purchaser's country.
ITB 19.1	The Bids shall remain valid till **90 days.**
ITB 20.1	The bidder shall furnish, as part of its bid, a bid security in the amount of **Nu. 8,540,000.00 million (Eight million five hundred forty thousand only).** Bid security shall remain valid till **120 days.**

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ITB 20.2	The ineligibility period will be **not applicable**.
ITB 20.3	If the bank issuing bid security is located outside the Employer's country, it shall have a corresponding financial institution in the Employer's country. The bid security shall be drawn in favour of "General Manager, Finance & Accounts Division, Bhutan Power Corporation Limited, Thimphu.
ITB 20.4	Subject to the succeeding sentences, any bid not accompanied by an irrevocable and callable bid security shall be rejected by the Employer as nonresponsive. If a Bidder submits a bid security that (i) deviates in form, amount, and/or period of validity, or (ii) does not provide sufficient identification of the Bidder (including, without limitation, failure to indicate the name of the Joint Venture or, where the Joint Venture has not yet been constituted, the names of all future Joint Venture Partners), the Employer shall request Them Bidder to submit a compliant bid security within 14 days of receiving such a request. Failure to provide a compliant bid security within the prescribed period of receiving such a request shall cause the rejection of the Bid.
ITB 21.1	Bidders shall submit their Bids by mail or by hand.
ITB 21.2	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: An organizational document, board resolution or its equivalent, or power of attorney specifying the representative's authority to sign the Bid on behalf of, and to legally bind, the Bidder. If the Bidder is an intended or an existing Joint Venture, the power of attorney should be signed by all partners and specify the authority of the named representative of the Joint Venture to sign on behalf of, and legally bind, the intended or existing Joint Venture. If the Joint Venture has not yet been formed, also include evidence from all proposed Joint Venture partners of their intent to enter into a Joint Venture in the event of a contract award in accordance with ITB 11.2.
21.2	The Bidder shall submit an acceptable authorization with bids.
D. Submission and Opening of Bids	
ITB 23.1	For bid submission purposes only, the Employer's address is: Attention: **Mr. Sangay Lungten** **Chief Manager** **Contracts Management Section** **Construction Division** **Construction & Procurement Department** **Bhutan Power Corporation Limited**

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	175 Yandren Lam SE, Thimphu, Bhutan ZIP code: sangay.lungten@bpc.bt Country: Bhutan The deadline for bid submission is: Date: **May 28, 2026.** Time: **1430 hours** (Bhutan Standard Time)
E. Evaluation and Comparison of Bids	
ITB 31.2	The qualifications of other firms such as the Bidder's subsidiaries, parent entities, or affiliates shall not be permitted.
ITB 36.1	The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid Prices expressed in various currencies into a single currency: Bhutanese Ngultrum (BTN) The source of exchange rate shall be: Bank of Bhutan Ltd. (BoB) The date for the exchange rate shall be: The rates of exchange to be used by the bidder for currency conversion during bid preparation shall be the selling rates for similar transactions prevailing on the date twenty-eight (28) days prior to the date of bid opening, as published by Royal Monetary Authority of Bhutan. If exchange rates are not so published for certain currencies, the bidder shall state the rates used and the source.
ITB 37.1	Domestic preference **shall not** apply.
ITB 39.1	The technical and financial weights to be used for the combined technical and financial scores will be as follows: T weight = Technical weight being equal to **70.** F weight = Financial weight being equal to **30.** The sum of technical and financial weights should be equal to **100.**
ITB 43.1	Standstill provisions shall apply. The duration of the standstill period will be 10 calendar days from the date of notice of intention for award of contract. The Employer shall, at the start of the standstill period, notify in writing each Bidder that submitted a bid, of its intention to award a contract to the successful Bidder at the end of standstill period. The notification using the form included in Section 9 (Contract Forms) shall include the following information: (a) the name of each Bidder who submitted a Bid; (b) the bid prices as read out at bid opening; (c) the name and evaluated prices of each Bid that was evaluated; (d) the names of Bidders whose bids were rejected and the reasons for their rejection;

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	(e) the name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded; and (f) a statement of the reason(s) the bid of the unsuccessful Bidder to whom the notification is addressed was unsuccessful, unless the price information under (e) of this paragraph already reveals the reason.
ITB 48.1	The procedures for Bidding-Related Complaints are referenced in the Procurement Directive for ADB Borrowers. The Bidder should submit its complaint following these procedures, in writing, to: For the attention: Sangay Lungten Title/position: Chief Manager Employer: Bhutan Power Corporation Limited Email address: sangay.lungten@bpc.bt

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Section 3: Evaluation and Qualification Criteria

This Section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders. In accordance with ITB 30 to ITB 39, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section 4 (Bidding Forms).

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1. Qualification

1.1 Eligibility

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

1.1.1 Nationality

Nationality in accordance with ITB 4.2.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Forms ELI - 1; ELI - 2 with attachments

1.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB 4.3.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Letter of Bid

1.1.3 ADB Eligibility

Not having been declared ineligible by ADB, as described in ITB 4.4.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Letter of Bid

1.1.4 Government-Owned Entity

Bidder required to meet conditions of ITB 4.5.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Forms ELI - 1; ELI - 2 with attachments

1.1.5 United Nations Eligibility

Not having been excluded by an act of compliance with a United Nations Security Council resolution in accordance with ITB 4.8.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Letter of Bid

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1.2 Historical Contract Nonperformance

1.2.1 History of Nonperforming Contracts

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Non-performance of a contract[a] did not occur as a result of contractor default since 1 January 2020.	Must meet requirement	Must meet requirement	Must meet requirement [b]	Not applicable	Form CON-1

[a] Nonperformance, as decided by the Employer, shall include all contracts where, any of the two conditions[1] below have been met:

1) a) the contract was terminated for cause by the employer due to the contractor's default(s) in fulfilling its obligations (including any environmental and social (E&S) obligations),

and

b) the contractor did not challenge such termination and/or call of the performance security or employer's claims, including referral to the dispute resolution mechanism under the respective contract
or
c) contracts that were so challenged, but fully settled against the contractor.

OR

2) (a) the performance security was called partly or wholly,
or
(b) claims were made against the contractor by the employer due to the contractor's default(s), which have led to works not being completed, i.e. taking-over certificate not having been issued;

and

(c) the contractor did not challenge the call of the performance security or employer's claims, including referral to the dispute resolution mechanism under the respective contract
or
(d) contracts that were so challenged, but fully settled against the contractor as a result of the dispute resolution mechanisms.

In cases where challenged by the contractor, Nonperformance must be based on all information on fully settled disputes or litigation, i.e., dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

[b] This requirement also applies to contracts executed by the Bidder as a Joint Venture partner.

[1] For example, non-performance should meet condition 1 or condition 2. Condition 1 within itself should meet 1a "and" 1b or 1c; condition 2 within itself should meet 2a or 2b "and 2c or 2d.

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1.2.2 Suspension Based on Execution of Bid-Securing Declaration

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Not under suspension based on execution of a Bid-Securing Declaration pursuant to ITB 4.6.	Must meet requirement	Must meet requirement	Must meet requirement	Not applicable	Letter of Bid

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1.2.3 Pending Litigation and Arbitration

Pending litigation and arbitration criterion shall apply.

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
All pending litigation, arbitration, or other material events impacting the net worth and/or liquidity of the bidder, if any, shall be treated as resolved against the Bidder and so shall in total not represent more than 50% percent of the Bidder's net worth calculated as the difference between total assets and total liabilities.	Must meet requirement	Not applicable	Must meet requirement	Not applicable	Form CON - 1

1.2.4 Declaration: Environmental, Health, and Safety Past Performance

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Declare any contracts that have been suspended or terminated and/or performance security called by an employer for reasons related to the noncompliance of any environmental, health, and safety contractual obligations in the past 5 years.	Must make the declaration.	Not applicable	Each partner must make the declaration.	Not applicable	Form CON-2

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1.3 Financial Situation

1.3.1 Historical Financial Performance

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Submission of audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, for the last three (3) years to demonstrate the current soundness of the Bidder's financial position. As a minimum, the Bidder's net worth for the last year calculated as the difference between total assets and total liabilities should be positive.	Must meet requirement	Not applicable	Must meet requirement	Not applicable	Form FIN - 1 with attachments

1.3.2 Average Annual Construction Turnover

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Minimum average annual construction turnover of Nu. 640.00 million Calculated as total certified payments received for contracts in progress or completed, within the last three (3) years.	Must meet requirement	Must meet requirement	Must meet 25 % of the requirement	Must meet 40 % of the requirement	Form FIN - 2

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1.3.3 Financial Resources

If the bid evaluation process and the decision for the award of the Contract takes more than 1 year from the date of bid submission, Bidders may be asked to resubmit their current contract commitments and latest information on financial resources supported by the latest audited accounts or audited financial statements, or if not required by the law of the Bidder's country, other financial statements acceptable to the Employer. The Bidders' financial capacity will be reassessed on this basis.

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
For Single Entities The Bidder must demonstrate that its financial resources defined in FIN – 3, less its financial obligations for its major contract commitments as defined in FIN – 4, meet or exceed the total requirement for the Subject Contract of Nu. 80.00 million.	Must meet requirement (100%)	Not applicable	Not applicable	Not applicable	Form FIN – 3 and Form FIN – 4
For Joint Ventures 1. One partner must demonstrate that its financial resources defined in FIN – 3, less its financial obligations for its own major contract commitments as defined in FIN – 4, meet or exceed its required share from the total requirement for the Subject Contract. AND	Not applicable	Not applicable	Not applicable	Must meet requirement (60%)	Form FIN – 3 and Form FIN – 4
2. Each partner must demonstrate that its financial resources defined in FIN – 3, less its financial obligations for its own major contract commitments as defined in FIN – 4, meet or exceed its required share from the total requirement for the Subject Contract. AND	Not applicable	Not applicable	Must meet requirement (30%)	Not applicable	Form FIN – 3 and Form FIN – 4
3. The Joint Venture must demonstrate that the combined financial resources of all partners defined in FIN – 3, less all the partners' total financial obligations for the major contract commitments as defined in FIN – 4, meet or exceed the total requirement for the Subject Contract of Nu. 80.00 million.	Not applicable	Must meet requirement (100%)	Not applicable	Not applicable	Form FIN – 3 and Form FIN – 4

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1.4 Construction Experience

1.4.1 Contracts of Similar Size and Nature

Criteria	Compliance Requirements				Documents
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Continuous experience under construction contracts in the role of prime contractor (single firm or JV member) five (5) years from the Bid submission deadline. It should have been in satisfactory operation for a minimum period of one (1) year as on the date of bid opening and that is similar to the proposed works, where the value of the Bidder's participation exceeds Nu. 340 million. The similarity of the Bidder's participation shall be based on: [a, b] 1. Supply, Construction, Testing & Commissioning of transmission line of 132kV or higher voltage.	Must meet requirement	Not applicable	Not applicable	Must meet requirement	Form EXP – 1[c]

[a] For contracts under which the Bidder participated as a Joint Venture partner or Subcontractor, only the Bidder's share, by value, shall be considered to meet this requirement.
[b] For contracts implemented by a Joint Venture contractor, if the Bidder comprises the same Joint Venture, the "Single Entity" requirements will apply.
[c] In addition to the submission requirement Form EXP – 1, the Bidder shall provide the following supporting documents:

[*If the Employer will consider a "substantially completed contract" as one in which the works have been completed, insert the following text:*
1. Signed Contract Agreement, and
2. Taking-Over Certificate, Contract Completion Certificate, or Performance Certificate, in sufficient detail to verify the contract name, value, and completion time (or substantial completion). If the documents are other than in English, an accurate certified translation of these documents in English shall be provided].

[If the Employer will consider a "substantially completed contract" as one in which the Contractor has completed all its obligations under the contract, insert the following text:
1. Signed Contract Agreement, and
2. Contract Completion Certificate or Performance Certificate, in sufficient detail to verify the contract name, value, and completion time. If the documents are other than in English, an accurate certified translation of these documents in English shall be provided.]

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1.4.2 Construction Experience in Key Activities

1.4.2 (a) Must be complied with by the Bidder. In case of a Joint Venture Bidder, the Bidder or at least one of the partners must meet the requirement in the key activity. For contracts under which the Bidder participated as a Joint Venture partner, only the Bidder's designated scope of works under the contracts shall be considered to meet this requirement.

Table A

Criteria	Compliance Requirements		Documents
Requirement	**Single Entity**	**Joint Venture**	**Submission Requirements**
For the above or other contracts executed during the period stipulated in 1.4.1, a minimum construction experience is required in the following key activities:	Must meet requirement	Must meet requirement	Form EXP – 2[a]
1. Supply and Installation of the 18 km 132kV or higher transmission line			
2. Erection of at least 530 MT towers in hilly areas or similar terrain, with documentary evidence such as completion certificates.			
3. Construction of tower foundations under all types of soil.			
4. Strung ACCC conductors and earth wire/OPGW for a minimum length of 20km.			
5. Testing, commissioning, and successful energization of transmission lines.			

[a] Submission requirements: Form EXP – 2 shall be supported by documents such as Signed Contract Agreement, Taking-Over Certificate or Contract Completion Certificate indicating the contract name, value, completion date (or percentage of substantial completion), activities performed by Joint Venture partners, and other relevant details sufficient to demonstrate compliance with the requirements.

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1.4.3 Specific Experience in Managing Environmental, Health, and Safety Aspects

Criteria	Compliance Requirements		Documents
Requirement	**Single Entity or Its Specialist Subcontractors**	**Joint Venture or Its Specialist Subcontractors**	**Submission Requirements**
For the contracts in 1.4.1 and 1.4.2 above and/or any other contracts [substantially completed and under implementation] as prime contractor, Joint Venture partner within past five years' experience in managing Environmental, Health, and Safety (EHS) risks and impacts in the following aspects: i. Preparation of site-specific Environmental Management Plan (EMP). ii. Experience in conducting risk assessment and developing and implementing health and safety management plans to protect workers, communities, and other stakeholders from potential hazards associated with the project.	Must meet requirements	All members must meet requirements	Form EXP – 3

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1.5 Organizational Environmental, Health, and Safety System[2]

1.5.1 Environmental, Health, and Safety Certification

Criteria	Compliance Requirements		Documents
Requirement	**Single Entity**	**Joint Venture**	**Submission Requirements**
Availability of a valid International Organization for Standardization ISO certification or internationally recognized equivalent (equivalency to be demonstrated by the Bidder), and applicable to the worksite: 1. Quality Management System Certificate ISO 9001:2015 2. Environmental Management System Certificate ISO 14001:2015 3. Occupational Health and Safety Management System Certificate ISO 45001:2018	Must meet requirements	One member must meet requirements	Form EXP – 4

1.5.2 Environmental, Health, and Safety Documentation

Criteria	Compliance Requirements		Documents
Requirement	**Single Entity or Its Specialist Subcontractors**	**Joint Venture or Its Specialist Subcontractors**	**Submission Requirements**
Availability of in-house policies and procedures for Environmental, Health, and Safety (EHS) management: i. Existence of a system for monitoring compliance with EHS commitments for the Bidder's and all its partners. ii. Existence of official company procedures for the management of the following: o Health & Safety resources and facilities and EHS monitoring system, o Health and Safety on worksites policy and related guidance,	Must meet requirements	One member must meet requirements	Form EXP – 5

[2] Use of this criteria is optional and shall be based on the assessment of EHS risks and complexity of works. Based on the EHS assessment, specify, as appropriate, specific requirements to manage EHS aspects.

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○ Local recruitment and EHS trainings of local staff/local partners, ○ Waste management practice, ○ Site rehabilitation and re-vegetation practices, ○ Control of infectious and communicable diseases (HIV/AIDS, malaria, COVID-19, etc.) ○ Traffic management practice; ○ Protection of water resources; ○ Biodiversity protection practices; ○ Local cultural heritage protection practice; ○ Erosion and sedimentation practices. ○ Community stakeholder engagement practice.			

1.5.3 Environmental, Health, and Safety Dedicated Personnel

Criteria	Compliance Requirements		Documents
Requirement	**Single Entity or Its Specialist Subcontractors**	**Joint Venture or Its Specialist Subcontractors**	**Submission Requirements**
Availability of in-house personnel dedicated to Environmental, Health, and Safety (EHS) issues: i. Environmental, Health and Safety Specialist	Must meet requirements	One member must meet requirements	Form EXP – 6

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2. Evaluation

The evaluation methodology shall be based on a merit point criterion where scores are applied to the evaluation of the Technical Proposals and, thereafter, a combination of technical weighted score and financial weighted score is calculated using the weights specified in ITB 39.1.

The first-ranked bid is the one that:

(i) is substantially responsive to the bidding document, and
(ii) has the highest score of the combined technical and financial evaluation.

2.1 Technical Evaluation

2.1.1 Determination of Substantial Responsiveness

Prior to scoring the technical factors and/or sub-factors of the technical proposal, a determination of responsiveness shall be carried out in accordance with ITB 29 and ITB 32. This determination may include the verification of the following criteria:

Criteria	Compliance	Documents
Requirement	**Single Entity or Joint Venture**	**Submission Requirements**
Compliance to the requirement for a defined completion time (when no alternative completion time is allowed).	Must meet requirement without material deviation, reservation, or omission	Technical Proposal
Responsiveness of the bidder's Environmental, Health, and Safety Management Plan (EHSMP) to the requirements of the project Environmental Management Plan (EMP).	Must meet requirement without material deviation, reservation, or omission	Technical Proposal
Compliance to other sustainable procurement, if applicable.	Must meet requirement without material deviation, reservation, or omission	Technical Proposal
Other compliance requirements indicated in the bidding document.	Must meet requirement without material deviation, reservation, or omission	Technical Proposal

If the technical proposal is declared not substantially responsive to the requirements of the Bidding Document, the Bid shall be rejected, and it shall not be evaluated further. However, noncompliance with equipment requirements described in Section 6 (Works' Requirements) shall not normally be a ground for bid rejection, and such noncompliance will be subject to clarification during bid evaluation and rectification prior to contract award.

2.1.2 Completion Time

An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows: Not applicable

2.1.3 Technical Alternatives

Technical alternatives, if permitted under ITB 13.3, will be evaluated as follows: Not applicable

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2.1.4 Technical Scoring

The evaluation approach shall be based on a scoring methodology as per the principles spelled out below:

Technical Factors	Weightings (1)	Scores (2)	Weighted Score (1) x (2)
1. Work plan and Construction methodology	20%	(max = 100)	T1
2. Key Personal	30%	(max = 100)	T2
3. Equipment	20%	(max = 100)	T3
4. Quality Assurance and Safety Management	15%	(max = 100)	T4
5. Environmental and Social Safeguards	15%	(max = 100)	T5
TOTAL	100		T = T1 + T2 + T3 + T4 + T5

Evaluation of the Technical Factors

The number of points to be assigned for each sub-factor mentioned above shall be broken down as follows:

Technical Factors	Weightings (1)	Scores (2)	Weighted Score (1) x (2)
1. Work Plan and Construction Methodology The bidder shall submit a comprehensive Work Plan and Construction Methodology that demonstrates a clear understanding of the project scope and execution strategy.	**20%**	**(max = 20)**	**T1**
	Sub-Factor Weightings (1)	**Score (2)**	**Weighted Score (1) x (2)**
A. Work Breakdown Structure (WBS) • A detailed WBS identifying discrete and distinct milestones. • Each milestone shall indicate key deliverables, start and finish dates, and interdependencies. • The WBS shall clearly differentiate between phases such as mobilization, civil works, electrical works, testing and commissioning, and handover.	25%	(max = 20)	
B. Construction Methodology • Description of construction methods, techniques, and resources proposed for executing the project efficiently. • Justification for the selected methods, taking into account safety, quality, and environmental aspects. • Any special construction procedures or innovations to be applied.	25%	(max = 20)	

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C. Schedule and Sequencing • A logical sequence of activities aligned with the WBS. • Critical path and anticipated project duration. • Identification of potential risks and mitigation measures affecting the schedule.	25%	(max = 20)	
D. Resource Planning • Details of labour, equipment, and materials planned for each milestone. • Deployment strategy to meet project deadlines effectively.	25%	(max = 20)	
Subtotal Score T1	**100%**	**20**	
2. Key Personnel The bidder shall propose qualified Key Personnel demonstrating relevant academic qualifications and professional experience in similar transmission line works.	**30%** **Sub-Factor Weightings (1)**	**(max = 30)** **Score (2)**	**T2** **Weighted Score (1) x (2)**
A. Project Manager	(7/30)	(max =7)	
i. Bachelor's degree or higher with over 10 years of general experience, including at least 5 years in similar transmission line works.	100%	(max =7)	
ii. Bachelor's degree with over 7.5 years of general experience, including at least 3.75 years in similar transmission line works.	75%	(max =7)	
iii. Bachelor's degree with over 5 years of general experience, including at least 2.5 years in similar transmission line works.	50%	(max =7)	
iv. Bachelor's degree or lower with less than 5 years of general experience, including less than 2.5 years in similar transmission line works.	0	(max =7)	
B. Project Engineer	(5/30)	(max = 5)	
i. Bachelor's degree or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 5)	
ii. Bachelor's degree with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 5)	
iii. Bachelor's degree with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 5)	
iv. Bachelor's degree or lower with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 5)	
C. Site Supervisor (Civil)	(4/30)	(max = 4)	
i. Diploma in civil engineering or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 4)	
ii. Diploma in civil engineering with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 4)	

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iii. Diploma in civil engineering with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 4)	
iv. Diploma in civil engineering with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 4)	
D. Site Supervisor (Electrical)	(4/30)	(max = 4)	
i. Diploma in electrical engineering or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 4)	
ii. Diploma in electrical engineering with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 4)	
iii. Diploma in electrical engineering with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 4)	
iv. Diploma in electrical engineering with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 4)	
E. Survey Engineer	(3/30)	(max = 3)	
i. Diploma in survey engineering or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 3)	
ii. Diploma in survey engineering with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 3)	
iii. Diploma in survey engineering with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 3)	
iv. Diploma in survey engineering with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 3)	
F. Environmental Health and Safety Expert	(3/30)	(max = 3)	
i. Bachelor's degree or higher in environmental science / environmental management / environmental engineering / safety or equivalent, with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 3)	
ii. Bachelor's degree with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 3)	
iii. Bachelor's degree with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 3)	
iv. Bachelor's degree or lower with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 3)	

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G. Biodiversity Specialist	(2/30)	(max = 2)	
i. Bachelor's degree or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 2)	
ii. Bachelor's degree with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 2)	
iii. Bachelor's degree with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 2)	
iv. Bachelor's degree or lower with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 2)	
H. EHS On-Site Supervisor	(2/30)	(max = 2)	
i. NEBOSH / IOSH (or similar qualifications) or higher with over 5 years of general experience, including at least 2 years in similar transmission line works.	100%	(max = 2)	
ii. NEBOSH / IOSH (or similar qualifications) with over 3 years of general experience, including at least 2 years in similar transmission line works.	75%	(max = 2)	
iii. NEBOSH / IOSH (or similar qualifications) with over 2 years of general experience, including at least 1 year in similar transmission line works.	50%	(max = 2)	
iv. NEBOSH / IOSH (or similar qualifications) with less than 2 years of general experience, including less than 1 year in similar transmission line works.	0	(max = 2)	
Subtotal Score T2	**100%**	**30**	
Note: Additional supporting documents required for the above key personals. 1. *Original signed CVs of the committed key personnel, along with experience certificates from the concerned authorities.* 2. *Copies of Account Documents of all personnel if they have been recruited on permanent pay rolls by the Contractor.* 3. *Copies of University graduation certificate.*			
3. Construction Equipment Availability of suitable equipment for the foundation, erection, and stringing works.	**20%** **Sub-Factor Weightings (1)**	**(max = 20)** **Score (2)**	**T3** **Weighted Score (1) x (2)**
A. Concrete Mixer – 3 Nos.	(4/20)	(max = 4)	
i. 3 numbers	100%	(max = 4)	
ii. 2 numbers	75%	(max = 4)	
iii. 1 number	50%	(max = 4)	
iv. Zero	0	(max = 4)	
B. Concrete Vibrator (M/C5) – 3 Nos.	(2/20)	(max = 2)	
i. 3 numbers	100%	(max = 2)	
ii. 2 numbers	75%	(max = 2)	
iii. 1 number	50%	(max = 2)	

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iv. Zero	0	(max = 2)	
C. Total Station – 3 Nos.	(4/20)	(max = 4)	
i. 3 numbers	100%	(max = 4)	
ii. 2 numbers	75%	(max = 4)	
iii. 1 number	50%	(max = 4)	
iv. Zero	0	(max = 4)	
D. Winch Machine – 3 Nos.	(4/20)	(max = 4)	
i. 3 numbers	100%	(max = 4)	
ii. 2 numbers	75%	(max = 4)	
iii. 1 number	50%	(max = 4)	
iv. Zero	0	(max = 4)	
E. Die-Set suitable for ACCC and Dead End Compression Machine (Hydraulic) – 3 Nos.	(2/20)	(max = 2)	
i. 3 numbers	100%	(max = 2)	
ii. 2 numbers	75%	(max = 2)	
iii. 1 number	50%	(max = 2)	
iv. Zero	0	(max = 2)	
F. Dynamometer – 3 Nos.	(2/20)	(max = 2)	
i. 3 numbers	100%	(max = 2)	
ii. 2 numbers	75%	(max = 2)	
iii. 1 number	50%	(max = 2)	
iv. Zero	0	(max = 2)	
G. Turn Table – 3 Nos.	(2/20)	(max = 2)	
i. 3 numbers	100%	(max = 2)	
ii. 2 numbers	75%	(max = 2)	
iii. 1 number	50%	(max = 2)	
iv. Zero	0	(max = 2)	
Subtotal Score T3	**100%**	**20**	
Note: Supporting documents required for the above equipment. *1. Purchase Bill invoice Documents.* *Equipment not supported by a purchase bill invoice shall not be awarded any points.*			
4. Quality Assurance and Safety Management The bidder shall submit project-specific Quality Assurance / Quality Control and Health, Safety and Environment plans consistent with the technical specifications.	**15%**	**(max = 15)**	**T4**
	Sub-Factor Weightings (1)	**Score (2)**	**Weighted Score (1) x (2)**
A. QA/QC Plan – Project-specific Quality Assurance and Quality Control Plan consistent with the technical specifications.	50%	(max = 15)	
B. Health, Safety and Environment (HSE) – Site-specific HSE Plan, including safety measures for working as per the technical specifications.	50%	(max = 15)	
Subtotal Score T4	**100%**	**15**	

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5. Environmental and Social Safeguards The bidder shall demonstrate understanding of ADB environment and social safeguards requirements, including measures to minimize environmental impact.	**15%**	**(max = 15)**	**T5**
	Sub-Factor Weightings (1)	**Score (2)**	**Weighted Score (1) x (2)**
A. Mitigation Measures – Understanding of ADB environment and social safeguards requirements, including measures to minimize environmental impact.	100% (15/15)	(max = 15)	
i. Bidders with experience in ADB-funded projects.	100%	(max = 15)	
ii. Bidders with experience in other projects.	75%	(max = 15)	
Subtotal Score T5	**100%**	**15**	
Total Technical Score	**100%**	**100**	**T1 + T2 + T3 + T4 + T5**

For qualitative criteria (T1 & T4), the following fixed rating scale shall apply:

Rating	**Description**
10	Outstanding — fully responsive, detailed, project-specific, and demonstrates excellent understanding with strong supporting evidence
8	Good — responsive and relevant, with only minor omissions or weaknesses
6	Adequate — generally responsive and acceptable, but lacking detail, project specificity, or clarity in certain aspects
4	Marginal — partially responsive, with notable weaknesses, insufficient detail, or limited confidence in the proposed approach
2	Poor — weak, generic, incomplete, or inconsistent with the technical requirements
0	Nonresponsive — not addressed, or materially deficient

For qualitative criteria, the weighted score shall be calculated as follows:

Weighted Score = (Rating / 10) × Criterion Weight

After determining the technical factors score, the next step is to calculate the technical weighted score. The formula specified below will be used to calculate a Bidder's technical weighted score (T_{ws}):

$$\mathbf{T}_{ws} = \frac{T}{T_{high}} * \mathbf{T}_{weight}$$

Where:

T_{ws} = Technical weighted score;
T = Total technical score given to the Bid;
T_{high} = Highest technical score among all bids in compliance; and
T_{weight} = Technical weight being equal to 70.

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a. Financial Evaluation

2.2.1 Detailed Financial Evaluation

Prior to financial scoring, it is necessary to conduct a detailed price comparison on the following criteria described below in addition to the criteria listed in ITB 38.2 (a–f), the evaluated bid price shall be determined using the following method:

2.2.1.1 Quantifiable Nonconformities and Omissions

Subject to ITB 17.2 and ITB 38.2, the evaluated cost of quantifiable nonconformities including omissions, is determined as follows:

"Pursuant to ITB 33.3, the cost of all quantifiable nonmaterial nonconformities shall be evaluated, including omissions in Daywork where competitively priced but excluding omission of prices in the Bill of Quantities. The Employer will make its own assessment of the cost of any nonmaterial nonconformities and omissions for the purpose of ensuring fair comparison of Bids."]

2.2.1.2 Domestic Preference

If domestic preference is provided for under ITB 37.1, the following procedure shall apply: **Not applicable**

2.2.1.3 Life Cycle Costs (Not applicable)

2.2.2 Financial Scoring

After evaluating the bid price of each Bidder, the next step is to conduct the financial scoring. The following formula will be used to calculate a Bidder's financial weighted score (F_{ws}).

$$\mathbf{F_{ws}} = \frac{P_{low}}{P} * \mathbf{F_{weight}}$$

Where:

F_{ws} = Financial weighted score;

P = Evaluated Bid Price of the Bid;

P_{low} = Lowest of all evaluated Bid Price among all bids in compliance; and

F_{weight} = Financial weight being equal to 30.

2.3 Combined Technical and Financial Scores

The combined score (CS) shall be calculated for each substantially responsive bid using the following formula:

$$\mathbf{CS} = \frac{P_{low}}{P} * \mathbf{F_{weight}} + \frac{T}{T_{high}} * \mathbf{T_{weight}}$$

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The first-ranked bid shall be the one that obtains the highest CS.

2.4 Multiple Contracts (Not applicable)

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Section 4: Bidding Forms
- Without Prequalification -

This section contains the forms to be completed by the Bidder and submitted as part of its Bid.

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Letter of Technical Bid

-Note-

The Bidder must accomplish the Letter of Technical Bid on its letterhead clearly showing the Bidder's complete name and address.

Date: .....

OCB No.: .....

Invitation for Bid No.: .....

To: [insert complete name of the Employer]

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.

(b) We acknowledge that we have read and understand ADB's Anticorruption Policy (1998) and Investigation and Enforcement Framework, both as amended from time to time.

(c) We offer to execute in conformity with the Bidding Documents the following Works: [insert narrative]

(d) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of [insert bid validity period as specified in ITB 19.1 of the BDS] days starts from the date fixed for the bid submission deadline in accordance with ITB 23.1, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(e) Our firm, including any Subcontractors or Suppliers for any part of the Contract, have nationalities from eligible countries in accordance with ITB 4.2.

(f) Our firm, Joint Venture partners, and Subcontractors or Suppliers for any part of the contract who are named in the bid do not have any conflict of interest in accordance with ITB 4.3.

If there is any conflict of interest, please state details:

(i) Parties involved in the conflict of interest: _____

(ii) Details about the conflict of interest: _____

(g) We are not participating, as a Bidder, either individually or as partner in a Joint Venture, in more than one Bid in this bidding process in accordance with ITB 4.3(e), other than alternative offers submitted in accordance with ITB 13.

(h) Our firm, Joint Venture partners, members of our respective management and supervisory boards of directors, proposed personnel, parent company, Subcontractors or Suppliers for any part of the contract who are named in the bid, consultants, manufacturers, and service providers, are not subject to, or not controlled by any entity or individual that is subject to a suspension or a debarment imposed by the ADB or a debarment imposed by the ADB in

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accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the ADB and other development banks.[1]

(i) We have checked all the parties mentioned in the declaration above against ADB's Publicly Disclosed Debarment of Suspension Subregister accessed via https://sanctions.adb.org/.

(j) Our firm, Joint Venture partners, members of our respective management and supervisory boards of directors, proposed personnel, parent company, Subcontractors or Suppliers for any part of the contract who are named in the bid, consultants, manufacturers, and service providers, are not suspended, debarred, declared ineligible, or subject to any international sanctions by any international organization, multilateral development bank and other donor agency.

If applicable, please state details:

(k) Our firm, Joint Venture partners, members of our respective management and supervisory boards of directors, proposed personnel, and parent company, in the last 10 years preceding the date of this letter of bid, have never been convicted of any criminal offense, or been subjected to any criminal, civil, or administrative orders, monitorship or enforcement actions, involving any integrity violation or on grounds comparable to any integrity violation.

If applicable, please state details:

(l) Our firm, Joint Venture partners, members of our respective management and supervisory boards of directors, proposed personnel, parent company, Subcontractors or Suppliers for any part of the contract who are named in the bid, consultants, manufacturers, and service providers, can make and receive payments through the international banking system or otherwise discharge the Employer's obligation upon initiation of wire transfer.

If unable to make or receive funds through the international banking system or otherwise discharge the Employer's obligation upon initiation of wire transfer, please state the details:

(i) Nature of the restriction: _____

(ii) Jurisdiction of the restriction: _____

(iii) Other relevant details: _____

(m) Our firm, Joint Venture partners, members of our respective management and supervisory boards of directors, proposed personnel, parent company, Subcontractors or Suppliers for any part of the contract who are named in the bid, consultants, manufacturers, and service providers, are not from a country which is prohibited to export goods or services to, or receive any payments from the Employer's country and/or are not prohibited to receive payments for particular goods or services by the Employer's country by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations.

(n) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract.[2]

[1] These institutions include African Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and the World Bank Group. According to paragraph 9 of the Agreement, other international financial institutions may join upon the consent of all Participating Institutions and signature of a Letter of Adherence by the international financial institution substantially in the form provided (Annex B to the Agreement). Upon adherence, such international financial institution shall become a Participating Institution for purposes of the Agreement. Bidders are advised to check www.adb.org/integrity for updates.

[2] If none has been paid or is to be paid, indicate "None".

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Name of Recipient	Address	Reason	Amount
.....	.....	.....	.....
.....	.....	.....	..... .

(o) We understand that it is our obligation to notify the Employer of any changes in connection with the matters described in paragraphs (f), (h), (i), (j), (k), (l), (m), and (n) of this Letter of Technical Bid.

(p) [We are not a government-owned enterprise] / [We are a government-owned enterprise, but meet the requirements of ITB 4.5].[3]

(q) We have not been suspended nor declared ineligible by the Employer based on execution of a Bid-Securing Declaration in accordance with ITB 4.6.

(r) At any time following submission of our Bid, we shall permit, and shall cause our Joint Venture partners, directors, key officers, key personnel, associates, parent company, affiliates or subsidiaries, including any Subcontractors, consultants, subconsultants, manufacturers, service providers or Suppliers for any part of the contract to permit ADB or its representative to inspect our site, assets, accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB. We understand that failure of this obligation may constitute obstructive practice that may result in debarment and/or contract termination.

(s) Regardless of whether the contract will be awarded to us, we shall preserve all accounts, records and other documents related to bid submission for at least 5 years from the date of submission of the bid or the period prescribed in applicable law, whichever is longer.

(t) If we are awarded the contract, we shall preserve all accounts, records and other documents related to the procurement and execution of the contract for at least 5 years after completing the works contemplated in the relevant contracts or the period prescribed in applicable law, whichever is longer.

(u) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 6 (Works' Requirements) and our technical proposal, or as otherwise agreed with the Employer.

(v) We certify on behalf of the Bidder, that the information provided in the bid has been fully reviewed, given in good faith, and to the best of our knowledge is true and complete. We understand that it is our obligation to inform the Employer of any changes to the information as and when it becomes known to us. We understand that any misrepresentation that knowingly or recklessly misleads, or attempts to mislead may lead to the automatic rejection of the Bid or cancellation of the contract, if awarded; and may result in enforcement and disclosure actions, in accordance with ADB's Anticorruption Policy and Investigation and Enforcement Framework (both as amended from time to time).

[3] Use one of the two options as appropriate.

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Name: [insert complete name of person signing the bid]

In the capacity of [insert legal capacity of person signing the bid]

Signed: [insert signature of person whose name and capacity are shown above]

Duly authorized to sign the Bid for and on behalf of [insert complete name of the Bidder]

Date: [insert date of signing]

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Letter of Price Bid

-Note-

The Bidder must accomplish the Letter of Price Bid on its letterhead clearly showing the Bidder's complete name and address.

Date: .....

OCB No.: .....

Invitation for Bid No.: .....

To: [insert complete name of the Employer]

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.

(b) We acknowledge that we have read and understand ADB's Anticorruption Policy (1998) and Investigation and Enforcement Framework, both as amended from time to time.

(c) We offer to execute in conformity with the Bidding Documents and the Technical Bid submitted for the following Works. [insert narrative]

(d) The total price of our Bid, excluding any discounts offered in item (d) below is:

[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]

The total bid price from the Summary of Bill of Quantities should be entered by the bidder inside this box. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the bid.

(e) The discounts offered and the methodology for their application are: [insert discounts and methodology for their application if any]

(f) Our Bid shall be valid for a period of [insert bid validity period as specified in ITB 19.1 of the BDS] days starts from the date fixed for the bid submission deadline in accordance with ITB 23.1, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

(g) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document.

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(h) We understand that this bid, together with your written acceptance thereof included in your notification of award through the issuance of Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed.

(i) We understand that you are not bound to accept the first-ranked bid or any other bid that you may receive.

(j) At any time following submission of our Bid, we shall permit, and shall cause our Joint Venture partners, directors, key officers, key personnel, associates, parent company, affiliates or subsidiaries, including any Subcontractors, consultants, subconsultants, manufacturers, service providers or Suppliers for any part of the contract to permit ADB or its representative to inspect our site, assets, accounts, and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB. We understand that failure of this obligation may constitute obstructive practice that may result in debarment and/or contract termination.

(k) Regardless of whether the contract will be awarded to us, we shall preserve all accounts, records, and other documents related to bid submission for at least 5 years from the date of submission of the bid or the period prescribed in applicable law, whichever is longer.

(l) If we are awarded the contract, we shall preserve all accounts, records, and other documents related to the procurement and execution of the contract for at least 5 years after completing the works contemplated in the relevant contracts or the period prescribed in applicable law, whichever is longer.

(m) We confirm and stand by our commitments and other declarations made in connection with the submission of our Letter of Technical Bid.

(n) We certify on behalf of the Bidder, that the information provided in the bid has been fully reviewed, given in good faith, and to the best of our knowledge is true and complete. We understand that it is our obligation to inform the Employer of any changes to the information as and when it becomes known to us. We understand that any misrepresentation that knowingly or recklessly misleads, or attempts to mislead may lead to the automatic rejection of the Bid or cancellation of the contract, if awarded; and may result in enforcement and disclosure actions, in accordance with ADB's Anticorruption Policy and Investigation and Enforcement Framework (both as amended from time to time).

Name: [insert complete name of person signing the bid]

In the capacity of [insert legal capacity of person signing the bid]

Signed: [insert signature of person whose name and capacity are shown above]

Duly authorized to sign the Bid for and on behalf of [insert complete name of the Bidder]

Date: [insert date of signing]

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Bid-Securing Declaration (Not applicable)

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Affiliate Company Guarantee

Name of Contract/Contract No.: _____

Name and Address of Employer: _____

[together with successors and assigns].

We have been informed that [name of Contractor] (hereinafter called the "Contractor") is submitting an offer for the above-referenced Contract in response to your invitation and that the conditions of your invitation require its offer to be supported by an affiliate company guarantee.

In consideration of you, the Employer, awarding the Contract to the Contractor, we [name of affiliated company] irrevocably and unconditionally guarantee to you, as a primary obligation, that (i) throughout the duration of the Contract, we will make available to the Contractor our financial, technical capacity, expertise, and resources required for the Contractor's satisfactory performance of the Contract; and (ii) we are fully committed, along with the Contractor, to ensuring a satisfactory performance of the Contract.

If the Contractor fails to so perform its obligations and liabilities and comply with the Contract, we will indemnify the Employer against and from all damages, losses, and expenses (including legal fees and expenses) which arise from any such failure for which the Contractor is liable to the Employer under the Contract.

This guarantee shall come into full force and effect when the Contract comes into full force and effect. If the Contract does not come into full force and effect within a year of the date of this guarantee, or if you demonstrate that you do not intend to enter into the Contract with the Contractor, this guarantee shall be void and ineffective. This guarantee shall continue in full force and effect until all the Contractor's obligations and liabilities under the Contract have been discharged, when this guarantee shall expire and shall be returned to us, and our liability hereunder shall be discharged absolutely.

This guarantee shall apply and be supplemental to the Contract as amended or varied by the Employer and the Contractor from time to time. We hereby authorize them to agree on any such amendment or variation, the due performance of which and compliance with which by the Contractor are likewise guaranteed hereunder. Our obligations and liabilities under this guarantee shall not be discharged by any allowance of time or other indulgence whatsoever by the Employer to the Contractor, or by any variation or suspension of the works to be executed under the Contract, or by any amendments to the Contract or to the constitution of the Contractor or the Employer, or by any other matters, whether with or without our knowledge or consent.

This guarantee shall be governed by the law of the same country (or other jurisdiction) that governs the Contract and any dispute under this guarantee shall be finally settled under the [Rules or Arbitration provided in the Contract]. We confirm that the benefit of this guarantee may be assigned subject only to the provisions for assignment of the Contract.

Signed by:……	Signed by: ……
[signature]	[signature]
……	……
[name]	[name]
……	……
[position in parent/subsidiary company]	[position in parent/subsidiary company]

Date:……

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Environmental, Health, and Safety Code of Conduct

Environmental, Health, and Safety Code of Conduct for Contractor's Personnel Form

NOTE TO BIDDER

The minimum content of the Environmental, Health, and Safety (EHS) Code of Conduct form as set out by the Employer shall not be substantially modified*. However, the Bidder may add requirements as appropriate, including to take into account Contract-specific issues/risks.*

The Bidder shall initial and submit the EHS Code of Conduct form as part of its bid.

ENVIRONMENTAL, HEALTH AND SAFETY
CODE OF CONDUCT FOR CONTRACTOR'S PERSONNEL

We are the Contractor, [enter name of Contractor]. We have signed a contract with [enter name of Employer] for [enter description of the Works]. These Works will be carried out at [enter the Site and other locations where the Works will be carried out]. Our contract requires us to implement measures to address environmental, health, and safety (EHS) risks related to the Works.

This EHS Code of Conduct is part of our measures to deal with environmental, health and safety risks related to the Works. It applies to all our staff, laborers and other employees at the Works Site or other places where the Works are being carried out. It also applies to the personnel of each subcontractor and any other personnel assisting us in the execution of the Works. All such persons are referred to as "**Contractor's Personnel**" and are subject to this EHS Code of Conduct.

This EHS Code of Conduct identifies the behavior that we require from all Contractor's Personnel.

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel shall:

1. carry out its duties competently and diligently;

2. comply with this EHS Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety, and well-being of other Contractor's Personnel and any other person;

3. maintain a safe working environment, including by:

    (a) ensuring that workplaces, machinery, equipment, and processes under each person's control are safe and without risk to health;

    (b) wearing required personal protective equipment;

    (c) using appropriate measures relating to chemical, physical, and biological substances and agents; and

    (d) following applicable emergency operating procedures.

4. report work situations that it believes are not safe or healthy and remove itself from a work situation that it reasonably believes presents an imminent and serious danger to its life or health;

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5. treat other people with respect and not discriminate against specific groups such as women, people with disabilities, migrant workers, or children;

6. report violations of this EHS Code of Conduct; and

7. not retaliate against any person who reports violations of this EHS Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that it believes may represent a violation of this EHS Code of Conduct, or that otherwise concerns it, it should raise the issue promptly. This can be done by calling [insert number] to reach the Contractor's hotline (if any) and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

CONSEQUENCES OF VIOLATING THE ENVIRONMENTAL, HEALTH, AND SAFETY CODE OF CONDUCT

Any violation of this EHS Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination of the employment and/or engagement contract and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this EHS Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this EHS Code of Conduct, I can contact [enter name of Contractor's contact person(s) with relevant experience] requesting an explanation.

Name of Contractor's Personnel: [insert name]
Signature: _____
Date: [day month year]: _____

Countersignature of authorized representative of the Contractor:
Signature: _____
Date: [day month year]: _____

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INTEGRITY PACT

1 General:

Whereas, **Sangay Tenzin, Director, Construction & Procurement Department**, representing **Bhutan Power Corporation Limited (BPC),** hereinafter referred to as the "**Employer**" on one part, and _____ **representing** _____as the other part hereby execute this agreement as follows:

This agreement shall be a part of the tender document, which shall be signed and submitted along with the bidding documents. The head of the employing agency/or his authorized representative should be the signing authority. For the bidders, the bidder himself or his authorized representative must sign the Integrity Pact (IP). If the winning bidder had not signed during the submission of the bid, the tender should be cancelled.

2 Objectives:

Now, therefore, the Employer and the Bidder agree to enter into this pre-contract agreement, hereinafter referred to as Integrity Pact, to avoid all forms of corruption or deceptive practice by following a system that is fair, transparent, and free from any influence/unprejudiced dealings in the bidding process and contract administration , with a view to: -

2.1 Enabling the Employer to obtain the desired contract at a reasonable and competitive price in conformity to the defined specifications of the works, goods, or services; and

2.2 Enabling bidders to abstain from bribing or any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also refrain from bribing and other corrupt practices.

3. Scope

The validity of this IP shall cover the bidding process and contract administration period.

4. Commitments of the Employer:

The Employer Commits itself to the following: -

4.1 The Employer hereby undertakes that no official of the Employer, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the Bidder, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process and contract administration.

4.2 The Employer further confirms that its officials have not favoured any prospective bidder in any form that could afford an undue advantage to that particular bidder in the bidding process and contract administration and will treat all Bidders alike.

4.3 Officials of the Employer, who may have observed or noticed or have reasonable suspicion, shall report to the head of the employing agency or an appropriate government office any violation or attempted violation of clauses 4.1 and 4.2.

4.4 Following report on violation of clauses 4.1 and 4.2 by the official (s), through any source, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings, shall be initiated by the Employer and such a person shall be debarred from further dealings related to the bidding process and contract administration.

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5 Commitments of Bidders:

The Bidder commits himself/herself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of the bidding process and contract administration in order to secure the contract or in furtherance to secure it and, in particular, commits himself/herself to the following: -

5.1 The Bidder shall not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantages, commission, fees, brokerage, or inducement to any official of the Employer connected directly or indirectly with the bidding process and contract administration, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding process and contract administration.

5.2 The Bidder shall not collude with other parties interested in the contract to manipulate the bidding process and contract administration in any form or manner.

5.3 If the bidder(s) have observed or noticed or have reasonable suspicion that the procuring agency or other bidders have violated the provisions of the IP, the bidder shall report such violations to the head of the procuring agency.

6 Sanctions for Violation:

The breach of any of the aforesaid provisions shall result in administrative charges or penal actions as per the relevant rules and laws.
The breach of the IP or commission of any offence (forgery, providing false information, misrepresentation, providing false/fake documents, bid rigging, bid steering or coercion) by the Bidder, or anyone employed by him, or acting on his/her behalf (whether with or without the knowledge of the Bidder), shall be dealt with as per the terms and conditions of the contract and other provisions of the relevant laws including Debarment Rules.

The breach of the IP or commission of any offence by the officials of the procuring agency shall be dealt with as per the rules and laws of the land in vogue.

The Employer/relevant agency shall also take all or any one of the following actions, wherever required:-

6.1 To immediately call off the pre-contract negotiations without giving any compensation to the Bidder. However, the proceedings with the other Bidder(s) would continue.

6.2 To immediately cancel the contract, if already awarded/signed, without giving any compensation to the Bidder.

6.3 The Earnest Money/Security Deposit shall stand forfeited.

6.4 To recover all sums already paid by the Employer.

6.5 To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the Bidder, in order to recover the payments already made by the Employer, along with interest.

6.6 To cancel all or any other Contracts with the Bidder.

6.7 To debar the Bidder from entering into any bid from the government of Bhutan as per the Debarment Rule.

7. Conflict of Interest

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7.1 A conflict of interest involves a conflict between the public duty and private interests (for favour or vengeance) of a public official, in which the public official has a private interest, which could improperly influence the performance of their official duties and responsibilities. Conflict of Interest would arise in a situation where any concerned members of both parties are related either directly or indirectly or have any association or had any confrontation. Thus, the conflict of interest of any tender committee member must be declared in the prescribed form (sample form attached).

7.2 The Bidder shall not lend or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any committee member, and if he does so, the Employer shall be entitled forthwith to rescind the Contract and all other contracts with the Bidder.

8. Examination of Books of Accounts

8.1 In case of any allegation of violation of any provisions of this Integrity Pact or payment of a commission, the Employer/authorized persons or relevant agencies shall be entitled to examine the Books of Accounts of the Bidder, and the Bidder shall provide necessary information of the relevant financial documents and shall extend all possible help for the purpose of such examination.

9 9. Monitoring and Administration:

9.1 The respective procuring agency shall administer and monitor the IP as per the relevant laws.

9.2 The bidder shall have the right to appeal as per the arbitration mechanism contained in the relevant rules.

10. Validity:

10.1 The validity of this Integrity Pact shall cover the bidding process and extend until the completion of the contract to the satisfaction of both the Employer and the Bidder.

10.2 Should one or several provisions of this IP turn out to be invalid, the remainder of this IP remains valid. In this case, the parties will strive to come to an agreement with their original intentions.

We hereby declare that we have read and understood the clauses of this agreement and shall abide by it. Further, the information provided in this agreement is true and correct to the best of our knowledge and belief.

The parties hereby sign this Integrity Pact at _____ on _____.

For Employer



Sangay Tenzin
Director, C&PD

For Contractor

Affix
Legal
Stamp

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Witness:

Witness



(Drukchu Dorji)
General Manager,
CD

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Bidders Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria), the Bidder shall provide the following information requested in the corresponding Information Sheets.

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Form ELI - 1: Bidder's Information Sheet

Bidder's Information			
		Information of the Bidder	**If the Bidder is a subsidiary or branch, information of any parent company or companies**
Names	**Full legal name(s)**		
	Full trading name(s) (if any)		
Addresses	**Registered address(es)**		
	Trading address(es)		
	Postal address(es) (if different from trading address)		
Type of organization			
Country of constitution, incorporation, and/or registration			
Year of constitution, incorporation, and/or registration			
Corporate or registration number			
In case of a Joint Venture, legal name of each partner			
Bidder's authorized representative (name, address, telephone number(s), fax number(s), e-mail address)			

Attached are copies of the following documents:

1) In case of a single entity, articles of incorporation or constitution and company incorporation or registration of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2.
2) Authorization to represent the firm or Joint Venture named above, in accordance with ITB 21.2.
3) In case of a Joint Venture, a letter of intent to form a Joint Venture or Joint Venture agreement, in accordance with ITB 4.1.
4) In case of a government-owned enterprise, any additional documents not covered under 1 required to comply with ITB 4.5.

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Form ELI - 2: Joint Venture Information Sheet

Each partner of the Joint Venture and Specialist Subcontractor must fill out this form separately.

Joint Venture / Specialist Subcontractor Information			
Bidder's legal name			
		Information of Joint Venture Partner or Specialist Subcontractor	**If any Joint Venture Partner or Specialist Subcontractor is a subsidiary or branch, information of any parent company or companies**
Names	**Full legal name(s)**		
	Full trading name(s) (if any)		
Addresses	**Registered address(es)**		
	Trading address (es)		
	Postal address (es) (if different from trading address)		
Type of organization			
Country of constitution, incorporation, and/or registration			
Year of constitution, incorporation, and/or registration			
Corporate or registration number			
Joint Venture Partner's or Specialist Subcontractor's authorized representative information (name, address, telephone number(s), fax number(s), e-mail address)			
Attached are copies of the following documents: 1) Articles of incorporation or constitution and company incorporation or registration of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2. 2) Authorization to represent the firm named above, in accordance with ITB 21.2. *3)* In the case of a government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.			

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Form CON - 1: Historical Contract Nonperformance

Each Bidder must fill out this form in accordance with Criteria 1.2.1 and 1.2.3 of Section 3 (Evaluation and Qualification Criteria) to describe any history of nonperforming contracts and pending litigation or arbitration formally commenced against it.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

Table 1: History of Nonperforming Contracts

Choose one of the following:

❑ No nonperforming contracts.

❑ The following is a description of nonperforming contracts involving the Bidder (or each Joint Venture partner if Bidder is a Joint Venture).

Year	Description	Amount of Nonperformed Portion of Contract ($ equivalent)	Total Contract Amount ($ equivalent)
[insert year]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street, city, country] Reason(s) for nonperformance: [indicate main reason(s)]	[insert amount]	[insert amount]

Table 2: Pending Litigation and Arbitration

Choose one of the following:

❑ No pending litigation, arbitration, or any other material events impacting the net worth and/or liquidity of the bidder.

❑ The following is a description of all pending litigation, arbitration involving the Bidder, or any other material events impacting the net worth and/or liquidity of the bidder (or each Joint Venture partner if Bidder is a Joint Venture).

Year	Matter in Dispute	Value of Pending Claim ($ equivalent)	Value of Pending Claim as a Percentage of Net Worth ($ equivalent)
[insert year]	Contract Identification, as applicable: [indicate complete contract name, number, and any other identification] Name of Employer, parties involved in the material events impacting the net worth and/or liquidity of the bidder: [insert full name] Address of Employer, parties involved in the material events impacting the net worth and/or liquidity of the bidder: [insert street, city, country] Matter of Dispute: [indicate full description of dispute] Party who initiated the dispute: [indicate "Employer" or "Contractor"] Status: [indicate status of dispute]	[insert amount]	[insert amount]

NOTE

Table 2 of this form shall only be included if Criterion 1.2.3 of Section 3 (Evaluation and Qualification Criteria) is applicable.

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Form CON – 2: Environmental, Health, and Safety (EHS) Performance Declaration

Each Bidder must fill out this form in accordance with Criterion 1.2.4 of Section 3 (Evaluation and Qualification Criteria).

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

In case of a Specialist Subcontractors, each Specialist Subcontractor must fill out this form and provide the Specialist Subcontractor's name:

Specialist Subcontractor: _____

Environmental, Health, and Safety Performance Declaration in accordance with Section 3 (Evaluation and Qualification Criteria)
☐ **No suspension or termination of contract**: An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental, Health, and Safety (EHS) performance since the date specified in Section 3 (Evaluation and Qualification Criteria), Criterion 1.2.4.
☐ **Declaration of suspension or termination of contract**: The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to EHS performance since the date specified in Section 3 (Evaluation and Qualification Criteria), Criterion 1.2.4. Details are described in the following table.
☐ **Declaration of request for replacement of Key Environmental, Health, and Safety Personnel**: The following contract(s) has/have experienced a request by the Employer to replace EHS Personnel for reasons related to EHS performance since the date specified in Section 3 (Evaluation and Qualification Criteria), Criterion 1.2.4. Details are described in the following table.
☐ **Declaration of past major project related incidents including fatalities resulted from EHS issues on site**: The following contract(s) has/have experienced a fatality resulted from EHS issues on site since the date specified in Section 3 (Evaluation and Qualification Criteria), Criterion 1.2.4. Details are described in the following table.

Year	**Suspended or terminated portion of contract**	**Contract Identification**	**Total Contract Amount** (current value, currency, exchange rate and $ equivalent)
[insert year]	[insert amount and percentage]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street, city, country] Reason(s) for suspension or termination: [indicate main reason(s) e.g. discharge over environmental limit, workers did not have required health and safety permits to undertake high risk work, work carried out did not adhere to approved construction methodology and quality control plan]	[insert amount]
[insert year]	[insert amount and percentage]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street/city/country] Reason(s) for suspension or termination: [indicate main reason(s)]	[insert amount]

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…	…	[list all applicable contracts]	…

Performance Security called by an employer(s) for reasons related to EHS performance

Year	Contract Identification	Total Contract Amount (current value, currency, exchange rate and $ equivalent)
[insert year]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street, city, country] Reason(s) for suspension or termination: [indicate main reason(s) e.g., discharge over environmental limit, workers did not have required health and safety permits to undertake high risk work, work carried out did not adhere to approved construction methodology and quality control plan]	[insert amount]

Key EHS personnel replacement requested by the Employer for reasons related to EHS performance

Year	Contract Identification and Reasons	Personnel replacement action and results
[insert year]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street, city, country] Reason(s) for requesting for replacement: [indicate main reason(s)]	[insert description]

Fatality due to EHS issues on Site

Year	Contract Identification	Follow-on actions taken by the contractor
[insert year]	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: [insert full name] Address of Employer: [insert street, city, country] Description of fatality event: Causation:	[insert description]

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Form FIN - 1: Historical Financial Performance

Each Bidder must fill out this form.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

	Financial Data for Previous 3 Years [$ Equivalent]		
	Year 1:	**Year 2:**	**Year 3:**
Information from Balance Sheet			
Total Assets (TA)			
Total Liabilities (TL)			
Net Worth = TA – TL			
Current Assets (CA)			
Current Liabilities (CL)			
Most Recent Working Capital		To be obtained for most recent year and carried forward to FIN - 3 Line 1; in case of Joint Ventures, to the corresponding Joint Venture Partner's FIN – 3.	
Information from Income Statement			
Total Revenues			
Profits Before Taxes			
Profits After Taxes			

❑ Attached are copies of financial statements (balance sheets including all related notes and income statements) for the last 3 years, as indicated above, complying with the following conditions:

1) Unless otherwise required by Section 3 of the Bidding Document, all such documents reflect the standalone financial situation of the legal entity or entities comprising the Bidder and not the Bidder's parent companies, subsidiaries, or affiliates.
2) Historical financial statements must be audited by a certified accountant.
3) Historical financial statements must be complete, including all notes to the financial statements.
4) Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

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Form FIN - 2: Average Annual Construction Turnover

Each Bidder must fill out this form.

The information supplied should be the Annual Turnover of the Bidder or each partner of a Joint Venture for the total certified payments received from the clients for contracts in progress or completed, converted to United States dollars at the rate of exchange at the end of the period reported.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

Annual Turnover Data for the Last _____ Years (Construction only)			
Year	**Amount Currency**	**Exchange Rate**	**$ Equivalent**
		Average Annual Construction Turnover	

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Form FIN – 3: Availability of Financial Resources

Bidders must demonstrate sufficient financial resources, usually comprising of Working Capital supplemented by credit line statements or overdraft facilities and others to meet the Bidder's financial requirements for its current contract commitments, and the subject contract.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

Financial Resources		
No.	**Source of financing**	**Amount** ($ equivalent)
1	Working Capital (to be taken from FIN - 1)	
2	Credit Line[a]	
3	Other Financial Resources[b]	
	Total Available Financial Resources	

[a] A credit line is an unconditional and legally binding loan extended to a Bidder by a financial institution. The credit line must be free from any pledge, encumbrance, or commitment to a third party or other transactions. Credit lines should be substantiated by a letter from the bank issuing the line of credit.

[b] Other financial resources are financial assets not considered in the Working Capital. They are noncurrent assets (i.e., with a maturity beyond a 12-month period) such as a loan and/or trade receivables, bank deposits, debt, or equity instruments (provided they are classified as "available for sale" in the financial statements), and are free from any pledge or commitment to a third party and get their value from contractual rights or ownership.

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Form FIN- 4: Financial Requirements for Current Contract Commitments

Bidders (or each Joint Venture partner) should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

Current Contract Commitments						
No.	**Name of Contract**	**Employer's Contact** (Address, Tel, Fax)	**Contract Completion Date**	**Outstanding Contract Value** (X) [a]	**Remaining Contract Period in months** (Y) [b]	**Monthly Financial Resources Requirement** (X / Y)
1						
2						
3						
4						
Total Monthly Financial Requirement for Current Contract Commitments						**$** . . . . .

[a] Remaining outstanding contract values to be calculated from 28 days prior to the bid submission deadline ($ equivalent based on the foreign exchange rate as of the same date).

[b] Remaining contract period to be calculated from 28 days prior to bid submission deadline.

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Form FIN - 5: Self-Assessment Tool for Bidder's Compliance to Financial Resources (Criterion 1.3.3 of Section 3)

This form requires the same information submitted in Forms FIN - 3 and FIN - 4. All conditions of "Available Financial Resources Net of CCC ≥ Requirement for the Subject Contract" must be satisfied to qualify.

Form FIN - 5A: For Single Entities

For Single Entities (A)	Total Available Financial Resources from FIN – 3 (B)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN – 4 (C)	Available Financial Resources Net of CCC D = (B - C)	Requirement for the Subject Contract (E)	Results: Yes or No [*D must be greater than or equal to E*] (F)
_____ (Name of Bidder)				. . . . .	

Form FIN - 5B: For Joint Ventures

For Joint Ventures (A)	Total Available Financial Resources from FIN – 3 (B)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN – 4 (C)	Available Financial Resources Net of CCC D = (B - C)	Requirement for the Subject Contract (E)	Results: Yes or No [*D must be greater than or equal to E*] (F)
One Partner:					
_____ (Name of Partner)				. . . . .	
Each Partner:					
_____ (Name of Partner 1)				. . . . .	
_____ (Name of Partner 2)				. . . . .	
_____ (Name of Partner 3)				. . . . .	
All partners combined	∑ D = Sum of available financial resources net of current contract commitments for all partners		∑ D = _____	. . . . .	

NOTE

Form FIN – 5 is made available for use by the bidder as a self-assessment tool, and by the Employer as an evaluation work sheet, to determine compliance with the financial resources requirement as stated in 1.3.3. Failure to submit Form FIN - 5 by the Bidder shall not lead to bid rejection.

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Form EXP – 1: Contracts of Similar Size and Nature

Fill out one (1) form per contract. Each contract shall be supported by documents such as Signed Contract Agreement, Taking-Over Certificate, Contract Completion Certificate, or Performance Certificate.

The exchange rate to be used to calculate the value of the contract for conversion to a specific currency shall be the selling rate of the Borrower's Central bank on the date of the contract.

Contract of Similar Size and Nature		
Contract No _____ of _____	**Contract Identification**	
Award Date		**Completion Date**
Total Contract Amount	**$**	
If partner in a Joint Venture or Subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**
Employer's name **Address** **Telephone number** **Fax number** **E-mail**		
Description of the Similarity in Accordance with Criterion 1.4.1 of Section 3 (Evaluation and Qualification Criteria)		

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Form EXP – 2: Construction Experience in Key Activities

Fill out one (1) form per contract. Each contract shall be supported by documents such as Signed Contract Agreement, Taking-Over Certificate, or Contract Completion Certificate.

Each Bidder must fill out this form.

If complied by Specialist Subcontractor, each Specialist Subcontractor must fill out this form and provide the Specialist Subcontractor's name:

Specialist Subcontractor: _____

Contract with Similar Key Activities		
Contract No _____ of _____	**Contract Identification**	
Award Date		**Completion Date**
Total Contract Amount	**$**	
If partner in a Joint Venture or Subcontractor, specify participation of total contract amount	**Percent of Total**	**Amount**
Employer's name **Address** **Telephone number** **Fax number** **E-mail**		
Description of the Key Activities in Accordance with Criterion 1.4.2 of Section 3 (Evaluation and Qualification Criteria)		

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Form EXP – 3: Specific Experience in Managing Environmental, Health, and Safety Aspects

Fill out one (1) form per contract.

Each Bidder must fill out this form.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name:

Joint Venture Partner: _____

1. Key Requirement no. 1 in accordance with Criterion 1.4.3 of Section 3: _____

Contract Identification				
Award date				
Completion date				
Role in Contract	**Prime Contractor** ☐	**Member in Joint Venture** ☐	**Management Contractor** ☐	**Subcontractor** ☐
Total Contract Amount	**$**			
Details of relevant experience				

2. Key Requirement no 2 in accordance with Criterion 1.4.3 of Section 3: _____

3. Key Requirement no 3 in accordance with Criterion 1.4.3 of Section 3: _____

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Form EXP – 4: Environmental, Health, and Safety Certification

Please provide the following information:

Availability of the following valid International Organization for Standardization (ISO) certification or internationally recognized equivalent (equivalency to be demonstrated by the Bidder), and applicable to the worksite:

- Quality management certificate ISO 9001
- Environmental management certificate ISO 14001
- Health and Safety management certificate ISO 45001

[a] Depending on the environmental, health, and safety issues of the worksite and the type of competition planned (national or international), the list of required certifications may be restricted to those corresponding to the main issue of the worksite management or removed altogether.

Form EXP – 5: Environmental, Health, and Safety Documentation

Please provide the following information:

Availability of in-house policies and procedures acceptable to the Employer for EHS management:

1. Existence of a system for monitoring compliance with EHS commitments for the Bidder's and all its partners.
2. Existence of official company procedures for the management of the following relevant points;

- EHS resources and facilities and EHS monitoring system;
- Health and Safety on worksites policy and related guidance;
- Local recruitment and EHS trainings of local staff/subcontractors and/or local partners;
- Community stakeholder engagement practice;
- Traffic management practice;
- Waste management practice;
- Protection of water resources;
- Biodiversity protection practices;
- Site rehabilitation and revegetation practice;
- Local cultural heritage protection practice;
- Erosion and sedimentation practices; and
- Control of infectious and communicable diseases (HIV/AIDS, malaria, COVID-19, and others)

Form EXP – 6: Environmental, Health, and Safety Dedicated Personnel

Please provide curriculum vitae (CV) [Form PER-2] of the in-house personnel of the main contractor and/or Joint Venture partners for the EHS positions specified in Section 6 (Works' Requirements):

- Environmental, Health and Safety Specialist

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Technical Proposal

The technical proposal is expected to include as a minimum information described in the following forms:

(i) Construction Management Strategy;
(ii) Construction Methods for Key Component;
(iii) Construction Schedule;
(iv) Quality Assurance and Quality Control;
(v) Environmental, Health, and Safety Management Plan;
(vi) Anticipated Risks Evaluation;
(vii) Personnel and Organizational Chart;
(viii) Personnel;
(ix) Equipment; and
(x) Material Procurement and Vendor Management Plan

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(i) Construction Management Strategy

The Bidder shall submit a construction management strategy that addresses as a minimum:

(a) organizational arrangements for the construction management, including: team structure, roles and responsibilities, interface arrangements, approval procedures, and quality assurance arrangements;
(b) subcontractor selection and management;
(c) obtaining and managing consents, permits, and approvals;
(d) site setup, including access, accommodation, welfare facilities, arrangement for plant and material storage;
(e) construction phasing proposals, including sequence of work and management of conflicting activities;
(f) ensuring that geotechnical investigations or other advance works meet the environmental requirements; and
(g) sustainability aspects demonstrating the Proposer's approach and commitment to sustainable construction practices (e.g., energy efficiency, reduction of wastage, material reduction, sources of materials, and others).

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(ii) Construction Methods for Key Component

Bidders shall provide typical method statements for the following key activities. Each method statement shall describe the proposed approach to the construction activity, the level of staffing and experience, the safe system of work, and the construction equipment to be used.

1.
2.
3.
4.

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(iii) Construction Schedule

Bidders shall set out a work program for construction of the Works to be undertaken, including the mobilization phase, showing identification of major milestones, and critical path. Detailed timetables may be submitted (as appropriate) for the following aspects:

(a) Processes and deliverables needed to commence the Works;
(b) Execution of the Works within the Time for Completion, highlighting activities imposing constraints on the construction sequence;
(c) Testing, commissioning, and handing over of the completed Works; and
(d) [*include any other relevant information as may be appropriate*].

Work programs shall be submitted in paper (hard copy) and in a PDF format compatible with known computer programs, such as, for example, PRIMAVERA, TILOS, CAD, or MS Project (GANTT graphics), or similar programs.

Programs must include milestones, when they are applicable, and the specific personnel designation and/or labor outlines, planned for the fulfillment of each program and phase or program activity:

General work program with an outline of designated personnel and tables of theoretical duration of tasks or activities; graphic displays of the work progress in flowcharts to show daily production for each activity and the critical path.

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(iv) Quality Assurance and Quality Control

Bidders shall have to submit their approach and resources for the quality assurance procedure and quality control process in connection with works and services to be executed under the Contract.

A draft quality management plan should be submitted as supporting documentation.

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(v) Environmental, Health, and Safety Management Plan[7]

The Bidder shall submit an outline Environmental, Health, and Safety Management Plan (EHSMP) commensurate with the risks and impacts of the proposed works and activities as described in the EMP. These strategies and plans shall describe in detail the actions, materials, equipment, management processes, and others that will be implemented by the Contractor, and its subcontractors to avoid, minimize, and/or mitigate environmental, health, and safety risks associated with implementing the projects activities throughout the project cycle.

In developing these strategies and plans, the Bidder shall have regard to the EHS provisions of the contract and EHS risks, including those as may be more fully described in Section 6 (Works' Requirements).

[7] For projects categorized as Category C for environment for which no EMP has been prepared, this subsection should be omitted.

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(vi) Anticipated Risks Evaluation

The Bidder should submit a risk register identifying the hazards anticipated during the implementation of the contract (e.g., geotechnical and subsurface risks).

For the key hazards ranked by impact, the risk register shall include a description of the hazard, an assessment of the potential impact on EHS, cost, program or other, and the proposed mitigation strategy for each hazard.

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(vii) Personnel and Organizational Chart

The Bidder shall describe the organization of its personnel (an organizational chart shall be provided) specifying the number and specialities of each class of personnel.

For each key personnel, the Bidder shall specify the time periods and number of working days to perform each activity under the works implementation phases.

Likewise, for each specialty, the Bidder shall describe the number of personnel and will show their input over the time periods for the implementation of the Works.

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(viii) Personnel

Form PER – 1: Proposed Personnel

Bidder should provide the details of the proposed personnel and their experience record in the relevant Information Forms for each candidate:

1.	**Title of position**
	Name
2.	**Title of position**
	Name
3.	**Title of position**
	Name
4.	**Title of position**
	Name
5.	**Title of position**
	Name
6.	**Title of position**
	Name
[*As needed*]	**Title of position**
	Name

NOTE
All titles of positions will be as listed in Section 6 (Works' Requirements).

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Form PER – 2: Resumé of Proposed Personnel

The Bidder shall provide all the information requested below. Use one form for each position.

Position		
Personnel Information	**Full Legal Name**	**Date of Birth**
	Known as	**Place of Birth**
	Nationality	**Citizenship**
	Type of Government ID **Attach a copy of ID to this form**	**ID number**
	Professional Qualifications	
Present Employment	**Name of Employer**	
	Address of Employer	
	Telephone	**Contact (Manager or Personnel Officer)**
	Fax	**Email**
	Job Title	**Years with Present Employer**

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company, Project, Position, Relevant Technical and Management Experience

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Declaration

I, the undersigned, certify that to the best of my knowledge and belief, the information contained in this Form PER – 2 correctly describes myself, my qualifications, and my experience.

I confirm that I am available throughout the expected time schedule for this position as provided in the Bid.

I understand that any misrepresentation or omission in this Form may:

a) be taken into consideration during Bid evaluation;
b) result in my disqualification from participating in the Bid;
c) result in my dismissal from the Contract.

Name of Key Personnel: _____ [*insert name*] _____

Signature: _____

Date (day month year): _____

Countersignature of authorized representative of the Bidder:

Name of authorized representative: _____

Signature: _____

Date: (day month year): _____

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(ix) Equipment

Form EQU: Equipment

The Bidder shall provide adequate information and details to demonstrate clearly that it has the capability to meet the equipment requirements indicated in Section 6 (Works' Requirements), using the following Forms. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of Equipment		
Equipment Information	**Name of manufacturer**	**Model and power rating**
	Capacity	**Year of manufacture**
Current Status	**Current location**	
	Details of current commitments	
Source	**Indicate source of the equipment** ☐ **Owned** ☐ **Rented** ☐ **Leased** ☐ **Specially manufactured**	

Omit the following information for equipment owned by the Bidder.

Owner	**Name of owner**	
	Address of owner	
	Telephone	**Contact name and title**
	Fax	**Telex**
Agreements	**Details of rental, lease, or manufacture agreements specific to the project**	

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(x) Material Procurement and Vendor Management Plan

A clear and structured plan for procuring all major line materials from the BPC-approved vendor list, including the process for submitting manufacturing authorizations.

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Schedules

Schedule of Payment Currencies

For .....*insert name of Section of the Works* .....

Separate tables may be required if the various sections of the Works (or of the Bill of Quantities) will have substantially different foreign and local currency requirements. In such a case, the Employer should prepare separate tables for each Section of the Works.

	A	B	C	D
Name of Payment Currency	**Amount of Currency**	**Rate of Exchange to Local Currency**	**Local Currency Equivalent C = A x B**	**Percentage of Net Bid Price (NBP) 100xC / NBP**
Local Currency		**1.00**		
Foreign Currency #1 _____				
Foreign Currency #2 _____				
Foreign Currency #3 _____				
Net Bid Price				**100.00**
Provisional Sums Expressed in Local Currency	*To be entered by the Employer*	**1.00**	*To be entered by the Employer*	
BID PRICE				

NOTE

The rates of exchange shall be the selling rates 28 days prior to the deadline for submission of bids published by the source specified in BDS 18.

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Schedule of Cost Indexation

NOT APPLICABLE

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Tables of Adjustment Data

NOT APPLICABLE

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Bill of Quantities

Summary:

SL.NO.	SCHEDULE	AMOUNT (Nu. /-)
1	SUPPLY OF MATERIALS	
2	ERECTION, TESTING & COMMISSIONING	
TOTAL		

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Schedule 1: Supply of Materials

Item No.	Description	Unit	Provisional Quantity	Unit Rate for Supply and Delivery per Finish Tower			Total FAS Price (excluding GST/CD)	Provision for GST/CD			Total FAS Price in NU. (Including GST/CD)
				Ex-Work Price	FAS (excluding GST/CD)	FAS (including GST/CD)		GST %	CD%	Value (GST+CD) in NU.	
			1.00	**2.00**	**3.00**	**4=3+6x(3+7x2)**	**5=1x3**	**6.00**	**7.00**	**8=6x4+6x7+4**	**9=1x4**
1.0	**Supply of Tower Materials**										
1.1	Fabrication, galvanisation and supply & delivery of various types of towers, & its body extensions (complete), stub setting templates complete, excluding stubs and bolts & nuts but including hangers, D-shackles, pack washer etc. (payment shall be released for identified MT for complete tower)										
i)	HT Steel	MT	202.15								
ii)	Mild Steel	MT	278.43								
1.2	Fabrication, galvanisation & supply & delivery of stubs for various types of towers with pack washers excluding supply of bolts & nuts										
i)	HT Steel	MT	22.86								
ii)	Mild Steel	MT	1.89								
1.3	Fabrication, galvanisation, supply & delivery of Nuts & Bolts for towers except for stubs										
i)	Hexagonal Bolts & Nuts including Step Bolts	MT	24.09								
1.4	Fabrication, galvanisation, supply & delivery of Nuts & Hex. Bolts for stubs including plain washers										
i)	Hexagonal Bolts & Nuts including Plain Washers	MT	0.51								
2.0	**Supply of the following tower accessories**										
2.1	Danger Plate	Nos.	57.00								
2.2	Number Plate	Nos.	57.00								
2.3	Phase Plate (Set of three)	Set	57.00								
2.4	Aviation Requirements										
2.4.1	Span Markers	Nos.	20.00								
2.4.2	Aviation Signal/Obstruction Light (to be provided as per IS:5613)-Medium Intensity	Set	15.00								
2.5	Counterpoise Earthing as per specification										
2.5.1	120 mtr (30 x 4 legs)	Set	57.00								
2.5.2	280 mtr (70 x 4 legs)	Set	5.00								
2.6	Pipe Type Earthing (one of the Legs of each tower if required)	Set	5.00								
2.7	Circuit plate (Set of two)	Set	57.00								

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3.0	**Design, Manufacturing, Supply Conductor Accessories**										
3.1	ACSR Panther Equivalent ACCC Conductor	Linear Km (*)	105.36								
3.2	Vibration Dampers for ACCC Conductor	No.	1,056.00								
4.0	**Design, Manufacturing, Supply & delivery of Insulators & Hardware's Compatible for Panther Equivalent ACCC Conductor**										
4.1	**Suspension Insulator Strings Including Hardware Fittings, Arching Horns, etc., All complete**										
4.1.1	Suspension Pilot String Insulator assemblies (70kN-1X9)	Set	16.00								
4.2	**Tension Insulator Strings Including Hardware Fittings, Arching Horns, etc., All complete**										
4.2.1	Single String Tension Insulators Assemblies (90kN-1X10)	Set	520.00								
4.2.2	Double String Tension Insulators Assemblies (90kN-2X10)	Set	184.00								
5.0	**Supply and Delivery of OPGW and Accessories**										
5.1	24 Core Non-Slotted Composite OPGW in three tubes as per specification	Linear Km (*)	17.56								
5.2	Jointing kits for OPGW/ In Splice enclosure for OPGW including downlead C-Clamp, Earthing clamp, etc. Complete	Set	11.00								
5.3	OPGW Tension Assemblies (Dead End) with armour rod	Set	120.00								
5.4	Vibration Damper for OPGW	Nos.	176.00								
5.5	Bonding Connection for OPGW	Set	120.00								
6.0	**Supply and installation of spiral bird diverters with Accessories on OPGW**										
6.1	Supply, spiral bird diverters including insurance and handling Testing, inspection and commissioning, all incidental work etc. as per the technical specification	Nos.	1,980.00								
7.0	**Mandatory Spare parts**										
7.1	ACSR panther equivalent ACCC conductor	Linear km(*)	3.00								
7.2	Mid-span Joint for ACSR panther Equivalent ACCC Conductor	Nos.	5.00								

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7.3	Repair Sleeve for ACSR panther equivalent ACCC conductor	Nos.	5.00								
7.4	Dead-end of ACSR panther equivalent ACCC conductor along with the Core retainer & Socks wire mesh	Nos.	5.00								
8.0	**Stringing Equipment**										
8.1	60 Ton Press Head and Pump	Nos.	1.00								
8.2	Dies for Hydraulic Press compatible with ACSR panther equivalent ACCC conductor	Nos.	1.00								
8.3	Conductor Stripper with bushing compatible with ACSR panther equivalent ACCC conductor	Nos.	1.00								
8.4	Carbon Composite Core Cutter for ACSR panther equivalent ACCC	Nos.	1.00								
Total of Schedule 1											

(*) Linear km is the horizontal distance measured between the conductor / OPGW attachment points of adjacent towers. The rate shall thus include allowances for unequal attachment heights, sag, scrap, creep or jumpers, OPGW splicing requirements including coiling and dowleads etc. No additional amount will be paid for supply and erection of any mid-span joints / repair sleeves / repair armour rods etc., since these shall be avoided and if used, will be with explicit approval from Employer.

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Schedule 2: Erection, Testing & Commissioning

Item No.	Description	Unit	Provisional Quantity	Unit Rate (Nu.)	Total Price including GST (Nu.)
		1	2	3	4 = 2 x 3
1	**Access, Clearing & Survey**				
1.1	Detailed Transmission Line survey including mobilization, preliminary survey to approval where asked, profiling, tower spotting, center pegging, check survey, line of sight clearing & tree cutting, submission of drawings etc. for approval.	Route km	17.56		
1.2	Check Survey for Transmission Line including mobilization, center pegging of lost pegs, profile survey to approval in case of need and where asked, tree cutting & RoW clearing, submission of drawings etc. all as specified.	Route km	17.56		
2	**Geotech Investigation**				
2.1	Excavation of trial pits at location including necessary shoring, dewatering, collecting samples, and conducting penetrometer test (if possible), backfilling, etc.,… as per standard practice and to specifications.	No.	30.00		
2.2	Conducting electrical resistivity test as per standard practice and to specifications.	No.	57.00		
2.3	Conducting laboratory tests on selected soils, rocks and water samples including transporting the same to the approved laboratory test, as per standard practice and to specifications.	Lump Sum	1.00		
2.4	Preparation and submission of final report of geotechnical investigations both soft & hardcopy as detailed in specifications.	Lump Sum	1.00		
3	**Benching Works for Tower foundations, retaining walls, revetment walls, etc.**				
3.1	In all types of Soil except Soft & Hard Rock	Cu.m	21,792.60		
3.2	In Soft/fissured Rock	Cu.m	12,712.35		
3.3	In Hard Rock	Cu.m	1,816.05		
4	**Tower/ Retaining wall/ Revetment wall Foundation works**				
4.1	Excavation & back filling in various type of soils including items like shoring, dewatering, etc. all complete as per specification				
4.1.1	Normal Dry Soil	Cu.m	4,072.93		
4.1.2	Wet Soil	Cu.m	339.41		
4.1.3	Dry Fissured Rock	Cu.m	2,036.47		
4.1.4	Hard Rock	Cu.m	339.41		
4.2	Supply & Concreting (including all associated works related to foundation not covered in 4.1&4.3)				
4.2.1	M20 Concrete Nominal Mix 1:1.5:3	Cu.m	782.06		
4.2.2	M10 Lean Concrete Nominal Mix 1:3:6	Cu.m	89.35		
4.3	Supply & placement of reinforcement steel (Fe 500)	MT	82.01		
5	**Installation of Stubs including nuts and bolts**	MT	25.26		
6	**Erection of various type of towers, complete body with approved extensions / leg (equal / unequal) extensions (complete) including bolts & nuts, step bolts. Hangers, D shackes, etc. including punching up to ACD**	MT	504.67		
7	**Installation of following tower accessories**				

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7.1	Danger Plate	Nos.	57.00		
7.2	Number Plate	Nos.	57.00		
7.3	Phase Plate (Set of three)	Sets	57.00		
7.4	Aviation Requirements				
7.4.1	Span Markers	Nos.	20.00		
7.4.2	Aviation Signal/Obstruction Light (to be provided as per IS:5613)- Medium Intensity	sets	15.00		
7.5	Counterpoise Earthing as per specification				
7.5.1	30mtr * 4 legs	Sets	57.00		
7.5.2	70mtr * 4 legs	Sets	5.00		
7.6	Pipe Type Earthing (One of the leg of each tower if required)	Sets	5.00		
7.7	Circuit plate (Set of two)	Sets	57.00		
8	**Supply & Installation of following items for tower protection works**				
8.1	RRM in (1:5 Cement: Mortar) complete work including excavation & back filling with selected materials	Cu.m	861.97		
8.2	Gabion wall Stone bound in G.I mesh 4mm (8SWG) (including excavation & weaving of mesh)-3m Height	Cu.m	572.10		
8.3	M15 (1:2:4) nominal mix concrete for top seal cover of revetment including centering and shuttering	Cu.m	7.63		
8.4	Supply and concreting the PCC U-shape drain of 100 mm thick base, 100 mm thick side wall, 600 mm base width and overall depth of 450 mm in nominal mix of 1:2:4 concrete with 20 mm aggregate and 50 mm thick pad of concrete of 1:3:6 nominal mix with 40 mm aggregate including the earthwork in excavation, compaction of the base soil, backfilling with selected materials, disposall of surplus earth within 50 m lead, centering and shuttering, shoring, etc.., all complete	m	806.66		
8.5	Providing and Construction crib walls with timber section of 100 to 150 mm diameter including excavation in all types of soil and back filling as per the drawing. The rate shall include for excavation to foundation level, disposal of surplus excavated materials within all lead as per the site engineering, providing, laying timber sections as specified back filling with compaction, reinstatement of (road) surfaces works, bioengineering as well as all labour, equipment, tools and incidentals necessary to complete the works.	Sq.m	635.66		
9	**Stringing of Conductors and OPGW**				
9.1	Laying, stringing, tensioning, clamping, jointing, etc., all complete of ACSR Panther Equivalent ACCC conductor including hoisting of insulators/strings, hardware fittings, dampers and all other accessories for all three phase of double circuit power conductors for complete route.	Linear km (*)	17.56		
9.2	Stringing of OPGW including fixing of OPGW Accessories, Jointing box and Hardware etc… all complete.	Linear km (*)	17.56		
10	**Supply and installation of spiral bird diverters with Accessories on OPGW**				
10.1	Supply, spiral bird diverters including insurance and handling Testing, inspection and commissioning, all incidental work etc. as per the technical specification	Nos.	1,980.00		
11	Occupational Health and Safety	Lump sum			
Total of Schedule 2					

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(*) Linear km is the horizontal distance measured between the conductor / OPGW attachment points of adjacent towers. The rate shall thus include allowances for unequal attachment heights, sag, scrap, creep or jumpers, OPGW splicing requirements including coiling and downleads etc. No additional amount will be paid for supply and erection of any mid-span joints / repair sleeves / repair armour rods etc., since these shall be avoided and if used, will be with explicit approval from Employer.

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Daywork Schedule

Specified Provisional Sums

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Summary of Bill of Quantities

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Section 5: Eligible Countries

Regional Member	
Afghanistan	Solomon Islands
Armenia	Sri Lanka
Australia	Taipei, China
Azerbaijan	Tajikistan
Bangladesh	Thailand
Bhutan	Timor-Leste
Brunei Darussalam	Tonga
Cambodia	Türkiye
People's Republic of China	Turkmenistan
Cook Islands	Tuvalu
Fiji	Uzbekistan
Georgia	Vanuatu
Hong Kong, China	Viet Nam
India	**Non-regional Member**
Indonesia	Austria
Japan	Belgium
Kazakhstan	Canada
Kiribati	Denmark
Republic of Korea	Finland
Kyrgyz Republic	France
Lao People's Democratic Republic	Germany
Malaysia	Ireland
Maldives	Israel
Marshall Islands	Italy
Federated States of Micronesia	Luxembourg
Mongolia	Netherlands
Myanmar	Norway
Nauru	Portugal
Nepal	Spain
New Zealand	Sweden
Niue	Switzerland
Pakistan	United Kingdom
Palau	United States
Papua New Guinea	
Philippines	
Samoa	
Singapore	

Section 6: Works' Requirements

This section comprising Works' Requirement contains the Specifications, Project Signage Requirements, Environmental, Health, and Safety (EHS) Management Requirement, Drawings, Supplementary Information that describe the Works to be procured, Key Personnel Requirements, and Equipment Requirements.

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Technical Specifications for Wobthang Transmission Line

For detailed technical specifications, please refer to the separate document ‘Technical Specification’**.**

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Project Signage Requirements

Notes

1. The Contractor is responsible for the design, supply and installation of the project information signage. The signage shall provide relevant information to the public about the project, including the proper designation of the project, the Employer, the Contractor and the Bank.

2. For this purpose, one or several sign boards shall be installed at the Site as soon as practicable after the Commencement Date and shall remain in place at all times until taking-over of the Works. If sign board(s) is(are) damaged or becomes unreadable during this period, it shall be promptly replaced by the Contractor at the Contractor's cost.

3. The sign board design shall be submitted by the Contractor to the Engineer for Review in accordance with Sub-Clause 4.4.6 [*Sign Board Design*]. Unless otherwise required under the applicable Laws, the sign board design should comply with the following:

   a) General

   - The number and locations of sign board(s)

   b) **Content**

   - Borrowing Country's flag/logo
   - Project and Contract title
   - Accepted Contract Amount
   - Time for Completion
   - Bank's name and logo (in accordance with Branding Tool Kit – Visual Identity guidelines of the Asian Development Bank and, as the case may be, the other financiers' requirements)
   - Employer's name
   - Contractor's name
   - Engineer's name
   - Complaint handling contact information (email and/ or phone number)

   c) Design

   - The General layout including sample colors: to be proposed by the Contractor
   - Dimensions: minimum of 2.5 Meters X 2.5 Meters
   - Font size and type: they should be such as to ensure that the content shall be visible from a distance.
   - Language of the signage: national and/or local language and English
   - Material: the sign board(s) shall be made of a material that shall be weatherproof and appropriate to withstand the whole execution period until taking-over of the Works

4. No other signage is allowed except with the approval of the Engineer. The Contractor shall not post, nor display any sign or item that could provide misleading information about the project. No national symbols or flags other than those of the Country may be displayed without the express approval of the Engineer.

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Environmental, Social, Health, and Safety Management Requirement

The Contractor shall submit, as part of the Technical Proposal, an Environmental Management Plan (Bidder's EMP) and other E&S management documents, as outlined below, as may be relevant, commensurate with the risks and impacts of the proposed works and activities as described in the project ESIA"

The Contractor will ensure to adhere to its responsibilities as per the Environment Management Plan (EMP) and Biodiversity Management Plan (BMP) in the Environmental and Social Impact Assessment (ESIA) and relevant provisions of Resettlement Plan (RP) which are attached to this document as Annexure 1 & 2 (EMP & BMP) and Annexure 3,4, 5 & 6 (RP) respectively. The contractor will be obligated to undertake relevant mitigation and monitoring actions as set out in the EMP at the construction site for the transmission line as well as at any temporary workers camps/overnight accommodation provided by them, and to assist with operation of the Grievance Redressal Mechanism (GRM). The Contractors' responsibility will include but not be limited to the following.

General

- Ensure all their subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the final EMP and BAP and any updates to it, as well as their own CEMP and that this responsibility is cascaded down any chain involved.
- Implementing all actions and responsibilities allocated to the contractor under the EMP and BMP for the full duration of the contractor's involvement in the project and relevant provisions and section of contract on RP.
- Not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB SPS
- Coordinate meaningfully with affected community and households prior to start of any construction activities and throughout the implementation period.
- Put in place appropriate incentives and/or penalties for non-compliance by workers related to disregard requirements set forth in the EMP and BMP, avoid using PPE, and prohibit firewood/NTFPs collection and fishing, hunting, or poaching by workers.
- Comply with any corrective action plan (CAP) required and cover the costs where corrective action is required due to non-compliance on behalf of the contractor, its subcontractor or third parties.
- Ensuring adherence to all applicable Royal Government of Bhutan environment, health, safety, and labour laws and regulations in force at the time.
- Ensuring adherence to ADB's SPS (2009) and ESS6, and the related IFC Environment, Health, and Safety (EHS) general guidelines.
- The contractor will maintain a corporate EHS policy and, preferably, hold environmental management certifications such as ISO 14001 (or equivalent) and occupational health and safety certification such as ISO 45001.
- Ensuring adequate budget and staff resources are allocated to comply with and implement the contractor's responsibilities under the EMP and BMP and to supervise and monitor the active construction site to protect the environment and ensure the health and safety of all workers and affected communities.
- Preparing a Contractor's Environment Management Plan (CEMP) with all other subplans as specified in the EMP and BMP for review and approval by BPC prior to the commencement of works.
- Ensuring that all construction workers, including all formal and informal employees and subcontractors, understand their responsibilities to implement the EMP and BMP and mitigate and manage environmental impacts associated with pre-construction and construction activities

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- Providing and ensuring attendance at EHS, OHS, community health and safety, biodiversity, and all other relevant training for formal and informal construction workers and other personnel as required. All trainings, including induction and regular tool box talks, will be recorded and reported within monthly environmental monitoring reports.
- Employing adequately skilled and experience workers, ensuring each is appropriately trained and certified to safely and effectively carry out their roles and responsibilities. Qualified first aiders and trained fire marshals will be on site as well as an EHS Experts and a Biodiversity Specialist.
- Ensuring worker recruitment records and worker contracts are provided and align with national an good international practice worker and labour requirements.
- Adopting a zero-tolerance approach to OHS on the project, enforce all workers to comply with the OHS requirements of the EMP and BMP including the wearing of appropriate PPE on the construction site. All issued PPE will be logged and inventoried.
- Supporting Employer in undertaking ongoing meaningful public consultation and implementing the site-level GRM; in particular, the contractor's GRM focal shall thoroughly document details of complaints and make its best efforts to immediately resolve the complaints at project site level; all GRM related information will be reported in the contractor's monthly reports to BPC.
- Submitting monthly environmental management reports to the Employer (the reports to be included as part of the contractor's monthly progress reports), relating the work undertaken over the reporting period and documenting environmental mitigation and management measures including monitoring and survey activities that have been carried out, problems encountered, record data including near misses and accidents, grievances received, workers welfare, labour issues, functionality of the GRM, spills, accidents, training, and toolbox talks etc, and all follow-up actions that were taken (or will be taken) to correct problems.
- Informing the Employer immediately in case of any approved detailed design changes or unanticipated environmental impacts occurring during the project implementation stage, and as required, provide any information needed to the Employer to enable them to promptly update the ESIA/EMP/BMP for clearance by ADB before any changes are implemented.

Informing the Employer within 24 hours in case of chance find or accident on site and within 48 hours provide an incident report with corrective actions detailing how reoccurrence will be prevented.

CEMP

A Contractors' Environmental Management Plan (CEMP) will be prepared by the Contractor and approved by the Employer prior to any works commencing on site. The CEMP will provide details on how the contractors plan to implement the EMP and BMP and relevant parts of the IFC EHS Guidelines on Construction and Demolition. The CEMP will be required to be updated as necessary to accommodate incidents (e.g. construction methods or site conditions change, or in response to an accidents, incidents, near misses), and re-approved by the Employer. The CEMP will include a Construction Method Statement identifying all construction activities, schedule, off- and on-site access routes, anticipated traffic volumes, and construction methods to be used as well as temporary construction facilities needed and their location e.g., laydown areas, water source, stores, construction workers rest areas, toilets/washrooms, temporary workers' camps/overnight accommodation etc. The CEMP need to include

BMP

Key information set forth in the BMP relating or mitigation, management, surveys, and/or checks must be adhered to, implemented, and correctly scheduled to ensure impacts to wildlife, habitats, and trees are avoided or minimized. All vegetation must be physically inspected for active birds nests, mammals, reptiles within 24 hours of it being removed (with further checks required if delays occur), such pre-clearance checks will act to confirm no presence of wildlife. Works will be scheduled to avoid bird nesting seasons, and restricted to avoid disturbance of fauna, minimizing dust, noise and light where possible. Ecological toolbox talks and biodiversity awareness training will be conducted to ensure various methods and techniques of vegetation removal are understood and applied, and information on invasive species, meaningful consultation, topsoil preservation, and the avoidance of key areas. Bird diverters must be purchased from a reputable company as approved by the International Biodiversity Specialist prior to their installation.

M**anagement Plans**

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The proposal shall also include details relating to in-house policies and procedures acceptable to the Employer for E&S management such as the existence of official company procedures, plans (proportionate to risks) and monitoring / reporting systems including, but not limited to the following:

i. ***Health and Safety Management Plan (HSMP).*** The plan will document outlining the Projects systematic approach to preventing workplace injuries, illnesses, and incidents by identifying hazards, assessing risks, implementing controls (elimination, substitution, PPE), ensuring legal compliance, and providing training, all driven by visible leadership and worker involvement. It details responsibilities, emergency procedures, and performance monitoring to create a proactive safety culture, moving beyond reactive fixes to protect workers and meet regulatory duties.

ii. ***Pollution Prevention Plan*** Designed to eliminate or reduce waste and pollutants at the source before they are created, treated, or disposed of. It identifies, evaluates, and implements methods—such as using greener materials, improving efficiency, and changing processes—to save money, enhance safety, and ensure compliance with environmental regulations

iii. ***Blasting Management Plan*** *(if necessary)* Detail how blasting activities will be planned and executed, how explosives will be stored and used on-site in accordance with the Bhutanese Explosive Rules and how occupational and community H&S risks will be managed

iv. ***Site Restoration Plan.*** To be developed to ensure all work sites will be cleaned, rehabilitated and restored to an acceptable condition after work is completed

v. ***Air Quality, Noise and Vibration Management Plan*** Detail construction noise from all sources will be controlled and monitored to prevent disturbance to nearby residents, institutions/schools, health clinics and religious sites

vi. ***Solid and Hazardous Waste Management Plan*** To cover solid and hazardous wastes generated to be managed in an environmentally sound and safe manner, per national regulations and the IFC EHS General Guidelines section on Waste Management

vii. ***Traffic Management Plan*** A comprehensive document outlining strategies to manage vehicles, pedestrians, and cyclists safely around construction sites, events, or road works. Its primary purpose is to eliminate or reduce risks by controlling traffic, ensuring safety, and minimizing disruption. Key elements include site maps, hazard identification, traffic control measures, and designated routes.

viii. ***Emergency Preparedness and Response Plan***. To include communication systems and protocols to report an emergency e.g., health emergency, work-related accident, traffic accident, accident involving the community, natural disaster including landslide, fire especially forest fire, virus outbreak etc.

ix. ***Labour Management Plan*** To outline policies, procedures, and resources to manage labor risks, ensure compliance with national labor laws and ADB SPS (2009) requirements, and promote fair, safe working conditions

x. ***Invasive Species Management Plan.*** Identification of target species, clear objective setting, implementation of integrated control methods (physical, chemical, biological), and long-term monitoring. Key components include early detection and rapid response

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(EDRR), mapping infestations, stakeholder collaboration, and habitat restoration to prevent re-establishment. (#G1 of Table IX-3)

xi. ***Worker Accommodation Plan***. A strategic document ensuring that staff housing meets health, safety, and hygiene standards. Key requirements include, but are not limited to, providing adequate space per person, separate single-sex rooms, proper ventilation, sanitary facilities, fire safety, and adequate recreation areas.

xii. ***Community Engagement Plan.*** A document outlining how a project will identify, analyze, and communicate with individuals or groups (stakeholders) affected by or influential to its success, detailing who, what, when, and how to engage them through clear communication, feedback, and involvement to build trust, manage expectations, and achieve project goals. Key components include, communication methods, engagement frequency, responsibilities, and feedback mechanisms, ensuring transparency and alignment throughout the project lifecycle.

xiii. **Sediment and Erosion Management Plan.** A document for construction projects that details strategies to manage soil erosion and runoff, protecting local waterways from pollution. It is a "living" document to guide upon most appropriate and management practices such as installing silt fences, sediment basins, and stabilized site entrances

xiv. **Vegetation Clearance Management Plan (see BMP)** is a structured framework designed to maintain safety and compliance by managing vegetation near infrastructure, such as electric lines or within construction corridors. It ensures that minimum clearance spaces are maintained, reducing fire risks and preventing service disruption

Grievance Redressal Mechanism (GRM)

The Contractor will require to take necessary steps to operationalize the GRM as mentioned in the Resettlement Plan (RP). The GRM needs be set up and be operationalized before the commencement of any civil works, including enabling works. The contractor is required to engage a GRM focal person from the pre-construction stage and maintain throughout the construction period. The contractor's focal will actively engage with the aggrieved local communities and construction workers throughout pre-construction and construction stages. During construction, for any urgent matter, emergency and H&S issues, the contractor's site-level focal is required to take note of the grievance/complaint, record it in the GRM register maintained at site, and get immediately in contact with the Contractor's Environmental & Health Supervisor (EHS) along with the Community Liaison Officer (CLO) of the Employer. The Contractor will also have in place, prior to works commencement, a functional *workers* GRM and a grievance log for all staff to access.

Resettlement Plan

The Contractor shall comply with all applicable social, labor, and occupational health and safety standards under Bhutanese law and the Asian Development Bank's Safeguard Policy Statement (2009), including the strict prohibition of child labor and forced labor. The Contractor shall restore all temporarily affected land to at least its pre-project condition at no cost to affected persons. A dedicated staff member shall be appointed to manage grievances at the contractor level, participate in the project-level Grievance Redress Committee provided in the Resettlement Plan, and liaise with local communities to ensure timely and effective communication. For works near settlements or public roads, the Contractor shall provide adequate advance notice of construction schedules and anticipated impacts.

All construction activities, including access, equipment, and material storage, shall be strictly confined to designated project boundaries, rights-of-way, and corridors of impact provided by Employer, unless prior approval is obtained. Encroachment onto private land is prohibited, and the Contractor shall clearly

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demarcate work areas and implement measures to prevent unauthorized use of private property. Any encroachment that occurs must be immediately reported to the Employer, and the Contractor shall be responsible for all necessary corrective and restorative actions. The Contractor shall give preference to employing members of project-affected households and use local products as feasible and appropriate, including women and individuals identified as vulnerable or disadvantaged, for both skilled and unskilled work, based on their skills and interest.

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Drawings

Please refer to the separate document ‘Technical Specification’

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Supplementary Information Regarding Works to Be Procured

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Key Personnel Requirements

Using Form PER – 1 and PER – 2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements. The list of key personnel should be consistent with Section 3 (Evaluation and Qualification Criteria):

No.	Position	General Qualifications	Total Work Experience (years)	Experience in Similar Work (years)
1	Project Manager	Min. Bachelors	10+ years	5+ years of experience in Transmission line
2	Project Engineer	Min. Bachelors in Civil/Electrical Engineering	5+ years	2+ years of experience in Transmission line
3	Site Supervisor	Min. Diploma in Civil Engineering	Civil Engineer with 5+ years of experience	2+ years of experience in Transmission line
4	Site Supervisor (Electrical)	Min. Diploma in Electrical Engineering	Electrical Engineer with 5+ years of experience	2+ years of experience in Transmission line
5	Survey Engineer	Min. Diploma in Survey Engineering	Survey Engineering with 5+ years of experience	2+ years of experience in Transmission line
6	Environmental Health and Safety Expert	Min. Degree in environmental science/environmental management/environmental engineering/safety or equivalent	5+ years of experience in projects	2+ years of experience in Transmission line
7	Biodiversity specialist	Min. Bachelors with Experience in ecology, forestry and preferably ornithology	5+ years of experience in projects	2+ years of experience in linear infrastructure projects
8	EHS on-site supervisor	NEBOSH/IOSH (or similar qualifications)	5+ years of experience	

Alternative candidates for key positions shall not be evaluated.

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Using Form EXP-6 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has EHS personnel who meet the following requirements:

Key Personnel as Determined by the Environmental Management Plan (EMP) and other safeguard management plans[1]

No.	Position/Specialization	Relevant Academic Qualifications	Minimum Years of Relevant Work Experience	Minimum Time On-site (%FTE)
1				
2				

FTE = full-time employee.

[1] For projects categorized as Category C for environment for which no EMP has been prepared, there is no need to consider this table.

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Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

No.	Equipment Type and Characteristics	Minimum Number Required
A	**Foundation works:**	
1	Concrete Mixer	3
2	Concrete Vibrator (M/C5)	3
3	Total Station	2
B	**Erection & stringing works:**	
1	Winch Machine	3
2	Dead end Compression Machine (Hydraulic)	3
3	Dynamometer	3
4	Turn Table	3

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Contract Management Plan

The Contractor shall prepare the monthly progress report as per the format defined hereinafter, also referred to as the Contract Management Plan, in line with the requirements stipulated in Sub-Clause 4.20 [*Progress Reports*] and in Part D of the Particular Conditions [*Metrics for Progress Reports on Environmental, Health, and Safety (EHS)*].

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Annexure 1: Environmental Management Plan

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Pre-construction phase					
General risks	Reduce risks	1. Integrate all ESIA-EMP requirements (including the EMP) into the bidding documents and civil works contracts; 2. Compliance with national laws and regulations and SPS 2009 requirements 3. Appoint a qualified and experienced E&S Officer (fulltime) upon loan effectiveness for the project 4. BPC to appoint dedicated safeguard specialists 5. Complete site-specific geological and geotechnical investigations for tower and foundation locations. 6. Ensure the Bill of Quantities (BOQ) follow the prevailing Bhutan Schedule of Rates (BSR) 2025 which includes a Guideline for OHS, and Guideline for Temporary Living Accommodation 7. Ensure obtainment of Environmental Clearance for TL and Roads, Clearance from Department of Surface Transport, Forest Clearance prior to the commencement of the construction activities 8. Within three months of receiving the Environment Clearance, prepare a detailed implementation plan and submit to DECC for no-objection 9. Review and approve the CEMP together with PIAC 10. Finalize the training program with PIAC 11. When unanticipated environmental impacts become apparent, inform ADB and update the IEE for clearance and disclosure by ADB	PMU/PIAC	PMU	- EMP included in bid documents; EMP cost items included in BoQs - Environmental Clearance for TL and Roads, Clearance from Department of Surface Transport, Forest Clearance obtained prior to works and shared with contractors - Detailed Implementation plan - No breaches of national regulations and/or international good practice guidelines. No breaches of EMP, contractor, subcontractors or other third parties with prompt corrective action taken if required. Status of EMP compliance documented in EMRs - Prepare and submit semi-annual EMRs for ADB review and approval as per required timelines and schedule - Report any accidents, fatalities to ADB within 48 hours as well as any unanticipated incidents along with corrective actions taken within one week
Contract award and mobilization	Contractor awareness	12. Organize and conduct pre-bid meetings with potential contractors. Topics will cover compliance requirements (ADB and national requirements), budgeting for EMP provisions, need for a dedicated personnel and experts (ESS expert, EHS expert and an ecologist) on the team, preparation of CEMP, self-monitoring and reporting	PMU / PIAC	PMU	- Pre-bid meeting participant list - Briefing documentation and participant list

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		requirements 13. Once the Contractor is selected conduct awareness training on responsibilities and actions set forth in EMP, BMP and BAP implementation, to comply with ADB and RGoB requirements (Labour and Employment Act of Bhutan 2007 and Rules and Regulations on Occupational Health and Safety and Welfare, 2022, the Regulation on Occupational Health and Safety for the Construction Industry 2022)			
	Contractor staffing, planning budgeting and implementation of safeguards	14. Appoint qualified and experienced safeguard staff as detailed under Chapter 8 15. Ensure all subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the final EMP and any updates to it, as well as their own CEMP and that this responsibility is cascaded 16. Subcontractors to be required to appoint an EHS representative for each construction site. EHS representative must have the necessary training, experience and certification 17. No illegal forced or child labor to be employed in construction with the minimum age for employment on the construction site to be 18 given hazardous nature of works involved – no persons under 18 to be employed 18. Contractors must not discriminate and must proactively encourage the employment of suitably skilled women on the project 19. Contractor to prepare a detailed training plan upon contract award elaborating how training and awareness raising activities required by EMP will be conducted. Training should not be limited awareness level but is dependent on the roles and responsibilities. H&S sensitive positions e.g. rigger, scaffolder, excavation competent person etc. should have the necessary	PMU / PIAC	PMU	- Appointment letter for safeguard staff to the project - Approved CEMP with Subplans (HSMP, Pollution prevention plan, blasting plan, site restoration plan, air quality, noise and vibration management plan, solid and hazardous waste plan, traffic management plan, emergency preparedness and response plan, labour management plan, worker accommodation plan, and stakeholder engagement plan. - Approved training plan - Number of approved subcontractors - Minutes of coordination meetings, participant list - Inclusion of budget for worker accommodation, OHS, trainings - Training reports

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		experience and certifications 20. Contractors must proactively encourage local employment for unskilled roles whilst ensuring suitably qualified and experienced workers for skilled role 21. Plan, coordinate and conduct specialized training and induction for staff and workers in collaboration with the local forest office, police, health personnel and gewog. 22. Prior to the start of and then throughout construction contractor to conduct training for construction management and provide all workers and visitors onsite, irrespective of them being formally or informally employed by contractor, subcontractor or third-party with an EHS induction before being allowed on-site including dos and don'ts in relation to construction site, temporary workers camps, local communities, forests, protected area 23. Provide all workers with: (i) EHS induction training, (ii) Daily Toolbox Talks, (iii) monthly HIV/AIDS awareness trainings, (iv) monthly first aid & ERP trainings, (v) quarterly training on SEAH, code of conduct and culturally acceptable practices, biodiversity conservation awareness, prohibition on firewood and NTFPs collection by workers, prohibition on fishing, hunting, or poaching by workers; chance find procedures; H&S including use of PPE etc. 24. Document retain records of all training activities.			
Detailed design and updates to ESIA	Minimize land use change	25. Contractors to ensure that detailed designs reflect the requirements of the ESIA/EMP and international engineering best practice/good EHS practice including site-specific measures where these are required 26. Finalize access road alignments, stream crossing and the number and location of culvert 27. conduct a detailed structural assessment of load carrying capacity of existing bridges and if required provision for upgrade of the bridges to accommodate project vehicles	PMU / PIAC	PMU	- Land Use certificate - No objection provided for the locations of contractor facilities - Number of diverters and insulation incorporated into design - ESIA updated as required to reflect detailed design and any unanticipated impacts and

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		in consultation with Department of Surface Transport and the Gewog 28. Identify suitable muck disposal sites for road construction 29. Follow the Guidelines for Environment Friendly Road Construction (EFRC)" issued by the Department of Roads (2019) 30. Identify gradient management needed at certain points to ensure safe and efficient transportation. 31. Ensure provision of proper engineering solutions to enhance road usability and safety. 32. At Take Off points from highway, gewog and farm roads, maintain adequate buffer for future road widening and safety as per Road Act 2013 and the conditions of the Department of Surface Transport. 33. Follow BMP to minimize impacts beyond the RoW for both TL and access roads. 34. Through design, ensure the vegetation clearance and slope cutting is kept to the required minimum as per DOFPS requirements 35. Include measures in design to mitigate impact on birds, see BMP 36. Align roads as much as possible so that these are co-located within the RoW to reduce project footprint and where possible, minimize number of permanent roads 37. Locate site contractor facilities (site offices, storage sheds, worker camps), away from communities and sensitive receptors and on already disturbed, degraded or non-productive land.			reviewed and cleared by ADB prior to the start of related works - Finalized detailed for access road alignment - Confirm and assess suitability of muck/soil disposal sites and include in updated ESIA. - Include meeting minutes of community consultations in updated ESIA
Construction EHS management planning		38. Contractor to develop Contractors site-specific Environmental Management Plans (CSEMPs) and H&S Plans including all subplans as required by the EMP to be approved by BPC in line with IFC EHS guidelines including the Construction and Demolition section and ILO Code of Practice. These will be living documents, to	Contractor	PMU/PIAC	- CSEMPs/H&S Plans and all subplans cleared and approved before work are reflective of Project EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project.

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		be updated as required and re-approved by PGCB as construction proceeds, if construction methods or site conditions change 39. Facilities generating noise and dust or those that may generate sediment laden runoff or wastewater (e.g., concrete batching plant, asphalt plant, refueling areas, labor camps, maintenance yards, storage areas) must be sited at least 500m from residential property and outside biodiversity sites, protected areas, physical cultural resource. 40. HSMP will contain Safe Systems of Work (e.g. PTW) / Safe Work Practices especially for high consequence activities e.g. lifting and rigging, TL stringing etc. b) risk assessment and control (high level and site/activity specific) 41. Laydown and storage areas that are not potential pollution sources may be located a minimum of 50m distant. No land requiring extensive landfill or levelling will be used, there will be no clearance of trees/vegetation on land to be used by the contractor. Photographic record of land condition to be undertaken before any works to establish temporary facilities. 42. Contractor to seek to locate all temporary construction facilities required including laydown and storage areas in suitable areas, non-sensitive areas as agreed to by BPC. Any use of public or private land required for temporary construction facilities will be negotiated with private landowner and submit land ownership papers and copy of agreement for temporary land use with a photographic record of pre-project condition. 43. Sites that are waterlogged or supporting natural habitat must not be used. Drainage must be installed at all temporary facility locations to avoid waterlogging – the drainage must not exacerbate waterlogging on the adjacent land.			- Copies and any updates to these plans are to be attached to EMR - Abide by requirements set forth in Workers' accommodation: Processes and Standards: A guidance note by IFC and the EBRD (2009)

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		44. Design of sanitation and welfare facilities at construction sites and labor camps/overnight accommodation to conform to IFC EHS general guidelines, ILO's guidance on worker accommodation and national regulation 45. If contractors use existing or install their own borewell for construction water supply permissions will be obtained from authorities together with agreement of local communities before abstraction 46. Contractors will use locally sourced materials as far as practical to reduce transportation, but all raw materials will be sourced only from existing licensed source 47. Contractors to provide adequate facilities for the collection, separation, and storage of construction waste			
Change in land use	The land use within the RoW and access roads will be permanently changed from forest/grazing land	48. Align the roads as much as possible so that these are co-located within the RoW to reduce project footprint 49. Ensure the vegetation clearance and slope cutting is kept to the required minimum 50. Aside from the TL and road, site contractor facilities such as site offices, storage sheds, worker camps on already disturbed, degraded or non-productive land. 51. Wherever possible, minimize the number of permanent roads 52. Restore cleared and disturbed areas to original or equivalent pre-project land use	Contractor / PIAC	PMU	- Detail road design site inspection records of contractor facilities - restoration report
Project design	Land acquisition	53. Provide compensation to the affected people following the resettlement plan before construction commences	PMU	PMU	- Compensation completion report - Signed receipts
Community Forest	Compensation of loss of community forest resources	54. Compensate the Community Forests for loss of timber and non-wood forest products (NWFP) 55. Provide cut trees to the respective Community Forests, if required by the CFMGs.	PMU	PMU	- Compensation payment receipts - Engagement of community forest members in tree removal - Receipt of trees felled by community forest

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		56. Engage CFMG members to carry out tree felling and clearing activities, where feasible, to ensure minimum disturbance beyond the approved Right of Way (RoW); and avoid over-clearing of vegetation.			
Community Forest	Reduce loss of NWFP	57. Map key NWFP collection areas within the Community Forest; and agreed upon with the community. 58. Strictly prohibit workers from collecting fuelwood, timber, or non-wood forest products from Community Forests 59. Avoid removal of undergrowth, unless alternative NWFP collection areas are identified 60. Include degraded areas with the community forest for Compensatory Afforestation	PMU/PIU	PMU	- Through community consultation develop detailed maps of NWFP areas
Community Forest	Compensation for removal of trees on community forest	61. Pay compensation for removal of trees on community forest	PMU/PIU	PMU/Gewog	- Degraded areas in community forest included under compensatory afforestation plan
Cultural Heritage	Determination of cultural heritage sites and practices	62. Carry out consultation and mapping to establish if there are any potentially important tangible and intangible cultural heritage that may be in use by the local community. 63. BPC will update the community on the revised project timeline and project commencement date via Gewog, 64. Minimize impacts on cultural heritage, Consultation and information dissemination	PIU/PIAC	PMU	- Attach map to EMR - Update ESIA as necessary
Employment	Provide local employment	65. Contractor will disseminate information on job opportunities or mitigation measures under subplans, prepare contracts with local communities, and keep them informed in case of any changes in project design. 66. Contractors will also discuss and agree upon tree felling sub-contracts with the community	Contractor	PIU	- Consultation record - Community contracts

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Establishment of a functioning Grievance Redress Mechanism (GRM)		67. Contractor's EHS team too operationalize the informal site level GRM per ESIA to resolve and address grievances entering the formal GRM 68. Maintain record of all grievances registered, status, time taken for redressal and outcomes, etc. 69. Nominate a GRM Focal Point for each construction site who will keep affected persons and local communities informed of the status of work and be readily available onsite to receive, document and deal with grievances at site level 70. GRM to be disseminated through community meetings, one-on-one consultations, posters, leaflets, brochures, SMS, or sign boards in prominent areas. Contractor to provide notice boards at all substations, construction site offices and active work sites including highly visible details of the GRM including the name, designation, contact numbers 71. GRM will be available to all workers to receive and handle complaints about unfair treatment or unsafe living or working conditions, ensuring no coercion nor reprisal. Construction workers will be given access to register any grievances with the contractors or direct access to the GRM Focal person 72. Contractor to carry out awareness raising among workers on the GRM at the start of employment onsite, including details on how to submit a grievance, process, and timeframes including disseminating GRM contact details on noticeboards and placing suggestion boxes at construction site offices and at employer provided staff accommodation	Contractor	PIU	- Notification on establishment of the GRM and nomination of GRM focal person - Photographic evidence of GRM posters, signboards - Copies of GRM dissemination materials - Community feedback and consultation records
Meaningful consultations, information disclosure and community awareness		73. Prepare a detailed stakeholder engagement plan for meaningful consultation with the local community 74. Contractor to consult with and seek agreement of landowners and local communities within 500m on	PIAC/PIU	PMU	- Stakeholder engagement plan prepared, and ESIA (minimum of a summary of key risk, impacts and management measures) locally disclosed and accessible to affected person in a suitable language

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		proposed locations for any temporary labor camps, site offices, storage areas, areas for waste management 75. Contractor to consult with and seek agreement of local communities to temporarily use any community resources (e.g., water supplies) during construction to ensure additional demand will not place unnecessary stress on community resources 76. Contractor to communicate at least one month prior to the commencement of works advance notice to local communities through community meetings, one-on-one consultations, posters, leaflets, brochures, SMS, or sign boards in prominent areas about the agreed schedule of and details of the planned construction works including its anticipated impacts, such as traffic disruption (road closures, diversions, including notices/signs on either end and marking of the diversion routes) to help manage any disruption and disturbance to and potential conflicts with local communities			- Details of all consultations and awareness raising included in the EMR
Construction Phase					
Worker recruitment	Employment opportunities and labour management	77. Ensure that bidding and contract documents include specific provisions requiring contractors to comply with all applicable labour laws and core labour standards 78. Hire local workers to the extent possible, to benefit the local communities through employment generation and also reduce the risk from the influx of workers. 79. Prepare a Contractor's Labor Management Plan (LMP) as a component of the CEMP. 80. Comply with national rules for local and foreign worker recruitment, including the Handbook on Recruitment and Employment of Foreign Workers in Bhutan. 81. Provide all workers with clear, written employment contracts with clear employment terms, detailing working hours, wages, overtime, leave, and benefits and	Contractor / PIU	PMU	- Record of local employment

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		compliance with codes of practice and standard procedures 82. Comply with labour regulations restrictions on employment of persons below 18, forced or coerced labor, discrimination, 83. Brief workers on gender discrimination and sexual harassment and establish as functional worker grievance redress mechanism (GRM) for workers to raise concerns regarding working conditions, terms of employment, 84. Ensure that EMP requirements are cascaded down to all sub-contractors, regardless of whether they are formally or informally employed			
Environment safeguards training and awareness raising activities		85. Contractors to ensure workers with a specific role have, before been allocated the task, attended specialized health and safety training related that role e.g., health and safety stewards, first aiders, fire safety officers, as well as ensuring workers have received task-specific training for working at height, demolition, working with electricity, etc. 86. Only allow suitably trained and qualified workers to work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height and be provided with and wear the appropriate PPE for their role. 87. Untrained workers must not be permitted to work with either live electricity or at height. During construction site and activity specific risk assessments to be undertaken prior to the commencement of related work to identify the hazards present and applicable measures to be followed. 88. Contractor to undertake regular, compulsory awareness raising activities for all workers related to the EMP, including short monthly EHS refresher sessions, daily toolbox talks and posting of information at construction	PIAC/PMU	PMU	- Training records (date, participants and topics) - Risk assessment report - Emergency Drill reports - Certificates of specialized positions (electricians and firs aiders) and worker competency record - Site inspection reports - Chance find procedure briefings conducted.

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		site offices, labor camps, and all work sites etc. 89. Contractors to conduct regular emergency preparedness and response drills involving all workers irrespective of them being formally or informally employed by contractor, subcontractor or third -party to prepare them in case of an environmental or health and safety incident including fire, spillage, natural disaster, disease outbreak, etc. 90. Emergency preparedness and response training for construction management will include modules on first aid and fire safety including training on how to use first aid and firefighting equipment provided onsite. 91. All construction workers to be made aware of the chance-find procedure and types of finds to be reported. 92. Driver training to include advice on behaviour to reduce the potential for disturbance			
Construction workers	Occupational Health and Safety	93. Comply with the Regulation on Occupational Health and Safety for the Construction Industry, 2022, 94. Prepare, as part of the CEMP a Health and Safety Management Plan (HSMP) and a Construction Emergency Preparedness and Response Plan prior to commencement of works. 95. Ensure all staff comply with approved health and safety policies, procedures, safety programs, and work rules at all times. 96. Provide appropriate training and supervision to all personnel, 97. Allow only trained and certified personnel for technical work such as stringing of conductors, 98. Clearly identify, mark, and barricade hazardous areas and trenches/excavated areas, including warning signs indicating hazards	Contractor	PIU	- Approved Health and Safety Management Plan (HSMP) and Construction Emergency Preparedness and Response Plan (CEPRP) - Records of worker induction and refresher trainings, - Site inspection reports - Vehicle inspection logs - PPE inventory and issuance records, - Qualified first aider(s) and trained fire marshal(s) on site - Displays/signage/barricades - Occupational injury and illness register, including reporting and compensation records

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Natural Hazards and Disasters	Minimize risk of damage to Project facilities due to natural hazard and disasters	99. Integrate disaster-resilient design standards (seismic design, slope stability criteria, drainage capacity) for all tower locations along with slope protection structures based on site specific assessments. 100. Ensure safe setbacks from rivers, streams, and steep slopes. 101. Strengthen coordination between Dzongkhag, gewog, Royal Bhutan Police (for firefighting) and BPC for emergency preparedness in case the need arises.	PIU/PIAC	PMU	- Assessment reports - Design standards - Coordination meetings
Site Preparation & Worker Camps	Sanitary conditions, overcrowding, disease risk, and environmental degradation from camps.	102. Ensure that bidding and contract documents include specific provisions requiring contractors to comply with all applicable labour laws regarding provision of weather proof (rain, wind and cold), climate suited worker accommodation with safe drinking water, lighting and sanitation facilities, safe from wildlife and away from steep slopes (landslide risk) and at least 30m from river banks and as per IFI or GIP guidelines 103. Where feasible, explore the option of renting existing homes/ buildings for offices and accommodation to minimize the project footprint and associated environmental disturbance. 104. Contractors will prepare a Worker Accommodation Plan especially because teams will need to move from one location to another. 105. Worker and labor accommodation must be weather proof and able to withstand cold conditions, snow or heavy rainfall. 106. Locate camps on existing clearings or disturbed areas and within the RoW 107. Use prefabricated, containerized, or modular units that can be assembled and dismantled with minimal foundation	Contractor/ PIAC/PIU	PMU	- Provisions in bidding documents - Assessment reports - Number of rented houses/apartments - Worker Accommodation Plan - Accommodation inspection report - Camp location and facilities (type of sanitation facilities, water storage facilities, - Fire extinguishers - Inspection report - Abide by requirements set forth in Workers' accommodation: Processes and Standards: A guidance note by IFC and the EBRD (2009

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		108. Design camps to be fully relocatable as work progresses. 109. Equip camps with fire extinguishers and ensure that there is adequate water storage tanks. 110. Use above-ground, temporary water and power connections that can be removed without trenching 111. Provide portable toilets or containerized septic units with sealed holding tanks or compact soak systems, or construct pits with liners to prevent seepage into forest soils. 112. If camps are not movable then these must be design based on ILO[1] or EBRD/IFC, and national standards (Temporary Living Accommodation Standards in the Bhutan Schedule of Rates 2024/25) to ensure adequate habitable spaces, sanitation facilities, waste management, fire protection and control and other welfare requirements. 113. Require camps to be fully dismantled and relocated once work at a particular site is completed. 114. Conduct a joint inspection with the Forest Range Office prior to demobilization sign-off.			
Worker recruitment and management	Risk of discrimination against workers, employment of underage workers, harassment, and inadequate access to grievance redress mechanisms.	115. Comply with national rules for local and foreign worker recruitment, including the Handbook on Recruitment and Employment of Foreign Workers in Bhutan. 116. Prohibit employment of persons below 18 years of age. 117. Ensure gender-sensitive employment, including equal pay for equal work. 118. Brief workers on gender discrimination and sexual harassment. 119. Prepare and implement a Labour Management Plan (LMP) prior to mobilization.	Contractor/PIU	PMU	- Approved Labour Management Plan (LMP) - Worker recruitment records and Worker contracts - Records of worker induction and training - Functional Worker Grievance Redress Mechanism and worker grievance logs - Site inspection reports on labor conditions and worker welfare

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		120. Define employment terms, including working hours, wages, overtime, leave, and benefits. 121. Ensure non-discrimination and equitable treatment of all workers. 122. Include measures to prevent harassment, exploitation, and GBV. 123. Establish a worker grievance redress mechanism.			
Occupational Health and Safety (OHS)	Risks from steep terrain, machinery rollover, ropeways operation, excavation, electrical hazards, and natural hazards	124. Prepare and implement, as part of the CEMP, a Health and Safety Management Plan (HSMP) and a Construction Emergency Preparedness and Response Plan prior to commencement of works. The HSMP must take into consideration the Regulation on Occupational Health and Safety for the Construction Industry 2022. 125. Prohibit child labor; no person under the age of 18 shall be employed or engaged in project activities, including at solar power plant sites. 126. Ensure all staff comply with approved health and safety policies, procedures, safety programs, and work rules at all times. 127. Provide appropriate training and supervision to all personnel, particularly those working on or near HV and LV electrical equipment, including ancillary workers such as panel cleaners. 128. Allow only trained and authorized personnel to install, operate, maintain, or repair electrical equipment. 129. Clearly identify, mark, and barricade hazardous areas and equipment, including warning signs indicating electrical hazards and wiring sequences. 130. Install safety signboards and symbols at all high-risk locations to alert workers and third parties. 131. Maintain construction areas in good condition to ensure safe movement of vehicles and workers	Contractor / PIU	PMU/ DOL	- Approved Health and Safety Management Plan (HSMP) and Construction Emergency Preparedness and Response Plan (CEPRP) - Records of worker induction and refresher trainings, - Site inspection reports - Vehicle inspection logs - PPE inventory and issuance records, - Qualified first aider(s) and trained fire marshal(s) on site - Displays/signage/barricades - Occupational injury and illness register, including reporting and compensation records

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		132. Ensure vehicles operate are fitted with functional horns, reverse alarms, lights, and mirrors. 133. Provide all workers (direct, subcontracted, formal, or informal) with appropriate PPE, along with training on correct use, care, and maintenance, in accordance with IFC EHS Guidelines. 134. Enforce PPE use through a disciplinary system, including removal from site for repeated non-compliance. 135. Provide N95 dust masks or equivalent to workers exposed to vehicle exhaust, dust, and earthworks. 136. Install fire extinguishers and firefighting equipment at all work sites and ensure these are checked and refilled as required. 137. Ensure a qualified first aider and trained fire marshal are present on-site during construction activities. Emergency contact number and details for medical, fire, etc. are to be displayed in all construction site 138. Construction workers to be given medical checkup per statutory requirements before being allowed on site; medical records are to be maintained by the contractor's labor officer 139. Ensure all workers are aware of the and key contact numbers for staff as well as emergency numbers (ambulance, hospital) 140. Keep a well-stocked first aid kits are at all work locations. 141. Provide transport arrangements to the nearest healthcare facility, including ambulance services for serious emergencies. 142. Ensure all occupational injuries and illnesses are documented, reported, and compensated in accordance with Bhutanese regulations.			

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		143. Maintain a log of all incidents, near-misses, and accidents, and include these records in monthly monitoring reports. 144. Ensure good housekeeping at construction site, storage areas, staff accommodation, etc. -- to be kept neat and tidy, e.g., no materials, equipment, trash laying around, cleanup worksites so that they are free of debris on daily basis			
Water requirements	Demand for water for domestic and construction purposes	145. Obtain clearance for water abstraction from Gewog. 146. Ensure water source is not blocked and repair any pipe leakages immediately. 147. Ensure adequate water supply for domestic and construction use is arranged.	Contractor	PIU/PMU	- Water abstraction clearance - Grievance logs regarding water
Transportation, use of construction plant, demolition and earthworks including works for temporary facilities	Safety risks on steep slopes and narrow access roads, traffic disruption	148. Construction equipment and vehicles to meet national emission standards including for air and noise. A provision for a daily log sheet to document dust suppression activities, 149. The use of horns in areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) will be prohibited. 150. Regularly check and maintain construction equipment and vehicles to keep them in good working order 151. In areas where the terrain is too difficult and inaccessible for standard machinery mobilization, contractors will explore ropeway options to transport items like sand and aggregates. 152. The contractor must consult local representatives during mobilization to identify if there are any water channels/pipelines that may be damaged and 153. Traffic Management plan to manage traffic flow and 154. Alert communities during traffic/road disruption	Contractor	PMU	- Alternatives/Ropeway installation - Consultation records - Alerts on traffic disruption - Traffic Management Plan

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Site clearance and earthworks including works for temporary facilities		155. Ensure clear demarcation of the working area and avoid encroachment outside the agreed impact area. Implement careful construction practices to avoid damage to trees. 156. Vehicle movements to be restricted to demarcated working areas to reduce unnecessary impacts to adjacent land. 157. Demarcation of trees to be avoided and retained as per the Tree Plantation Plan. Only marked trees are to be felled after joint verification with PMU and approval of tree list. 158. In case tree cutting is required, PMU to secure the necessary permit from the DOFPS and schedule tree cutting/trimming outside the bird breeding season with all trees **checked by an ecologist** for nesting birds and other fauna prior to being cut. Similarly, any burrows will be checked for fauna by an ecologist before any earthworks commence. 159. Record all trees removed during construction, (including location, species, size, and economic value) in accordance with the relevant plans and requirements. 160. Use of herbicides or burning to clear vegetation is strictly prohibited. 161. Minimize removal of existing vegetation and topsoil. Excavated spoil to be reused as a landscaping material. 162. Topsoil disturbed will be separately stored and used to restore exposed surfaces which will be promptly revegetated with native species including areas used for temporary construction facilities 163. Topsoil storage areas will be protected from vehicle movements to avoid soil compaction. 164. Carry out works during the dry season to minimize soil erosion and sedimentation and in wet conditions minimize the use of heavy machinery.	Contractor	PMU	- Tree removal permit and record of trees removed - Tree plantation plan - Report on soil quantities reused and disposed - Site inspection report

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		165. Consideration of the temporary use of removable steel plates to protect soil and its vegetation cover especially in locations that are subject to being waterlogged. 166. Strict prohibition of cutting of fuelwood or timber for cooking and heating by the construction workers. Contractor to provide alternative fuel source (e.g., kerosene/LPG) which will be stored safely. Trainings will be provided to workers on identification of threatened species, dos and do 167. Stockpiles of spoils and other dust generating materials to be kept to a minimum. Cover stockpiles with tarpaulin. Locate stockpiles as far away as possible from residential property to avoid inconvenience from fugitive dust and from waterbodies to minimize pollution. 168. Ensure soil is enclosed by a solid fence or equivalent to avoid windblown dust and sediment laden runoff entering waterbodies. 169. Minimize double handling and drop loads. 170. Remove materials that have the potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used onsite cover, seed or fence stockpiles to prevent wind whipping 171. Trucks transporting any loose materials or loose spoil from construction sites to local approved disposal sites will be covered with tarpaulin to reduce dust. 172. Position any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from sensitive receptors (houses, schools, clinics, mosques, etc.) 173. Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays. Impose speed limits on construction vehicles to minimize exhaust and dust emissions along areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) –			

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		10km/hr on site and 30km/hr on unpaved roads otherwise per the national limits. 174. Clean dust from access roads daily and then once after all construction work is completed. Strictly prohibit the burning of waste generated by project-related activities. 175. Ensure workers working near or having long exposure to vehicle exhausts and earthworks are provided with clean N95 dust masks to avoid inhalation or particulate matter and other pollutant			
Biodiversity risks and impacts	See Biodiversity Management Plan and Biodiversity Action Plan				
Soil & Water Resources	Soil erosion, sediment runoff into streams (Tang Chhu, Chamkhar Chhu), and water contamination.	176. Develop and implement Sediment management Plan. 177. Maintain a 30m buffer from all rivers and 15m from streams respectively. 178. Schedule earthworks during the dry season to minimize erosion by surface water runoff. 179. Install silt fences (semi-permeable geotextile) along permanent streams or water bodies to prevent runoff. 180. Restrict discharge of sediment laden surface water runoff directly into surface water. 181. No wastewater will be discharged direct to surface waterbodies or groundwater without adequate treatment. Use of pit latrines is prohibited as is open defecation and urination. 182. Provision of adequate onsite sanitation facilities including connection to existing sewerage system linked to a wastewater treatment plant, septic tanks with soak-aways or alternative temporary sanitary facilities that do not allow untreated disposal of sewage to adjacent water bodies e.g., portable toilets where the wastewater generated is enclosed in a container and will later be taken offsite for wastewater	Contractor	PMU / DECC	- Sediment Management Plan - Water quality test results (turbidity, TSS)

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		183. Provide spill prevention kits (sorbent pads, loose sorbent material, etc.) at storage areas and other at-risk locations within clearly labelled containers to immediately confine any spills or leaks that occur. 184. Provision of designated hard standing areas for equipment servicing, refueling and wash down at least 50 m from surface water and groundwater wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite.			
Noise and disturbance	Disturbance due to blasting	185. Follow silent/controlled blasting techniques that minimize vibrations, dislodging fragmentation of rock fragmentation. 186. Comply with the Explosives Rules, 1989 in terms of permits, procurement, transportation, storage, security personnel, safety precautions, maintenance of records and blasting procedures. This includes ensuring that a competent person/blaster with a shotfirer's certificate and experience in preparing and carrying out blasting work is utilized. 187. Ensure the safety of all blasters through proper provisioning of the requisite PPE. 188. Ensure the safety of other workers during blasting operation through use of warning signs and audible signals before the commencement of blasting.	Contractor	PMU/PIU	- Blasting plan - Record of blasting materials and usage - Storage of blasting materials - Certification of blaster - Safety measures undertaken during blasting
	Influx of workers, vegetation clearance, use of machinery, vehicles and material transporting trucks and access road construction	189. Prior information on work scheduling will be provided to the local representative to be shared with the community 190. The Contractor Representative (Liaison Person) will be available on-site, and their contact details will be provided to the local representative. This will allow residents to lodge any grievances to the contractor. 191. All construction equipment must be kept in good working condition.	Contractor	PMU/PIU	- Notification on work schedules - GRM records related to traffic, noise, or access disruption - Equipment maintenance logs and idling-control checks - Site inspection reports on traffic and access management

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		192. All vehicles and equipment shall be turned off when not in use.			
Community Health and Safety	Risk from Blasting activities	193. Report any loss or theft of explosives immediately to the permit issuing authority and to the nearest police station. 194. Immediately remove all remaining explosives from the site upon completion of blasting. 195. Prepare Emergency Preparedness and Response Plan and follow emergency procedures to evacuate injured persons immediately to a health facility in case of accidents. 196. Inform the community when the blasting work is going to commence so that all are aware about this and place an alarm prior to blasting work	Contractor	PMU/PIU	- Blasting permits and blasting record/log - Shotfirer/blaster certification and PPE records - Community notification record - Incident or complaint records related to blasting activities - Blasting Management Plan
Community Health and Safety	Social conflict, spread of disease, traffic risks to pedestrians/children.	197. Screen all foreign workers for communicable diseases (HIV/AIDS, TB, malaria, dengue) at entry. 198. Conduct orientation for workers on local culture and sexual harassment/abuse. 199. Prepare and require workers to follow Code of Conduct 200. Conduct consultations with communities regarding construction schedules and worker influx. Warn community/children of traffic risks 201. Place clear warning signs on access roads and at worksites to alert the public to construction and potential hazards. 202. Install physical barricades at active construction sites to keep out the public, animals, and vehicles. 203. Enforce safe driving, including adhering to project-specific speed limits, especially in settlements and on village roads 204. Establish a GRM and share GRM procedures and contact details via accessible channels (e.g., notice boards,	Contractor	PMU/PIU / Gewog Administration	- Training attendance sheets - GRM dissemination and grievance logs - Consultation minutes - Approved Code of Conduct

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		meetings, social chat channels) for rapid and effective community response			
Air Quality & Dust	Dust from excavation/transport; Exhaust emissions (NOx, CO) from machinery.	205. Establish and enforce vehicle speed limits appropriate to road conditions (e.g., maximum of 20 km/h on unsurfaced roads) to minimize dust generation. 206. Cover trucks transporting loose or fine materials (e.g., sand, soil, aggregates) and spoil with tarpaulin to prevent dust emissions and spillage during transport. 207. Carry out dust suppression through regular sprinkling of water at excavation sites, haul roads, and other dust-prone areas, particularly during dry and windy conditions. 208. Keep stockpiles of soil, aggregates, and waste materials covered to prevent wind-blown dispersal and erosion during rainfall, and locate them away from adjacent properties where practicable. 209. Ensure routine maintenance of all construction machinery and transport vehicles in accordance with manufacturers' specifications. Maintenance records shall be kept in a logbook and made available for inspection at least once every two months.	Contractor	PMU/PIU	- Vehicle maintenance log - Visual inspection of dust suppression
Air Quality & Dust	Deterioration of air quality due to operation of excavators and material and worker transporting vehicles	210. All construction equipment, vehicles, and stationary sources (including diesel generator sets) must be regularly serviced and maintained in good working condition in accordance with manufacturer specifications, must pass applicable emission tests, and must have maintenance recorded in logbooks. 211. Avoid unnecessary idling of vehicles and machinery. 212. Diesel generators used as power sources must comply with Bhutanese emission standards and good international industry practice, including appropriate stack-height design 213. Instruct staff and workers to avoid burning of waste .	Contractor	PMU/PIU	- Vehicle service log - Air quality monitoring reports - Site inspection report

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		214. Construction activities shall comply with national ambient air-quality standards 2020 and WHO guidelines for TSPM, PM_{10}, and $PM_{2.5}$ at nearby receptors; additional mitigation measures shall be implemented if exceedances are detected.			
Traffic risks	Increase in traffic along narrow routes will increase traffic and heighten risk of accidents for school children and risk of damaging roads.	215. Prepare and implement a Traffic Management Sub-Plan, avoiding peak traffic and school hours. 216. Document pre-project road conditions and restore any construction-related damage at contractor's cost. 217. Provide advance notice to communities on increased traffic and road-safety risks to children. 218. Enforce speed limits, regular vehicle maintenance, and use of back-up warning sirens. 219. Inform communities of the GRM for traffic, road damage, or access-related grievances.	Contractor	PMU/PIU	- Approved Traffic Management Sub-Plan - Report on pre-construction road condition - Prior notification to community - Number of road/property damage incidents recorded
Waste Management	Pollution from construction debris, sewage, and hazardous waste (oil/grease).	220. Comply with the Waste Prevention and Management Act of Bhutan, 2009 and Regulation, 2012 (amended 2016), Applicable EHS Codes of Practice, IFC EHS General Guidelines – Waste Management and Hazardous Materials Management and the Basel Convention for any transboundary movement of hazardous waste 221. Prepare a Solid and Hazardous Waste Management Sub-Plan as part of the Construction Environmental Management Plan (CEMP) prior to commencement of works. The Sub-Plan must consider the existing capacity of Dzongkhag waste disposal facilities. The plan must cover waste minimization, segregation, collection, storage, transport, reuse, recycling, and final disposal for excavated and construction waste, scrap metals and packaging waste, domestic and biodegradable waste and hazardous waste (used oil, grease, contaminated soil, chemical containers). The plan shall apply to all construction sites, tower locations, access roads, pulling stations, and temporary workers' camps.	Contractor	PMU/PIU / DECC	- Waste Management Sub-Plan - Site inspection report - Waste disposal documentation

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		222. Establish a segregated waste collection system prior to construction especially at the worker camps so that waste is not mixed with hazardous waste. 223. Brief workers on waste segregation and fines for indiscriminate disposal of waste. Apart from organic waste which can be dumped into pits and covered with soil all other waste must be taken out of the project site to either recycling agents, scrap dealers or to the waste disposal site. 224. All waste shall be stored in designated and secure area using appropriate containers (bins, drums, or cement bags) in a secure area to prevent these being opened by wildlife or blown off due to strong winds. 225. Hazardous waste must be stored in a secure, roofed area with an impermeable floor, such as plastic. Bunds will be installed to hold 110% of the largest container of liquid hazardous wastes, integrity checks of bunds, drains, and impermeable floors 226. For off-site storage and disposal, the contractor must consult the District Environment Officer and make disposal plans accordingly. 227. Spill response kits (absorbent pads, sand, containers) shall be maintained at all fuel and hazardous material storage locations. In the event of spills, immediate cleanup must be undertaken and contaminated materials must be treated as hazardous waste 228. Contractor must instruct staff and workers to avoid burning of waste			
Physical Cultural Resources	Damage to religious sites or chance finds during excavation.	229. BPC will brief contractors on avoiding/minimizing impacts on physical and cultural heritage (including religious sites, sacred landscapes, and associated practices) during the pre-bid meeting. 230. The Contractor must:	Contractor	PMU/PIU / DoCDD	- Chance Find Procedure - Incident reports

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		• Integrate cultural heritage protection into the CEMP, specifically avoiding disturbance during the Dorjitse Tsechu (October) and minimizing impact on sacred water sources (Menchhu, Drupchhu). • Brief workers on sacred sites/local beliefs, stressing prevention of damage, pollution, noise, and disturbance to areas considered abodes of deities/spirits. • Avoid establishing camps/storage within 50m of cultural structures. • Install barricades/access controls near cultural structures to prevent unauthorized entry/disturbance. • Strictly prohibit workers from touching, removing, damaging cultural items, or polluting water bodies (Drupchhu, Menchhu) near tower locations. • Engage with local communities/religious authorities to share schedules, agree on mitigation, and identify required "no-work" days during religious events. • Ensure personnel/transporters avoid blocking access roads to Dorjitse Monastery, especially during the *Dorjitse Lamai Kuchoed* prayer festival due to increased traffic. 231. In case of discovery of a chance find, (archaeological, historical, cultural, religious objects, or graves) during the excavation, the following steps must be undertaken by the contractor and BPC; 232. Upon detection of any chance find, the contractor must immediately stop all activity within 30m of the find and immediately notify the supervisor onsite and the BPC. No construction is to be carried out by the Contractor until notified by BPC. 233. The BPC in turn will document the chance finds and inform the Department of Department of Culture and Dzongkhag Development, Ministry of Home Affairs of the discovery immediately to avoid delay in the construction work.			

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		234. The Department of Culture and Dzongkhag Development (DoCDD) may provide their assessment from the photo documentation or conduct in-person site assessment to assess the chance find in detail and relay appropriate instruction to BPC/ 235. BPC must ensure that there are no delays in the verification process or in notifying the contractor of the procedures to be followed based on the assessment by the DoCDD 236. BPC must monitor to ensure that the instruction given by the DoCDD is carried out correctly. 237. No works will resume until clearance is provided by the Department of Culture, MoHA and BPC permits works to resume.			
Site reinstatement including of temporary facilities	Risk that construction sites not restored or cleaned up and workers still remain onsite	238. Upon completion of all work, dismantle all offices, storage sheds, worker camps 239. Ensure the entire site is cleaned up, and remove construction materials and debris and dispose these at an approved disposal site 240. Restore disturbed sites with local/native floral species 241. Repair any damaged roads or property 242. Ensure that all foreign workers are repatriated upon completion of work as required by the Labor Regulation. 243. Provide a photographic record will have been made of the pre-construction condition of land used for temporary facilities before construction to inform the reinstatement works. After completion of the construction work any temporary structures will be completely removed and the temporary land will be restored to its earlier condition with all waste being removed 244. All spoil and construction waste and scrap material must be removed on the completion of works and temporarily disturbed sites restored back to their earlier condition.	Contractor	PMU/PIU	- Work completion and closure report - Restoration and handover certificate - Site inspection report

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		Roads and footpaths utilized to be cleaned and restored back to their previous condition satisfactorily to the community which is using them			
Operation Phase					
TL operation	Ongoing vegetation clearance within RoW	245. Undertake selective trimming only; avoid unnecessary tree felling; comply with forestry clearance conditions	PMU/PIU	PMU	- Maintenance reports
Worker Health and Safety	Electrocution risk, risk of wildlife encounter	246. Fit transmission towers with anti-climbing devices (e.g., barbed wire) to prevent unauthorized access. 247. Install and maintain clear warning signage, including voltage information, at hazardous locations. 248. Ensure plant access control and security measures are in place to keep people away from danger areas. 249. Include electrical safety requirements in the project's Safe Systems of Work (SSoW) and ensure staff comply with all safety policies, procedures, and work rules. 250. Ensure all staff involved in electrical works are trained, competent, and adequately supervised, and that other personnel working nearby are informed of potential hazards. 251. Require all electrical works to be conducted under a Lockout–Tagout (LOTO) system, with circuits tested to confirm a zero-energy state before work begins. 252. Provide mandatory induction and refresher training for workers on: 253. Working in remote and forested locations; 254. Operation and maintenance procedures; and 255. Emergency response and wildlife awareness.	PMU/PIU	PMU	- Visual inspection of towers - Safety audit reports - Maintenance logs - Worker briefing reports

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		256. Prohibit maintenance work during unsafe weather conditions, including heavy rain, snow, or windstorms. 257. Provide and enforce use of appropriate Personal Protective Equipment (PPE) for all repair and maintenance activities. 258. Clearly mark hazardous areas and equipment, with signage visible to workers, visitors, and third parties. 259. Maintain first-aid kits at all worksites and ensure transport arrangements to the nearest healthcare facility are available at all times. 260. Display emergency contact numbers prominently at work locations. 261. Require prompt reporting of all accidents, injuries, spills, environmental incidents, and near-miss events to the site-in-charge for investigation and corrective action.			
Community health and safety	Community safety risks from live conductors	262. Restrict public access to TL towers through fencing, anti-climbing devices, and locked gates, where applicable. 263. Contractor is responsible for ensuring H&S of everyone on construction site including visitors and sub-contractor workers regardless they have been formally or informally employed 264. Install and maintain clearly visible warning signage in local language(s) at towers, access points, and high-risk locations. 265. Conduct regular inspection and maintenance of TLs, towers, and Right of Way (RoW), including vegetation management, to prevent electrical faults and fire hazards. 266. Implement a fire prevention and response protocol, including coordination with local authorities for rapid response in the event of electrical fires. 267. Inform and sensitize nearby communities prior to operation on electrical safety risks, restricted activities within the	PMU/PIU	PMU	- Warning signs installed and maintained (- Site inspection records - Awareness programs participant list/attendance sheet - Safety related incidents - Record of corrective actions

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
		RoW, emergency contacts, and the project's Grievance Redress Mechanism (GRM). 268. Promptly address any reported safety concerns or incidents through corrective actions.			
Access roads	Risk of illegal tree felling and poaching	269. Inform and sensitize local communities on the purpose and necessity of closing temporary access roads after construction. 270. Physically close and rehabilitate temporary roads that are no longer required for operation and maintenance. 271. Coordinate with the Gewog Administration and relevant authorities to restrict access and prevent use of closed roads by unauthorized persons. 272. Install barriers (gate/soils or rock piles) and signage at closed access points to deter illegal entry. 273. Support periodic monitoring and joint patrols, where feasible, with local authorities and CFMGs	PIU	PMU	- Road closure notification - Briefing/meeting attendance list - Inspection and monitoring reports - Number of temporary access roads physically closed and rehabilitated - Reports of illegal activities - Meeting records
Tower and TL	Risk of damage due to natural hazards and disasters	274. Conduct regular inspection and maintenance of towers, foundations, slopes, and drainage structures, particularly before and after the monsoon season. 275. Establish and implement an Emergency Preparedness and Response Plan, including procedures for extreme weather events and natural disasters. 276. Strengthen coordination with Dzongkhag, Gewog, Royal Bhutan Police, and other relevant authorities for emergency response and disaster management. 277. Suspend maintenance activities during high-risk weather conditions and resume work only when conditions are safe.	PIU	PMU	- Routine inspection and maintenance reports - Approved Emergency Preparedness and Response Plan (EPRP) - Records of coordination meetings with Dzongkhag/Gewog/RBP
Decommissioning Phase					

Item	Mitigation Aim	Mitigation Measures	Implementing Agency	Supervising Agency	Monitor Indicators
Decommissioning works	Worker health and safety risk	278. Workers will be required to follow standard procedures during decommissioning, provided with PPE and appropriate safety briefings 279. Contractors shall use only qualified and certified personnel for decommissioning works.	Contractor	BPC	- Records of worker induction and refresher trainings, - PPE inventory and issuance records, - Worker qualification - Occupational injury and illness register, including reporting and compensation records
	Waste Generation	280. Follow the 3Rs principle (Reduce, Reuse, Recycle) shall be applied to minimize overall waste generation and maximize recovery of recyclable materials such as steel, aluminum, and copper. 281. Segregate all wastes generated from dismantling activities into biodegradable and non-biodegradable waste streams. 282. Collect all recyclable materials, store these safely in temporary storage areas, and transport to licensed scrap dealers or recycling companies 283. Restrict workers from carrying out open burning, uncontrolled dumping, or burial of waste, particularly within forest areas or near water bodies	Contractor	BPC	- Inspection and monitoring reports - Waste disposal report
	Completion of Decommissioning Works and Site Restoration	284. Upon completion of decommissioning works, all labor camps, site offices, storage yards, and ancillary facilities will be fully dismantled and removed from the site. 285. Disturbed areas will be restored using appropriate bio - engineering and native vegetation planting to promote natural regeneration and slope stabilization. 286. Temporary access tracks will be rehabilitated unless otherwise agreed with landowners or relevant authorities. 287. The restored areas will be protected from further disturbance to allow vegetation to establish.	Contractor	BPC	- Site inspection report - Area restored and regeneration success

Annexure 2: Biodiversity Management Plan

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
A: General Pre-Construction Actions									
A1	Ensure compliance during construction	The Project Management Unit (PMU) will recruit an independent, competent National Biodiversity Specialist (NBS) in full time role as part of the Project Implementation Unit (PIAC), the site-based employees of the PMU. The NBS will manage the implementation of the BMP and BAP. PMU to recruit an independent, competent International Biodiversity Specialist (IBS) as part of the Project Implementation Assistance Consultant (PIAC) team. The IBS will advise on the implementation of BMP and BAP. They will work closely with the Biodiversity Manager employed by the Contractor. The preferred candidates must be approved by both the PMU and ADB competent authorized person(s).	At least three months before construction	PMU	BPC	An open, public and transparent recruitment process. Receipt of at least three applications for both roles, formal offer employment, inclusive of detailed scopes of work, and three-month management review of performance	Written and signed contracts. Completion of three months employment	One-off	BPC
A2	Biodiversity training and awareness raising	The NBS will deliver biodiversity awareness training to all construction workers pre-construction. Construction workers will be taken to include all primary and secondary contractors (e.g. sub-contractors). The training will		NBS	IBS	Collection and review of signatory list showing attendance of workers at the	More than 90% workforce attendance at	Before construction, renewed annually	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		be compulsory and must be renewed annually. The training must be written by the IBS and NBS and in accordance with the project risks and opportunities. Preparation and publication of information and warning signs at site offices, worker camps, and at all work sites in forest habitat.				awareness training	biodiversity training		
A3	Verification of contractors' BMP document	Review, improve and approve the Contractors' BMP (and wider EMP), which will describe in detail how the Contractor will implement every BMP action including the precise locations and timing of all mitigation / monitoring, the persons responsible for each action, and when and how each activity will be completed, checked, and verified.	Before any construction starts on site	IBS	IBS	Publication of approved Contractor's BMP	Written approval of report by PMU and ADB competent and authorized person(s)	Once	PMU
B: Protected Areas (Wangchuck Centennial National Park and Bumthang Wetlands)									
B1	Protection of Wangchuck Centennial National Park (WCNP)	Consult with the Department of Forests and Park Services (DoFPS) and the local communities to ensure construction works are undertaken in full compliance with all permits, and acknowledgement and regard for the WCNP conservation objectives and community requirements.	Pre-construction	PIU (NBS)	PIAC	Preparation of a work subplan for work within the WCNP to demonstrate how work will be carried out in accordance with permits, regulations and agreements with park staff and	Approval of the work subplan by WCNP staff	Throughout all works in and near WCNP	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Commit to follow the rules and regulations of the WCNP during all construction activities. Commit to avoid and minimize tree and vegetation clearance within WCNP, plan access routes to avoid vegetation and prioritize open land, plan the pylon location so that natural habitat loss is minimized. Fence/physically mark the vegetation surrounding the construction area to protect surrounding vegetation. All vegetation work to be supervised by the NBS.				local communities.			
B2	Compensate for the permanent and temporary loss of vegetation from the WCNP	All trees and vegetation to be lost will be surveyed, quantified and replaced to provide an area at least equivalent to that which is removed (see Natural Habitat and Forest actions in C1-5 below for more detail)	During construction	PIU (NBS)	PIAC	Preparation of compliant baseline report. Development and implementation of a replanting strategy.	Approval of baseline report and formal acceptance of the replanting by DoFPS.	Once on approval of baseline report and on approval of replanting	DoFPS
		Finalize the BAP *Consult with the DoFPS and the Park Management Office, and the local communities, review all of the Park's conservation objectives and commit to financing or implementing additional conservation objectives – details are included in the BAP.*	*Pre-construction*	*PIAC (IBS)*	*PMU*	*Preparation and agreement of additional conservation actions - BAP*	*Published BAP approved by ADB competent and authorized person(s)*	*Within 6 months of construction start date*	*BPC*

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
B3	Avoid impacts to birds associated with the Bumthang Wetlands	*Finalize the BAP* *Continue Bird Vantage Point surveys to confirm the species present, their abundance and behavior near the Project area, particularly the population of Himalyan Griffon, Mountain Hawk Eagle, Black-necked Crane for at least three years – details are included in the BAP.*	*Pre-construction*	*PIAC (IBS)*	*PMU*	*Complete survey methods in accordance with best practice, completion of a compliant set of surveys over the required period.*	*Approval of the final survey report by IBS.*	*Monthly, throughout construction*	*BPC*
C: Natural Habitat and Forests									
C1	Avoid habitat loss	Plan all vegetation clearance and write pre-vegetation clearance plans for all pylon locations, access roads and other infrastructure detailing exactly what will be removed, how, when and what will be retained and how. Design and mark the location of all pylons and access routes prior to any works commencing. Select the exact location of the pylons, the access roads and the location of all other construction activities that avoid vegetation (e.g. preferentially select the path with fewest trees). Identify natural breaks in vegetation to be used as preferred access routes. No construction vehicles will be permitted outside these access routes.	Pre-construction and during construction	Contractor	PIU (NBS)	Publication of pre-vegetation clearance plans	Publication of the final Project Tree Clearance Register Written approval by the DoFPS (i.e. permit issuance) Compliance with national legislation	Before any vegetation is removed	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Survey and record the exact number of trees and shrubs, and their species, within the construction footprint that must be removed to facilitate construction. Valuable trees must be highlighted. Record the species of each tree, its width and height, and condition (health) in the Project's Tree Clearance Register. The details will inform the nationally required compensation payment values (see below). Complete all pre-construction works (above actions) alongside representatives from the DoFPS, local community heads, and other relevant stakeholders. Commit to no vegetation removal until all above actions have been completed.	Pre-construction and during construction						
		Realign the pylon locations, access road routes or design alternative construction methods if trees that are of value to vulnerable bird species (listed in D1 below) are within the right of way (RoW) (as informed by the pre-construction bird survey).		Contractor	PIU	Ensure bird data is used to inform final design and pre-clearance wildlife checks are completed.	Approval of design by NBS.	Before any vegetation is removed	PMU
		Where practical Contractors to use drone technology to undertake the stringing of the wires and avoid felling trees unnecessarily.		Contactors	PIU	Finalized design detailing use of drone technology showing retention	Approval of design by NBS	During works site clearance	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Where possible raise the height of the project's towers lowest structure to ensure trees 20m in height or shorter will be retained				of trees where possible, and showing height of towers.		throughout construction.	
		Avoid impacts to IUCN Endangered or Vulnerable tree species: *Taxus wallichiana, Acer sterculiaceum, Picea brachytyla* and *Populus rotundifolia* . Suvey the RoW and physcailly mark the trees of conservation concern, take GPS coordinates and ensure their presence is included in the vegetation clearnace plans. Trim/pollard these species rather than fell where impacts are not completely unavoidable.		Contractors	PIU	Finalised design reflecting results of pre-construction tree surveys and showing limited impacts to threatened species.	Publication of pre-vegetation clearance plans highlighting location of key tree species. No damage to any target trees	Pre-clearance During Construction	PMU
C2	Minimize impact of felling and clearance of trees Minimize impact of felling and clearance of trees	Protect all retained trees, including those beyond the RoW limits and their root systems throughout the construction period by using tree tags, barrier tape, spray paint, temporary fencing and ecological supervision when clearance being undertaken. The location of protective measures will be confirmed in the pre-vegetation clearance plans. Deliver ecological toolbox talks to the vegetation clearance team at the beginning of works, whenever	Pre-construction and during construction	Contractor	PIU (NBS)	Continual and daily site inspection by NBS. Monthly photographs of tree protection measures at each construction site for towers/access. Review of signatory list showing	No recorded loss or damage to retained trees at each works site More than 90% worker attendance at each talk/ presentatio n	Quaterly inspection reports	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		new staff begin on the project, and undertake monthly updates. Ensure that only the vegetation pre-approved for clearance is removed and no more.				presence of workers at talk			
		All vegetation clearance must be phased, that is all trees and scrub must be removed in one direction either along the length of the alignment or within the 27m wide RoW from the center point, outwards towards the retained vegetation. This will permit all wildlife to naturally move off-site into the retained vegetation.		Contractor	PIU (NBS)	Continual and daily site inspection by NBS.	Dead or injured wildlife	Quarterly inspection reports	PMU
		Undertake a pre-removal checks for wildlife. All vegetation must be physically inspected for active birds nests, mammals, reptiles etc within 24 hours of it being removed. The checks should be repeated if there are delays in the planned clearance of more than 12 hours. Delay works if any rare or notable species are discovered during the pre-works check. NBS to provide support during clearance if wildlife is recorded. Undertake soft felling of trees, with PIU in attendance if the pre-works checks cannot confirm absence of wildlife. Soft felling of large trees involves the cutting of individual		Contractor	PIU (NBA)	Logbook of site works at each location will include written confirmation of pre-work checks, any findings and actions taken. PMU to review and confirm satisfaction with a sample of the documentation.	No reported loss or harm of notable or rare species / disseminati on findings and required amendmen ts to contractor BMPs within the project.	Timing of site checks TBC by works site program. PMU checks and communicati on every 2 weeks or as needed.	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		branches and slowly lowering to the ground.							
		Manually clear trees, using methods that cause minimal disturbance to the surrounding vegetation (i.e. avoiding large mechanical clearance machinery). Specific methods and techniques must be specified and approved by NBS.	During construction	Contractor	PIU (NBS)	Continual and daily site inspection by NBS. Monthly log, evidenced by photographs, confirming clearance methods used.	No unnecessary or avoidable damage to trees.	Monthly	PMU
		Fell and give any felled trees, dead wood and non-timber forest products (NTFP) of value to the CFMG in accordance with agreements reached during consultation with affected stakeholders.	Construction and post-construction	Contractor	PIU (NBS)	Logbook of recovered felled trees confirming handover of material by contractors to CFMGs, verified by both parties.	Published CFMG satisfaction. DoFPS approval.	Quarterly	PMU
		Collaborate with the DoFPS, Forest Offices and CFMGs, ensuring their involvement in the tree felling process.	Pre-construction	Contractor	PIU (NBS)	Consultation and written records of meetings with the Forest Offices or CFMG.	Published consultation records	Process confirmed before works start	PMU
		Reinstate all temporary works areas to their original condition, with revegetation of disturbed areas using plant species native to the area and approved by DoFPS.	Post-construction	Contractor	PIU (NBS)	Prepare generic and work site specific vegetation restoration plans, with DoFPS. Replant post-construction.	Approval of restoration plans and post-implementation report by NBS	Visual inspection of restoration sites weekly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
C3	Minimize impacts to forest resources	Use non-timber sources of energy (e.g., kerosene/LPG, which will be stored in safe conditions) for cooking and heating within all construction and accommodation camps. Prohibit construction workers entering forest area/habitat outside of their working hours, and purchase, sale, and use of firewood, timber and NTFPs, hunting and poaching of fauna by workers. Conduct training sessions with workers to raise awareness of the potential impacts of worker camps on forest ecosystems.	During Construction	Contractor	PIU (NBS)	Set standards for the workers with which the contractor must comply to minimize potential for unauthorized use and unintended damage of forest resources. Carry out inspections to ensure compliance and report on findings.	Zero extraction of vegetation off-site without approval. Zero fires. Signatures from all works confirming 90% attendance of awareness programs	Workforce training, once per person, renewed annually.	PMU
		Remove topsoil from all project footprint areas and temporarily store in designated areas the edge of the works, away from watercourses. Protect the topsoil and do not mix with any other material. Re-deposit topsoil as soon as possible once works are completed in any area. Restore the original contours of the land as closely as possible. Regularly maintain and monitor rehabilitated areas monthly to maintain a high vegetation cover	During construction and post-construction	Contractor	PIU (NBS)	Logbook of daily activities including the dates of removal and redeposit, location of storage areas of topsoil, including photographic evidence Report of maintenance and monitoring of rehabilitated areas	Approval of report of rehabilitated areas All topsoil replaced in-situ	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		and limit soil erosion due to water runoff and wind.							
C4	Reforestation and Afforestation	BPC shall formally agree and secure funding for compensatory reforestation through a Memorandum of Understanding (MoU) with the Department of Forests and Park Services (DoFPS). The MoU shall confirm the commitment to compensate for the clearance of 50.2 ha of forest through the establishment of at least 100.4 ha of new forest, or an equivalent area of enhanced degraded forest, in accordance with national requirements. BPC shall also confirm arrangements with the three affected CFMGs for the restoration and enhancement of approximately 9 ha of degraded community forest areas, including roles, responsibilities, and benefit-sharing arrangements.	Before and during Construction	PMU	BPC	Consultation with DoFPS. Publication of pre-vegetation clearance reports with details of all trees and vegetation being removed.. Includes photographs of restoration measures.	Signed MoU	Once, during Construction	BPC
		Prior to any vegetation clearance, the Contractor, under the supervision of BPC and DoFPS, shall: Count, tag, and geo-reference every tree approved for felling.		Contractor	PIU (NBS)	Comprehensive and complete field surveys. Pre-vegetation clearance plans for the entire RoW	DoFPS approval	Before vegetation starting	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Record species, diameter at breast height (DBH), height, and general health condition. Complete and maintain a Tree Clearance Register. The verified data shall be submitted to DoFPS and used to finalise compensatory planting requirements, fees, and payments, in accordance with national forest valuation procedures.							
		In collaboration with DoFPS, local Forest Offices, and affected communities, BPC shall: Confirm and finalise compensatory afforestation and reforestation sites, building on those identified in the ESIA. Ensure that selected sites are legally available, ecologically suitable, and consistent with district and national forest management plans. Obtain all required approvals and permits from DoFPS prior to site preparation. Meaningful consultation with CFMGs and local stakeholders shall be undertaken to confirm access, management arrangements, and livelihood considerations.		PIU	PIAC	Comprehensive pre-clearance vegetation surveys. Continual compliance with national legislation.	DoFPS approval	Before vegetation starting	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Write one or more DoFPS-approved Afforestation/Reforestation Plans covering a minimum of 100.4 ha. Each plan will include, as a minimum: - Target area and mapped planting locations - Number of seedlings and planting density - Species composition (native species only, reflecting local forest types) - Minimum seedling size and quality standards - Planting methods, timing, and site preparation requirements - Inclusion of suitable non-timber forest product (NTFP) species where appropriate to support community benefits - Management, protection, and maintenance measures - Monitoring indicators, reporting requirements, and success criteria - Roles and responsibilities of BPC, the Contractor, DoFPS, Forest Offices, and local user groups		Contractor	PIU/PIAC	Continual consultation with the DoFPS. IBS review of the Plans against the Tree Clerance Register. Detailed development of the plans in accordance with national requirements.	Published Afforestation/Reforestation Plans. Approval and permits from DoFPS	Before the end of construction	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		- Detailed cost estimates and funding arrangements.							
		All ground preparation, planting, and initial maintenance will be implemented by the Contractor, or delegated parties, strictly in accordance with: - The DoFPS-approved Afforestation/Reforestation Plan - Applicable national forestry legislation, rules, and technical guidelines. Local communities will be engaged in planting and early management wherever feasible, to build ownership and support long-term sustainability.		PIU	PIAC	Complete all planting in accordance with the DoFPS and national legislation	100.4 ha of planted new forest	Before the end of construction	PMU
		The health and survival of planted trees will be monitored for a minimum period of five years following planting. Monitoring will include survival rates, growth performance, and evidence of grazing, fire, or pest impacts. BPC may formally delegate day-to-day management of plantation areas to local Forest Offices or CFMGs, subject to written agreements and continued technical and financial support		To be confirmed	DoFPS	Report of health and survival status of newly planted trees	At least 80% of tree survival during construction. At least 60% tree survival at within five years.	Monthly	BPC

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		from the Project for the agreed monitoring period. Training must be provided to all managing and monitoring the trees. Corrective actions, including infill planting, shall be implemented where survival rates fall below DoFPS-defined thresholds.							
		Periodic progress and monitoring reports will be written and issued to DoFPS and PMU confirming compliance with approved plans, legal requirements, and BMP commitments. Successful completion of compensatory reforestation obligations will be formally approved by DoFPS.		PIU	PMU	Site visits, quantitative monitoring all sites (including sport checks and quadrats) and use of a DoFPS and PMU approved report template.	Published quarterly reports	Quarterly	PMU
C5	Avoidance and control of forest fires.	No Contractors or Project staff will take wood off site or start any fires. Construct and maintain firebreaks in strategic locations to help prevent the spread of fires throughout construction period. Do not use fire as a land clearance method. Store fuel outside and in fuel bunds. Refuel outside of the forest area/habitat to minimize the risk of forest fire. Provide fire-fighting equipment and ensure adequate water supply.	Pre-construction and during construction	Contractor	PIU (NBS)	Plan showing location and specification for firebreaks Logbook of firebreak and equipment inspections Production of works site management plans	Approval of firebreak and worksite management plans No incidents reported	Once in advance of construction Site and equipment inspections, logbook review: 2 x month	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Appoint and train fire marshals. Educate the workforce through providing compulsory basic fire training to all workers and toolbox talks. Undertake training drills in preparation for forest fire. Install informative signages throughout the project area, including an emphasis on preventing fires, to improve awareness of forest fires.	Pre-construction and during construction	Contractor	PIU (NBS)	Production and approval of training material and signage Record of training events and attendance Photographs of installation and maintenance of signage	No incidents reported	Completion of drills: every 4 months.	PMU
D: BIRDS									
D1	Reduce risk of bird collision of with transmission infrastructure	Continue Vantage Point (VP) surveys and studies for collision sensitive species Himalyan Griffon (Gyps himalayensis), Mountain Hawk Eagle (Nisaetus nipalensis), Black-necked Crane (Grus nigricollis) already carried out for the ESIA and for at three further years. Use the results of the surveys and studies to confirm areas with unacceptably high collision risk as the basis for designing avoidance and mitigation measures.	Pre-construction	NBS	IBS/PMU	Completion of report detailing results of vantage point surveys	Written acceptance of the report by IES	One off report	PMU
		Finalize the BAP *Continue Bird Vantage Point surveys to confirm the species present, their abundance and behavior near the Project area,*	*Pre-construction*	*PIAC (IBS)*	*PMU*	*Complete survey methods in accordance with best practice, completion of a*	*Approval of the final survey report by IBS.*	*Monthly, throughout construction*	*BPC*

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		particularly the population of Himalyan Griffon, Mountain Hawk Eagle, Black-necked Crane for at least three years – details are included in the BAP.				*compliant set of surveys over the required period.*			
		Continually use the survey data to review the identify areas along the Project alignment used more frequently by birds at higher risk to collision with the pylon wires (e.g. birds with poor forward-facing eye-sight or poor maneuverability). Potential refinement of the pylon tower locations to reduce collision risk.	During construction	PIU (NBS)	PIAC (IBS)	Quarterly review of the VP data. Revised layout including any amendments to reduce collision	Quarterly report. Confirmation of opportunities to reduce impacts to birds.	Quarterly	PMU
		Purchase and install bird diverters along the entire route alignment. Bird diverters must be purchased from a professional and reputable company approved by the IBS (cheaper alternatives must not be used and can be dangerous). Bird diverters must be purchased from Powerline Sentry (or a similar company). Diverters must be installed every 10m for the entire route. A reduction in the frequency of bird diverts may only be permitted if the data (from the bird VP surveys) provides strong justification that the risk to the rare bird species is very, very low and will continue to be.	During construction	Contractor	PIU (NBS)	Site audit to confirm the correct installation of bird diverters every 10 m	Quarterly report with photographic evidence.	Ongoing	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Install insulation materials on all energized and exposed part of the pylon tower infrastructure to reduce the risk of electrocuting birds. Insulators may include arcing horns or surge arrestors to safeguard against insulator damage during lightning strikes.	During construction	Contractor	PIU (NBS)	Site audit to confirm the correct installation of bird diverters every 10 m	Quarterly report with photographic evidence.	Ongoing	PMU
D2	Avoid disturbance to breeding / nesting birds	In areas where suitable nesting or bird foraging habitat exists, complete surveys to confirm existing breeding and roosting locations for species of conservation significance / legally protected, including but not limited to: Himalayan griffon, Satyr tragopan, Himalayan monal, Mountain hawk-eagle and River lapwing. Restrict high-disturbance activities (tree felling, blasting, tower erection) if nesting or roosting is confirmed or suspected stop all works within 500m of the nest sites until the young birds have fledged. If not practical contact the IBS for advice.	During construction	Contractor	PIU (NBS)	Report of survey including dates, species found, location, and a map of construction exclusion zone around nests/roosts approved by IBS.	Measures implemented to protected breeding birds and nest habitats in accordance with site works plans and programs.	Ongoing in accordance with construction program	PMU
		Schedule vegetation clearance outside the nesting bird season (July-September), where practical Undertake a pre-clearance nesting bird check of the vegetation to be cleared within 24 hours of works	During construction	Contractor	PIU (NBS)	Report of pre-clearance nesting bird checks including dates, species found, location, and	Quarterly report with photographic evidence.	Ongoing	BPC

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		commencing, where avoidance of the breeding season is not practical. Delay clearance of trees supporting nesting birds, wherever possible. This applies both to low vegetation and larger shrubs and trees. Active nests for any protected species or IUNC Redl listed Species (Vulnerable, Endangered or Critically Endangered) must be delayed until after the works have been completed.				whether the area is approved for clearance or not. Plans of trees to be retained, photographs of trees post construction.			
E: MAMMALS									
E1	Minimize habitat loss and disturbance in areas known or likely to support vulnerable or endangered mammals	As far as possible, minimize loss and disturbance (for example for tower installation, workers camps, stock piles etc.) of suitable habitat in areas where IUCN Vulnerable, Endangered or Critically Endangered mammals, including but not limited Asiatic black bear, Asiatic golden cat, Common leopard, Himalayan serow, Sambar, Wild dog are present recorded in surveys for the ESIA. Fence/physically mark the vegetation surrounding the construction area to protect surrounding vegetation.	Pre and during construction	Contractor	PIU (NBS)	Plans demonstrating any necessary and possible amendments to temporary construction areas to limit impacts on mammals. Working hours restricted during dusk and nighttime. Works site inspections	Quarterly report with photographic evidence.	Monthly inspections	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Minimize work noise and light disturbances where practical.							
E2	Avoid loss of fauna due to poaching	Conduct a toolbox talk before construction, with a reminder session every month during construction and whenever new staff are inducted into the project, to raise awareness of the threatened species present and the potential risks to them. This will include: - roles and responsibilities - information on all endangered, and protected species wildlife species using photographs and of national regulatory requirements - required behaviors including bans on hunting, foraging, and trapping Obtain signatures for all site workers and contractors to confirm attendance talks/inductions.		Contractor	PIU (NBS)	Review of signatory list showing presence of workers at talk	More than 90% worker attendance at toolbox talk	Monthly and annual	PMU
		Commit to zero poaching. Enforce a hunting ban for all workers, with anti-poaching clauses included within all contractual agreements. No potential hunting equipment will be allowed in the project area including traps and firearms. Prohibit dogs on site.		Contractor	PIU (NBS)	Contracts to include commitment to zero poaching. Inspections to demonstrate no evidence of poaching	Compliant contractual document	Monthly	PMU
F: OTHER/GENERAL WILDLIFE									

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
F1	Avoid and minimize disturbance to fauna	Undertake pre-clearance site checks before any vegetation clearance or construction to confirm that no animals are present. Robustly fence or cover excavated pits at the end of each working day to prevent fauna accidentally falling in, or install escape ramps to allow their escape. Check all open foundations and trenches daily and move animals present to safety. Install a temporary fence around compounds and worksites at the end of each working day if required, to prevent entry of mammals during the night.	During construction	Contractor	PIU (NBS)	NBS to be present during site works to help check and implement the BMP requirements.	Quarterly report with photographic evidence.	Monthly compliance checks	PMU
		Actively minimise light use, particularly where it is not necessary or can be avoided. Where lighting is required, use directional lighting to avoid light spill into retained, adjacent habitat.		Contractor	PIU (NBS)	Compliance with specification confirmed through worksite inspections (see above)	Quarterly report	Monthly	PMU
		Restrict or reduce work from 1 hour before sunset to 1 hour after sunrise, where practical, to avoid disturbance to the fauna in (a) forest areas/habitat, and (b) within 10km of a protected area.		Contractor	PIU (NBS)	Review of log of daily working hours	Quarterly report	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		Limit unnecessary noise during all construction by scheduling loud works during the day, using hand tools instead of large machinery, where practical and using low speeds when travelling, all in accordance the EMP).		Contractor	PIU (NBS)	Implementation of construction in line with the EMP	Quarterly report	Monthly	PMU
		Minimise emission of dust throughout works by using dust suppression techniques as applicable to location and nature of work.		Contractor	PIU (NBS)	Implementation of construction in line with the EMP	Quarterly report	Monthly	PMU
F2	Avoid and minimize killing and injury of fauna	Install anti-climbing devices on the transmission towers upon completion of each tower to prevent wildlife such as monkeys climbing the towers. Anti-climbing devices can include physical barriers such as spikes or mesh covers. Monitor anti-climbing devices monthly to ensure they remain functional.	During construction	Contractor	PIU (NBS)	Design showing anti-climbing devices and report of installation including photographs Report of inspections of anti-climb devices	Approval of design by IBS Quarterly report with photographs confirming installation	Monthly	PMU
		Maintain a minimum vertical clearance of 7 m between the conductor and tree canopy ground along the RoW. This gap ensures a safe passage for fauna by minimizing the risk of wildlife collisions or obstructions caused by the project infrastructure.		Contractor	PIU (NBS)	Site inspections	Quarterly report	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
F3	Avoid loss of fauna and flora due to poaching	The measures described for endangered and protected mammals (E2) above must apply to all fauna and flora at risk of degradation from poaching.	Durning construction	Contractor	PIU (NBS)	Review of signatory list showing presence of workers at talk	More than 90% worker attendance at toolbox talk	Monthly and annual	PMU
G: INVASIVE AND NON-NATIVE SPECIES, AND SPREAD OF PLANT DISEASES									
G1	Avoid the introduction of non-native species	No planting of non-native species will occur and species selection for all reforestation and afforestation will follow DoFPS and the National Plant Protection Centre under the Ministry of Agriculture and Livestock's specifications. Where re-planting of native trees occurs, only topsoil taken from that local area will be used.	During construction	Contractor	PIU (NBS)	Written plans for all habitat rehabilitation and forest planting.	No invasive species recorded in restored areas	Monthly	PMU
		Complete pre-vegetation clearance checks to identify and remove all invasive species from the proposed worksites (or to inform when work sites should be moved).If invasive species are recorded, the NBS must approve the clearance and disposal methods and monitor the works on site. Disposal of invasive species will be carried out responsibly e.g. moved as a covered load to a suitable site for burning or deep burial, with thorough inspection and cleaning of vehicle before leaving the disposal site.		Contractor	PIU (NBS)	Completion of pre-clearance checks and the NBS present on site.	No evidence of spreading invasive species	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		All invasive species survey methods (for all recorded and potentially present specie), all species-specific disposal and treatment methods (i.e. specific methods for each invasive species) and long-term monitoring methods will be documented in an Invasive Species Management Plan. It must be written by, or consistent with, the National Plant Protection Centre guidelines. It will be published before any vegetation clearance starts. The methods will apply Good Industry Practice (GIP) (e.g. cleaning of equipment before transport to site) throughout all works to prevent accidental introduction or spread of non-native species.		Contractor	PIU (NBS)	Written methods for the cleaning of all equipment and machinery. Methods approved by the IBS and hte DoFPS. Worksite inspections to record compliance.	Published Invasive Species Plan. DoFPS approval. IBS approval. No evidence of spreading invasive species	Once pre-construction. Monthly	PMU
G2	Avoid spreading plant pathogens	Pine trees must be inspected before felling for signs of the pine wilt disease, which is present throughout the area, and the presence of the longhorn beetle that causes its spread. The felling of infected or potentially infected trees must only take place in accordance with the approved methods provided to the Project in writing by the DoFPS or another regulatory body responsible for Bhutan's domestic phytosanitary,		Contractor	PIU (NBS)	Completion of a comprehensive pre-vegetation clearance checks. Receipt of approved removal or treatment methods. Record of management of potentially infected material	No evidence of spreading pine wilt disease	Monthly	PMU

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		which may include restrictions on the movement and use of infected timber.				and worksite inspections to record compliance.			
H: ECOSYSTEM SERVICES									
H1	Avoid loss and degradation of ecosystem services	Temporary and permanent clearance of natural forest habitat must not result in loss or degradation of provisioning and regulating ecosystem services in the project area. This can be achieved through actions listed above in this BMP that relate to forest clearance and replanting, principally: Compensate for the permanent and temporary loss of forest and scrub habitat from the WCNP Avoid impacts of habitat loss to forest/habitats Minimize impact of felling and clearance of trees Reforestation and revegetation	During construction	Contractor	PIU (NBS)	See previous actions	See previous actions	See previous actions	PMU
H: OTHER ENVONMENTAL MANAGEMENT PRATICES THAT ARE RELEVANT TO BIODIVERSITY									
H1	*N/A*	*Refer to the EMP for details on the management and monitoring requirements for chemical use, waste management, dust suppression, noise and light disturbance, water management and working near water, and*	*Pre and during construction*	*Contractor*	*PIU*	*Various*	*Various*	*Continual*	*BPC*

# Ref	Mitigation Aim	Action Required	Project Phase	Accountability		Monitoring			
				Responsible for Action	Accountable for Action	Verification	KPI	Timing and frequency	Responsible
		pollutant and contamination control.							

Annexure 3: Entitlement Matrix

S.N.	Type of Loss	Entitled Person	Compensation at replacement cost/Entitlement
1	Private Land (agriculture, residential, commercial) Titleholders	Titled landholders, and those with recognized/ recognizable rights to land they occupy according to the national law	Options for: Land for land compensation of equal value and productivity, or Cash compensation at market value and full replacement cost for affected land, [1] based on land availability and preference of affected persons If land is not available, compensation paid according to PAVA current rates Residual land if not suitable to use according to its purpose should be acquired based on consent of affected land person and compensated accordingly For affected households whose livelihood is land-based, or to be physically displaced, preference shall be given to replacement land compensation based on choice of affected persons; in case of lack of suitable land and replacement land is not feasible, lack of land should be documented and demonstrated satisfaction of ADB, and robust livelihood restoration and improvement strategy and activities provided to APs. All other associated costs incurred for processing and securing the new land registration certificate will also be paid to the affected landowner at actual cost.

2.	Private Land (agriculture, residential, commercial) Non-Titleholders	Those without recognized/recognizable rights to land they occupy, essentially those squatting/encroaching on land	Cash compensation for affected non-land associated and improvements Cash for cost of transportation (maximum cost of 2 truckloads and charges for four persons to unload and unload trucks) of personal effects and belongings to place the impacted person wants to move to.
3.	Private land affected by ROW of transmission line and access roads	Titled landholders, or those with recognized/recognizable rights to land they occupy	The land will be acquired and replaced with government land if available adjacent to the affected plot. If government land is not available adjacent to the affected plot, but if the affected owner has similar land elsewhere in the same gewog, and adjacent government land is available in that other location, then land will be adjusted and supplemented to the other plot. If government land is not available anywhere near, then as per procedures, BPC is obligated to assist in acquiring substitute land in the same village or chiwog or gewog or Dzongkhag (wherever government land is available in one of these; in order of availability in coordination with local government and the National Land Commission (NLC).[2] All other associated costs incurred for processing and securing the new land registration certificate will also be paid to the affected landowner at actual cost.
5	Structures and houses (Titleholders)	All affected households regardless of land title holding status (including encroachers and squatters)	Cash compensation for all loss structure at market value and full replacement cost for structure and all non-land assets and losses without deducting depreciation; Right to salvage material they need, if the government has no need for the materials.

[2] The BPC has confirmed that replacement land adjacent to the affected plots of all APs of the TL ROW and access roads is available and will be replaced.

6	Structures and houses (Non-Titleholders)	All affected households regardless of land title holding status (including encroachers and squatters)	Cash compensation for all affected structures/non-land assets at full replacement cost Right to salvage material without cost for APs and deducting compensation
7	Crops	All affected households regardless of land title holding status (including encroachers and squatters)	Cash compensation of lost crops at market price. Cash compensation for loss of standing crops at current market prices. At least 3 months advance notice before acquisition Assistance for initiating farming in new places such as provision of seeds of cereals and vegetables, and agronomic advice
8	Trees	All affected households regardless of land title holding status (including encroachers and squatters)	Cash compensation of lost trees calculated for (i) fruit tree – at annual gross production value for fruit trees for period of four years until new replanted tree becomes productive; and assistance to farmers in kind or cash for replanting seedlings and trees, Cash compensation for (ii) non-fruit tree compensation cost, based on the rate established the respective valuation specialist for timber/wood/ornamental trees, irrespective of the tree's age; and cost for tree sapling, labour for tree replanting Advance notice of at least 3 months
9	Business/income Licensed & Non-Licensed	All affected households regardless of land title holding status (including encroachers and squatters)	Permanent loss. Cash assistance for income loss , equivalent to 6 months income from business if income/tax records available, or 6 months payout of daily minimum wages Temporary loss. Cash assistance for income loss , equivalent to 3 months income from business if income/tax records available, or 6 months payout of daily minimum wages

			Assistance to relocate and restore livelihood (e.g. vending space, space, transitional support) Priority for employment opportunity in project works
10	Employment	All affected households regardless of land title holding status (including encroachers and squatters)	Permanent loss: Transition allowance equivalent to the income of 3 months of last salary paid (without deductibles) from last job at time of detachment; and Assistance in quest for and re-employment in a similar and equivalent salaried alternative job and/or priority for project works employment Temporary loss: Compensation of salary for the duration of employment iterruption
11	Significant impact assistance	All affected households losing 10% or more productive land/income generating asset regardless of of land title holding status (including encroachers and squatters)	One time assistance allowance at the rate of minimum wage rate (Nu. 400/day) for 6 months
12	Vulnerability assistance	All vulnerable affected households regardless of land title holding status including encroachers and squatters	One time assistance allowance at the rate of minimum wage rate (Nu.400/day) for 6 months
13	Transportation cost	All affected households regardless of land title holding status (including encroachers and squatters) need transportation	Transportation allowance at the rate of average cost of truck hire for 2 trrips from place of residence or business operation to the place the goods need to be transportated

14	Relocation assistance (transitional cost support)	All affected households regardless of land title holding status (including encroachers and squatters if any relocated	One-time lump sum transitional allocation allowance at the rate of minimum wage rate (Nu. 400/day) for 6 months.
15	Community land/livelihood resource	All APs regardless of land title status and community	Allocation of alternative resources incluidng land for livestock grazing and other livelihood resource.[3]
16	Community structures	Community members who are using the public goods such as roads, water supply systems, farm roads, grazing areas etc.	Full restoration after relocation or realignment of community structures ensuring full functionality of the structures
17	Loss of access to nyes (sacred sites) in government reserved forests	All affected households regardles odf land holding status	Restoration of access to such religious and cultural spaces
18	Relocation assistance (transitional cost support for physical relocation)	All affected households regardless of land title status (including encroachers and squatters)	Transitional assistance at the national daily wage rate for six months
19	Unanticipated impact	All APs as applicable	Compensated and mitigated according to ADB SPS

[3] Local government (Gewog and Dzongkhag) and National Land Commission (NLC)

Annexure 4: Grievance Redressal Mechanism

GRM Level	Composition	Maximum timeline
First Level of GRM (Site-level)	Responsibility: Contractor's project manager supported by contractor's GRM focal (BPC site engineer during operation) Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive) Contractor's representative BPC's Project Manager when on-site Total meeting members: 4-6	2 working days: acknowledging complaints receipt, 5 working days: a meeting between contractor's project manager and complainant and action plan agreed upon (or escalation to level 2) Maximum 15 working days: action taken, and grievance resolved, however any environment safeguard grievances that are an emergency or pose a H&S risk to workers or community members must be resolved immediately by the contractor Information and reporting to BPC GRM focal on a two-weekly basis by the contractor
Second Level GRM	Responsibility: BPC's project manager is supported by BPC GRM focal (BPC project manager on operation)	3 working days: confirmation of receipt to the complainant
(Project- level)	Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive) Representative of the contractor BPC environment and social safeguards officer Local rural office and community organization representative Total meeting members: 4-8	14 working days: a meeting between the project manager and complainant and action plan agreed upon (or escalation to level 3) Maximum 15 working days: action taken, and grievance resolved Information and reporting to BPC board and management by BPC GRM focal.

GRM Level	Composition	Maximum timeline
Third Level of GRM (Committee level)	Responsibility: BPC project manager as facilitator of GRC, handing over to BPC project manager upon operation Other parties involved, as applicable: Aggrieved person and/or up to two representatives of aggrieved person (gender-inclusive) BPC GRM focal Representative of the contractor Government representatives as applicable depending on environmental or social issues being resolved (e.g., land revenue, survey, forest office, agriculture office, municipality representative, etc.) NGOs/CSOs representatives depending on environmental or social issues being resolved. Total meeting members: <10	2 working days: confirmation of receipt to the complainant 15 working days: grievance redress committee meeting and the action plan agreed upon Maximum 44 working days: action taken, and grievance resolved Information and reporting to BPC board and management by BPC GRM focal. a

Annexure 4:

Affected plot details (Access roads)

FID	Plot ID	Gewog	Dzongkhag	Area	Affected Area (acre)	Access Road Name/ID
1	TNG-3003	Tang	Bumthang	2.128	0.05	Road 5
2	TNG-3797	Tang	Bumthang	1.233	0.05	Road 6
3	TNG-874	Tang	Bumthang	0.753	0.025	Road 2c
4	TNG-3012	Tang	Bumthang	0.901	0.016	Road 6R29-31

Affected plot details (Transmission Line)

FID	Plot ID	Gewog	Dzongkhag	Area	Affected Area (acre)	Right of Way
1	TNG-3797 & 3039	Tang	Bumthang	2.80	0.14	AP 30 to AP 31

Annexure 7: Contractor Safeguard Obligations & Compliance Requirements

1. General Obligations

1.1 The Contractor shall comply with all applicable social safeguard requirements as outlined in the approved Resettlement Plan (RP), including all updates issued by the Employer (BPC).

1.2 The Contractor shall ensure that all construction activities are carried out in a manner that:

- Avoids or minimizes impacts on private land, assets, and livelihoods.
- It prevents damage to crops, trees, structures, and community resources.
- Respects agreed with access conditions and land use restrictions.

1.3 The Contractor shall not commence any works in areas involving affected persons (APs) until:

- Compensation and entitlement have been fully paid and confirmed by the Employer.

2. Contractor's Institutional Arrangements

2.1 The Contractor shall appoint, prior to commencement of works:

- (a) One Grievance Redress Mechanism (GRM) Focal Person.
- (b) One Social Safeguard Supervisor at site.

2.2 The appointed personnel shall:

- Coordinate with the Employer (BPC) and Project Management Unit (PMU).
- Ensure implementation of all safeguard provisions.
- Act as the primary interface with affected persons and local communities.

3. Grievance Redress Mechanism (GRM)

3.1 The Contractor shall implement the site-level GRM as the first tier of grievance handling.

3.2 The Contractor shall:

- Maintain a Grievance Register at site.
- Accept grievances in verbal or written form at no cost to complainants.
- Issue acknowledgment of receipt within 2 working days.
- Propose resolution within 5 working days.
- Resolve grievances within a maximum of 15 working days, where feasible.

3.3 The Contractor shall:

- Immediately address urgent issues (e.g., safety, environmental damage);
- Escalate unresolved grievances to the Employer (BPC) for higher-level resolution.

3.4 All grievances, actions taken, and outcomes shall be:

- Properly documented.
- Reported to the Employer on a bi-weekly basis.

4. Protection of Land, Assets, and Livelihoods

4.1 The Contractor shall:

- Restrict activities within approved Right-of-Way (RoW) and designated work areas.
- Avoid encroachment into private land beyond approved limits.

4.2 The Contractor shall not:

- Cut trees, damage crops, or disturb land outside approved areas without prior authorization.

4.3 In case of any damage caused by the Contractor (including outside planned impacts), the Contractor shall:

- Immediately report the incident to the Employer.
- Restore the damage or compensate affected persons at full replacement cost, as determined by the Employer

5. Access Roads and Construction Activities

5.1 The Contractor shall strictly follow the approved:

- Access road alignments.
- Temporary and permanent land use designations.

5.2 The Contractor shall:

- Minimize land disturbance during construction of access roads.
- Use existing roads wherever feasible.

5.3 Any deviation from approved alignments shall require:

- Prior written approval from the Employer.

6. Stakeholder Engagement and Community Relations

6.1 The Contractor shall:

- Support the Employer in conducting consultations with affected people and local communities;
- Provide advance notice of construction activities to nearby communities.

6.2 The Contractor shall:

- Ensure respectful engagement with local communities.
- Avoid disruption to local livelihoods and access.

7. Compliance with Clearances and Legal Requirements

7.1 The Contractor shall comply with all applicable:

- Forestry clearances.
- Community Forest conditions.
- Local authority (Gewog/Dzongkhag) permissions.

7.2 The Contractor shall ensure that:

- No activities violate the conditions of issued No Objection Certificates (NOCs).

8. Labor and Social Compliance

8.1 The Contractor shall comply with all applicable labor laws, including:

- Prohibition of child labor.
- Prohibition of forced labor.
- Equal pay for equal work regardless of gender.

8.2 The Contractor shall:

- Provide a safe and gender-sensitive working environment.
- Conduct awareness programs on health, safety, and social risks.

9. Monitoring, Reporting, and Documentation

9.1 The Contractor shall:

- Maintain records of all safeguard-related activities, including:

    - Grievances
    - Consultations
    - Incidents and corrective actions

9.2 The Contractor shall submit:

- Monthly reports to the Employer on safeguard compliance.
- Immediate reports on any serious incidents or non-compliance.

10. Non-Compliance and Corrective Actions

10.1 Any failure by the Contractor to comply with this Annexure shall constitute:

- A breach of contract.

10.2 The Employer reserves the right to:

- Issue instructions for corrective actions.
- Suspend works in affected areas.
- Impose penalties as per contract conditions.

11. Unanticipated Impacts

11.1 In the event of any unforeseen social or land-related impacts:

- The Contractor shall immediately notify the Employer.
- Works in the affected area shall be suspended until guidance is issued.

11.2 All such impacts shall be addressed in accordance with:

- The Resettlement Plan.
- Applicable laws and ADB safeguard requirements.

Section 7: General Conditions of Contract

The Conditions of Contract consists of two parts, this Section 7 (General Conditions of Contract) and the following Section 8 (Particular Conditions of Contract).

Red Book:

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The Conditions of Contract are the "General Conditions" which form part of the *Conditions of Contract for Building and Engineering Works, Designed by the Employer* (Red Book) Second Edition 2017, reprinted in 2022 with amendments published by the Fédération Internationale Des Ingénieurs – Conseils (FIDIC) and the following Section 8 "Particular Conditions of Contract."

An original copy of the above FIDIC publication, i.e., *Conditions of Contract for Electrical and Mechanical Plant and for Building and Engineering Works Designed by the Employer,* must be obtained from FIDIC.

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Section 8: Particular Conditions of Contract

Part A – Contract Data

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
1.1.20	Cost plus Profit	5%
1.1.27	Defects Notification Period (DNP)	12 Months from the date of handing taking of the Works.
1.1.31	Employer's name and address	Bhutan Power Corporation Limited (BPC), Yarden Lam, Chubachu, Thimphu, Bhutan. Attention: **Mr Sangay Lungten** Address: Chief Manager, Contract Management Section, Construction Division, Contracts & Procurement Department, Bhutan Power Corporation Limited, Thimphu, Bhutan. Phone Number: +975-2 322046 Mobile No.: +975 17150540 Email: sangay.lungten@bpc.bt / cmsection@bpc.bt
1.1.35	Engineer's name and address	Tandin Gyeltshen, Chief Manager, Construction Section, Construction Division, Contracts & Procurement Department, Bhutan Power Corporation Limited, Thimphu, Bhutan. Phone Number: +975-2 321846/321847 Mobile No.: +975 17761090 Email: tandingyeltshen@bpc.bt/ electrificationdiv@bpc.bt
1.1.52	Local Currency	At the end of Sub-Clause 1.1.52, insert: Bhutan's local currency is "Ngultrum." The acronym for Ngultrum is "Nu" or "BTN."
1.1.73	Section	Not applicable
1.1.84	Time for Completion	16 Months reckoned from the Commencement Date.

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
1.1.89	Bank's name	Asian Development Bank
1.1.90	Borrower's name	Royal Government of Bhutan
1.1.92	Integrity Pact	The Pact signed between the Employer and Contractor committing the persons/officials of both parties not to exercise any corrupt influence on any aspect of the Tender/Contract.
1.3 (a) (ii)	Electronic transmission system	E-mail
1.3 (d)	Address of Employer for communications	Attention: Mr. Sangay Lungten Address: Chief Manager, Contract Management Section, Construction Division, Contracts & Procurement Department, Bhutan Power Corporation Limited, Thimphu, Bhutan. Phone Number: +975-2 322046 Mobile No.: +975 17150540 Email: sangay.lungten@bpc.bt / cmsection@bpc.bt
1.4	Governing Law	The law of the Kingdom of Bhutan
1.4	Ruling language	English
1.4	Language for communications	English
1.8	Number of additional paper copies of Contractor's Documents	1 copy
1.9	Errors in the Employer's Requirements	28 days *At the end of the first paragraph, insert:* The reasonable period between notice and the required drawing(s) shall not be more than 28 days (Excluding holidays). *At the end of the second paragraph, insert:* The reasonable period for the Engineer to issue the drawings or instructions shall be 28 days (Excluding holidays) after the receipt of notification from the Contractor.
1.15	Total liability of the Contractor to the Employer under or in connection with the Contract	Accepted contract Amount
2.1	Time for access to the Site	The whole of the Site within 14 days after the Commencement Date:

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
2.4	Employer's Financial Arrangements	Asian Development Bank Project: 58265-001: Solar Farm Expansion Project
3.1	The Engineer	The Employer shall appoint one of its employees as the Engineer, who shall carry out the duties assigned to him in the Contract.
3.2	Engineer's Duties and Authority	A Variation resulting in an increase of the m Accepted Contract Amount in excess of 1% shall require prior consent of the Employer.
4.2	Performance Security	The Performance Security shall be in the form of a bank guarantee in the amount(s) of 10% of the Accepted Contract Amount and in the same currency (ies) in which the Accepted Contract Amount is payable.
4.7.2 (a)	Period for notification of errors in the items of reference	As per FIDIC 28 days
4.18	Protection of the Environment	*At the end of Sub-Clause 4.18, insert:* a) The Contractor shall strictly adhere to all notifications/guidelines of RGoB related to the protection of the Environment, conditions stipulated by the Department of Environment and Climate Change (DECC), environment clearances and permits issued to the Employer including conditions set out in the Forest Clearance and stipulated in the Technical Specifications. b) The Contractor will comply with ADB SPS (2009); ESF ESS6; IFC Environment, Health, and Safety (EHS) General Guidelines; and other good international practice (GIP) requirements required by the ESIA, EMP and BMP. c) The Contractor shall implement all necessary measures as required in the ESIA, EMP and BMP to avoid, minimize, mitigate and offset environmental impacts in the Projects' area of influence. d) The contractor will prepare a Construction Environment Management Plan (CEMP) and management subplans, the ESIA and EMP illustrate 13 sub plans are required: i) Health and Safety; ii) Pollution Prevention; iii) Blasting Management, iv) Site Restoration; v) Air quality, Noise and Vibration; vi) Solid and Hazardous Waste Management, vii) Traffic Management; viii) Emergency Preparedness and Response; ix) Labour Management; x) Invasive Species; xi) Worker Accommodation; xii) Community Engagement; and xiii) Sediment and Erosion control. Plans will be submitted to the Employer

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
		for review and approval prior to the commencement of any construction activities. e) The Contractor shall ensure strict adherence to the approved CEMP throughout the execution of the Works. Compliance with the CEMP shall be subject to monitoring by the Employer, PIAC, ADB safeguard missions and/or any relevant regulatory authorities, through both scheduled inspections and unannounced (ad hoc) site visits. f) The Contractor shall conduct all construction activities in a manner that avoids any unnecessary impacts, destruction, degradation or alteration of the environment in the Projects' area of influence and shall immediately restore any affected areas as directed by the Engineer at no additional cost to the Employer. g) The contractor will carry out environmental monitoring (e.g., air, noise, water, biodiversity), evaluate the effectiveness with which the CEMPs and management plans are implemented, and identify, implement, and report all corrective actions h) In the conduct of construction activities and operation of construction equipment, the Contractor shall utilize such practicable methods and devices as are reasonably available to control, prevent and otherwise minimize impacts upon air pollution; noise, water, biodiversity, soil, communities, change of land use, and cultural heritage. i) If any provision(s) is/are not complied with within a reasonable time, even after issuance of a notice in this respect, the necessary operations would be carried out by the Engineer/concerned authorities of RGoB at the cost of the Contractor plus the administrative charges of the Employer.This will be retained from the balance 10% retention payment as per section 14.7. j) The Contractor shall indemnify, defend, and hold the Employer harmless from and against all claims, damages, losses, liabilities, and expenses, including but not limited to all legal fees and associated costs, arising from or resulting from any failure of the Contractor to adhere to the provisions of this Sub-Clause. Such indemnity shall encompass all consequences, whether direct or indirect, that are attributable to the Contractor's non-compliance

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
		To achieve the above, the Contractor will adhere to, amongst others, the following specific actions and measures: (i) Carry out trainings (e.g., OHS, EHS community H+S), and meaningfully consult with communities through consultations (ii) Strictly adhere to measures outlined in the BMP, including following tree felling protocols, methods and requirements; avoid impacts upon key fauna and flora species use drone technology for stringing; protect all retained trees; deliver ecological toolbox talks; undertake pre-removal checks for wildlife; collaborate with the DoFPS, Forest Offices and CFMGs, ensuring their involvement in the tree felling process. (iii) Ensure no unauthorized quarrying is permitted in connection with the execution of the Works. (iv) Maintain and monitor rehabilitated areas (v) Prohibit fires, maintain firebreaks in strategic locations, store fuel outside forested areas, provide firefighting equipment and ensure adequate water supply and storage. (vi) Identify risks and hazards, implement site specific health and safety measures to prevent hazards, provide personal protective equipment, first aid, emergency transportation, worker insurance and compensation as required and ensure workers receive appropriate induction, and safety training and supervision. viii) Do not engage in child or forced labour, worker discrimination or tolerate sexual harassment among workers. ix) Consult the PMU and Gewog to identify sacred cultural or religious sites or monuments located within or nearby the Project vicinity. x) integrate cultural heritage protection into CEMP and subplans xi) execute chance finds in strict adherence the Department of Culture and Dzongkha Development, Royal Government of Bhutan (RGoB) requirements xii) unequivocally prohibit activities within the vicinity of sacred sites that may be construed as disrespectful or offensive xiii) Do not restrict public access to sacred sites, except in instances where prior written approval has been obtained from the Employer.

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
4.19	Period of payment for temporary utilities	Each month
4.20	Number of additional paper copies of progress repots	1 copy, Electronic copy monthly until the Taking-Over Certificate.
6.1	Engagement of Staff and Labour	At the end of Sub-Clause 6.1, insert: The Contractor shall, to the extent feasible, prioritize the employment of personnel possessing the requisite qualifications and experience, who are nationals of Bhutan. Furthermore, the Contractor shall, as far as reasonably practicable, recruit unskilled labour from the local communities in proximity to the Project Site.
6.3	Recruitment of Persons	After the end of Sub-Clause 6.3, insert: The Contractor shall be responsible for returning all persons he recruited and employed for the purposes of or in connection with the Contract to the location where they were recruited or to their domicile. The Contractor shall submit, within seven (7) days, to the Employer, verifiable evidence of the return of the aforementioned personnel, which may include but is not limited to transportation receipts, exit visas, or other pertinent documentation required by the applicable authorities.
6.4	Labour Laws	*Delete Sub-Clause 6.4 and substitute:* The Contractor and its Subcontractors shall, during the entire term of the Contract, adhere strictly to and be obligated by all relevant provisions of the most recent Labour and Employment Act of Bhutan, along with any amendments, rules, regulations, or notifications promulgated thereunder. Failure to comply with the aforementioned Act shall be deemed a substantial breach of the Contract, granting the Employer the right to pursue any and all remedies permitted under the Contract or applicable law. The Contractor shall indemnify, defend, and hold harmless the Employer and the Employer's Personnel, upon request and regardless of the termination or expiration of the Contract, from and against any and all claims, demands, actions, proceedings, losses, damages, liabilities, costs, charges, and expenses (including all legal and professional fees and expenses) arising out of or in connection with:

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
		a) any breach or violation by the Contractor or its Subcontractors of any applicable laws, including labour, employment, or welfare laws; and b) any failure to observe, perform, or comply with statutory obligations imposed by any Government Instrumentality. In the event that the Employer or any personnel associated with the Employer holds liability to pay, or indeed pays, any sums by way of penalty, fine, reimbursement, or compensation stemming from a default or non-compliance by the Contractor or its Subcontractors, or if any recovery is pursued in this respect by an authority, individual, court, or Government Instrumentality, the Employer shall have the right to recover such amounts from the Contractor. This recovery may be executed, among other methods, through the deduction of any amounts owed or to become payable to the Contractor under the Contract, which includes deductions from the Performance Security or Retention Money. Furthermore, the Employer is entitled to recover any amounts deemed necessary to sufficiently cover any actual or anticipated losses or damages incurred by the Employer in this regard. It is expressly agreed that under no circumstances shall any employee, labourer, or agent engaged by the Contractor or its Subcontractors be considered an employee or agent of the Employer. The Contractor shall bear sole and exclusive responsibility for all statutory, contractual, and financial obligations pertaining to its personnel. The Contractor shall not be entitled to any payment, reimbursement, or claim whatsoever in relation to its compliance with this Sub-Clause, including adherence to applicable Laws, except to the extent permitted under Sub-Clause 13.6 [*Adjustments for Changes in Laws*] of the General Conditions of Contract. Without prejudice to the foregoing, the Contractor shall indemnify, maintain indemnification for, and protect the Employer and the Employer's Personnel against all claims, liabilities, losses, damages, and expenses (including legal fees and expenses) that arise from or are connected with: a) any bodily injury, illness, disease, or death of any individual, including any personnel of the Contractor, that arises out of, occurs in the course of, or is caused by the design of the

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
		Contractor (where applicable), as well as the execution, completion of the Works, or the remedying of any Defects; b) Any loss of or damage to any property, whether real or personal (excluding the Works), shall be addressed to the extent that such loss or damage originates from, occurs during, or is a result of the Contractor's design (where applicable), execution, completion of the Works, or rectification of any Defects.
6.5	Normal working hours	8 hours a day Delete Sub-Clause 6.5 and substitute: In accordance with the stipulations outlined in the Contract, the Contractor is granted the option to carry out the Works continuously, including during local holidays and designated days of rest, on the condition that such execution does not incur any additional costs or financial liabilities to the Employer.
8.3	Number of additional paper copies of program	1 copy, the initial Programme and each revised Programme shall be submitted to the Engineer in one electronic copy. Delete the first line of Sub-Clause 8.3 and substitute: The Contractor shall submit a comprehensive Programme for the execution of the Works to the Engineer within a period of 28 days following the receipt of the Notice pursuant to Sub-Clause 8.1 [Commencement of Works]. The Programme shall be prepared using an acceptable scheduling software, preferably the most recent version of MS Project or Primavera. At the end of Sub-Clause 8.3, insert: The Construction Programme shall be subject to review and revision at intervals of three months, or with greater frequency if deemed necessary, as the Works advance to ensure alignment with project requisites. The updated Programme shall encompass a chart delineating the principal quantities of Work scheduled for execution on a monthly basis, along with a corresponding schedule of payments projected to be rendered by the Employer to the Contractor. The submission to, and subsequent approval by, the Employer of such Programmes, or the provision of such particulars, shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
8.8	Delay damages payable for each day of delay	Zero point one (0.1) Percent per day of the Accepted Contract Amount.
8.8	Maximum amount of delay damages	Ten (10) Percent of the Accepted Contract Amount.
13.4 (b) (ii)	Percentage rate to be applied to Provisional Sums for overhead charges and profit	
13.7	Adjustment for changes in Cost	All Prices in the contract are firm, and no Price Variation/Price Adjustment is applicable. Thus, the reference to any indices for Price Variation in the contract would not be applicable to the Contract.
14.2	Total Advance Payment	10% of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable
14.2.3	Repayment of Advance payment	(a) Deductions shall be made at the amortization rate of **12.5%**; provided that the advance payment shall be completely repaid prior to the time when **80%** of the Accepted Contract Amount less Provisional Sums has been certified for payment.
14.3	Period of payment	Quarterly
14.3 (b)	Number of additional paper copies of Statements	1 copy
14.3 (iii)	Percentage of retention	Ten (10) Percent of the Interim Payment Certificate.
14.3 (iii)	Limit of Retention Money (as a percentage of Accepted Contract Amount)	Ten (10) Percent of the Accepted Contract Price.
14.5 (b) (i)	Plant and Materials	Not applicable
14.5 (c) (i)		Plant and Materials for payment when delivered to the Site: Applicable
14.6.2	Minimum Amount of Interim Payment Certificates	5 million
14.7 (a)	Period of payment of Advance Payment to the Contractor	30 days
14.7 b (i)	Period for the Employer to make interim payments to the Contractor under Sub-Clause 14.6 (interim Payment)	30 days
14.7 b (ii)	Period for the Employer to make the Final Payment to the Contractor under Sub-Clause 14.13	30 days
14.7 (c)	Period for the Employer to make final payment to the Contractor	56 days

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
14.9	Release of Retention Money	*At the beginning of Sub-Clause 14.9, insert:* After the issue of the Taking Over Certificate for the Works by the Employer's representative, and submission of Bank Guarantee by the Contractor of an equivalent amount to cover the Defects Notification Period. Upon the expiration of the Defects Notification periods for the Works, the full Retention Money shall be certified by the Engineer for payment to the Contractor (or return of the bank guarantee, as the case may be). Provided that, in the event of different Defects Notification Periods being applicable to different Sections or parts of the Permanent Works pursuant to Sub-Clause 11.2 [*Extension of Defects Notification Period*], the expression "expiration of the Defects Notification Period" shall, for the purposes of this Sub-Clause, be deemed to mean the expiration of the latest of such periods. Provided also that if at such time, there shall remain to be executed by the Contractor any work instructed, pursuant to Sub-Clauses 11 [Defects after Taking Over], in respect of the Works, the Engineer shall be entitled to withhold certification until completion of such work of so much of the balance of the Retention Money as shall, in the opinion of the Engineer, represent the cost of the work remaining to be executed. In contracts with a duration exceeding 12 months, the Procuring Agency may also provide for the release of such retention money upon completion of 50% of the contract value, subject to the contractor providing an unconditional Bank Guarantee for such retention, valid for 30 days beyond the Defects Notification Period. The Bank Guarantee for Defect Liability, if applicable, shall be furnished from banks/financial institutions located in Bhutan.
14.11.1 (b)	Number of additional paper copies of draft Final Statement	1 copy
17.2	Liability for Care of Works	*In the last paragraph of Sub-Clause 17.2, delete "Cost Plus Profit" and substitute:* cost, which shall be included in the Contract Price.
19.1	Permitted deductible limits	Insurance required for the Works: 110%
19.2.1 (b)	Additional amount to be insured (As a percentage of the replacement value, if less or more than 15%)	

Ref. Sub-Clause (Col 1)	Conditions (Col 2)	Data (Col 3)
19.2.1 (iv)	List of risks arising from Exceptional Events which shall not be excluded from the insurance cover for the Works	
19.2.2	Extent of insurance required for Goods	
	Amount of insurance required for Goods	
19.2.3 (a)	Amount of insurance required for liability for breach of professional duty	
19.2.3 (b)	Insurance required against liability for fitness for purpose	*Insert* "Yes" *or* "No"
19.2.3	Period of insurance required for liability for breach of professional duty	
19.2.4	Amount of insurance required for injury to persons and damage to property	
19.2.6	Other insurances required by Laws and by local practice (give details)	
21.1	Time for appointment of Dispute Avoidance and Adjudication Board (DAAB) member(s)	Mutually agreed between the parties.
21.1	The DAAB shall comprise	One sole Member
21.1	List of proposed members of DAAB	FIDIC/SIAC Precedential list/mutually agreed by the parties.
21.2	Appointing official for DAAB members	Employer and the Contractor.
21.6 (a) (i)	Rules of arbitration and administration of arbitration proceedings	Singapore International Arbitration Centre (SIAC).
21.6 (a) (ii)	Number of arbitrators	In accordance with SIAC.
21.6 (a) (iii)	Place of arbitration	As mutually agreed by the Parties.

Table: Summary of Sections (if any)

Description of Parts of the Works That Shall Be Designated a Section for the Purposes of the Contract (Sub-Clause 1.1.76)	**Value: Percentage* of Accepted Contract Amount (Sub-Clause 14.1)**	**Time for Completion (Sub-Clause 1.1.86)**	**Delay Damages (Sub-Clause 8.8)**	**Defect Notification Period (DNP) (Sub-Clause 11.1)**

*These percentages shall also be applied to each half of the Retention Money under Sub-Clause 14.9.

Part B – Special Provisions

Clause/Sub-Clause	Special Provisions
Sub-Clause 1.1.16 Contractor's Equipment	The following is added at the end of the definition. The Contractor's Equipment includes, but not limited to, the equipment stated in the Employer's Requirements.
Sub-Clause 1.1.33 Employer's Requirements	The following is added to the definition. The Employer's Requirements include Environmental, Health, and Safety Management Plant and Equipment requirements.
Sub-Clause 1.1.59 Particular Conditions	The Sub-Clause is replaced by: "Particular Conditions" means the document entitled Particular Conditions included in the Contract, which consists of Part A – Contract Data, Part B – Special Provisions, Part C – Fraud and Corruption, and Part D – Environmental, Health, and Safety (EHS) Metrics for Progress Reports."
Sub-Clause 1.1.74 Site	The Sub-Clause is replaced with: "Site" means the places where the Permanent Works are to be executed, including storage and working area, and to which Plant and Materials are to be delivered, and any other places specified in the Contract as forming part of the Site."
New Sub-Clause 1.1.89 Bank	"Bank" means the financing institution (if any) named in the Contract Data.
New Sub-Clause 1.1.90 Borrower	"Borrower" means the person (if any) named as the borrower in the Contract Data.
Sub-Clause 1.2 Interpretation	Sub-paragraph (a) is replaced with the following: "Words indicating one gender include all genders; "he/she" is replaced with: "it"; "him/her" is replaced with "it"; "his/hers" and "his/her" are replaced with: "its"; "himself/herself" are replaced with: "itself." Furthermore, "and" is deleted from the end of sub-paragraph (i) and added at the end of sub-paragraph (j). sub-paragraph (k) is added: (k) "The word 'tender' is synonymous with 'bid' or 'proposal', the word 'tenderer' with 'bidder' or 'proposer', and the words 'tender documents' with 'request for bids documents' or 'request for proposal documents', as applicable."
Sub-Clause 1.5 Priority of Documents	Delete sub-paragraphs from (a) to (k) and replace with the following; (a) the Contract Agreement; (b) the Letter of Acceptance; (c) the Letter of Technical Bid; (d) the Letter of Price Bid; (e) the Particular Conditions Part A – Contract Data;

Clause/Sub-Clause	Special Provisions
	(f) the Particular Conditions Part B – Special Provisions; (g) the Particular Conditions Part C – Corrupt and Fraudulent Practices; (h) the Particular Conditions Part D – Environmental, Health, and Safety (EHS) Metrics for Progress Reports; (i) List of Eligible Countries as defined by the Bank; (j) these General Conditions; (k) the Employer's Requirements including EMP, EHS, personnel and equipment requirements; (l) the Schedules, including the Price Activities and Sub-Activities; (m) The Contractor's Proposal, including the Environmental, Health, and Safety Code of Conduct for Contractor's Personnel and the Environmental, Health, and Safety Management Plan (EHSMP); (n) the Joint Venture Undertaking (if the Contractor is a Joint Venture); and (o) any other documents forming part of the Contract. [*Note: As needed, additional documents may be added in the list such as the gender action plan, resettlement plan, Indigenous Peoples Plan.*]
Sub-Clause 1.6 Contract Agreement	The last paragraph is replaced with: "If the Contractor comprises a Joint Venture (JV), the Contract Agreement shall be signed either by the authorized representative of the JV or by the authorized representatives of each member of the JV in accordance with Sub-Clause 1.14 [*Joint and Several Liability*]." [*Note: In case the Contract Agreement is signed by the authorized representatives of each member of the JV, the JV leader (as referred to in Sub-Clause 1.14 [b]) should be indicated in the Contract Agreement*.]
Sub-Clause 1.12 Confidentiality	The following is added at the end of the second paragraph: "The Contractor shall, however, be permitted to disclose such particulars if required to establish its qualifications to compete for other projects." "or" at the end of (b) is deleted; "or" at the end of (c) is added; and the following is then added as (d): "is required to be provided to the Bank."
New Sub-Clause 1.17 Inspections and Audit by the Bank	The following Sub-Clause is added after Sub-Clause 1.16: "Pursuant to paragraph 2.1 (e) of Particular Conditions - Part C [*Corrupt and Fraudulent Practices*], the Contractor shall permit and shall cause its agents (whether declared or not), Subcontractors, subconsultants, service providers, suppliers, and personnel, to permit the Bank and/or persons appointed by the Bank to inspect the Site, assets, and/or the accounts, records and other documents relating to the procurement process, selection and/or Contract execution or performance, and to have such accounts, records, and other documents audited by auditors appointed by the Bank. The Contractor's and its Subcontractors' and subconsultants' attention is drawn to Part C [*Corrupt and Fraudulent Practices*] which provides, inter alia, that obstructive practice constitutes an integrity violation subject to Contract termination (as well as to a determination of ineligibility pursuant

Clause/Sub-Clause	Special Provisions
	to the Bank's Anticorruption Policy and Investigation and Enforcement Framework, both as amended from time to time). The Bank's right to inspect the Site, assets, and/or the Contractor's accounts, records and other documents relating to the procurement and performance of the Contract stated in Sub-Clause 1.17 [*Inspection and Audit by the Bank*] and Part C shall survive termination and/ or expiration of this Contract."
Sub-Clause 2.1 Right of Access to the Site	Add after the first sentence of the first paragraph: "For any part of the Site (or the whole Site as the case may be) for which the Contractor is to be given access to, and possession of, there shall be no physical works at the Site or any part thereof (as the case may be) unless the Employer shall give a Notice to the Contractor stating that all relevant provisions of the applicable Resettlement Plan were complied with and confirming that all compensation to the affected persons have been duly paid as per the Resettlement Plan. This Notice shall specify the date on which access to, and possession of the part of the Site (or as a whole as the case may be) shall be given to the Contractor."
Sub-Clause 2.4 Employer's Financial Arrangements	The first paragraph is replaced with: "The Employer shall submit, before the Commencement Date, reasonable evidence that financial arrangements have been made for financing the Employer's obligations under the Contract." The following sub-paragraph is added at the end of Sub-Clause 2.4: "In addition, if the Bank has notified to the Borrower that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Borrower having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in its notice of the extent to which such funds will be available."
Sub-Clause 3.1 The Engineer	Add the following at the end of first paragraph: "The Engineer shall be a third party capable of acting neutrally between the Parties."
Sub-Clause 3.2 Engineer's Duties and Authority	Add the following at the end of the third paragraph: "The Engineer shall obtain the consent in writing of the Employer before taking action under the following Sub-Clauses of these Conditions: a) Sub-Clause 13.2 [*Value Engineering*]: stating consent or otherwise to a value engineering proposal submitted by the Contractor in accordance with Sub-Clause 13.2; or b) Sub-Clause 13.3 [*Variation Procedure*]: instructing a Variation, except: (i) if, in the opinion of the Engineer, an emergency situation occurs that may affect the safety of life or of the Works or of adjoining property. In such a situation, the Engineer may, without relieving the Contractor of any of his duties and responsibility under the Contract, instruct the Contractor to execute all such work, or to do all such things, as may, in the opinion of the Engineer, be necessary to

Clause/Sub-Clause	Special Provisions
	abate or reduce the risk and the Contractor shall forthwith comply with such instruction; or (ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data."
Sub-Clause 3.3 Engineer's Representative	Add the following third paragraph after paragraph 2. "The Engineer shall obtain the consent of the Employer before appointing or replacing an Engineer's Representative."
Sub-Clause 3.4 Delegation by the Engineer	The following is added at the end of the second paragraph: "If any assistants are not fluent in this language, the Engineer shall make competent interpreters available during all working hours, in a number sufficient for those assistants to properly perform their assigned duties and/or exercise their delegated authority."
Sub-Clause 4.1 Contractor's General Obligations	Replace the first paragraph with the following: "The Contractor shall execute the Works in accordance with the Contract. All Contractor's equipment, material, and services to be incorporated in or required for the Works shall have their origin in any Eligible Country as defined by the Bank. The Contractor undertakes that the execution of the Works and the completed Works will be in accordance with the documents forming the Contract, as altered or modified by Variations, and with the Site-Specific Environmental and Social Management Plan (ESMP) (as per Sub-Clause 4.4.4)" The following is inserted after the fourth paragraph: "The Contractor has the obligation to notify the Employer of any changes in connection with the representations made in the Letter of Bid. If the Contractor is debarred or suspended by ADB, it shall inform the Employer of such debarment or suspension. The following is added as (g); and the current (g) and (h) of the Sub-Clause are then renumbered as (h) and (i) respectively. "if so stated in the Specification, the Contractor shall: design structural elements of the Works taking into account climate change considerations; apply the concept of universal access (the concept of universal access means unimpeded access for people of all ages and abilities in different situations and under various circumstances); consider the incremental risks of the public's potential exposure to operational accidents or natural hazards, including extreme weather events; and any other requirement stated in the Specification."
Sub-Clause 4.2.1 Contractor's Obligations	The first paragraph is replaced with: "The Contractor shall deliver the Performance Security to the Employer within 28 days after receiving the Letter of Acceptance and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable bank or financial institution selected by the Contractor and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer."
Sub-Clause 4.2.2	Add the following sub-paragraph (f) after sub-paragraph (e):

Clause/Sub-Clause	Special Provisions
Claims under the Performance Security	"(f) failure by the Contractor to perform any other obligations under the Contract."
Sub-Clause 4.2.3 Return of Performance Security	In sub-paragraph (a) "21 days" is replaced with "28 days."
Sub-Clause 4.3 Contractor's Representative	The following is added at the end of the last paragraph: "If any of these persons is not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number that the Engineer considers to be sufficient for those persons to properly perform their delegated powers, function, and/or authority."
Sub-Clause 4.4 Subcontractors	The following is added at the end of the third paragraph of Sub-Clause 4.4: "When requesting such a prior consent, the Contractor shall submit, in addition to any other required document, an undertaking from each proposed Subcontractor to confirm that they have read, understand. and shall comply with the EHS obligations set out in Sub-Clause 4.24 [*Environmental, Health, and Safety Code of Conduct*]." The following is added at the end of the last paragraph of Sub-Clause 4.4: "The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [*Confidentiality*] apply equally to each Subcontractor. Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors. All subcontracts relating to the Works shall include provisions which entitle the Employer to require the subcontract to be assigned to the Employer under sub-paragraph (a) (i) of Sub-Clause 15.2.3 [*After Termination*]."
Sub-Clause 4.5.1 Objection to Nomination	In sub-paragraph (c): "and" is deleted from the end of (i); "." at the end of (ii) is replaced with: ", and". The following is then added as (iii): "(iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 4.5.2 [*Payment to nominated Subcontractors*]."
Sub-Clause 4.6 Co-operation	The following is added after the first paragraph: "The Contractor shall also, as stated in the Employer's Requirements or as instructed by the Engineer, cooperate with and allow appropriate opportunities for the Employer's Personnel to conduct any environmental and social assessment."
Sub-Clause 4.8 Health and Safety Obligations	The following is included after deleting "and" at the end of (f) and replacing "." with ";" at the end of (g): (h) "provide health and safety induction training of Contractor's Personnel as appropriate and maintain training records; (i) actively engage the Contractor's Personnel in promoting understanding, and methods for, implementation of health and safety requirements, as well as in providing information to the Contractor's Personnel, and provision of personal protective equipment without expense to the Contractor's Personnel;

Clause/Sub-Clause	Special Provisions
	(j) put in place workplace processes for Contractor's Personnel to report work situations that they believe are not safe or healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health; (k) ensure that Contractor's Personnel who remove themselves from such work situations shall not be required to return to work until necessary remedial action to correct the situation has been taken. Contractor's Personnel shall not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal; (l) subject to Sub-Clause 4.6 [*Co-operation*], collaborate with the entities and Personnel under paragraphs (a), (b), and (c) of Sub-Clause 4.6 [*Co-operation*], in applying the health and safety requirements. This is without prejudice to the responsibility of the relevant entities for the health and safety of their own personnel; (m) establish and implement a system for regular (not less than every 6th month) review of health and safety performance and the working environment and related reporting on incidents and accidents as per Sub-Clause 4.20 [*Progress Reports*]; (n) establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks of the construction site work to the health and safety of local communities; (o) conduct an awareness program concerning the risk of sexually transmitted infections (STI) and sexually transmitted diseases (STD) including HIV/AIDS via an approved service provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals. Delete all the paragraphs after the first paragraph and replace with the following: "As soon as practicable after the Contractor has been given access to, and possession of, the first part of the Site (or the whole Site, as the case may be), the Contractor shall submit to the Engineer for Review a detailed Site-Specific Health and Safety Management Plan (SSHSMP) showing how the Contractor intends to comply with health and safety requirements prescribed in the Contract. The SSHSMP shall include measures the Contractor proposes to manage the health and safety risks and impacts related to the Works, provide site workers with safe and healthy working conditions, and establish an operating system to prevent accidents, injuries, and disease. At a minimum, it shall be based on the Environmental, Health, and Safety Management Plan (EHSMP) and EHS Code of Conduct for Contractor's Personnel submitted as part of the Contractor's Tender and agreed upon as part of the Contract, and address requirements in the Environment Management Plan (EMP) of the project. The procedures for Review of the SSHSMP and its updates shall be as described in Sub-Clause 5.2.2 [*Review by Engineer*]. The Contractor shall, as stated in the Employer's Requirements and as the Engineer may reasonably require, maintain records and make reports (in compliance with the applicable health and safety regulations and Laws) concerning the health and safety of persons and any damage to property."
Sub-Clause 4.13	Add the following at the end of the second paragraph:

Clause/Sub-Clause	Special Provisions
Rights of Way and Facilities	"For any such additional facilities that the Contractor may need to obtain, the Contractor shall comply with: (a) the measures and requirements relevant to the Contractor which are set forth in the Resettlement Plan attached hereto as Annex to the Particular Conditions of Contract, to the extent it concerns impacts on affected people during construction; and (b) any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the resettlement plan. The Accepted Contract Amount is deemed to include all expenses to ensure compliance with these measures, requirements, and actions."
Sub-Clause 4.15 Access Route	The following is added at the end of Sub-Clause 4.15: "The Contractor shall take all necessary safety measures to avoid the occurrence of incidents and injuries to any third party, associated with the use of, if any, the Contractor's Equipment on access routes and other public roads or other infrastructure. The Contractor shall monitor road safety incidents and accidents to identify safety issues and establish and implement necessary measures to resolve them. The Contractor shall adequately record the condition of roads, agricultural land adjacent to the access route, and other infrastructure prior to the start of transporting Goods. The Contractor shall be liable for the reinstatement of all such access routes, agricultural land, and other public roads and infrastructure to the extent any such damages were caused by the Contractor."
Sub-Clause 4.18 Protection of the Environment	Sub-Clause 4.18 [*Protection of the Environment*] is replaced with: "The Contractor shall take all necessary measures to fulfill the following obligations under the Contract to protect the environment, including (but not limited to): (a) protect the environment (both on and off the Site); and (b) limit damage and nuisance to people, property, and protected areas and habitat of threatened species (if any) resulting from pollution (including embodied emissions in construction materials), noise, vibration, and other results of the Contractor's operations and/ or activities. The Contractor shall ensure that emissions, surface discharges, effluent, and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Employer's Requirements, nor those prescribed by applicable Laws. In the event of damage to the environment, property, and/or nuisance to people on or off Site as a result of the Contractor's operations and/or activities, the Contractor shall agree with the Engineer the appropriate actions and time scale to remedy, as practicable, the damaged environment to its former condition. The Contractor shall implement such remedies at its cost to the satisfaction of the Engineer. As soon as practicable after the Contractor has been given access to, and possession of, the first part of the Site (or the whole Site, as the case may be), the Contractor shall submit to the Engineer for Review a detailed Site-Specific Environment Management Plan (SSEMP) which has been specifically prepared for the Works, the Site, and other places (if any), where the Contractor intends to execute the Works.

Clause/Sub-Clause	Special Provisions
	The SSEMP shall include measures the Contractor proposes to manage the environmental risks and impacts of the Works. At a minimum, it shall be based on the Environmental, Health, and Safety Management Plan (EHSMP) and EHS Code of Conduct for Contractor's Personnel submitted as part of the Contractor's Tender and agreed upon as part of the Contract, and address requirements in the Environment Management Plan (EMP) of the project. The SSEMP shall be in addition to any other similar document required under applicable environmental regulations and Laws, and shall set out all the requirements for the protection of the people, property, and the environment that: (i) are stated in the Employer's Requirements; and (ii) comply with all the Contractor's environmental obligations under the Contract. The procedures for Review of the SSEMP shall be as described in Sub-Clause 5.2.2 [*Review by Engineer*]."
Sub-Clause 4.20 Progress Reports	Replace 4.20 (g) with: "the Environmental, Health, and Safety (EHS) Metrics for Progress Reports set out in Particular Conditions – Part D" The following is added at the end of the Sub-Clause: "In addition to the reporting requirement of this sub-paragraph (g) of Sub-Clause 4.20 [*Progress Reports*] upon becoming aware of its occurrence, the Contractor shall inform the Engineer within 24 hours of any allegation, incident or accident, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel, or Contractor's Personnel. This includes, but is not limited to, any incident or accident-causing fatality or serious injury; significant adverse effects or damage to private property or to the natural environment, including protected areas and habitat of threatened species. The Contractor, upon becoming aware of the incident or accident, shall also inform the Engineer within 24 hours of any such incident or accident on the Subcontractors' or suppliers' premises relating to the Works which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's, its Subcontractors', and suppliers' personnel. The notification shall provide sufficient detail regarding such incidents or accidents. The Contractor shall provide full details of such incidents or accidents to the Engineer within the timeframe outlined in SSEMP, SSHSMP, or as agreed upon with the Engineer. The Contractor shall require its Subcontractors and suppliers to notify the Contractor of any incidents or accidents referred to in this Sub-Clause within the timeframe outlined in SSEMP, SSHSMP, or as agreed upon with the Engineer."
Sub-Clause 4.21 Security of the Site	At the end of Sub-Clause 4.21, the following paragraphs are added: "If required in the Employer's Requirements, further to conducting a site security risk assessment, the Contractor shall submit for the Engineer's No-objection a security management plan that sets out the security arrangements for the Site. The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct toward Contractor's Personnel, Employer's

Clause/Sub-Clause	Special Provisions
	Personnel, and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Employer's Requirements. The Contractor shall not permit any use of force by security personnel in providing security, except when used for preventive and defensive purposes in proportion to the nature and extent of the threat. In making security arrangements, the Contractor shall also comply with any additional requirements stated in the Employer's Requirements."
Sub-Clause 4.23 Archaeological and Geological Findings	The first paragraph is replaced with the following: "All fossils, coins, articles of value or antiquity, structures, groups of structures, and other remains or items of geological, archaeological, paleontological, historical, architectural, or religious interest found on the Site shall be placed under the care and custody of the Employer. The Contractor shall: a. take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's Personnel or other persons from removing or damaging any of these findings; b. train relevant Contractor's Personnel on appropriate actions to be taken in the event of such findings; and c. implement any other action consistent with the Employer's Requirements and relevant Laws."
Sub-Clause 4.24 Environmental, Health, and Safety Code of Conduct	New Sub-Clause 4.24 is added as following: "The Contractor shall adhere to the Environmental, Health, and Safety (EHS) Code of Conduct for the Contractor's Personnel submitted as part of the Contractor's Tender. The Contractor shall take all necessary measures to ensure that each Contractor's Personnel is made aware of the of EHS Code of Conduct, including specific behaviors that are prohibited and understands the consequences of engaging in such prohibited behaviors. These measures include providing instructions and documentation that can be understood by the Contractor's Personnel and seeking to obtain, as part of the site induction training, that person's signature acknowledging receipt of such instructions and/or documentation, as appropriate. The Contractor shall keep records of such acknowledgement of receipt. The Contractor shall also ensure that the EHS Code of Conduct is visibly displayed in multiple locations on the Site and any other place where the Works will be carried out, as well as in areas outside the Site accessible to the local community and project-affected people. The posted EHS Code of Conduct shall be provided in languages comprehensible to Contractor's Personnel, Employer's Personnel, and the local community. The Contractor's SSEMP (as per Sub-Clause 4.8 [*Health and Safety Obligations*]) and SSHSMP (as per Sub-Clause 4.18 [*Protection of the Environment*]) shall include appropriate processes for the Contractor to verify compliance with these obligations."
Sub-Clause 5.1 General Design Obligations	Add the following after the second paragraph: "If so stated in the Employer's Requirements, the Contractor shall:

Clause/Sub-Clause	Special Provisions
	(a) take into account climate change considerations in the design of structural elements of the Works and new buildings, if any; (b) apply the concept of universal access to the design and construction of structures and new buildings, if any (the concept of universal access means unimpeded access for people of all ages and abilities in different situations and under various circumstances); (c) consider the incremental risks of the public's potential exposure to operational accidents or natural hazards, including extreme weather events; and (d) any other requirement stated in the Employer's Requirements."
Sub-Clause 5.2 Contractor's Documents	In the first paragraph, delete the word "and" at the end of sub-paragraph (b), at the end of sub-paragraph (c) replace "." by "; and" and add sub-paragraph (d) as follows: "(d) described in Sub-Clause 4.8 [*Health and Safety Obligations*] and Sub-Clause 4.18 [*Protection of the Environment*]."
New Sub-Clause 5.2.3 Construction	Add the following at the end of sub-para (a): "The sign board design shall be considered relevant to the whole of the Works. Hence, no work shall commence until the Engineer has given (or is deemed to have given) his approval to the sign board design and until the sign board(s) have been properly installed in the agreed-upon location(s) at the Site."
Sub-Clause 6.1 Engagement of Staff and Labor	The following paragraphs are added at the end of the Sub-Clause: "The Contractor shall provide the Contractor's Personnel information and documentation that are clear and understandable regarding their terms and conditions of employment. The information and documentation shall set out their rights under relevant labor Laws applicable to the Contractor's Personnel (which will include any applicable collective agreements), including their rights related to hours of work, wages, overtime, compensation, and benefits, as well as those arising from the Employer's Requirements. The Contractor's Personnel shall be informed when any material changes to their terms or conditions of employment occur. The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labor with appropriate qualifications and experience from sources within the Country."
Sub-Clause 6.2 Rates of Wages and Conditions of Labor	The following paragraphs are added: "The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances, and any benefits as are subject to tax under the Laws of the Country for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on the Contractor by such Laws. The Contractor shall have paid its staff and labor all due wages and entitlements on or before the end of their engagement or employment."
Sub-Clause 6.5 Working Hours	The following is inserted at the end of the Sub-Clause: "The Contractor shall provide the Contractor's Personnel annual holiday and sick, maternity, and family leave, as required by applicable Laws or as stated in the Employer's Requirements."

Clause/Sub-Clause	Special Provisions
Sub-Clause 6.6 Facilities for Staff and Labor	The following is added as the last paragraph: "If stated in the Employer's Requirements, the Contractor shall give access to or provide services that accommodate the physical, social, and cultural needs of the Contractor's Personnel. The Contractor shall also provide similar facilities for the Employer's Personnel as stated in the Employer's Requirements."
Sub-Clause 6.7 Health and Safety of Personnel	In the second paragraph, "The Contractor" is replaced with: "Except as otherwise stated in the Employer's Requirements, the Contractor…" The following is added after the third paragraph: **"HIV-AIDS Prevention**. The Contractor shall conduct an HIV-AIDS awareness program via an approved service provider and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis, and to assist affected individuals. The Contractor shall conduct health and safety programs for workers employed under the project and shall include information on the trafficking of workers and the risk of sexually transmitted diseases, including HIV/AIDs in such programs. The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education, and Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labor (including all the Contractor's employees, all Subcontractors, and any other Contractor's or Employer's personnel, and all truck drivers and crew making deliveries to Site for construction activities), and to the immediate local communities, concerning the risks, dangers, and impact, and appropriate avoidance behavior with respect to, of Sexually Transmitted Diseases (STDs) or Sexually Transmitted Infections (STIs), in general, and HIV/AIDS, in particular; (ii) provide male or female condoms for all Site staff and labor, as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counseling, and referral to a dedicated national STI and HIV/AIDS program (unless otherwise agreed upon) of all Site staff and laborers. The Contractor shall include in the program to be submitted for the execution of the Works under Sub-Clause 8.3 [*Programme*] an alleviation program for Site staff and labor and their families in respect of Sexually Transmitted Infections (STIs) and Sexually Transmitted Diseases (STDs), including HIV/AIDS. The STI, STD, and HIV/AIDS alleviation program shall indicate when, how, and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause. For each component, the program shall detail the resources to be provided or utilized and any related subcontracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this program shall not exceed the Provisional Sum dedicated for this purpose."
Sub-Clause 6.9 Contractor's Personnel	The Sub-Clause is replaced with: "The Contractor's Personnel (including Key Personnel, if any) shall be appropriately qualified, skilled, experienced, and competent in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative and Key Personnel (if any), who: (a) persists in any misconduct or lack of care;

Clause/Sub-Clause	Special Provisions
	(b) carries out duties incompetently or negligently; (c) fails to comply with any provision of the Contract; (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment; (e) based on reasonable evidence, is determined to have engaged in any of the conducts defined in 2.1 (a) of Particular Conditions Part C (Corrupt and Fraudulent Practices) during the execution of the Works; (f) has been recruited from the Employer's Personnel in breach of Sub-Clause 6.3 [*Recruitment of Persons*]; (g) undertakes behavior which breaches the EHS Code of Conduct for Contractor's Personnel (EHS) as stated in Sub-Clause 4.24 [*Environmental, Health, and Safety Code of Conduct*]. If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience. In the case of replacement of the Contractor's Representative, Sub-Clause 4.3 [*Contractor's Representative*] shall apply. In the case of replacement of Key Personnel (if any), Sub-Clause 6.12 [*Key Personnel*] shall apply. Subject to the requirements in Sub-Clause 4.3 [*Contractor's Representative*] and 6.12 [*Key Personnel*], and notwithstanding any requirement from the Engineer to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Works are being carried out, any Contractor's Personnel who engages in (a), (b), (c), (d), (e), or (g) or has been recruited as stated in (f)."
Sub-Clause 6.12 Key Personnel	The following is inserted at the end of the last paragraph: "If any of the Key Personnel are not fluent in this language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer."
	The following Sub-Clauses 6.13 to 6.28 are added after Sub-Clause 6.12
Sub-Clause 6.13 Foreign Personnel	The Contractor may bring into the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national, or government permission required for bringing in the Contractor's personnel. The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.
Sub-Clause 6.14 Supply of Foodstuffs	The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Employer's Requirements at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.
Sub-Clause 6.15 Supply of Water	The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

Clause/Sub-Clause	Special Provisions
Sub-Clause 6.16 Measures against Insect and Pest Nuisance	The Contractor shall, at all times, take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.
Sub-Clause 6.17 Alcoholic Liquor or Drugs	The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter, or disposal thereto by Contractor's Personnel.
Sub-Clause 6.18 Arms and Ammunition	The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.
Sub-Clause 6.19 Festivals and Religious Customs	The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs, including those practiced by communities adjacent to the Site.
Sub-Clause 6.20 Funeral Arrangements	The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of its local employees who may die while engaged upon the Works.
Sub-Clause 6.21 Forced Labor	The Contractor shall not employ or engage forced labor. Forced labor means all work or services not voluntarily performed, that is, extracted from individuals under threat of force or penalty. The Contractor shall not employ persons who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harboring, or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation. The Contractor shall ensure that its Subcontractors and suppliers comply with all the obligations under this Sub-Clause.
Sub-Clause 6.22 Child Labor	The Contractor shall not employ or engage a child whose age is below the Country's statutory minimum age of employment or a child in contravention of International Labour Organization, Convention no. 138 (Minimum Age Convention). The Contractor shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. The Contractor shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment has been conducted by the Contractor with the Engineer's consent. The Contractor shall be subject to regular monitoring by the Engineer that includes monitoring of health, working conditions and hours of work. Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work: (a) with exposure to physical, psychological, or sexual abuse; (b) underground, underwater, working at heights or in confined spaces;

Clause/Sub-Clause	Special Provisions
	(c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads; (d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise, or vibration damaging to health; or (e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer. The Contractor shall ensure that its Subcontractors and suppliers comply with all the obligations under this Sub-Clause.
Sub-Clause 6.23 Employment Records of Workers	The Contractor shall keep complete and accurate records of the employment of labor at the Site. The records shall include the names, ages, genders, hours worked, and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [*Contractor's Records*]
Sub-Clause 6.24 Workers' Organizations	In countries where the relevant labor laws recognize workers' rights to form and to join workers' organizations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labor laws substantially restrict workers' organizations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organizations and collective bargaining or alternative mechanisms. Workers' organizations are expected to fairly represent the workers in the workforce.
Sub-Clause 6.25 Non-Discrimination and Equal Opportunity	The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions, and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-discrimination and equal opportunity, including for specific groups such as women, people with disabilities, Indigenous Peoples, and/or ethnic minorities migrant workers, and children (of working age in accordance with Sub-Clause 6.22 [*Child Labor*]).
Sub-Clause 6.26 Contractor's Personnel Grievance Mechanism	The Contractor shall have a grievance mechanism for the Contractor's Personnel, and where relevant the workers' organizations stated in Sub-Clause 6.24 [*Workers' Organizations*], to raise workplace concerns. The grievance mechanism shall be proportionate to the nature, scale, risks, and impacts of the Contract. The mechanism shall address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a

Clause/Sub-Clause	Special Provisions
	language they understand, without any retribution, and shall operate in an independent and objective manner. The Contractor's Personnel shall be informed of the grievance mechanism at the time of engagement for the Contract, and the measures put in place to protect them against any reprisal for its use. Measures will be put in place to make the grievance mechanism easily accessible to all Contractor's Personnel. The grievance mechanism shall not impede access to other judicial or administrative remedies that might be available or substitute for grievance mechanisms provided through collective agreements. The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to the Contractor's Personnel. Existing grievance mechanisms may be supplemented as needed with Contract-specific arrangements.
Sub-Clause 6.27 Training of Contractor's Personnel	The Contractor shall provide appropriate training to relevant Contractor's Personnel on obligations set out in the respective Sub-Clause 4.8 [*Health and Safety Obligations*], Sub-Clause 4.18 [*Protection of the Environment*], and Sub-Clause 6.28 [*Respectful Work Environmen*t].
Sub-Clause 6.28 Respectful Work Environment	The Contractor shall ensure that its employees and Subcontractors observe the highest ethical standards and refrain from any form of bullying, discrimination, misconduct, and harassment, including sexual harassment; and shall, at all times, behave in a manner that creates an environment free of unethical behavior, bullying, misconduct, and harassment, including sexual harassment. The Contractor shall take appropriate action against any employees or subcontractors, including suspension or termination of employment or subcontract, if any form of unethical or inappropriate behavior is identified. The Contractor shall conduct training programs for its employees and Subcontractors to raise awareness on and prevent any form of bullying, discrimination, misconduct, and harassment, including sexual harassment, and to promote a respectful work environment. The Contractor shall keep an up-to-date record of its employees and Subcontractors who have attended and completed such training programs and provide such records to the Employer or the Engineer at their first written request.
Sub-Clause 7.7 Ownership of Plant and Materials	The following is added before the first paragraph: "Except as otherwise provided in the Contract,"
Sub-Clause 8.1 Commencement of Work	The first paragraph is replaced with the following: "The Engineer shall give a Notice to the Contractor stating the Commencement Date, not less than 14 days before the Commencement Date. This Notice shall be issued promptly after the Engineer determines the fulfillment of the following conditions:

Clause/Sub-Clause	Special Provisions
	(a) signature of the Contract Agreement by both Parties and, if required, approval of the Contract by relevant authorities of the Country; (b) delivery to the Contractor of reasonable evidence of the Employer's financial arrangements (under Sub-Clause 2.4 [*Employer's Financial Arrangements*]; (c) except if otherwise specified in Sub-Clause 2.1 *[Right of Access to Site]* in the Contract Data, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [*Compliance with Laws*] as required for the commencement of the Works; (d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [*Advance Payment*] provided that the conditions set out under Sub-Clause 14.2.2 (a) and (b) have been fulfilled by the Contractor within 28 days from the receipt of the Letter of Acceptance. Otherwise, this sub-paragraph (d) shall not apply.
Sub-Clause 8.3 Programme	Add the following at the end of sub-paragraph (b): ", it being understood that the sequence of construction activities should take into account, to the extent possible, the constraints due to land acquisition as set out in the resettlement plan."
Sub-Clause 13.3.1 Variation by Instruction	Sub-paragraph 13.3.1 (a) is replaced with: "a description of the varied work performed or to be performed, including details of the resources and methods adopted or to be adopted by the Contractor, and sufficient information to enable an evaluation of environmental, health, and safety risks and impacts;"
Sub-Clause 13.4 Provisional Sums	The following is inserted as the penultimate paragraph: "A specific Provisional Sum for the work of the DAAB shall be used to cover the Employer's share of the DAAB members' fees and expenses, in accordance with Clause 21 [*Dispute and Arbitration*]. Notwithstanding the foregoing, no prior instruction from the Engineer shall be required for use of this specific Provisional Sum. The Contractor shall submit the DAAB members' invoices and satisfactory evidence of having paid 100% of such invoices as part of supporting documents of those Statements submitted under Sub-Clause 14.3 [*Application for Interim Payment*]. No overhead and profit shall be paid to the Contractor in respect of the Provisional Sum." The following is added at the end of the first paragraph: "If the Contract Price includes Provisional Sums for contingencies, it shall be used, in whole or part, at the discretion, and in accordance with the instructions, of the Engineer, to meet any of the Employer's payment obligations in connection with or arising out of the Contract."
Sub-Clause 13.6 Adjustments for Changes in Laws	The following paragraph is added at the end of the Sub-Clause: "Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time, and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the Table of Adjustment Data in accordance with the provisions of Sub-Clause 13.7 [*Adjustments for Changes in Cost*]."
Sub-Clause 14.1 The Contract Price	[*Note to the Employer: include one of the following two alternative texts at the end of sub-paragraph* (b) *or insert a description of the tax treatment on Contractor's Equipment in the Country as applicable.]*

Clause/Sub-Clause	Special Provisions
	[Alternative 1] "Notwithstanding the foregoing, Contractor's Equipment, including essential spare parts therefore, imported by the Contractor for the sole purpose of executing the Contract shall be exempted from the payment of import duties and taxes upon importation." **[Alternative 2]** "Notwithstanding the foregoing, Contractor's Equipment, including essential spare parts therefore, imported by the Contractor for the sole purpose of executing the Contract shall be temporarily exempt from the payment of import duties and taxes upon initial importation, provided the Contractor shall post with the customs authorities at the port of entry an approved export bond or bank guarantee, valid until the Time for Completion plus 6 months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment and spare parts, and callable in the event the Contractor's Equipment is not exported from the Country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer upon the importation of individual items of the Contractor's Equipment and spare parts. Upon export of individual items of the Contractor's Equipment or spare parts, or upon the completion of the Contract, the Contractor shall prepare, for approval by the customs authorities, an assessment of the residual value of the Contractor's Equipment and spare part to be exported, based on the depreciation scale(s) and other criteria used by the customs authorities for such purposes under the provisions of the applicable Laws. Import duties and taxes shall be due and payable to the customs authorities by the Contractor on (a) the difference between the initial imported value and the residual value of the Contractor's Equipment and spare parts to be exported; and (b) on the initial imported value of the Contractor's Equipment and spare parts remaining in the Country after completion of the Contract. Upon payment of such dues within 28 days of being invoiced, the bond or bank guarantee shall be reduced or released accordingly, otherwise, the security shall be called in the full amount remaining."
Sub-Clause 14.2.1 Advance Payment Guarantee	The first paragraph is replaced with: "The Contractor shall obtain (at the Contractor's cost) an Advance Payment Guarantee in amounts and currencies equal to the advance payment and shall submit it to the Employer with a copy to the Engineer. This guarantee shall be issued by reputable bank or financial institution selected by the Contractor and shall be based on the sample form annexed to the Particular Conditions or in another form agreed upon by the Employer (but such agreement shall not relieve the Contractor from any obligation under this Sub-Clause)."
Sub-Clause 14.3 Application for Interim Payment	Sub-paragraph (vi) is replaced with the following; "(vi) any other additions and/or deductions which have become due under the Contract or otherwise, including those under Sub-Clause 3.7 [*Agreement or Determination*], any amount due to the Contractor under Sub-Clause 21.4.3 (i) and any reimbursement due to the Contractor under Sub-Clause 9.5 of the General Conditions of the DAAB Agreement."
Sub-Clause 14.9 Release of Retention Money	The following is added at the end of Sub-Clause 14.9: "Unless otherwise stated in the Contract, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and issued by a reputable bank or financial institution

Clause/Sub-Clause	Special Provisions
	selected by the Contractor, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security under Sub-Clause 4.2 [*Performance Security*]. On receipt by the Employer of the required guarantee, the Engineer shall certify, and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release after the latest of the expiry dates of the Defects Notification Periods. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate. If the Performance Security required under Sub-Clause 4.2 [*Performance Security*] is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security, when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security."
Sub-Clause 14.15 Currencies of Payment	Throughout Sub-Clause 14.15, "Contract Data" is replaced with: "Schedule of Payment Currencies or the Schedules of Priced Sub-Activities (in case the use of various currencies is stated in the Schedules of Priced Sub-Activities), as applicable." Sub-paragraph 14.15 (a) (ii) is replaced with the following: "payments and deductions under Sub-Clause 13.6 [*Adjustments for Changes in Laws*] shall be made in the applicable currencies and proportions as specified in sub-paragraph (a) (i) above." Sub-paragraph 14.15 (b) is replaced with the following: "Whenever an adjustment is agreed upon or determined under Sub-Clause 13.2 [*Value Engineering*], Sub-Clause 13.3 [*Variation Procedure*] or Sub-Clause 13.4 [*Provisional Sums*], the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified in sub-paragraph (a) (i) above."
Sub-Clause 15.1 Notice to Correct	"and" is deleted at the end of (b) and "." is replaced by: "; and" in (c). The following is then added as (d): "(d) specify the time within which the Contractor shall respond to the Notice to Correct." In the third paragraph, "shall immediately respond" is replaced with: "shall respond within the time specified in (d)." Furthermore, at the end of the third paragraph, "to comply with the time specified in the Notice to Correct." is replaced with: "to comply with the time specified in (c)."
Sub-Clause 15.2.1 Notice	Sub-paragraph (h) is replaced with: "is found, based on reasonable evidence, to have engaged in Corrupt and Fraudulent Practices as defined in paragraph 2.1 (a)

Clause/Sub-Clause	Special Provisions
	of Part C of the Particular Conditions [*Corrupt and Fraudulent Practices*], in competing for or in executing the Contract."
Sub-Clause 15.2.2 Terminations for Contractor's Default	*In Sub-Clause 15.2.2, delete "14 days" and replace it with:* "28 days"
Sub-Clause 15.8 Fraud and Corruption	The following new Sub-Clause is added: "15.8.1 The Bank requires compliance with the Bank's Anticorruption Policy and Investigation and Enforcement Framework (both as amended from time to time), as set forth in Particular Conditions—Part C—Corrupt and Fraudulent Practices. 15.8.2 The Employer requires the Contractor to disclose any commissions, gratuities, or fees that may have been paid or are intended to be paid to agents or any other party with respect to the bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity, or fee."
Sub-Clause 16.1 Suspension by Contractor	*In the first line of the second paragraph of Sub-Clause 16.1, replace "21 days" with:* "28 days"
Sub-Clause 16.2 Termination by Contractor	In the first paragraph of Sub-Clause 16.2.2, replace "14 days" with: "28 days"
Sub-Clause 16.2.1 Notice	At the end of sub-paragraph (i): "; or" is replaced with: "." Sub-paragraph (f) is replaced with: "(f) the Contractor does not receive a Notice of the Commencement Date under Sub-Clause 8.1 [*Commencement of Works*] within 182 days after receiving the Letter of Acceptance, for reasons not attributable to the Contractor;" Sub-paragraph (j) is replaced with: "the Employer is found, based on reasonable evidence, in accordance with the Bank's Anticorruption Policy and Investigation and Enforcement Framework (both as amended from time to time) to have incurred in integrity violations, such as those defined in Part C [*Corrupt and Fraudulent Practices*] of the Particular Conditions of Contract at any time in relation to work or the Contract."
Sub-Clause 16.2.2 Termination	The following is added at the end of Sub-Clause 16.2.2: "In the event the Bank suspends the loan or grant from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to the Contractor by the expiry of 14 days after the relevant time period referred to in Sub-Clause 14.7 [*Payment*], issuance of the Interim Payment Certificates to which they relate, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [*Delayed Payment*], take one of the following actions: (i) suspend work or reduce the rate of work under Sub-Clause 16.1 [*Suspension by Contractor*], or (ii) terminate the Contract by giving Notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the Notice."
Sub-Clause 17.2	*In the last paragraph of Sub-Clause 17.2, delete "Cost Plus Profit" and substitute:* Cost, which shall be included in the Contract Price.

Clause/Sub-Clause	Special Provisions
Liability for Care of Works	
Sub-Clause 17.7 Use of Employer's Accommodation and Facilities	The following Sub-Clause is added as 17.7: "The Contractor shall take full responsibility for the care of the Employer-provided accommodation and facilities, if any, as detailed in the Employer's Requirements, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works). If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at its own cost, rectify the loss or damage to the satisfaction of the Engineer."
Sub-Clause 18.1 Exceptional Events	Sub-paragraph (c) is substituted with "(c) riot, commotion, disorder, or sabotage by persons other than the Contractor's Personnel and other employees of the Contractor and Subcontractors;"
Sub-Clause 18.5 Optional Termination	In sub-paragraph (c), "and necessarily" is inserted after ""was reasonably."
Sub-Clause 19.1 General Requirements	The following paragraphs are added after the first paragraph: "Wherever the Employer is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with terms (if any) agreed upon by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause."
Sub-Clause 19.2 Insurance to be provided by the Contractor	The following is inserted as the first sentence in Sub-Clause 19.2: "The Contractor shall be entitled to place all insurances relating to the Contract (including, but not limited to the insurance referred to Clause 19) with insurers from the List of Eligible Countries as stated in Sub-Clause 1.5 [*Priority of Documents*]."
Sub-Clause 19.2.5 Injury to employees	The second paragraph is replaced with: "The Employer and the Engineer shall also be indemnified under the policy of insurance, against liability for claims, damages, losses, and expenses (including legal fees and expenses) arising from injury, sickness, disease, or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel."
Sub-Clause 20.2 Claims for Payment and/or EOT	The first paragraph is replaced with: "If either Party considers that it is entitled to claim under Sub-Clause 20.1 (a) or (b), the following claim procedure shall apply:"
Sub-Clause 20.2.7 General requirements	In the first paragraph, replace "until" with "after" and delete "reasonably."
Sub-Clause 21.1 Constitution of the DAAB	In the first paragraph, the second sentence is replaced with: "The Parties shall jointly appoint the member(s) of the DAAB within 28 days after the Commencement Date, unless stated otherwise in the Contract Data." In the second paragraph, at the end of the first sentence, after deleting: ".", the following is added: ", each of whom shall meet the criteria set forth in Sub-Clause

Clause/Sub-Clause	Special Provisions
	3.3 of Appendix – General Conditions of Dispute Avoidance/Adjudication Agreement." After the second paragraph, insert the following paragraph: "If the Contract is with a foreign Contractor, the DAAB members shall not have the same nationality as the Employer or the Contractor."
Sub-Clause 21.2 Failure to Appoint DAAB Member(s)	In the first paragraph, in the text that follows sub-paragraph (d), replace the words "the President of FIDIC or a person appointed by the President" by the following: "the appointing entity or official named in the Contract Data (if not named in the Contract Data, the President of FIDIC, or a person appointed by the President)."
Sub-Clause 21.4.3 The DAAB's decision	Item (i) of penultimate paragraph is deleted and replaced as follows: "subject to sub-paragraph (ii) below, this amount shall be due and payable in the next Payment Certificate, for which the Engineer is obliged to certify, and the Employer is obliged to make payment; and"
Sub-Clause 21.6 Arbitration	In the first paragraph, delete starting from: "international arbitration" up to the end of (c), and replace with the following: "arbitration. Arbitration shall be conducted as follows: (a) if the Contractor, or if the leader of the JV in case the Contractor is a JV, is from outside the Country, unless otherwise specified in the Contract Data: (i) the Dispute shall be finally settled under the Rules of Arbitration of the Singapore International Arbitration Centre (SIAC), with proceedings administered by SIAC; (ii) the Dispute shall be settled by one or three arbitrators appointed in accordance with these Rules; and (iii) the place of arbitration shall be Singapore or any other neutral place mutually agreed upon by both the Employer and the Contractor. The arbitration shall be conducted in the ruling language defined in Sub-Clause 1.4 [*Law and Language*]. (b) If the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country."

	APPENDIX – GENERAL CONDITIONS OF DISPUTE AVOIDANCE/ADJUDICATION AGREEMENT
1. Definitions	In Sub-Clause 1.8 a (i): "authorized representative of the Contractor or of the Employer" is replaced with: "Contractor's Representative or authorized representative of the Employer."
2. General Provisions	Sub-Clause 2.2 is deleted in its entirety.
7. Confidentiality	In Sub-Clause 7.3: "or" is deleted from the end of sub-paragraph (b); "." at the end of sub-paragraph (c) is replaced with: ", or." The following is then added as (d): "(d) is required by the Bank."

Part C – Corrupt and Fraudulent Practices

1. Purpose

1.1 ADB's Anticorruption Policy and Investigation and Enforcement Framework (both as amended from time to time) and this annex apply with respect to procurement under ADB-financed activities.

2. Requirements

2.1 ADB requires Borrowers (including beneficiaries of ADB-financed activity) and their personnel, as well as firms and individuals participating in an ADB-financed activity, including but not limited to, Bidders, Suppliers, and Contractors, agents, subcontractors, subconsultants, service providers, sub-suppliers, manufacturers (including their respective officers, directors, employees, and personnel) under ADB-financed contracts to observe the highest standard of ethics during the procurement and execution of such contracts in accordance with ADB's Anticorruption Policy (1998, as amended from time to time). In pursuance of this policy, ADB

(a) defines, for the purposes of this provision, the terms set forth below as follows:

(i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;

(ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

(iii) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

(iv) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;

(v) "abuse" means theft, waste, or improper use of assets related to ADB-related activity, either committed intentionally or through reckless disregard; and

(vi) "integrity violation" means any act, as defined under ADB's Investigation and Enforcement Framework (as amended from time to time), which violates ADB's Anticorruption Policy, including (i) to (v) above and the following: failure to disclose and manage conflict of interest[1], obstructive practice, violation of debarment, retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standards.

(b) will reject a proposal for award if it determines that the Bidder recommended for award or any of its officers, directors, employees, personnel, subconsultants, subcontractors, service providers, suppliers, or manufacturers has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract.

[1] Conflict of interest" means any situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations.

(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation, including by failing to inform ADB in a timely manner at the time they knew of the integrity violations;

(d) will impose enforcement and disclosure actions on a firm or an individual at any time, in accordance with ADB's Anticorruption Policy and Investigation and Enforcement Framework, including declaring ineligible, either indefinitely or for a stated period of time, to participate[2] in ADB-financed, -administered, or -supported activities, or to benefit from an ADB-financed, -administered, or -supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and

(e) will have the right to require that a provision be included in bidding documents and in contracts financed, administered, or supported by ADB, requiring Bidders, suppliers, and contractors, consultants, manufacturers, service providers, and other third parties engaged or involved in ADB related activities, and their respective officers, directors, employees, and personnel, to permit ADB or its representative to inspect the site and their assets, accounts, and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

2.2 All Bidders, consultants, contractors, suppliers, manufacturers, service providers, and other third parties engaged or involved in ADB-related activities and their respective officers, directors, employees, and personnel, are required to cooperate fully in any investigation when requested by ADB to do so. As determined on a case-by-case basis by ADB, such cooperation is set out in detail in the Investigation and Enforcement Framework (as amended from time to time).

2.3 All Bidders, consultants, contractors, and suppliers shall require their officers, directors, employees, personnel, and agents to ensure that, in its contracts with its subconsultants, Subcontractors, and other third parties engaged or involved in ADB-related activities, such subconsultants, Subcontractors, and other third parties similarly are required to cooperate fully in any investigation when requested by ADB to do so.

2.4 The Contractor undertakes that no fees, gratuities, rebates, gifts, commissions, or other payments, other than those shown in the bid, have been given or received in connection with the procurement process or in the contract execution.35F[3]

[2] Whether as a Contractor, Subcontractor, Consultant, Manufacturer, or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document).

[3] The undertaking also applies during the period of performance of the contract.

Part D – Environmental, Health, and Safety

Metrics for Progress Reports

Metrics for regular reporting:

a. Incident for Nonconformance

(a) environmental incidents or nonconformance with contract requirements as defined in EMP, BMP, and management subplans and SPS (2009). Non-conformance includes, amongst other aspects: contamination; pollution; spills; erosion/sedimentation; natural hazard incidence; damage to ground or water supplies; impacts upon cultural heritage; waste; traffic incidents; impacts upon communities or community infrastructure; exceedance of air, noise or vibration standards; impacts to soil or topsoil; avoidable impacts upon biodiversity, natural habitats, or ecosystem services.
(b) health and safety incidents, near misses, accidents, injuries that require treatment and all fatalities;
(c) interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);

b. Status of All Permits and Agreements

(a) work permits required/authorized, actions taken for those not received;
(b) status of permits and consents (e.g., Environmental Clearance, Forest clearance for vegetation clearance for the TL RoW and Access Roads, Foreign Worker Permit, Water Abstraction Consent, Waste disposal consent, Land lease agreements for private land,). See ESIA for full details.
(c) list areas and facilities with permits required (quarries, asphalt, and batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, and others).
(d) list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent).
(e) identify and highlight major activities and environment, health, and safety activities undertaken in each area in the reporting period (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation).
(f) list parts of the Site for which Notice to commence work and confirmation by the Employer as per Sub-Clause 2.1 [*Right of Access to the Site*] was received by the Contractor and the other parts of the Site for which such Notice is pending.

c. Compliance [4]

(i) Compliance status for conditions of all relevant consents and permits for the Work, including quarries, and others): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;
(ii) compliance status of SSHSMP (as per Sub-Clause 4.8 [*Health and Safety Obligations*]) and SSEMP (as per Sub-Clause 4.18 [*Protection of the Environment*]): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance; and
(iii) other unresolved issues from previous reporting periods related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not

[4] For projects categorized as Category C for environment for which no EMP has been prepared, item (ii) should be deleted.

dealt with, continued compensation or blasting issues, and others. Cross-reference other sections as needed.

d. Supervision

(i) Biodiversity and Ecological Supervision

(a) number of days worked, number of full surveys/rapid surveys, reports to construction, and project management on relocation of species of conservation importance, or wildlife and bird species encountered/injured and/or rescued; number of partial and full site inspections (by area: road section, RoW, natural habitat, quarries, borrow areas, spoil areas, work site, highlights of activities (including violations of environmental, health, and safety requirements observed, actions taken), number of trainings provided; details of actions to avoid degradation of ecosystem services and flora and fauna; avoidance of spreading pathogens and invasive species, minimization of habitat loss or bird breeding/nesting/ sites; avoidance of fire; tree felling records as per agreed methods; avoidance of NTFP; records of phased felling/soft felling; records of planned vegetation clearance; compliance of sub-contractors with EMP and BMP, bird diverter installation.

(ii) Environment, Health and Safety Supervision (International / National)

(a) days worked, areas inspected, numbers of inspections of each (e.g., road section, work camp, accommodations, quarries, borrow areas, spoil areas, swamps, forest crossings, and others), highlights of activities or findings (including violations of environmental requirements and best practices, actions taken), reports to environmental specialist, construction, and/or site management;
(b) health and safety specialist: number days worked, number of full inspections and partial inspections, reports to construction, and project management
(c) number of workers, work hours, metric of personal protection equipment (PPE) use (percentage of workers with full PPE, partial PPE, and others), worker violations observed (by type of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any); number of accidents/incidents / near misses, corrective actions, number of penalties awarded, number of workers accessing GRM.
(d) number of partial and full site inspections (by area: road section, work camp, accommodations, quarries, borrow areas, spoil areas, work site, storage areas, clinic, community centers, and others), highlights of activities (including violations of environmental, health, and safety requirements observed, actions taken), reports to health and safety specialist, construction, and site management.
(e) Site restoration reports

e. Worker Accommodations

(a) number and types of worker accommodation and number of expatriates housed in accommodations, number of locals;
(b) date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, air quality, separation of accommodation and facilities.
(c) drinking water, waste management, fire safety,

(d) actions taken to recommend and/or require improved conditions, or to improve conditions for all relevant EHS aspects.

f. Training

(a) number of new workers, number receiving induction training, dates of induction training; summary of content
(b) number and dates of toolbox talks / training, number of workers receiving training on: Environment, Health, and Safety (EHS)-related; occupational health and safety (OHS); PPE; driver; community health and safety; fire safety; electrical safety; working from heights; SEAH; code of conduct; biodiversity conservation/risk awareness; EMP, BMP and BAP requirements; emergency response; chance-finds; flag person; and GRM.
(c) number and dates of those trained on communicable diseases (including STDs), welfare of staff and labour, unsanitary conditions, vulnerable people.

g. Grievances

(a) number of grievances from affected communities, key stakeholders, workers, as recorded in the Contractor's GRM
(b) number of grievances publicized, number of locations the GRM is available, signs or adverts publicizing the GRM.
(i) traffic and road safety incidents and accidents involving project or non-project vehicles and equipment: provide date, location, incident, damage, cause, follow-up/corrective action

h. Mitigation, Issues, and Corrective Actions*:*

(a) bidding and contract documents: include specific provisions requiring contractors to comply with all applicable labour laws and core labour standards; hire local workers to the extent possible; prepare a Contractor's Labor Management Plan (LMP)

(b) Workers camps: provisions requiring contractors to comply with all applicable national labour laws, GIP, and relevant IFI guidelines [5] regarding provision of weatherproof (rain, wind and cold), climate suited worker accommodation with safe drinking water, lighting and sanitation facilities, safe from wildlife and away from steep slopes (landslide risk) and at least 30m from river banks.

(c) Air quality and dust: number of exceedances above applicable thresholds, number of working bowsers, number of waterings per day, number of complaints, actions taken to resolve; types of mitigation employed to reduce dust (covers, sprays, operational status); percentage of lorries with covers, actions taken for uncovered vehicles;

(d) Noise disturbance: number of exceedances above required standards, timing and duration of exceedance, number of complaints, actions taken to resolve.

(e) Sediment and erosion control: types of controls implemented at each location, status of water crossings, water sampling results, actions taken to resolve issues, emergency actions needed to

[5] Workers accommodation: processes and standards. A Guidance note by IFC and the EBRD. (2009)

control erosion or sedimentation; waste water discharge; onsite sanitation facilities; provision of spill kits; provision of hard standing areas.

(f) Biodiversity: measures to avoid habitat destruction and vegetation clearance; measures to avoid impacts to Endangered or Vulnerable tree species; methods to protect retained; pre-removal surveys for wildlife; reinstatement of all temporary works areas; topsoil storage sites; installation of reputable bird divertors; outcome of fauna and avian surveys; records of species planted; measures to remove all invasive species from proposed worksites; tree felling methods; consultation will key ministries and departments.

(g) Quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken in the reporting period at each, and highlights of environmental protection: land clearing, boundary marking, topsoil salvage, traffic management;
(h) Blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, and others), incidents of off-site damage or complaints (cross-reference other sections as needed);
(i) Pollution prevention: spill clean-ups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination);
(j) waste management: types and quantities generated and managed, including amount taken off-site (and by whom) or reused, recycled, or disposed on-site, name of facility, receipt/invoice of wastes taken to licensed facility.
(k) Water: obtain extraction and usage clearances; ensure protection mitigations undertaken; prevent water logging; drainage installation;
(l) use of temporary right of way and any additional facility that have temporary and/or permanent impacts on affected persons' assets, access to assets and/or livelihoods (income sources). It shall put in place corresponding mitigation measures, and implement them; and
(m) Restoration of the environment due to damage caused by the construction activities
(n) Decommissioning planning, decommissioning implementation

(ii) *Health and Safety Mitigation*

(a) Detail hazard prevention and control measures undertaken in the reporting period.
(b) Compliance with approved Health and Safety Management Plan (HSMP), Traffic Management Plan, and Emergency Preparedness and Response Plan (EPRP).
(c) Number and types of signage to alert communities and workers of hazards; set back from rivers and streams;
(d) number of fire extinguishers and firefighting equipment across work sites; presence of qualified first aider and trained fire marshal
(e) Number of engagement with communities and key stakeholders to ensure adequate community health hand safety is achieved

Annex to the Particular Conditions

Form of Performance Security

[*Note: See corresponding form in Section 9 of the Bidding Document*]

Form of Advance Payment Bank Guarantee

[*Note: See corresponding form in Section 9 of the Bidding Document*]

Form of Retention Money Guarantee

[*Note: See corresponding form in Section 9 of the Bidding Document*]

Land Acquisition and Resettlement Plan

Section 9: Contract Forms

This section contains forms which, once completed, will form part of the Contract. The forms for Performance Security, Advance Payment Guarantee and Retention Money Security, when required, shall only be completed by the successful Bidder after contract award.

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INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Notice of Intention for Award of Contract

[on letterhead paper of the Employer]

[date of notification]

To: *[name of the Bidder]*
Attention: *[insert name of the Bidder's authorized representative]*
Address: *[insert address of the Bidder's authorized representative]*
Telephone/Fax numbers: *[insert telephone/fax numbers of the Bidder's authorized representative]*
E-mail Address: *[insert e-mail address of the Bidder's authorized representative]*

This is to notify you of our intention to award the contract [insert name of the contract and identification number, as given in the Bid Data Sheet]. You have [insert number of days as specified in ITB 43.1 of the BDS] days from the date of this notification to (i) request for a debriefing in relation to the evaluation of your Bid; and/or (ii) submit a bidding-related complaint in relation to the intention for award of contract, in accordance with the procedures specified in ITB 48.1.

The summary of the evaluation are as follows:

1. List of Bidders

Name of Bidder	Bid Price as Read Out at Opening	Evaluated Bid Price	Technical Score	Financial Score	Combined Technical and Financial Scores

2. Reason/s Why Your Bid Was Unsuccessful

……
……
……

3. The Successful Bidder

Name of Bidder:	
Address:	
Accepted Contract Amount:	
Duration of Contract:	
Scope of the Contract Awarded:	
Amount Performance Security Required:	

Authorized Signature: ……

Name and Title of Signatory: ……

Name of Agency: ……

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Letter of Acceptance

[on letterhead of Employer]

[date]

To: *[Name and address of the contractor]*

Subject: Contract No. *[please specify]*

This is to notify you that your Bid dated [date] for execution of the *[name of the contract and identification number, as given in the Bid Data Sheet]* for the Accepted Contract Amount in the equivalent of *[amount in words and figures and name of currency]*, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract and any additional security required as a result of the evaluation of your bid, using for that purpose the Performance Security Form included in Section 9 (Contract Forms) of the Bidding Document.

Authorized Signature: ……

Name and Title of Signatory: ……

Name of Agency: ……

Attachment: Contract Agreement

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Contract Agreement

THIS CONTRACT AGREEMENT made the *[date]* day of *[month], [year],* between *[name of the Employer]* (hereinafter "the Employer"), of the one part, and *[name of the Contractor]* (hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as *[name of the contract]* should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein.

The Employer and the Contractor agree as follows:

1. In this Contract Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Contract Agreement. This Contract Agreement shall prevail over all other Contract documents.

   (a) the Contract Agreement;

   (b) Letter of Acceptance;

   (c) Letter of Technical Bid;

   (d) Letter of Price Bid;

   (e) the Particular Conditions – Part A – Contract Data;

   (f) the Particular Conditions – Part B – Special Provisions;

   (g) the Particular Conditions – Part C – Corrupt and Fraudulent Practices;

   (h) the Particular Conditions – Part D – Environmental, Health, and Safety (EHS) Metrics for Progress Reports;

   (i) List of Eligible Countries as defined by the Bank;

   (j) General Conditions of Contract;

   (k) the Specifications including EMP, EHS, personnel, and equipment requirements;

   (l) the Drawings;

   (m) completed Schedules including Bill of Quantities;

   (n) Environmental, Health, and Safety Code of Conduct for Contractor's Personnel;

   (o) Environmental, Health, and Safety Management Plan (EHSMP);

   (p) the Joint Venture Undertaking (If the Contract is a Joint Venture); and

   (q) any other documents forming part of the Contract.[1]

3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Contract Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

[1] Tables of Adjustment Data may be added if the contract provides for price adjustment (see GCC 13.7).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Contract Agreement to be executed in accordance with the laws of *[name of the borrowing country]* on the day, month, and year indicated above.

Signed by ……
for and on behalf of the Employer

in the presence of

Witness, Name, Signature, Address, Date

Signed by ……
for and on behalf the Contractor

in the presence of

Witness, Name, Signature, Address, Date

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Performance Security

[Bank's name, and address of issuing branch or office][2]

Beneficiary: ……. *[Name and address of the Employer]* …….

Date: ……..

Performance Guarantee No.: ……

We have been informed that *[name of the Contractor]* (hereinafter called "the Contractor") has entered into Contract No. *[reference number of the contract]* dated *[date]* with you, for the execution of *[name of contract and brief description of works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we *[name of the bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[name of the currency and amount in words]*[3] *[amount in figures]* such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the *[date]* day of *[month], [year]*,[4] and any demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.[5]

……
[Signature(s) and seal of bank (where appropriate)]

NOTE TO THE BIDDER

If the bank issuing performance security is located outside the Employer's country, it shall be counter-guaranteed or encashable by a bank in the Employer's country.

[2] All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

[3] The guarantor shall insert an amount representing the percentage of the accepted contract amount specified in the contract and denominated either in the currency(ies) of the contract or in any freely convertible currency acceptable to the Employer.

[4] Insert the date 28 days after the expected expiry of defect notification period. The Employer should note that in the event of an extension of the time for completion of the contract, the Employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months] [1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

[5] Or the employer may use "Uniform Rules for Demand Guarantees (URDG), ICC Publication No. 458, except that sub-paragraph (ii) of Sub-article 20(a) is hereby excluded" as appropriate.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Advance Payment Guarantee

[Bank's name, and address of issuing branch or office][6]

Beneficiary: ……. *[Name and address of the Employer]* …….

Date: ……..

Advance Payment Guarantee No.: ……..

We have been informed that *[name of the Contractor]* (hereinafter called "the Contractor") has entered into Contract No. *[reference number of the contract]* dated *[date]* with you, for the execution of *[name of contract and brief description of works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum *[name of the currency and amount in words]*[7] *[amount in figures]* is to be made against an advance payment guarantee.

At the request of the Contractor, we *[name of the bank]* hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[name of the currency and amount in words]*[8] *[amount in figures]* upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor:

(a) used the advance payment for purposes other than the costs of mobilization and cash flow support in respect of the Works; or

(b) has failed to repay the advance payment when it has become due and payable in accordance with the conditions of the Contract, specifying the amount payable by the Contractor.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number *[Contractor's account number]* at *[name and address of the bank]*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety percent (90%) of the Contract Price has been certified for payment, or on the *[date]* day of *[month], [year]*,[9] whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

---

[6] All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

[7] The guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the Contract, or in any freely convertible currency acceptable to the Employer.

[8] Footnote 41.

[9] Insert the expected expiration date of the time for completion. The Employer should note that in the event of an extension of the time for completion of the contract, the Employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed *[6 months] [1 year]*, in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.[10]

. . . . . .

[Signature(s) and seal of bank (where appropriate)]

NOTE TO THE BIDDER

If the bank issuing advance payment guarantee is located outside the Employer's country, it shall be counter-guaranteed or encashable by a bank in the Employer's country.

[10] Or the employer may use "Uniform Rules for Demand Guarantees (URDG), ICC Publication No. 458, except that sub-paragraph (ii) of Sub-article 20(a) is hereby excluded" as appropriate.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Retention Money Security

[Bank's name, and address of issuing branch or office][11]

Beneficiary: ……. *[Name and address of the Employer]* …….

Date: ……..

Retention Money Guarantee No.: ……

We have been informed that *[name of the Contractor]* (hereinafter called "the Contractor") has entered into Contract No. *[reference number of the contract]* dated [date] with you, for the execution of *[name of contract and brief description of works]* (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, the Beneficiary retains money up to the limit set forth in the Contract ("the Retention Money"), and that when the Taking-Over Certificate has been issued under the Contract and the first half of the Retention Money has been certified for payment, payment of *[insert the amount of the second half of the Retention Money or, if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security]* is to be made against a Retention Money guarantee.

At the request of the Contractor, we *[name of the bank]* as Guarantor hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *[name of the currency and amount in words]*[12] *[amount in figures]* such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

It is a condition for any claim and payment under this Guarantee to be made that the second half of the Retention Money referred above must have been received by the Contractor on its account number *[Contractor's account number]* at *[name and address of the bank]*.

This Guarantee shall expire, no later than the *[date]* day of *[month], [year]*,[13] and any demand for payment under it must be received by us at this office on or before that date.

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[11] All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

[12] The Guarantor shall insert an amount representing the amount of the second half of the Retention Money or if the amount guaranteed under the Performance Guarantee when the Taking-Over Certificate is issued is less than half of the Retention Money, the difference between half of the Retention Money and the amount guaranteed under the Performance Security and denominated either in the currency(ies) of the second half of the Retention Money as specified in the Contract, or in a freely convertible currency acceptable to the Beneficiary.

[13] Insert the date 28 days after the expected latest of the expiry dates of Defect Notification Periods. The Employer should note that in the event of an extension of the Time for Completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months] [1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.[14]

.....

[Signature(s) and seal of bank (where appropriate)]

NOTE TO THE BIDDER

If the bank issuing retention money security is located outside the Employer's country, it shall be counter-guaranteed or encashable by a bank in the Employer's country.

[14] Or the employer may use "Uniform Rules for Demand Guarantees (URDG), ICC Publication No. 458, except that sub-paragraph (ii) of Sub-article 20(a) is hereby excluded" as appropriate.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Technical Specification

PART I - GENERAL TECHNICAL REQUIREMENTS & SCOPE OF WORK

1.0 Project Description

With the growing domestic power demand and aim to attain energy security in the country, Druk Green Power Corporation Limited (DGPC) has ventured into development of a 108MWp (DC) Photovoltaic (**PV**) solar plant at Wobthang, Bumthang.To evacuate the generated power, Bhutan Power Corporation Limited (BPC) has decided to construct a 17.56 km (Desk top) 1xDC 132kV transmission line.The line transverse through the gentle slope of the Tang gewog and terminates at Garpang substation, Choekhor Gewog, Bumthang.

Particular details relevant to this Project:

Sl.#	Description	Detail data/information
1	Single/Double Circuit	Double Circuit
2	Voltage Level	132 kV
3	Line Length(approx.)	17.56 km
4	Type of Conductor to be used	ACSR Panther Equivalent ACCC Conductor
5	Terrain Type	Mountainous
6	Snow or Non-Snow Zone	Non-Snow Zone
9	Closest Airport	Bathpalathang Airport, Jakar

The particulars of the route are detailed in relevant portions of these tender documents.

Project Location and Layout:

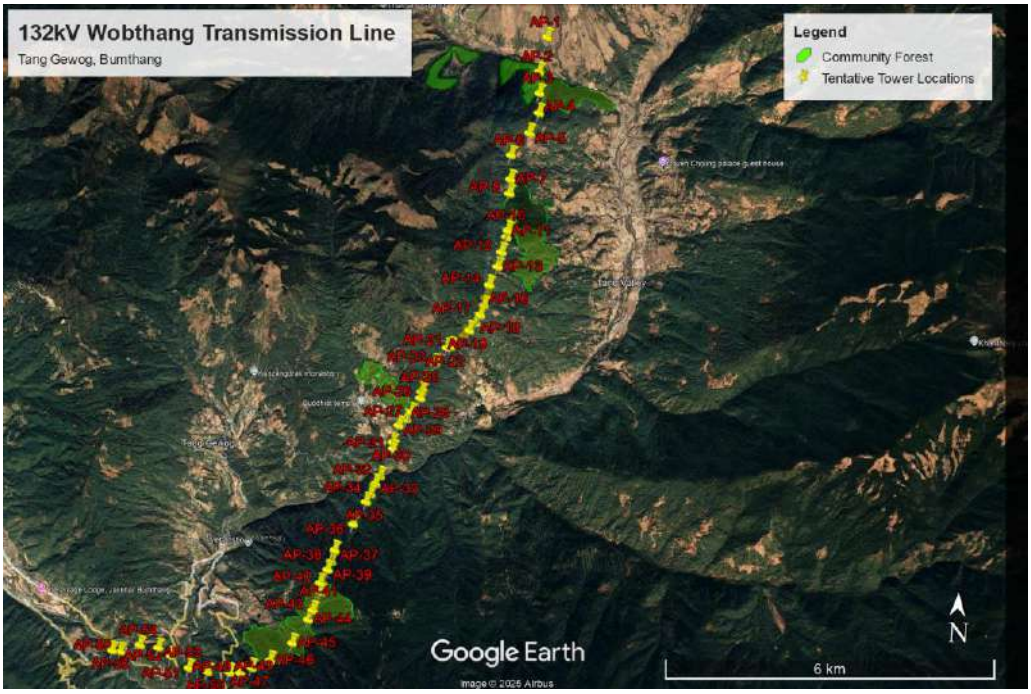


Figure 1: 132kV D/C Wobthang Transmission Line

The tentative tower schedule based on the walk on survey is given in **Annexure D.**

1.1 Site/Service Conditions

The equipment/material to be supplied under this project shall be suitable for satisfactory continuous operation under the following local conditions as specified below unless otherwise indicated elsewhere:

Basic Design Parameter	**Basic Design Value**
Altitude above MSL	800-6800 meters
Ambient Air Temperature Min Max	0.0°C 40.0°C
Isokeraunic level	70
Annual Rainfall*	71.39 mm
Climate	Dry and cold temperature
Relative Humidity	20 – 100%
Seismic Acceleration Level *Horizontal* *Vertical*	 0.1 g 0.05 g
Basic Wind Speed*1	47 m/s (As per IS 875 / 802)
Wind Zone	4 (As per IS 875 / 802)
Reference wind speed (IS802) (Maximum wind velocity for design *2)	34.18m/s (K=1.375; IS 802)
Design wind speed (IS 802)	34.18m/s (K_1=1, K_2=1)
Terrain Category	2 (As per IS 802)
Maximum solar radiation	1033.79 W/m^2 (MSL)
Reliability Level	1 (As per IS 802)
Earthquake Zone Category	5
Snow Incidence in Winter *3	0 mm

*Monsoon period is generally from May to September.
*1: Peak gust velocity (3 sec mean)
*2: Wind speed at 10m above ground and with an averaging period of 10min considers gust factor K=1.375
*3: Icing 12.5mm shall be considered to design above 2500m MSL

1.2 Special Requirements

Equipment supplied under this Contract will be installed in locations which can be considered hostile to its proper operation. Particular problems which shall receive special consideration relate to operation in wide-ranging temperatures and the presence of insects and vermin. Special consideration shall also be given to the electrical characteristics of the equipment when installed at altitude up to 4,000m.

1.3 Access

The tentative tower locations are proximate to farm roads/ Highway or can be reached through by construction of access road with min. aerial distance of approx. 50 m to max. 2 km. In case the construction of access roads is challenging, alternative methods like rope way shall have to be adopted for the timely completion of the project. The line also transverses through the several community forest (CF), requiring the stick adherence to the community guidelines and condemning trespassing the area other than allocated by BPC.

The nearest airport is Bathpalathang Airport, Bumthang, which is then connected to Paro International Airport with crowfly distance as given below;

Bathpalathang Airport to Garpang Substation:	5.5 km
Bathpalathang Airport to Wobthang, Tang Gewog:	14 km
Bathpalathang Airport to Paro International Airport:	131.75 km

The general transmission line route along with layout of access road is given in the Transmission Line Route map enclosed with these specifications.

1.4 Geotechnical

1.4.1 The requirement of geotechnical study is indicated separately in the specification. If such study is included in the Scope of the Works, the Contractor shall carry out the geotechnical study along the transmission line route and submit one (1) copy (Both soft & hard) of the Soil Investigation/Geotechnical Study Report to the Employer for approval.

1.4.2 Where the geotechnical study is already carried out earlier, a copy of the same will be provided to the successful bidder.

2.0 Scope of Work

The work shall be a Turnkey Project including Supply, Construction, Testing & Commissioning of a 132kV D/C transmission line from Wobthang Solar Project to Garpang Substation, Choekhor Gewog, Bumthang. The Bidder shall carry out the detailed survey, check survey of the entire line route, and all the works associated with the finalization of the tower locations, along with the type of tower to be used at each of the locations. The transmission line route map provides the locations of these towers.

The pre-designed tower and foundation shall be issued by Employer and the Contractor, under this tender is required to carry out all the works associated with the construction of the transmission line i.e. foundation-casting, tower erection, stringing of conductors and OPGW along with the insulators/hardware as required, testing and commissioning. Line profile and Stringing chart shall also be in the scope of the bidder but approved by the Employer. The work shall be carried out as per the designs/drawings furnished by the Employer.

The type of foundation to be cast shall be based on the geo-tech report provided by the Contractor, and the Contractor shall be responsible for the information provided therein. Based on the geo-tech data furnished by the Contractor, the appropriate type of foundation shall be adopted at the site. In the event the site parameters are at variance with the soil classification considered in the standard drawings provided by the Employer for different types of foundations, the Employer will provide the necessary modifications to the designs for such locations.

The stringing works shall be carried out by the Contractor based on the stringing chart to be approved by the Employer. The Contractor shall be responsible for ensuring that due care for the materials, like the conductor/OPGW/hardware etc., is taken, and any damages due to mishandling of the same shall be at the risk and cost of the Contractor.

The following is the Scope of Work under this Project:

(i) Detailed survey including route alignment, profiling by PLS-CADD software, tower spotting, optimization of tower locations, soil resistivity measurement & geotechnical investigation (including special foundation locations, viz. pile/well foundation locations).

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

Bidders may however visit the line route to acquaint themselves with terrain conditions, approach/accessibility to the site, salient features of route and associated details of the proposed transmission lines. Employers may also arrange joint site visits of line routes in Bhutan for all the interested Bidders who intend to participate in the bidding and have purchased the bidding documents.

For this purpose, they are requested to contract the following address: -

Chief Manager,
Contract Management Section,
Construction and Procurement Department
Bhutan Power Corporation Limited
Post Box 580,
Thimphu Bhutan
Tel: +975 2 325095 (extn:774(/322046)
e-mail: sangay.lungten@bpc.bt or cms@bpc.bt

(ii) A check survey shall be conducted to locate towers on the ground conforming to the approved profile and tower schedule. The contractor shall prepare detailed contouring/benching volume calculation sheets using Civil 3D/excel/or any other applicable applications of tower locations and submit tower schedule and line profile using PLS-CADD software including proposal of body/leg/chimney extension, wherever applicable, for approval by the Employer. All the documents should be submitted in saft copy as well.

The coordinates of all the tower locations shall also be recorded using GPS/DGPS of positional accuracy of at least 1m for easy relocation. The position of all tower locations shall be marked in the final digitized route alignment drawing with relative distances from any permanent benchmark.

Soil Investigation: The contractor shall also collect required data at each tower location in respect of soil strata, groundwater level, history of the water table in adjacent areas/surface water, and distance from the permanent benchmark (these details to be furnished in a tabulated form) and classify the suitable type of foundation at each tower location based on the data collected at each location, detailed soil investigations carried out at selected locations, etc.

(iii) Cutting of trees and bushes for the survey, stringing, and foundation works and to achieve the required ground clearance and ROW.

Right of Way and way leave clearance shall be arranged by the Employer in accordance with work schedules. Employers will secure way leave and right of way in the Forest area and has already obtained the forest clearance.

(iv) Manufacture, fabrication, galvanizing, supply, delivery, insurance, storage at site, transportation of materials to the construction site of all types of transmission line towers, including River crossing towers (wherever applicable) as per Employer design/drawings including fasteners, step bolts, hangers, D-shackles etc.

(v) All types of tower accessories like phase plate, circuit plate (wherever applicable), number plate, danger plate, anti-climbing device, and Bird guard (wherever applicable).

(vi) Supply of Conductor, Insulators, Earth wire, OPGW, Hardware Fittings and their Accessories.

(vii) The work shall be taken up as a turnkey package; therefore, all the materials required for completing the works shall be sourced by the contractor.

(viii) Classification of foundation for different types of towers and casting of foundation (including special foundation locations, viz. pile/well foundation locations) for tower footings as per Employer supplied foundations drawing.

(ix) Erection of towers, tack welding (where required) of bolts and nuts including supply and application of zinc-rich primer & two coats of enamel paint, tower earthing, fixing of insulator strings, stringing of conductors and earth wire/OPGW along with all necessary line accessories.

(x) Painting of towers (where required) & supply and erection/installation of span markers/LED signal and obstruction lights (wherever applicable) for aviation requirements (as required).

(xi) Testing and commissioning of the erected transmission lines; and

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

2.1 The Employer shall provide engineering documents like sag tension calculation, tower spotting data, and single line and clearance diagrams. The Employer shall also provide structural drawings & Bill of Materials of all types of transmission line towers and their extensions, river crossing towers/special towers as required to the Contractor after placement of award, in sequence, suiting the project requirement. Similarly, the drawings for all types of foundations for the towers shall also be provided by the Employer to the Contractor. However, the shop drawings shall be prepared by the Contractor, if required without any additional cost to the employer.

2.2 The following shall be specifically noted:

(a) The provisional quantities of fabricated & galvanized steel parts as per specifications required for towers, concrete, excavation volume & reinforcement steel for foundation and other items are given in the appropriate Schedule of Prices. However, the work shall be executed as per approved construction drawings. Payment of steel materials for towers shall be made based on the **black weight** without galvanization and no separate payment will be made for galvanization.

(b) The various items of work are described very briefly in the appropriate Schedule of prices. The various items of the Schedule of Prices shall be read in conjunction with the corresponding sections in the Technical Specifications, including amendments and additions, if any. The Bidder's quoted rates shall be based on the description of activities in the Schedule of Prices as well as other necessary operations required to complete the works detailed in these Technical Specifications.

(c) The Unit rates quoted shall include minor details which are obviously and fairly intended, and which may not have been included in these documents but are essential for the satisfactory completion of various works.

(d) The unit rate quoted shall be inclusive of all plant, equipment, men, material, skilled & unskilled labour, pandemic requirements, etc., essential for the satisfactory completion of various works.

(e) All measurements for payment shall be in S.I. units, and lengths shall be measured in meters corrected to two decimal places. Areas shall be computed in square meters & volume in cubic meters rounded off to two decimals.

2.3 The Bidder shall submit his offer taking into consideration that the tower and foundation designs/drawings shall be developed/provided by the Employer, and design rights will be strictly reserved with the Employer. The bidder shall quote the unit rates for various items of towers and foundations as per units mentioned in the appropriate Schedule of Prices. However, payment of these items identified in the schedule of prices shall be made as follows:

A)	**TOWER**	
i)	Supply items	On supply of respective complete towers.
ii)	Erection items	On the erection of the respective complete tower.
B)	**Foundation items:**	On completion of respective foundations in all respects.

The payment to be made for towers/foundations shall be worked out based on the unit rates and approved Bill of Materials (BOM) for towers and quantities/volumes as per approved tower foundation drawings.

2.4 Supply of all the raw materials such as steel, zinc for galvanizing, reinforcement steel, cement, coarse and fine aggregates for tower foundation, coke and salt for tower earthing, any materials required for slack span works at substation end etc. are included in the Contractor's scope of supply.

This specification also includes the supply of Conductor, Insulator, Earth wire, OPGW, hardware fitting and all types of accessories for conductor and earth wire as detailed in the specification. Contractors are required to procure and supply these line materials from the list of vendors enclosed as Annexure-A with this specification. The technical description of these line materials is given in the relevant section of this specification.

2.5 Bidders shall also indicate in the offer the sources from where they propose to procure the fasteners, step bolts, hangers, D-shackles etc., tower accessories, aviation signal (if required) etc.

2.6 **Stringing**

a) The entire stringing work of the conductor and OPGW shall be carried out by tension stringing technique. The bidders shall indicate in their offer the sets of tension-stringing equipment they have in their possession and the sets of stringing equipment they would deploy exclusively for this project which under no circumstance shall be less than the number and capacity requirement indicated in Qualifying Requirements for Bidder. However, the Bidder having requisite experience has the freedom to use a drone/helicopter for stringing at own cost. The Bidder intending to use a helicopter shall furnish detailed description of the procedure, type & number of helicopter & accessories etc., to be deployed for stringing operation.

b) In hilly terrain and thick forest or areas with site constraints, where the deployment of a tension stringing machine is not possible, manual stringing may be adopted after getting approval from the employer's site Engineer. The contractor shall deploy appropriate tools/equipment/machinery to ensure that the stringing operation is carried out without causing damage to the conductor/earth wire / OPGW conductor/earth wire /OPGW is installed at the prescribed sag-tension as per the approved stringing charts.

c) The stringing works include the slack span stringing between the last dead-end towers to be supplied under this contract and the terminal substation gantries (if the

same are ready), and the payment for this will be based on the unit rates in the contract for the supply and stringing works.

3.0 Units of Measurement

Metric units of measurement (System International) shall be used in all Contract documentation. Angular measurement shall be in degrees with 90 degrees comprising one right angle.

4.0 Standards & Codes

All equipment supplied under this Specification shall conform to the latest editions of the International Electrotechnical Commission (IEC) or Bureau of Indian Standards (BIS) Specifications. Alternative standards to IEC/ IS will only be accepted if the Contractor is able to satisfactorily demonstrate to the Employer prior to Contract Award that such standards are equal to or better than IEC/ BIS. Full details of differences, which affect the design or performance of the equipment, shall be stated in the Tender. However, structural/ civil Engineering design shall conform to the relevant latest BIS specifications.

5.0 Electrical Characteristics

5.1 High Voltage

Nominal System Voltage (kV)	**66**	**132**	**220**
Maximum system voltage kV	72.5	145	245
Basic Insulation Level (BIL) kV Peak (*)	325	650	1050
Rated one-minute power-frequency withstand voltage (kV rms) (*)	140	230	460
Rated short-time current (1 sec rms) kA	31.5	31.5	40
Rated Peak short-circuit current (peak value)kA	80	80	100

(*) These values apply up to 1000 m above Mean Sea Level (MSL) with IEC 60071-2 and IEC 6227-1

5.2.1 Low Voltage

For the information of Bidders, the prevalent standard LV system in Bhutan has the following parameters.

Nominal System Voltage (V)	400/230 on load
Maximum system voltage (V)	424/244
System frequency (Hz)	50
Rated 1-minute power-frequency withstand Voltage (V)	3000
Rated impulse voltage withstand - peak (V)	7500

6.0 Nuts, Bolts & Washers

6.1 All lattice steel tower structural members shall be secured by means of nuts and bolts with washers. Nuts and heads of all bolts shall be of the hexagonal type and of uniform outline dimension.

The minimum size of bolts for all structural connections shall be 16mm diameter in mild steel - 12 mm bolts will not be accepted.

All bolts and screwed rods shall be galvanized, including the threaded portions. All nuts shall be galvanised with the exception of the threads, which shall be oiled. All bolts attaching insulator set droppers, U bolts, and earth conductor clamps to the towers shall be provided with extra thread length to accommodate two nuts and a washer in an approved manner. The screwed thread of any bolts or studs shall not form part of a shearing plane between members.

All washers shall be included under this Contract, including locking devices and anti-vibration arrangements, which are to be subject to the approval of the Employer. The washers shall be of adequate thickness to abridge the projection of the shaft and the commencement of the threaded portion. Taper washers shall be fitted where necessary.

Nuts shall be finger-tight on the bolt and will be rejected if they are, in the opinion of the Employer, considered to have an excessively loose or tight fit. Bolts re-threaded after galvanising will be rejected. The Contractor shall allow for the supply of surplus bolts, nuts and washers in excess of the exact amount measured to allow for shortages due to loss, misappropriation etc. Bolts of a single diameter only shall be used for a given tower type and as far as possible for all tower types. Only in exceptional cases, different diameter bolts shall be used with the prior approval of the Employer. But even in the latter case, for each tower type, all the bolts used shall be of the same diameter.

Usage of High Tensile bolts will be restricted to only those joints specifically indicated in the Employer's approved designs.

7.0 Castings

All castings shall be free from blowholes, flaws and cracks as far as is practicable. No welding, filling or plugging of defective parts shall be done under any circumstances. All cast iron shall be of close-grained quality approved by the Employer.

8.0 Welding

All joints shall be bolted joints, and welded joints shall not be permitted either during the design stage or the construction stage. However, in case of additional unforeseen requirements during erection by the Employer, if welding needs to be resorted to, the same shall be done with prior approval of the Employer and shall conform to BIS specifications. In such a case, the Contractor shall specifically indicate the location and purpose along with the proposed methodology for welding for the Employer's approval.

9.0 Spare Parts, Tools and Appliances

The bidder shall state in the relevant schedules the spares, special tools and/ or appliances which are recommended. The Employer may order all, none or any of the

recommended items. Those ordered shall be delivered not later than the date of receipt of the last shipment of the associated item of plant. The price of the items shall be subject to the same price conditions as the associated item of plant. All spares shall be interchangeable with the original parts. They shall be treated and packed for long-term storage under the climatic conditions of the site.

Each item shall be clearly and permanently labelled on the outside of its container with its description and purpose. When several items are packed in one case, a general description of the contents shall be given on the outside of the case. Spare parts shall not be shipped in the same cases as components which are used for erection. The cases shall be clearly labelled to indicate that they contain spare parts or tools, and each tool or appliance shall be clearly marked with its size and purpose. All cases, containers, or other packages are liable to be opened for inspection and checking on-site.

10.0 Electrical Power Supplies

The Contractor shall arrange for the Power Supplies for construction purposes.

11.0 Materials and Finishes

Unless otherwise provided for in the Contract, all materials, fixtures, fittings, and supplies furnished (hereafter called "materials") shall be new and of standard first-grade quality. All assembly and construction work shall be done in a neat and professional manner. Materials shall be free of defects.

All of the plants, whether temporary or permanent, shall be in accordance with the Contract as to character, type, construction, constituent substances, weight, strength, shape, dimensions, etc.

In choosing materials and their finishes, due regard shall be given to the harsh climatic conditions which can occur in the area. Some relaxation of the following provisions may be permitted where equipment is hermetically sealed, but weatherproof materials should be used wherever possible.

All structural members, nuts and bolts shall be galvanised and shall conform to the requirements indicated elsewhere in the specifications.

12.0 Packing and Shipping

Any items liable to be damaged in transit shall be effectively protected and securely fixed in their cases. All cases of over 2 tonnes shall be marked to show where slings should be placed.

All cases shall be clearly identified, giving particulars of the manufacturer's name and type of equipment. All identification marks on the outside of cases shall be waterproof and permanent. All electrical equipment shall be adequately sealed and desiccating agents used where necessary to prevent damage from condensation. All equipment shall be packed and protected, bearing in mind that it will be shipped to a harsh environment, that a considerable period may elapse between its arrival on site and its unpacking and that covered storage may not always be obtainable.

All wood and other materials used in packing cases shall be insect free. Adequate protection and precautions are to be taken to exclude termites and other vermin, noxious insects, larvae or fungus from the packing materials or plant. All contents must be clearly marked for easy identification against the packing list.

The Contractor shall protect all steelwork before shipment to prevent corrosion and/ or damage. Bundles of steel sections shall be properly tied together by an approved method, and care shall be taken to ensure that they are robust and that they can be handled easily during shipment.

Bolts and nuts shall be double-bagged and crated for shipment. Creating dissimilar metals is unacceptable.

Packing cases where used shall be strongly constructed, and in no case shall timber less than 25 mm in thickness be used. The contents of packing cases shall be securely bolted or fastened in position with struts or cross battens. Cross battens supporting weight in any direction shall not rely for their support on nails or screws driven lengthwise into the grain of the wood but shall be supported by cleats secured from the inside.

Transmission line conductors and OPGW shall be delivered wound on strong wooden drums treated to an approved international standard by vacuum impregnation with copper-chrome- arsenate (CCA) preservative to resist rotting and termite and fungus attacks. Drums with an outside diameter exceeding 2.5 metres and an outside width exceeding 1.4 metres shall not be used except with the Employer's approval. The central hole of the drums shall be reinforced with a steel plate of thickness not less than 10 mm to fit an axle size 95 mm diameter. The interior of the conductor drums shall be lined with bituminous paper to prevent the conductor from being in contact with the timber. Waterproof paper and felt lining shall overlap at the seams by at least 20 mm, and the seams shall be sealed.

Drums shall be adequately protected by securely fastening substantial wooden battens around the periphery. These battens shall be secured by means of steel tape bindings.

The thread of bolts used to strengthen the cable drums shall be pinned in such a way that the nut can be tightened but cannot be readily removed.

The contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

13.0 Equipment Labels

All equipment shall be provided with labels or nameplates giving a description of the equipment, together with information regarding the rating, nominal voltage, nominal current and the like under which the item of plant in question has been designed to operate. The labels shall be permanently attached in a conspicuous position. Where this is not practicable, such labelling shall be provided on packaging to the Employer's approval.

Such nameplates or labels are to be of noncorrodible non-hygroscopic material with lettering of a contrasting colour or, alternatively, in the case of indoor equipment, of transparent plastic material with suitably coloured lettering engraved on the back.

All tower members shall be stamped with distinguishing numbers and/or letters corresponding to those on the approved drawings or material lists. These erection marks shall be permanently embossed before galvanizing and will be clearly readable afterwards. In addition, these erection marks shall be duplicated in block-painted lettering of a minimum of 30mm height on the outer galvanised surfaces of all tower members. Before leaving the factory, the ends of all tower members shall be painted to a nominated colour code to clearly distinguish the tower types. All like members shall be appropriately bundled and tied for identification and handling during shipment, transport and stacking at the site.

14.0 Quality Assurance

The Contractor shall submit in the tender an outline of the Quality Assurance Program (QAP)/Practices that will be applied to all aspects of the manufacturing process.

Within one month of receipt of a letter of intent for equipment under this specification, the Contractor shall submit a detailed Quality Assurance Manual, which generally conforms with the requirements of ISO 9002. Approval to proceed with the manufacture of equipment within this Contract will not be given until this Quality Assurance Manual has been received and approved by the Employer. Delays to the Contract completion date due to non-compliance with this specification requirement will be the Contractor's responsibility.

Major features of the Quality Assurance Program practiced by the Contractor and detailed in his Quality Assurance Manual shall be:

(a) The Contractor has defined all staff responsibilities and the QA systems operating within the organisation for the purpose of ensuring adequate quality of the end product.

(b) The Contractor has a senior officer with the authority to resolve matters of quality to the satisfaction of the Employer.

(c) The Contractor has adequate facilities under the control of properly trained staff to perform the quality control duties.

(d) All production operations and test functions are properly documented and available to any relevant member of the Contractor's workforce.

(e) A detailed inspection and test plan is prepared for the whole manufacturing operation.

(f) Regular and systematic programmes of testing are carried out for all incoming raw materials.

(g) Regular calibration checks are carried out on all measuring equipment used in the manufacturing operations.

(h) Statistical analyses are carried out regularly on appropriate test results to confirm that all processes are performing within the specified tolerances.

(i) Adequate procedures are planned for corrective action in the event that quality checks show that performance is not satisfactory.

(j) All checking activities, test results etc., are recorded on appropriate standardized forms, and these are verified, certified, recorded and filed in a systematic manner.

15.0 Site Services

15.1 Living Accommodation

The Contractor is to make his own arrangements in regard to accommodation for his expatriate/ local staff during the supervision of erection.

All dwellings and buildings existing or erected for the purpose by the Contractor shall comply with local regulations in regard to construction, water supply and sanitation and other requirements. Temporary construction camps must be provided with proper sanitation and other necessary facilities. All temporary accommodation shall be removed by the Contractor when no longer required and before the granting of the Final Certificate. After the removal of accommodation, the ground shall be left in a clean and tidy condition.

15.2 Office Accommodation

The Contractor shall provide, at his own cost, all necessary temporary buildings and facilities required for office accommodation for both his Site staff and the Employer's representatives, including Consultants, during the execution of the Works. Such office accommodation shall be adequately furnished and equipped with essential amenities, including but not limited to: internet connectivity, printing and photocopying facilities, office furniture, proper sanitary arrangements, and first aid facilities. The cost of providing, maintaining, and subsequently dismantling such accommodation shall be deemed to be included in the Contract Price.

15.3 Medical Facilities

The Employer will not provide these, and the Contractor shall make his own arrangements where these services may be required for his staff.

15.4 Labour Work Permits, Accommodation and Insurance

It will be the responsibility of the Contractor to ensure that all grades of expatriate labour have the current and correct work permits and/ or visas and to comply in every way with the immigration and/ or emigration regulations. He shall also ensure that he

complies with the labour equipment laws of the country and the requirements for leave, accommodation and insurance of all his employees and the employees of his sub-contractors. The Contractor, in all dealings with labour in his employment, shall have due regard to all recognised festival days of rest and religious or other customs.

15.5 Transport to Site

The Contractor is to bear all expenses in connection with the transport to the Site of all plant, material and things needed for the purpose of the Contract, including warehouse rent, handling and other charges which may occur. The Contractor is to observe any regulations which limit loads on roads and bridges over which material may be conveyed.

15.6 Plant Handling and Storage

The handling and storage of any plant at the Site will be the responsibility of the Contractor. The Contractor shall arrange for suitable lay-down areas. The Contractor is to advise on the protection of all material against corrosion, theft, and mechanical damage during storage and erection at the Site.

Only galvanised structural steelwork may be stored in the open. Plants sensitive to climate must be stored in closed buildings protected from dust and humidity.

15.7 Access

Wherever approved, the Contractor will be responsible for the construction and maintenance of any temporary accesses. When haulage or construction accesses are no longer required, the Contractor shall break up hardened surfaces, remove all imported material, and shall reinstate the original surface and topsoil of the disturbed areas to a natural condition.

15.8 Site Sanitation

The Contractor shall ensure that every construction site is maintained in a clean and sanitary condition. The Contractor shall provide refuse collection and disposal services, including sweeping of paved streets and cleaning of drainage channels. Adequate mobile or other toilets shall be provided at the work sites controlled by the Contractor. The Contractor shall ensure that such toilets remain in a hygienic condition.

15.9 Lighting and Power

All power and lighting circuits shall be constructed with due regard for personnel safety and shall comply with recognised codes of practice and local regulations. All circuits shall be fitted with earth leakage systems. The cost of the electricity connection, including any equipment required for getting the necessary connection and monthly energy charges, shall have to be paid by the Contractor, and the cost of these shall be deemed to be included in the Contract Price.

15.10 Spoil Areas

Disposal areas for transmission tower foundation spoil, wherever necessary, shall be determined by mutual agreement with the Employer, land owners, and local authorities. It shall be the responsibility of the Contractor to ensure that spoil does not negatively impact the natural beauty, function or ecosystems of the area.

16.0 Contractor's Responsibility

16.1 Safety of Personnel

The Contractor shall afford maximum safety to personnel directly engaged in this Contract or to persons who, in the normal course of their occupation, find it necessary to utilise temporary works erected and to frequent the working area.

Once any section of the plant has been made life, the Contractor and the Employer shall establish and agree to a system for ensuring the safety of personnel and equipment. While the plant is under the control of the Contractor, the Contractor shall be primarily responsible for the safety precautions. While the plant is under the control of the Employer, the Employer shall be primarily responsible for these precautions.

16.2 Contractor's Employees

The Contractor shall provide adequate transportation, accommodation, boarding and medical facilities for all personnel in his employment. He is also to comply with the requirements of all relevant Labour Laws of Bhutan.

The Contractor shall be responsible for the behaviour on site of all personnel employed by him.

16.3 Deleted

16.4 Progress Reports

At monthly intervals, the Contractor shall submit to the Employer detailed progress reports (in triplicate) in an approved form indicating the stage reached in the design, ordering of material, manufacture, delivery and supervision of erection of all components of the plant. All variances from the agreed schedule are to be promptly reported. These reports shall be forwarded promptly so that, on receipt by the Employer, the information contained therein is not more than seven days out of date. Copies shall also be forwarded to the Employer's representative on Site. These reports shall be prepared using project management software like Microsoft Project. The soft copies of the report shall also be supplied to the Employer.

The Contractor shall submit to the Employer a weekly return detailing for each portion of the works separately, the numbers of the various classes of workmen employed by him on the Site, the Contractor's equipment on site, or any other information that may reasonably be required.

Access to the Contractor's and Sub-Contractor's works shall be granted to the Employer at all reasonable times for the purpose of ascertaining progress.

16.5 Progress Meetings

The Contractor shall attend regular formal site Progress Review Meetings (PRM) with the Employer, where progress and construction-related issues will be reviewed. If requested by the Employer, the Contractor shall prepare for issue the day before the meeting detailed schedules showing the erection separately, fixing, concreting, commissioning, or other work activities planned for the next two weeks as well as progress achieved over the preceding week.

The Contractor shall also be required to attend other meetings from time to time on special subjects.

16.6 Relations with Local Residents and District Heads

The Contractor shall liaise with the local village/ Head of various organizations/agencies on matters concerning the impact of his operations on the local communities. Any problems the Contractor cannot resolve shall be referred to the Employer.

16.7 Public Relations

The Contractor shall not publish or provide any information relating to the progress or financial status of the works to any person or organisation without the prior consent of the Employer.

17.0 Environmental, Safety and Health Requirements

17.1 Overview

As per the requirement of the Environmental Clearance Guidelines for the Power Transmission and Distribution Lines, at the time of Contract execution, the Contractor will be required to provide project specific Environmental Management Plan (EMP) that addresses the issue of project implementation responsibilities. The EMP shall also incorporate the negative impacts and mitigation measures, and monitoring strategy proposed by the Proponent in accordance with the Environmental Clearance Guidelines for the Power Transmission and Distribution Lines.

Bhutan Power Corporation Limited (BPC) has a strong commitment to providing a safe and healthy workplace and protecting the environment, natural resources, and local communities that could be affected by project implementation and development. This philosophy is inherent in BPC’s approach to planning, designing, and constructing projects in the country. To facilitate this, BPC has a strong commitment to comply with minimum Environmental, Safety, and Health (ES&H) requirements that apply to all projects regardless of geographic location. The key principles of Employer’s Environmental and Social Policy are:

- Avoidance of environmentally and socially sensitive areas while planning project activities.

- Minimization of impacts when project activities occur in environmentally and socially sensitive areas.

- Mitigation of any unavoidable adverse impacts arising out of its projects.

Basic issues to be kept in mind while carrying out construction activities are to:

- Avoid socially sensitive areas with regard to human habitations and areas of cultural significance.

- Secure the interest of people affected by Employer's projects.

- Involve local people affected by transmission line projects as per the requirement and suitability.

- Consult affected people in decisions having implications to them if considered necessary.

- Apply, efficient and safe technology/practices.

- Keep abreast of all potential dangers to people's health, occupational safety and safety of the environment and the respective mitigatory measures.

- Establish preventive mechanisms to guarantee safety.

- Avoid unwarranted cutting of trees in forest areas.

17.2 Contractors Responsibility

The Contractor shall fully comply with applicable environmental laws, regulatory requirements, and BPC's requirements, including the key requirements listed below:

The Contractor shall designate a focal person at every project site to ensure compliance with environmental laws and regulations and any other requirements governing the project.

The Contractor should, as far as possible, ensure to avoid the occurrence of accidents at the work site. The Contractor shall ensure to provide reports on incidents and cases of accidents that occurred at the work site and the corresponding corrective and preventive measures taken to deal with such issues.

Managers and supervisors will participate in environmental self-assessments, monitoring and audits, and incident investigations; additionally, supervisors are responsible for conducting monthly meetings to emphasize important ES&H issues associated with their work activities, including any deficiencies and corrective actions.

All construction workers will be supplied with appropriate personal protective equipment (e.g., safety helmet, safety glasses, protective gloves and boots etc.) and tools where applicable to allow them to perform their work safely, maintain equipment in good working condition, and operate equipment in accordance with the manufacturers' recommendations.

Good "housekeeping" will be maintained to promote fire prevention and sanitary conditions.

BPC may set further safety requirements that may apply depending on the Contractor's scope of work, site-specific conditions, or when specialized equipment is used in accordance with the applicable norms of the country.

The Contractor shall demonstrate in his EMP proposal that he has incorporated all applicable safety and health requirements to the risks and hazards associated with their scope of work.

Contractors will be responsible for conducting regular inspections and periodic evaluations of their work activities to ensure compliance with the project's ES&H requirements, environmental clearance requirements etc. The contractor's inspection and audit results will be made available to BPC for review.

17.3 Environmental Monitoring and Management Plan.

Contractors are responsible for complying with all governing environmental laws, regulations, and clearances and are expected to employ effective field control and mitigation measures where applicable in their scope of works to deal with environmental issues such as Spill prevention and response, Erosion and sediment control, Dust control, Waste/debris management, Cleanup and restoration of disturbed areas, Camp Site Rehabilitation Plan, watershed Protection Approach, River and Stream Protection Approach, Illegal Activity viz., Hunting and Fishing of Wildlife, Stealing of forest resources, and Vandalism; Camp Location; Camp Facility and Sanitation; Drinking Water Facilities; Sewage Disposal Facilities; Stocking of materials and equipment etc.

Contractors will be required to comply with all access restrictions, including prohibitions on access to sensitive natural resources (e.g., wetlands, protected areas, eco-tourism sites, heritage sites, and special wildlife habitats) or areas adjacent to the worksite.

Depending on the Contract amount and/or the scope of work and its corresponding impact and effects the project may have on the total environment, the Contractors are required to develop a Contractors Site Environmental Management Plan that conforms to all environmental laws and other requirements governing the project.

17.4 Safety and Health

Contractors are responsible for complying with all applicable safety and health (S&H) regulations, manuals, and the Contractor's own S&H requirements as they apply to their scope of work. Contractors may be required to provide a written S&H Plan that

specifically addresses the hazards and corresponding mitigation measures associated with their scope of work.

Prior to starting work, Contractors will demonstrate to BPC that all applicable safety procedures have been adopted.

The contractor or Site In-charge is expected to perform weekly pre-task planning to identify potential hazards and the corresponding mitigation measure(s) to eliminate or minimize the risk associated with the performance of the work.

Contractors will be responsible for promptly reporting all injuries and near misses to BPC's onsite management and conducting an incident investigation in a timely manner. The incident investigation should focus on identifying and documenting the root cause(s), finding(s), and corrective action(s) to prevent a reoccurrence of the incident.

Contractors are required to provide an employee who is currently certified in first aid to render adequate treatment for their employees working onsite or make available first aid medical facilities available on site.

The Contractor shall hold the proponent/employer harmless from any liability for not complying with environmental laws and regulations and any other requirements governing the project.

BPC's receipt, review, and approval of the aforementioned plan are a condition precedent for mobilization of payment.

The Contractor shall inform/request the Employer regarding renewal of Environmental Clearance at least three months before the expiry of the same. Such request should include separate reports/documents such as achievement on the protection of flora and fauna, health and safety of personnel and mitigation measures and any other relevant documents as may be requested by the Employer for onward submission to the National Environment Commission (NEC) for renewal of the Environment Clearance for the Project.

The Contractor shall ensure that construction does not negatively impact the natural beauty, function, amenities, or ecosystems of the area, and care shall be taken to prevent permanent damage.

All rivers and streams shall be protected from direct or indirect spills of pollutants resulting from the Contractor's activities.

The Contractor shall provide drainage facilities at each tower site and shall revegetate the surface where necessary to prevent erosion and consequent weakening of the tower foundations.

The Contractor shall, as far as possible, protect the flora within the work sites. If areas are disturbed beyond the designated work boundaries, the Contractor shall reinstate the ground and re-establish suitable vegetation as directed by the Employer at no extra cost to the Employer. Such re-establishment shall take place as soon as practicable after the Employer's request.

The Contractor and his employees shall protect all fauna living within the site area and shall ensure that hunting, shooting, birds nesting, egg-collecting, or trapping does not occur. Permits to cut any trees shall be obtained from the relevant authorities through the Employer.

Any penalty imposed due to non-compliance to the rules and regulations shall be borne by the contractor.

18.0 Documentation

18.1 Engineering Data

The furnishing of engineering data by the Contractor shall be in accordance with the Schedule as specified in the Bidding Document. The review of these data by the Employer will cover only general conformance of the data to the specifications and not a thorough review of all dimensions, quantities and details of the materials or items indicated or the accuracy of the information submitted. The Contractor shall not consider this review by the Employer as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements specified under these specifications.

All engineering data submitted by the Contractor after review by the Employer shall form part of the contract document.

18.2 Drawings

In addition to those stipulated in the clause regarding drawings in GCC/SCC, the following also shall apply in respect of Contractor Drawings.

All drawings submitted by the Contractor, including those submitted at the time of Bid, shall be with sufficient detail to indicate the type, size, arrangement, dimensions, material description, Bill of Materials, the weight of each component break-up for packing and shipment, fixing arrangement required, the dimensions required for installation and any other information specifically requested in these specifications.

Each drawing submitted by the Contractor shall be clearly marked with the name of the Employer, the specification title, the specification number and the name of the Project. All titles, notes, markings and writings on the drawing shall be in English. All the dimensions should be to the scale and in S.I. units.

The drawings submitted by the Contractor shall be reviewed by the Employer as far as practicable within 15 working days and shall be modified by the Contractor if any modifications and/or corrections are required by the Employer. The Contractor shall incorporate such modifications and/or corrections and submit the final drawings for approval. Any delays arising from the failure of the Contractor to rectify the drawings in good time shall not alter the contract completion date.

The drawings submitted for approval to the Employer shall be in quadruplicate. One print of such drawings shall be returned to the Contractor by the Employer marked

"approved/approved with corrections". The contractor shall thereupon furnish the Employer additional prints as may be required, along with one reproducible in the original of the drawings after incorporating all corrections.

The work shall be performed by the Contractor strictly in accordance with these drawings, and no deviation shall be permitted without the written approval of the Employer, if so required.

All manufacturing, fabrication and erection work under the scope of the Contractor, prior to the approval of drawings, shall be at the Contractor's risk. The contractor may incorporate any changes in the design, which are necessary to conform to the provisions and intent of the contract, and such changes will again be subject to approval by the Employer.

The approval of the documents and drawings by the Employer shall mean that the Employer is satisfied that:

(a) The Contractor has completed the part of the Works covered by the subject document (i.e., confirmation of progress of work).

(b) The Works appear to comply with the requirements of the Specifications.

In no case, the approval by the Employer of any document does imply compliance with all technical requirements nor the absence of errors in such documents.

If errors are discovered at any time during the validity of the contract, then the Contractor shall be responsible for the consequences.

All drawings shall be prepared using AutoCAD software version 2000 or later only. Drawings, which are incompatible with AutoCAD software version 2000 or later, shall not be accepted. After final approval, all the drawings (structural drawings, BOMs, shop sketches and tower accessories drawings) shall be submitted to the Employer in CADs.

A copy of each drawing reviewed will be returned to the Contractor as stipulated herein. Copies of drawings returned to the Contractor will be in the form of a print with the Employer's marking or a print made from a microfilm of the marked-up drawing.

The following is the general list of the documents and drawings that are to be approved by the Employer.

a) Work Schedule (Master Network) Plan.
b) Detailed survey report and profile drawings showing ground clearance and tower locations (as applicable).
c) Final Tower Schedule and foundation classification for individual tower locations.
d) Tower structural drawing and bill of materials (black steel weight only).
e) Soil Investigation report.
f) Foundation working drawings/excavation Plan.

g) Tower footing earthing drawing.
h) Stub and stub-setting template drawings.
i) Stringing procedure and stringing chart
j) Tower accessories drawings like danger plate, nameplate etc.
k) Quality plans for fabrication and site activities, including Quality System.
l) Sub-vendors approval, etc.
m) Line material drawings.
n) Type test report for line materials.
o) Compressed records of splice/deadend & photo

All rights of the design/drawing for all types of towers and foundations shall be strictly reserved with the Employer only for this specific Project, and any designs/drawings/data sheets submitted by the contractor from time to time shall become the property of the Employer. Under no circumstances shall the Contractor be allowed to use/offer the above designs/drawings/data sheets to any other authority without prior written permission of the Employer. Any deviation from the above is not acceptable and may be a cause for rejection of the bid.

18.16 **Design Improvements**

The Employer or the Contractor may propose changes in the specification, and if both parties agree upon any such changes and the cost implication, the specification shall be modified accordingly.

18.17 **Design Co-ordination**

Wherever the design is in the scope of the Contractor, the Contractor shall be responsible for the selection and design of appropriate material/item to provide the best-coordinated performance of the entire system. The basic design requirements are detailed in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

18.18 **Design Review Meeting**

The contractor will be called upon to attend design review meetings with the Employer during the period of the Contract. The contractor shall attend such meetings at his own cost at the Corporate Office of the Employer or other venue as and when required. Such review meetings will generally be held four times a year. Such design review meetings are in addition to the monthly and quarterly Site Progress Review Meetings.

18.19 **Quality Assurance, Inspection & Testing**

To ensure that the supply and services under the scope of this Contract, whether manufactured or performed within the Contractor's works or at his Sub-Contractor's premises or at the site or at any other place of work, are in accordance with the specifications. The Contractor shall adopt a suitable quality assurance programme to control such activities at all points necessary. The Contractor shall broadly outline such a programme and shall be finalized after discussions before the award of the Contract. The contractor shall submit the detailed programme after the award of the contract and

finally be accepted by the Employer after discussion. A quality assurance programme of the Contractor shall generally cover but not be limited to the following:

(a) His organisational structure for the management and implementation of the proposed quality assurance programme.
(b) Documentation Control System.
(c) Qualification data for Contractor's key personnel.
(d) The procedure for purchase of materials, parts components and selection of sub-contractor's services, including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
(e) System for shop manufacturing, including process controls and fabrication and assembly controls.
(f) Control of non-conforming items and system for corrective action.
(g) Control of calibration and testing of measuring and testing equipment.
(h) Inspection and test procedure for manufacture.
(i) System for indication and appraisal of inspection status.
(j) System for quality audits.
(k) System for authorizing the release of manufactured products to the Employer.
(l) System for maintenance of records.
(m) System for handling storage and delivery and
(n) A quality plan detailing the specific quality control procedure adopted for controlling the quality characteristics relevant to critical and important items of supply.

The Quality plan shall be mutually discussed and approved by the Employer after incorporating necessary corrections by the Contractor as may be required.

18.20 Dispatch Documents

The Contractor shall supply consignment notes bearing the reference number of each dispatch, a list of the contents of each crate, identification numbers, dimensions, net and gross weights and, where necessary, any special instructions regarding storage and the type of packaging/ handling.

PART II - SPECIFIC TECHNICAL REQUIREMENTS

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CHAPTER 1

TRANSMISSION LINE GENERAL

1.0 General

The latest revisions of the relevant standards shall apply, irrespective of any reference to earlier revisions in these specifications, unless the earlier revisions indicated herein are more stringent than the latest ones.

1.1 Line Route

The details of the line route, tentative and/or final route alignment are enclosed with these specifications. The bidder is required to assess the complexity of the line route and is advised to visit the project site for a first-hand assessment of the same under intimation to the Employer. The bidder shall bear all costs associated with site visits.

1.2 General Constructional Details

The project requires the supply of towers, accessories, conductors and hardware, OPGW etc., from the contractor.

Towers shall be square-based lattice steel construction, self-supporting type, designed to carry the transmission line conductors with insulators, OPGW and all fittings under all loading conditions. All efforts shall be made to keep the towers as narrow-based as possible in view of the geology of the region. The towers, including stubs and cleats, extensions etc., shall be fully galvanized using a hot-dip galvanizing process. The tower members shall be fabricated using structural mild steel conforming to relevant standards. Hexagonal round-head galvanized M.S. bolts and nuts with 5mm washers shall be used for connections of fabricated members. Permanent staying will not be allowed.

1.3 Clearances

The minimum clearance between the line conductors and the ground in still air under the maximum specified temperature final tension shall be in accordance with the clearance requirements indicated below. It shall conform to the latest edition of Indian Standard IS 5613. In addition to these values, the Contractor shall allow for an additional clearance of 0.3 m for conductor creep and this shall be included in the calculation of tower heights.

The following clearance applies for altitude up to 1000m above Mean Sea Level (MSL), and the altitude correction factor as applicable shall be considered during contract execution for altitudes above 1000m.

1.3.1 Ground Clearance

Particulars	**Minimum Clearance (Meters)**		
	66 kV	**132 kV**	**220 kV**
Clearance to ground	6.1	6.1	7.0

1.3.2 Clearance to buildings

Particulars	**Minimum Clearance (Meters)**		
Clearance to buildings	**66 kV**	**132 kV**	**220 kV**
1)Vertical: from the highest object	4.0	4.6	5.5
2)Horizontal: from the nearest point	2.1	2.8	3.7

The minimum vertical clearance between the nearest conductor of high voltage or extra high voltage line and the highest part of the building shall be on the basis of maximum sag.

The minimum horizontal clearance between the nearest conductor of high voltage or extra high voltage line and any part of the building on the basis of maximum deflection due to wind pressure.

1.3.3 Line Crossing at different voltage levels

Where an overhead line crosses another overhead line, the following minimum clearance shall be maintained:

Nominal System Voltage	**Minimum Clearance (Meters)**			
	66 kV	**132kV**	**220 kV**	**400 kV**
Up to 66kV	2.44	3.05	4.58	5.49
132kV	3.05	3.05	4.58	5.49
220kV	4.58	4.58	4.58	5.49
400kV	5.49	5.49	5.49	5.49

Where two power lines cross each other, the crossing shall be made nearly at right angles.

1.3.4 Crossing with telecommunication lines

Particulars	**Minimum Clearance (Meters)**		
Telecommunication lines	**66 kV**	**132 kV**	**220 kV**
	2.44	2.75	3.05

1.3.5 Right of Way (ROW) requirement

The following Right of Way (ROW) requirements shall be followed.

Nominal System Voltage (kV)	**Right of Way (Meters)**
66	18
132	27
220	35

It may not be necessary to cut down all trees/obstacles to maintaining the full corridor requirement, especially in sloppy areas. Instead, it may be necessary to cut down trees that may fall outside the range of the required corridor. In such area(s), all

trees/obstacles that may hit the conductor and/or the transmission towers shall be felled. The cost of tree cutting and bush clearance shall be included in the survey, foundation, stringing and other associated works that require tree cutting and bush clearance as deemed appropriate by the bidders.

1.3.6 Conductor and OPGW Spacing and Clearance

For all towers, the clearances from conductors, jumper loops and all live metal to the tower steel work shall not be less than those specified below under still air conditions and at the assumed maximum swing of jumpers. Where uplift occurs at tension tower positions, the minimum clearance between any arcing horn and the jumper loop of the phase immediately above it shall not be less than the minimum still air clearance from live-to-earth metal stated below. The length of the angle tower cross arms shall provide for the distances between conductors of the two sides at straight line structures to be maintained in a plane normal to the conductors.

For angle towers carrying deviation angles up to 30°, cross-arms shall generally be so proportioned that live metal clearances are maintained under all conditions without the use of jumper suspension insulators. Jumper suspension insulators shall be used if towers with line deviation angles are in excess of 30°. The tower prices are deemed to include such requirements unless the Employer provides the designs.

The allowance shall be made for increasing or decreasing the length and varying the arrangements of all terminal cross-arms to enable down-lead span connections to be made in any desired phase sequence. Crossarms shall be arranged in a triangular configuration for single-circuit towers. The configuration shall be chosen to best suit the local conditions. For all types of tower construction, the OPGW shall be central above each set of conductors and shall provide a shield angle not greater than 30 degrees.

Conductors and OPGW tensions shall be so selected that the sag of the OPGW at mid-span of basic span at everyday tension provides a minimum clearance to the top conductors. A suitable calculation shall be performed to determine phase-to-phase and phase-to-earth clearances to prevent conductors from clashing. Additionally, the sag of the OPGW shall be not more than 90% of the sag of the line conductor at mid-span under all conditions.

1.3.7 Minimum clearance from live metal to earthed metal

Particulars	**Minimum Clearance (mm)**		
	66 kV	**132 kV**	**220 kV**
For Single Suspension String:			
Still air - no swing	915	1530	2130
For 15° swing	915	1530	1980
For 30° swing	760	1370	1830
For 45° swing	610	1220	1675
For Double Suspension String:	915	1530	2130
For Tension String (Single/ Double):	915	1530	2130
For Jumper Loops			

Particulars	Minimum Clearance (mm)		
	66 kV	132 kV	220 kV
Still air - no swing	915	1530	2130
For 10° swing	915	1530	2130
For 20° swing	610	1070	1675
For 30° swing	610	1070	

The above requirements refer to altitudes up to 1000m above MSL. For higher altitudes, an altitude correction factor at the rate of 1.25% for every 100m above 1000m shall be applicable.

1.3.8 Minimum Creepage Distance

Nominal System Voltage (kV)	Minimum Creepage Distance (mm/kV)
66	25
132	25
220	25

All the requirements indicated above for clearances refer to altitudes up to 1000m above MSL. For altitudes, more than 1000m above sea level, the altitude correction factor, as per relevant standards, shall be applicable. In case of discrepancies between the requirements specified above and the relevant standards, the more stringent conditions shall govern.

1.4 Design Standards

Where the design is in the scope of the contractor, the same shall cater to the design standards stipulated in the subsequent paragraphs. Towers and footings shall be designed on the basis of loads, permissible stresses and other relevant design provisions given in these specifications and in the latest revisions of the relevant IS codes, mainly IS:802 and IS:456. Reference shall be made to other IS and International Codes as and when required. All codes referred to herein shall be the latest editions. In case of conflict between the Specifications given herein and the IS Code provisions, the more demanding requirement shall be satisfied.

1.5 Temperatures of Conductors and OPGW

The tower design shall consider the following temperature conditions for the conductors and OPGW:

Particulars	Value (° C)
Minimum ambient temperature	
a) Non-Snow Zone Area	0
b) Snow Zone Area	-10
Average ambient temperature/Everyday temperature	
a) Non-Snow Zone Area	32
b) Snow Zone Area	15

Particulars	Value (° C)
Maximum ambient temperature	40
Maximum conductor temperature	75
Maximum Ground wire/OPGW temperature	53

1.6 Ice Loading

Towers located above 2500m elevation shall be designed for ice loading. The design radial thickness of ice shall be 12.5 mm.

1.7 Wind Loading

The design Wind Pressure (P_d) on towers, conductors and insulators shall be calculated in accordance with IS 802, based on a wind speed given elsewhere in these Specifications. It shall be noted that the transmission lines encounter hills/ridges, and accordingly, the factors for wind load computations shall consider relevant corrections in adopting factors. Accordingly, the following factors shall govern:

Particulars	Values
Reliability Levels of line	1 (Return period 50 years)
Terrain category	2
Basic Wind Speed (V_b)	47 m/s (at 10 meters above ground)
Reference Wind Speed (V_r)	V_b/K_o = 34.18 m/s (K=1.375)
Design Wind Speed (V_d)	V_r x K_1 x K_2=36.91 m/s; (K_1=1; K_2=1.08)
Design Wind Pressure (P_d)	0.6 x V_d xV_d=818 N/Sq.m
Design Radial Thickness of ice	12.5 mm

The wind load on towers, insulators and conductors shall be computed using the provisions of IS 802 with the above basic parameters.

1.8 Design Spans

The Special Towers (SP) stipulated in this Specification and any other tower types, if required during the execution of the line, shall be designed by the Contractor and submitted to the Employer for approval. Payment shall be made on the basis of material consumed as described in the Schedule of Prices.

Should Bidders consider it advantageous to the Employer, tower types may be further optimized. Full details of any advantage should be described in the tender.

The term Basic Span shall mean the horizontal distance between centers of adjacent supports on level ground from which the height of standard supports is derived with the specified conductor clearances to ground in still air at maximum temperature.

The term Wind Span shall mean half the sum of adjacent horizontal span lengths supported on any tower.

The term Weight Span shall mean the equivalent length of the weight of conductors supported at any one tower at a minimum temperature in still air. At suspension

positions, the minimum weight of the conductor supported shall not be less than 25 per cent of the total weight of the conductor in the two adjacent spans.

Conductor tensions shall be checked for the conditions given and also IS 802.

Conditions			%UTS	
Temperature	**Wind Pressure (%Full value)**	**Ice loading (%)**	**Conductor**	**OPGW**
Minimum	36	100	70	60
Everyday	100	0	70	60
Everyday	0	0	25	25

In addition to the above, the sag tension calculations shall also provide the values for the following conditions for Snow Zone Area.

Conditions		
Temperature	**Wind Pressure (%Full value)**	**Ice loading (%)**
Minimum	50	0
Everyday	25	100
Everyday	0	100

1.9 Corona and Radio Interference

The design of all line conductor fittings, vibration dampers, etc., shall avoid sharp corners or projections that produce high electrical stress in normal working. The design of adjacent metal parts and mating surfaces shall be such to prevent corrosion of the contact surfaces and to maintain good electrical contact under service conditions.

Particular care shall be taken during the manufacture of conductors and fittings and during subsequent handling to ensure smooth surfaces free from abrasion.

CHAPTER 2

SURVEY & ALIGNMENT

1.0 General

The Employer has already carried out a walk on survey. A map showing the line route is enclosed with the Bidding Document. This is to be used for the purpose of general reference and guidance only. The Contractor shall carry out the final route alignment as per the requirement, detail survey, tower spotting, profiling using PLS-CADD software, check survey, etc., and the documents/schedules submitted for approval shall be along with the soft copies of the PLS- CADD/PLS-Tower back up file.

2.0 Survey Equipment

The Contractor shall ensure that all the equipment/instruments and measurement devices are properly calibrated at the start of the work to reflect factual values. The Contractor shall present to the Employer calibration certificates for the equipment, traceable to National Standards. If required by the Employer, the Contractor shall have the instruments and devices tested at an approved laboratory at his own cost. The Contractor shall submit the corresponding calibration reports to the Employer before these instruments are used for the work. If the Employer desires to witness the calibration tests, the Contractor shall arrange for the same.

The Employer reserves the right to reject any instrument and debar its use for this work if the Employer finds the equipment defective or found wanting in any manner. The Contractor shall then immediately replace such instruments at his own cost without hampering the progress of work. No extension of time will be granted on this account.

3.0 Survey Personnel

The Survey shall be carried out under the direction and control of a qualified Surveyor.

The fieldwork shall be carried out and supervised full-time by qualified surveyors only. The Drawings shall be executed by experienced draughts person and personnel on a computer using AutoCAD. A qualified and experienced surveyor shall prepare the Report.

4.0 Transmission Line Survey

4.1 Access to Site

The Employer will provide such right of access along the line routes as the Employer agrees it necessary to enable the Contractor to proceed with setting out, preliminary and profile survey, and soil-investigation.

4.2 Route Clearing

The Contractor shall clear the line routes of trees to such an extent as will permit the erection of the lines and their subsequent safe operation. The required corridor, as mentioned elsewhere in this Specification on each side of the centerline of the transmission route, shall be made to facilitate construction. The width of the corridor shall be measured parallel to the ground, particularly on sloping terrain.

In addition to the above, after the completion of the line, those trees also shall be cut, which, if they fall, will endanger the line by falling on it. Such trees shall be cut to the extent that if they fall, they will leave the live line clear by at least 5m. It is expected that once a clear required corridor on either side of the line is made, cutting after completion of the line will be very small.

The timber thus cut shall be the property of the RGOB. The Contractor shall, at his own expense, be responsible for any arrangements necessary to avoid damage to orchards, gardens etc. Clearing will be carried out after the Employer has obtained wayleaves.

It shall be noted and remembered that unauthorized tree cutting is an offence in Bhutan; any tree cutting shall be started only after the requisite permission has been obtained by the Employer from the concerned authorities for each and every tree to be cut.

4.3 Preliminary Survey

The Contractor shall carry out a preliminary survey in the region where re-alignment is necessary, as specified herein below. Preliminary survey will not be necessary (except for a small line portion) along the original alignment, for which a report will be provided to the successful bidder.

The Contractor shall make immediate arrangements to set out the angle and terminal support positions. He shall then establish preliminary lines by instrument survey between angle and terminal points with an adequate number of intermediate line pegs and including the minimum clearing of vegetation necessary to obtain lines of sight if such circumstances arise.

The Contractor shall record the positions of angle and terminal pegs on sketches related to existing permanent features nearby or to additional pegs placed offline in such a way that the angle and terminal pegs can be conveniently and accurately replaced in the event of a loss. For the preliminary survey, wooden or any other convenient pegs may be used, but the same shall be replaced at the Contractor's cost, in case they are lost, till the Profile Survey is completed with peg-marking in that stretch of the line. The preliminary route shall then be offered for inspection by the Employer.

In certain stretches of the line, the Employer may find it necessary to again carry out the Preliminary Survey along an adjacent route discarding the one where the survey has been done. It shall be deemed that such changes have been considered in the per km rate of the survey, and the payment for the survey shall be made only for the length of the finally adopted route. No payment shall be made for the discarded stretches. The Employer shall make all efforts to limit such changes to the minimum.

The Employer's Representative will accompany the Contractor's staff during the preliminary survey. The preliminary survey shall be deemed complete when the Employer has approved the preliminary line.

4.4 Profile Survey & Setting Out

After obtaining the Employer's approval for the preliminary routes, the Contractor will proceed to peg out the centerline and carry out a profile survey in convenient sections and shall not await the completion of the entire preliminary survey. The profile survey shall be carried out for the entire line route, inclusive of original alignment and sections of re-alignment as approved by the Employer.

It is the responsibility of the Contractor to center-peg the line in such a manner that pegs are not easily removable. As a safeguard, it may be necessary to locate and tie in permanent features near the line, which will enable the speedy reinstatement of both angle and intermediate points in the event of unauthorized removal of any pegs. The pegging shall be done by 1:2:4 concrete block, 150 x 150 mm square in size, 400 mm buried in the ground and projecting 300 mm above ground. After concreting the concrete block to the required height, the top surface should be finished smoothly, with a slight slope from the center towards the 4 outer edges to drain off the rainwater falling on the coping.

The rate for the Survey shall be deemed to include center-pegging and reinstatement of any lost, removed or otherwise destroyed pegs.

The Contractor shall prepare strip plans and longitudinal sections for each complete line at scales of 1:2000 horizontal and 1:200 vertical.

The Contractor shall plot thereon the proposed support positions and submit the profiles for approval. The use of standard tower spotting software is recommended. The tower shall be so located that the wind and weight span loading specified in these Specifications are not contravened.

The profile drawings are to include the following: -

Strip map, continuous longitudinal section chainage between angle points, positions of pegs on line, ground line salient levels related to local datum levels, a ground line, ground clearance line, line of lowest conductor at maximum sag, an indication of side slopes where these affect ground clearances below the outer conductor phases (due account being taken of conductor swing with respect to vertical or other steep slopes and obstructions), walls, fences, hedges, buildings, streams and rivers, roads, power and telecommunication lines to be crossed or to deviate, pipelines, sections unsuitable for support positions, vegetation, and any other features affecting the line construction.

High-voltage power line crossings shall be surveyed and drawn up in sufficient detail to show that all required clearances are obtained. If necessary, separate plan and elevation scale sketches shall be prepared for the same.

Once the profile is approved, the Contractor shall lose no time in center pegging the supports for inspection by the Employer.

The rate for survey shall be deemed to include any and all costs that the Contractor shall have to bear to satisfy all that has been specified herein, including submission of survey drawings, removal of obstructions, crossing power lines, replacement of lost pegs etc., all included in an average rate per km of alignment.

A plan and a cross-section shall be prepared based on the survey at each tower location. The plan of the tower location shall include contours with intervals of 0.5 m at least 6 m beyond the tower leg away from the tower center. The cross-sections shall show ground levels on eight lines radiating from the tower center and extending 6 m beyond the tower legs, four lines in transverse and longitudinal directions of the tower and the other four lines in the directions of four tower legs. The Contractor shall prepare the plan and cross-section at a scale of 1:100 horizontal and vertical.

The Contractor shall indicate in the drawings his proposed setting levels, body extensions etc., for approval by the Employer. After the completion of the line and before final payment, a drawing showing the completed line marked on the 1:20000 map shall be submitted to the Employer.

Profile survey shall be deemed complete, and the Contractor shall be entitled to claim payment for the survey when all activities specified herein have been completed to the approval of the Employer. A small amount of 5% to 10%, at the discretion of the Employer, shall be withheld after the completion of the line to ensure that all trees likely to endanger the line on falling are cut as specified above, and drawing of the completed line marked on 1:20000 map is submitted.

4.5 Damage to Crops & Property

The Contractor shall take all precautions to avoid damage to land property, crops, etc. and shall ensure that the work is adequately supervised so that damage is reduced to the minimum. All surplus material shall be removed after erection, and the site shall be left in a clean and tidy condition to the satisfaction of the Employer.

Compensation for crops and property which may need to be paid to the affected landowners as a result of acquiring the ROW shall be paid by the Employer. However, damage caused by the Contractor as a result of careless and unprofessional work ethics shall be paid by the Contractor.

4.6 Removal of Obstructions

Where it is agreed that obstructions such as telecommunication lines, power lines or pipes are to be permanently removed or relocated to allow the erection of the lines, the Employer will initiate relocation procedures, obtain necessary consent and secure removal upon receipt of sufficient notice through the Employer from the Contractor of his planned date for commencing work at the places affected. The Contractor shall be responsible for ascertaining the periods of notice required and shall make appropriate allowance in his program.

Immediately after completion of the profile survey, the Contractor shall provide sketches showing the relative positions of the lines and the obstructions.

4.7 Crossing of Public Services

Where public services are to be crossed and are not to be permanently removed, the Employer will obtain necessary approval for crossing on the basis of sketches to be provided by the Contractor immediately after completion of the profile survey and showing the relative position of the lines and the services. Where the Contractor is about to erect a conductor along or across power lines, telecommunication lines, public roads or waterways, he shall be responsible for ascertaining and giving requisite notice to the appropriate authority of the date and time at which the Work will be carried out.

Existing LV lines (400/230V) will generally be switched off during working (daylight) hours while the conductor erection progresses at crossing points. The Contractor shall provide a scaffold to protect the existing lines from physical damage and to maintain adequate clearance against accidental contact with lines when energized outside working hours.

For existing lines at voltages exceeding 400/230V, extended outages will not be possible, and the Contractor shall provide live line scaffolds such that conductor erection can proceed safely over-energized lines. The Employer will arrange outages, for the erection and removal of live scaffolds, upon receipt from the Contractor of requisite notice (which the Contractor shall ascertain and allow for in his program), but the duration of such outages will be the minimum necessary for the work to be completed. Where essential supplies are affected, it may be possible to provide outages only at weekends or public holidays. The Employer shall inform the Contractor which existing lines are subject to such restriction, and the Contractor shall arrange his program accordingly.

Where it is necessary to provide scaffolding for other HV/EHV line crossings over roads or telecommunication lines in order not to interfere with the passage of traffic, this shall be carried out by the Contractor at such times as may be convenient to the authority concerned. Flagmen and approved types of danger or warning notices shall be provided by the Contractor to ensure the safety of the public. Scaffolding and decking shall be erected in a safe manner to the approval of the Employer, and the time taken to affect the crossing and remove the temporary work shall be kept to a minimum. The Contractor shall provide his Bid and drawings showing his proposed scaffolding.

The cost of all scaffolding, warning signs, notices and other necessary precautions shall be deemed to be included in the Schedule of Quantities/Rates for stringing. Separate payment shall not be made for the cost of live line scaffold for HV lines. Such costs are deemed to be included under the items of stringing and erection.

4.8 Other Crossing

The Contractor shall, at his own expense, make the necessary arrangements and take any necessary precaution where the route crosses other obstacles or ground over which erection cannot be carried out in the normal manner.

4.9 Livestock

The Contractor shall make adequate provisions to prevent the straying of or damage to livestock during the execution of the Contract Works. Until permanent reinstatement of fences, walls, hedges, and gates is completed, the Contractor shall be held responsible for any loss or damage to livestock due to failure to comply with the above requirement.

4.10 Drawings / Maps and Field Records

The Contractor shall initially produce check prints of all Drawings for review and comments of the Employer prior to proceeding with the final copies at no extra cost to the Employer. All comments of the Employer shall be incorporated into the final Drawings. The Detailed Survey Drawing shall identify and depict all prominent features and details with their sizes, elevations/ depths, bearings and coordinates. The Contractor shall mention and acknowledge all the drawings, all the reference survey and other data used for the Survey and for the compilation of the drawings. All drawings shall have their respective scales drawn upon them. Nameplates of drawings and Drawing Numbers shall be as directed by the Employer only. All drawings submitted by the Contractor shall be in one of the standard sizes decided with the approval of the Employer.

The Contractor shall prepare all drawings and maps in ink on good quality tracing paper weighing not less than 90/95 gm / sq.m. The Contractor shall submit the tracings and one reproducible and four prints of each map. The Contractor shall also submit all the drawing information on CDs, compiled in AutoCAD. All these drawings, prepared in AutoCAD, shall have various layers, and the Contractor shall furnish this information with the drawings.

The Contractor shall submit all the Field Records, Field Books, Calculations, Check Prints as marked up by the Employer, etc.

4.11 Errors & Accuracy

The Contractor shall be responsible for the correctness and accuracy of the work done. If any errors are detected, even if such work is approved, the particular work shall be redone by the Contractor at his cost. The Employer may check the survey work as required during the course of the survey. However, such checks shall not absolve the Contractor of his responsibility for the correctness and accuracy of the work.

All levels shall be read accurately to the nearest 5mm. The error for linear measurement shall not exceed 1:10,000. The error in angular measurements shall not exceed six (6) seconds per station. In any triangulation or traverse, the cumulative angular error shall not be more than 30/N seconds, where N is the number of traverse stations. The probable error of computed sides shall not exceed 1 in 5000.

The closing error for leveling shall not exceed ± (5 K) mm, where K is the distance of the traverse in kilometers.

4.12 Maintenance of Records

All book entries shall be made in ink in the proper field and level books in accordance with standard practice. Any wrong entries shall be neatly struck out and rewritten. All

such books shall be made available for inspection by the Employer during any stage of the Survey. If, in the opinion of the Employer, the book entries are unsatisfactory, he may order the survey work to be redone. The Contractor shall submit calculations to establish the accuracy of the work done, the area of the plot and such other calculations that may be necessary.

4.13 Measurements

Measurement of all transmission line work shall be on a linear horizontal length basis. The work covered shall be measured from the prepared drawing by AutoCAD. Transmission line length shall be measured parallel to the conductor (i.e. tower peaks) to be erected later on.

Quantities of work indicated in the Schedule of Quantities are only approximate. The Employer reserves the right to modify the extent of the Scope of the Survey in each area to be surveyed at any time during the course of the work. All work actually done will be measured and paid at the rates quoted.

Rates quoted shall include the supply of all documents, drawings, maps, and computer diskettes etc., all as per the Bid Documents. The rates shall also be inclusive of the cost of all cutting of vegetation, transportation, boarding and lodging of all personnel, stationeries, wages of temporary and permanent personnel, all materials, equipment, taxes, insurance and everything necessary for the due performance of work under this Contract complete as specified.

4.14 Submission of Reports

On completion of work, a full report of the work done shall be submitted. This shall be on the lines of Standard Civil Engineering practice and shall include a general write-up of the work executed along with angle point details, tower details, accessibility etc.

CHAPTER 3

SOIL INVESTIGATION

1.0 Geotechnical Investigation

1.1 General

Detailed report of the Geotechnical study, where carried out by the Employer, shall be furnished to the Contractor at the time of contract award. For this project, however, no such studies have been carried out and a detailed Soil Investigation is in the scope of the Contractor, which shall be carried out in strict compliance with the best practices and the following specifications. The Contractor should carry out a detailed geotechnical investigation along the route and submit a comprehensive Geotechnical report for designing the appropriate foundation type. All work shall be carried out strictly in accordance with these Technical Specifications unless otherwise approved by the Employer in writing. Where not specified, the latest edition of the applicable code of practice or procedure as laid down by the Bureau of Indian Standards (BIS) shall be followed. The Earth Manual of the United States Bureau of Reclamation shall also be referred to in the absence of relevant information, procedures and guidelines by BIS. Only the SI system shall be observed. The metric system may be used only if approved by the Employer. In case of any discrepancy between these Specifications and BIS, these Specifications shall govern.

1.2 Purpose

The purpose, in brief, of the proposed Geotechnical investigation is to ascertain the type of substrata such as soil, rock, etc., their characteristics and their suitability for the structures proposed to be built and to decide on the choice of the types of foundation to be adopted for the type and magnitude of envisaged loading.

1.3 Scope of Work

The scope of sub-soil investigation covers mobilization of necessary equipment and personnel, setting of equipment, boring, drilling, excavating trial pits, collection of undisturbed soil samples wherever possible, otherwise disturbed samples, conducting field and laboratory tests on soil and rock samples to find out the various parameters as detailed in this Specification and submission of Geotechnical report in five copies along with recommendations regarding the suitable type of foundations, soil improvement wherever necessary etc. The Contractor also provides technical services as and when called for by the Employer. The Contractor shall ensure that all the equipment/ instruments are properly calibrated at the start of the work to reflect factual values.

1.4 Field Investigations

Fieldwork shall be supervised on a full-time basis by a suitably qualified and experienced Civil/ Geotechnical Employer and/ or Geologist.

All the specified locations for boreholes and field tests shall be set out at the site by the Contractor from two established reference grid lines.

The ground level shall be related to an established benchmark or to a GTS benchmark or as directed by the Employer or indicated on the drawing.

1.5 Trial Pits

Trial pits of size 2m x 2m x 3.5m depth (except for sound rock at shallow depth) shall be excavated at every identified location. These trial pits shall be properly logged on all four sides up to the foundation depth. Undisturbed samples shall be collected at every one-meter depth. Pocket penetrometer tests shall be conducted at different depths, in different strata, and in cohesive soils only. In-situ densities shall be determined for the sample locations: The samples should be tested in the laboratory to find out the various parameters as detailed further ahead in this Specification. Groundwater samples shall be collected from each Trial pit.

1.6 Bore Holes

The boring shall be done at tower locations (to be decided by the Employer or his authorized representative) depending upon the necessity. For towers at the river or water body crossings, at critical angle points or dead-end points, the boreholes may be carried out depending upon terrain and type of soil as decided by the Employer. The test-boring through different layers of all types of soil shall have to be carried out by the Contractor as briefed here under.

(a) Boring in soil strata shall be carried out by Shell and Auger or percussion method. No bentonite slurry or any lubricant except water shall be used during boring and drilling. The diameter of the borehole shall be such as to permit the collection of undisturbed samples (UDS) of 90mm to 100mm diameter.

Selection of sampling tube and method of sampling, recording of boring, protection, handling and levelling of samples shall be done as specified in IS 1892 -1979 with the latest revision, if any, after obtaining approval from the Employer or his authorized representative. The Contractor shall furnish in the Geotechnical report in detail the equipment and method of boring actually adopted.

(b) In rock strata, boring shall be done by using a rotary cutting tool tipped with diamonds and equipped to recover cores with double/triple tube core barrels. The drill hole size shall be NX. For each run, Core Recovery and Rock Quality Designation (RQD) shall be noted carefully immediately after cores are taken out of the barrel.

Each and every core piece shall be serially and sequentially numbered from the top downwards as soon as the core pieces are removed from the core barrel. The serial number shall be painted with good-quality enamel paint or permanent marker. All core pieces shall be placed in core boxes in serial order in the correct sequence from the top downwards. Core boxes shall be made according to Specifications laid down in IS:4078.

(c) Depth of boring below ground level shall be 10m unless continuous bedrock is encountered earlier. If the rock is encountered within 10m, the minimum drilling in the

rock shall be 2m. Adequate study of rock and assessment of strength characteristics shall be done, and recommendations shall be given.

(d) For the purpose of payment, rock immediately underlying soil overburden and overlying hard rock and with rock quality designation (RQD) of 10% and less will be considered as "Weathered rock" or "Soft rock". If the RQD is greater than 10%, it will be treated as Hard Rock.

The soft or weathered rock underlying hard rock with a thickness of less than 0.5m will be considered as hard rock for payment purposes. The soft or weathered rock underlying hard rock and with a thickness greater than 0.5m will be considered and paid as soft/ weathered rock only.

(e) Undisturbed soil samples shall be collected for the initial 4.5m depth at every 1.5m interval and at the change of strata. After this initial 4.5m depth, samples shall be obtained, preferably at every 3m or where there is a change of strata.

(f) In case collection of undisturbed samples becomes difficult/ impossible, detailed soil testing on remoulded soil samples is to be considered upon approval of the Employer and reported in the soil report.

(g) Standard Penetration Test (SPT) as per IS: 2131 -1981 shall be conducted in different strata to obtain resistance of soil to penetration at every 1.5m interval and recorded properly. Part of the disturbed soil samples of medium stiff to hard cohesive soils obtained from SPT spoon shall be coated with paraffin wax and sealed immediately on collection to completely retain all moisture within the sample.

(h) Standard Penetration Tests shall also be conducted in weathered/ soft rock with Rock Quality Designation (RQD) less than 10%. In such a case, the test shall be conducted at every 1.5m interval, unless specified otherwise, with the first test at a depth of 0.5m below the elevation at which weathered/ soft rock is encountered. The procedure for the test shall be the same as that in soil, except that penetration corresponding to 20 and 120 blows shall be noted. Also, if the total penetration is more than the seating penetration of 15cm, then the break up of blow count for 15cm seating penetration and for the remaining portion of penetration shall also be given.

(i) Water samples shall be collected from boreholes before the addition of water to the hole. Care shall be taken to see that the water sample is not contaminated by surface water or rainwater. The water sample shall be collected in an airtight, scrupulously clean glass, inert plastic bottle, or jerry can. The bottle shall be rinsed three times with water being sampled before filling. The quantity of each water sample collected shall be about 1 litre. Water samples shall be tested as soon as possible after sampling.

(j) The ground water table shall be recorded carefully during the boring operation and incorporated in the bore log. To ascertain the general groundwater table, inquiries in surrounding villages could be made to find out the highest groundwater table in the year.

(k) Borehole shall be backfilled by bentonite-cement grout after completion. The cement and bentonite for the grout shall be in the ratio 1 to 1 by weight and shall be made into a slurry with no more water than is necessary for placing the slurry in the borehole. If

there is standing water in the borehole, the borehole shall be dewatered first before placing the mix. The pits shall be backfilled with proper ramming using the excavated material.

(l) The Contractor shall submit progressively the copy (soft & hard copies) of data from the fieldwork. As soon as each borehole/ trial pit is completed, the bore log/pit log with all relevant field details shall be submitted.

1.2 Soil Resistivity Measurement

Soil resistivity measurements shall be carried out at every tower. The test shall be conducted in the field as per IS: 3043 by Wenner's four-electrode method for 1.0, 2.0, 3.0 and 5.0m spacing in all directions. Results shall include location, pin spacing, direction, resistance and calculated resistivity along with curves.

1.3 Laboratory Tests

An adequate volume of test samples shall be collected from the site. Samples shall be properly sealed immediately after recovery and transported carefully to the laboratory for carrying out necessary laboratory tests to find out the following parameters in respect of each sample, all as specified in the relevant IS code. The Employer will direct the Contractor on samples to be tested and on the type of tests to be conducted.

The following tests shall be performed on the soil samples:

1. Grain size distribution (Hydrometer tests required for cohesive soils).
2. Liquid Limit, Plastic Limit, Plasticity Index and Shrinkage Limit.
3. Natural Moisture Content, Bulk and Dry Density of soil (on undisturbed soil samples only)
4. Consolidation Tests on undisturbed soil samples or on soil samples compacted to specified density (to establish e-log P curve, pre-consolidation pressure, coefficient of compression Cc, coefficient of consolidation C_v etc.)
5. Specific Gravity
6. Free Swell Index test (Swelling Pressure test, if required).
7. Triaxial Tests (consolidated undrained and consolidated drained as and when applicable) or Direct Shear tests depending on the classification of soil and density of soil. The results shall be represented in Tables, Graphs and Drawings.
8. Permeability Tests
9. Chemical tests on soil samples (either undisturbed soil samples or disturbed SPT soil samples coated with wax) and water at different layers to determine the requirement of protection of concrete and reinforcement steel.
10. Unconfined compression test for cohesive soil (if encountered) on undisturbed soil samples or soil samples compacted to specified density.

The following tests shall be performed on the rock samples:

1. Density, Porosity and Water absorption for rock cores.
2. Crushing strength of rock (with and without saturation for 7 days)

3. Brazilian test on rock core as per IS:10082 (only if adequate rock samples of L/D ratio equal to 2 are unavailable).

1.4 Recommendations

The recommendations based on observations and test results shall encompass theoretical as well as practical considerations for all foundations. Recommendations shall include but not be limited to the following:

(a) Geological description of the site, including that of faults, folds, etc., if any, based on published literature and investigation carried out.
(b) Seismic history of the site, including a brief description of previous earthquakes, if any, giving time, period, duration, magnitude, epicentre location, damage done, maximum ground acceleration produced etc. and relevant details about the design earthquake.
(c) Special considerations, if any, adopted in the design of previous structures of the region because of seismicity, faults, folds etc.
(d) Behaviour of proposed foundations under seismic conditions, including analysis for the possibility of liquefaction and expected settlement under earthquake.
(e) Analysis and recommendations for foundations subject to vibratory actions.
(f) Recommendations in regard to the use of subsurface material for various construction activities and methods for quarrying the same.
(g) Topographical details of the site and recommendations related to site preparation, including classification, source, placement and compaction of fill materials required to bring the general site levels to final grade level, if so warranted; recommendations regarding excavation, stable slopes for excavation, dewatering etc.
(h) The various parameters to be adopted for design, such as cohesion, angle of internal friction, angle of repose, unit weight, elastic moduli and modulus of sub-grade etc.
(i) Ultimate Bearing Capacities of various soil strata, defining the limiting changes of the routes. These values shall be based on shear strength and settlement consideration.
(j) On the basis of the above data and subsurface stratification, the definition of foundation types is to be adopted along the route, including the feasibility of adopting undercuts.
(k) Recommendations and precautions (if required) to guide construction activity such as mode of excavation for foundations, de-watering, backfilling etc.
(l) Comments on the chemical nature of soil and groundwater with respect to potential deleterious effects on concrete and steel and recommended protective measures.
(m) Seismic history of the site, including a brief description of previous earthquakes,
(n) Study on the probability of landslide (slope stability analysis) and erosion for individual tower location and recommendation on remedial measure.
(o) Specific recommendations regarding the type of soil improvement for weak soils.

(p) Recommended side slopes for cutting and embankment, if any.
(q) Recommendations on lateral earth pressures as relevant.
(r) Past observations and historical data, if available, for structures resting in the area under consideration or for other areas with similar profiles.
(s) Precautions are to be taken such that relevant construction activities do not cause damage in any way to adjoining structures in relation to subsurface characteristics.
(t) Recommendations for additional investigation beyond the scope of the present work if the Contractor considers such investigation necessary.

1.5 Submission of Soil Investigation Report

The Contractor shall submit a detailed Geotechnical Investigation report (in SI units) in both soft & hard copies. The report shall generally contain the geological history of the site, all detailed boreholes, summarized test data, observations, conclusions and recommendations. Actual field and laboratory observations, calculations of test results, supporting calculations for their recommendations made, etc. shall also be presented as appendices to the report.

CHAPTER 4

TRANSMISSION LINE TOWERS

Where the design is not in the scope of the contractor, the provisions under this chapter would be limited only to the extent applicable. For this project, the tower and foundation designs will be furnished by the Employer and accordingly, the tower design parameters under this chapter may not be applicable. However, all other relevant portions of this chapter would be applicable to ensure that the material, workmanship and other issues under the scope of work are not compromised.

1.0 Type of Towers

1.1 Non-Snow Towers

Towers located below 2500m level are classified as Non-Snow Towers and shall be categorized as given below:

Type of tower	Designation of tower	Typical use
Small Angle Tower(0-15°)	B	To be used for line deviation up to 15° with normal span and also for longer span with smaller angles.
Medium Angle Tower (15-30°)	C	To be used for line deviation for more than 15° and up to 30° with normal span and also for longer span with smaller angles.
Large Angle & Dead-End Tower (30-60°)	D	To be used for line deviation for more than 30° and up to 60° with normal span and also for longer span with smaller angles. These towers will also be used as Terminal Dead End Towers.
Special Towers	SP	These may be required for major river/valley crossing & under specific conditions where normal towers are unsuitable.

1.2 Snow Towers

Towers located above 2500 meters level shall be similarly classified as in 1.1 above, except that the prefix "S" is added for indicating that they fall in the Snow Zone area and have to be designed for snow load. Thus, towers falling in Snow Zone are classified as SB (Snow B), SC (Snow C), SD (Snow D) & SSP (Snow Special) towers.

3 Height of Towers

The height of the basic body of all tower types shall be as follows:

Voltage Level (kV)	Height of basic tower body up to the lowest conductor attachment (meter)
66	12.85
132	14.0
220	18.0

The height and span of SP and SSP-type towers shall be decided as per site requirements after the topographical survey and tower spotting are completed.

Towers for each type of construction shall be capable of being extended by 3, 6, 9, 12, and 18 m without alteration to the standard body. The towers shall be designed in such a manner that the members and connections at any level will not have to be changed when fitted with any combination of leg and body extensions at lower levels or used independently of extensions at lower levels.

1.4 Base Width of Towers

In view of difficult terrain and to minimize the total cost of towers, foundations, benching, and rock cutting/revetment work, Narrow Base Towers shall be used, and the base width of Normal as well as Special towers shall be kept to a techno-economic optimum value. The maximum base width i.e centre to centre distance between tower legs at the point of connection between the tower leg and chimney of the different towers with the highest extension, shall be limited to the following:

1.4.1 Base Width for Single Circuit Towers

a) **66 kV line**

Non-Snow Towers		**Snow Towers**	
Tower Type	**Base Width (m)**	**Tower Type**	**Base Width (m)**
B+9	3.0	SB+9	4.0
C+9	3.5	SC+9	5.0
D+9	4.0	SD+9	6.0
SP+9	5.o	SSP+9	7.0

b) **132 kV line**

Non-Snow Towers		**Snow Towers**	
Tower Type	**Base Width (m)**	**Tower Type**	**Base Width (m)**
B+9	4.0	SB+9	5.0
C+9	5.0	SC+9	6.0
D+9	6.0	SD+9	7.0
SP+9	7.0	SSP+9	9.0

c) **220 kV line**

Non-Snow Towers		**Snow Towers**	
Tower Type	**Base Width (m)**	**Tower Type**	**Base Width (m)**

B+9	4.0	SB+9	5.0
C+9	5.0	SC+9	6.0
D+9	6.0	SD+9	7.0
SP+9	8.0	SSP+9	9.0

1.4.2 Base Width for Double Circuit Towers

The base width requirement for 66kV and 132kV Double Circuit Towers is normally 1.5 times the base width of Single Circuit Towers. The base width requirement for a Double Circuit 220kV Tower is 1.6 times the base width of a 220kV Single Circuit Tower. Accordingly, the base width requirement for Double Circuit towers shall be calculated from the base width provided for Single Circuit towers above.

All Tower types (Type B, C, D, SB, SC, SD, SP and SSP towers) are referred to as TENSION or STRAIN TOWERS in these Specifications.

2.0 Tower Loadings

The loads and load-combinations shall generally be in accordance with IS 802 latest editions and as per the guidelines set here-in, adopting the more demanding parameters in case of a clash.

The following points have to be considered while calculating the loads on the towers.

2.1 Transverse Loads

Under broken wire conditions, the transverse load due to wind on the conductor or OPGW shall be assumed to be not less than 60% of the load under normal conditions (50% of unbroken span and 10% for broken conductor hanging from the tower on the other side) and transverse load due to deviation not less than 50% of that under normal condition.

2.2 Vertical Loads

While computing compression, the weight of the conductor and OPGW will be taken based on the maximum weight span. However, in evaluating the tension or uplift, the weight of the conductor and OPGW will be taken based on the minimum weight span, and the weight of the insulator string only is to be considered. The effect of unbalanced vertical loads will also be taken into account for the design of tower members.

2.3 Longitudinal Loads

The loads due to the mechanical tension of the conductor and OPGW shall be resolved into longitudinal and transverse components. This shall be taken for the maximum as well as minimum angle of deviation for which the tower is designed, and the condition which is most stringent for a member shall be adopted.

3.0 Material

3.1 Steel

The tower members shall be fabricated using mild steel structural sections having yield strength as per IS:2062 / 1999. High Tensile Steel may be used for the tower members subject to the following restrictions:

(a) The work using HT steel shall conform to all relevant IS codes of practice in addition to all that has been specified in these specifications.

(b) Either all members of all towers for the entire works shall be of HT steel, or only leg members of all towers shall be of HT steel, while all other members can be of Mild Steel for the entire works. No other combination of HT and MS shall be allowed.

3.2 Zinc

Zinc used for galvanizing shall be of 99.95% purity.

3.3 Bolts, Nuts and Flat Washers

All bolts shall conform to Property Class 5.6 as per IS:12427/1988. The diameter of bolts used shall be 16 mm or 20 mm, but only one size shall be used for one type of tower. Nuts shall conform to Property Class 5 as per IS:1363(Part-III/1982), with mechanical properties conforming to IS:1367 –1980. Galvanizing of bolts and nuts shall conform to IS:1367-1980. Testing of bolts and nuts shall be done in accordance with IS:1367 / 1980. Mild steel flat washers of 5 mm thickness shall be used with every bolt and nut. The manufacturing details shall conform to the relevant IS for flat washers.

3.4 Sectional Properties of Structural Members of Towers

Structural steel angle sections manufactured according to the latest IS:808 1989 will be used for the fabrication of towers.

4.0 Erection Stress

Where erection stress combined with other permissible co-existent stresses could produce a working stress in any member appreciably above the specified working stress, such additional material shall be added to the member, or such other provision made as is necessary to bring the working stress within the specified limit.

5.0 Design Calculations & Drawings

The following design calculations and drawings are required to be furnished for all types of towers:

a) The Contractor shall submit a detailed design of the tower, extensions, stub template, clearance diagram, outline diagrams and structural drawings etc.

b) After testing the tower, the Contractor shall furnish final design calculations and drawings, detailed assembly drawings, shop drawings indicating the details of chipping, notching etc., where required and erection drawings etc. The Contractor shall also submit copies of finally approved structural drawings, bill

of material, foundation designs & outline-diagram of structure. Re-producible of all designs/drawings will also be submitted to the employer after the same has been finally approved.

An approved computer program shall be used for the Three-Dimensional Space-Truss analysis of latticed towers supporting the transmission line. All information necessary for the approval of the analysis and design of the towers and tower foundations shall be submitted to the satisfaction of the Employer, in hard copy form and in electronic form on CDs or Pen Drives. Analysis of towers by manual methods and other approximate methods shall not be allowed.

6.0 Detailing of Tower Members

The Contractor shall be required to keep in consideration the following points while designing the structures:

a) All the members shall be designed out of structural mild steel sections or gusset plates having their sizes and properties as per relevant Indian Standard Specification bolted together by means of bolts and nuts only.

   Use of mild steel rounds will be permissible only for making the hangers or U-Bolts, or extension links for supporting the insulator strings and OPGW clamps at the tower, for which welding may be permitted if considered necessary.

b) All parts shall be made accurately to standard gauges so as to facilitate replacement and repairs. All corresponding parts of similar towers shall be interchangeable.

c) Members shall be connected directly to each other without using gusset plates, wherever practicable.

d) All the connections shall be detailed to minimize the eccentricity of the connections.

e) Notching shall not be normally permitted, but if unavoidable, the cut of outstanding flanges to the extent of sheared edge distance can be provided.

   Chamfering of the flanges up to 45° may be done. In the case where clearances are critical, the minimum sheared edge distance from bolt-hole centres shall be retained.

f) At all places where there is a gap between two connected members, mild steel packing washers or wrought iron tapered washers shall be provided, wherever possible. The size of the washer shall be determined as follows:

   i) Thickness: Equal to gap
   ii) Length and breadth: As per edge security considerations for the sheared edge.

g) The gap between the ends of two connected members in a butt joint shall not be more than 6 mm or less than 4 mm.

h) No individual members in any type of towers, extensions, templates and special structures shall be longer than 6 metres.

i) Same stub in respect of section size, length, and fabrication details shall be suitable for one type of tower with or without 6 metre extensions, irrespective of the type of foundation where it is used. For other extensions, the stubs may differ, but the same stub should be suitable for all types of foundations for one type of tower.

j) For members of a double diagonal web system which are bolted at their point of intersection, the slenderness ratio (KL/r) shall be determined from the following criterion:

   i) 'L' is the greatest distance from the point of intersection to either of the end connections, and 'r' is the minimum radius of gyration.

   ii) 'L' is equal to 0.75 times the distance between end connections, and 'r' is the radius of gyration of the members for its axis parallel to the plane of the connected leg.

   iii) In the criteria (i) above, if the member is supported intermediately, then the radius of gyration of members for its axis parallel to the plane of the connected leg may be considered. But in such cases, check as specified in criteria (ii) is also to be considered, and the worst slenderness ratio of the two only shall be considered for design.

   However, the following may be considered to offer restraint in the axial direction.

   i Hip bracings of patterns shown in sketches contained in example B-8.3 and B-8.4 (p 10) of IS:802 (Part-I/Sec-2)-1992.

   ii Horizontal redundant member fixed leg to leg and passing through the point of intersection of members of double angle-web system, if used, the KL/r of such horizontal leg shall not exceed 250 where 'L' is the distance between end connections (on legs) and 'r' is the radius of gyration of the member for its axis parallel to the plane of connected legs.

   iii Corner plan bracings shall not be considered to be effective in offering restraint in the axial direction.

k)

   i) In the case of K-bracings, the KL/r of the horizontal main bracing member shall not exceed 200 where 'L' is the distance between end-connections (on main leg members) and 'r' is the radius of gyration of the members for its axis parallel to the plane of connected legs.

ii) If plan bracing with complete and perfect framing and giving support to the central node is provided, KL/r of horizontal main bracings shall be considered according to bracings design.

iii) Hip bracing of the pattern shown in B-9.3 and B-9.4 (p.11) of IS:802 (Part-I/Sec.-2) 1992.

iv) Corner plan bracings shall not be considered to be effective in offering restraint in the axial direction.

l) The angle between any two members common to a joint of a trussed frame shall preferably be greater than 20° and never less than 15° due to the uncertainty of stress distribution between two closely spaced members.

7.0 Fasteners

For connecting members, bolts and nuts of 16 mm dia or 20 mm dia will be used with 5 mm flat washers underneath.

The following minimum flange width of sections, rolled edge distances, sheared edge distances, and bolt-to-bolt distances from the centre of the bolt holes shall be maintained:

Diameter of bolts	Minimum flange width of sections	Minimum rolled edge distances	Minimum sheared edge distances	Minimum bolt-to-bolt distances
16 mm	45 mm	20 mm	23 mm	40 mm
20 mm	50 mm	25 mm	28 mm	50 mm

The minimum width of flanges having no bolt holes shall be kept not less than 30 mm. While dimensioning the gauge lines, allowances should be kept for mill rolling tolerance on the negative side to the extent of 2.5 per cent of flange width. The distance from the centre of a bolt hole to the face of the overhanging flange of an angle or other members would be adequate for conveniently tightening the bolts by socket wrench or box spanners. But the minimum distance from the centre of bolts to the inner side of the overhanging flange should not be less than 18 mm. All measurements should be done from the outer heel edge. The length of bolts shall be such that the threaded portion does not lie in the plane of contact of members.

It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm over the nut after it is fully tightened. All nuts shall be fit hand tight to the point where the shank of the bolt connects the head. No bolt shall connect aggregate thickness of more than three times the bolt diameter, and also the number of members carrying stress to be connected by a single bolt shall not generally exceed three (including gussets and packing). The bolt at the joint shall be so staggered that

nuts may be tightened with spanners without fouling. 5 mm flat washers shall be provided for insertion under all nuts. The length of bolts shall be determined with this provision in sight. Any reinforcement of unbraced stubs by providing cleats etc., shall not be permitted.

8.0 Stub Setting Templates

For the correct setting of tower stubs, stub templates shall be designed, fabricated and supplied by the Contractor at his own cost for normal towers, towers with extensions and special towers/structures. The templates shall be made out of the same steel sections as used for tower members and shall be joined by bolts and nuts. The templates of towers shall be adjustable type so as to make them suitable for normal towers as well as towers with extensions. The stub templates shall be galvanized.

The slenderness ratio of any member in the template shall not exceed 250.

In the case of towers with unequal legs, props shall be used properly to achieve the correct alignment of the stubs, subject to prior approval from the employer.

9.0 Provision of Step Bolts

Provision of blank holes for step bolts of 16 mm diameter and 175 mm long, spaced 450 mm apart and extending from about 2.5 m above the ground level to the top of the tower, shall be made on one leg of each type of tower below waist level and on diagonally opposite legs above waist level. Proto-type towers, however, will be type tested without step bolts by keeping the holes blank.

7.0 Materials and Workmanship

Unless otherwise specified, all material shall be of the outdoor type, of the best quality and workmanship capable of satisfactory operation under the operating and atmospheric conditions specified. Unless otherwise specified herein, the materials shall conform, in all respect, to the requirement of the latest edition of the relevant Indian Standard Specifications on that behalf. Wherever Indian Standard Specifications have not been formulated, IEC shall apply.

The contractor may offer materials manufactured in accordance with other well-recognized standards but shall, in that case, supply a copy of the standard Specifications adopted by them and shall clearly mention in what respect such standard specifications differ from corresponding Indian Standard Specifications. However, material quality and strength should not go below the stipulations and requirements of Indian Standards.

All materials shall be erected after being approved and passed by the Employer. The erection of the lines shall be done according to the best practices being followed in the erection of EHV/UHV lines, with the best erection equipment so as to give satisfactory results.

7.1 Details of Tower Fabrication and Workmanship

The tower members shall be fabricated in accordance with IS:802 (Part-II)-1992 or latest version. The following important points that are relevant to fabrication work are described. The Employer reserves the right at all times to inspect the fabrication of tower parts at the Contractor's or subcontractor's works.

a) All parts of the towers shall be fabricated in accordance with the shop drawings as provided by the Employer or prepared from approved detailed assembly drawings.

b) Towers shall have bolted connections. Welding shall not be permitted at any point unless otherwise previously approved by the Employer.

c) The tower members shall be accurately fabricated so that these can be bolted together easily at the site without undue strain on the bolts or members.

d) No angle members shall have the two-leg flange brought together by closing the angle.

e) Structures shall be so designed that all parts shall be accessible for inspection and cleaning pockets or depressions which hold water shall have drain holes. It will be ensured that the stressed members will not have any blank hole after final assembly, except for holes on account of step bolts or planned holes in stubs.

f) Fabrication of the towers shall be carried out in conformity with the latest practice employed in manufacturing transmission line towers by using power-driven cropping, punching, shearing and drilling machines. Relevant Indian Standards shall govern the extent of various operations, and the standard practices followed for such operations.

g) No rough edge shall be permitted anywhere in the entire structure. The flanges of the angle sections at the ends of members shall be properly chamfered if there are even slight chances of fouling with other members or if they cause difficulty in the proper tightening of the bolts. All clippings, back cuts, grindings, bends, holes etc., shall be true to detailed drawings and free from burrs.

h) Full inter-changeability shall be guaranteed.

i) No welding, filling or plugging shall be permitted unless previously approved. Welding of two or more pieces to obtain the length of members specified will not be permitted.

j) All sections, plates and bars shall be straightened before any work is done on them free from twists, carefully levelled and made true to detailed drawings by methods which will not injure the materials so that when assembled, the adjacent surfaces are in close contact throughout. Hammering shall not be permitted for straightening or flattening of members.

k) Cutting of members shall be affected by shearing, cropping, flame cutting or sawing. Members over 10 mm thick shall be sawn or flame cut, followed by

grinding. The surface so cut shall be clean, smooth, reasonably square and free from any distortion.

l) Holes in the members shall be either punched or drilled with the help of jigs and fixtures. Drilled holes will be preferred. However, members up to 12 mm thickness may be punched, and members over 12 mm thickness shall be drilled. All burrs left after drilling or punching should be removed completely. Holes adjacent to the bend shall be drilled or punched after bending.

m) Holes for bolts shall be circular. Oval or lobed forms of holes shall not be permitted. The diameter of the hole shall be 1.5 mm more than the diameter of the bolts.

n) The holes shall be perpendicular to the plates or angles.

o) The accuracy of the location of holes shall be such that for any group, when assembled, it shall admit the bolt at right angles to the plane of connection.

p) Members shall be bent hot, but in case of small bends, cold bends may be done with the prior approval of the Employer, provided no fracture of material occurs. All the bending operations shall be done by pressure. No bending of members shall be done for slopes above 45°.

q) When members are spliced by a lap joint, the heel of the inside angle shall be rounded to the minimum possible radius consistent with proper fit with the fillet of the outside angle. The thickness of the ground heel shall not be less than that of the leg. Flat healing will not be allowed.

8.0 Tolerances

The following fabrication tolerances shall be allowed as per IS:7215-1974 or latest version.

i) The maximum allowable difference in diameter of the holes on the two sides of the plate or angle shall not exceed 0.8 mm i.e. allowable taper in punched hole shall not exceed 0.8 mm in diameter.

ii) The tolerance cumulative and between consecutive holes shall be within ±0.5 mm.

iii) The tolerance on the overall length of members shall be within ±1.6 mm.

iv) The tolerance on the back mark shall be within ±0.5 mm.

9.0 Marking

All parts covered under supply of the structures shall have distinct marks, as given in the detailed assembly drawing and Bill of Material, made with a steel punch and sufficiently indented with letters and figures not less than 12 mm x 18 mm in size so that these are clearly visible after galvanising. The letters shall indicate the type of towers B/C/D/SP SB/SC/SD/SSP in which the member is to be used, and the numeral shall indicate the member mark as per drawing and bill of material. These erection marks shall be stamped near one end and in the same relative position on each piece in such a way that the mechanical properties of members are not affected. Special care must be taken to stamp the correct erection mark. The Contractor shall be entirely responsible for any disruption of work, delay in completion of the line, or delay in payment of the bill on account of wrong erection marks.

10.0 Galvanising

All members of the towers, including stubs along with the cleats, bolts and nuts, fixing attachments for insulator strings and OPGW clamps, extension links, if any, and the fixing attachments for danger, number and phase plates shall be galvanised.

The galvanising shall be done after all fabrication work is completed on the members by hot dip process. Galvanising shall be done as per IS 4759 – 1996 or latest version. Material to be galvanised is to be kept free from grease and paint, etc., during and after fabrication. After galvanising, the surface shall be free from all sharp edges and metal nodules, and there shall be no clogging of bolt holes due to the stay of zinc.

The Contractor shall submit, before taking up mass fabrication and galvanising, a full specification of the quality of zinc to be used, stating its purity and the process of galvanising adopted by them for more authoritative and better control on the quality of galvanising. They shall also state the minimum and maximum percentage increase in the weight of the completely galvanised materials compared to their black weight and the quality of zinc required per metric ton of the black steel weight of the fabricated structure.

Tests on the galvanised samples of fabricated materials shall be carried out regularly in accordance with IS:2633 with the latest amendment. If the galvanising does not satisfy testing requirements, the entire batch represented by the sample piece shall be rejected and re-galvanised to satisfy the test requirements without any extra expenditure to the Employer's account. All galvanised towers and accessories shall be treated with sodium dichromate or an approved equivalent solution after galvanising so as to prevent white storage stains. Galvanising of bolts and nuts shall be done as per IS:1367 - 1980. In addition, a strict inspection of the galvanised material shall be carried out by the Contractor before dispatch, and any visible or suspected defects shall be rectified forthwith.

11.0 Packing

Light angle sections shall be wire bundled, and heavy angle sections may be sent loose. Cleat angles, plates, hangers, U-bolts, pack washers and similar loose pieces shall be nested and bolted together in multiples or securely wired together through holes.

Bolts, nuts, washers and other attachments shall be packed in non-returnable double gunny bags and accurately tagged in accordance with contents. The packing shall be done in such a manner as to avoid losses/damages during transit. Each bundle or package shall be appropriately marked. No extra charges for packing shall be admissible, and packing charges shall be assumed to be included in the contract rates.

12. 0 Payment

Payment of steel materials for towers shall be made based on the **black weight** without galvanization and no separate payment will be made for galvanization.

CHAPTER 5

TESTS & INSPECTION OF MATERIALS

For this Project, the tested tower designs would be furnished by the Employer. Accordingly, tower testing requirements at accredited test beds for ascertaining the adequacy of the design, as indicated in this chapter, would not be applicable. All other requirements of tower testing, including proto-assembly, material testing etc., for the towers and all testing requirements of other materials, if applicable, will be carried out.

1.0 Tests at Manufacturer's Works

The plant will be inspected during manufacture and testing by the Employer. The Contractor shall provide every facility to enable the Employer to carry out the necessary inspection of the plant, and the cost of all tests during manufacture and preparation of test record shall be deemed to be included in the contract price except for the air fares (to and fro Bhutan). Apart from the tests specified here below, other tests mentioned in the Specifications of individual components of the works shall also be performed to the satisfaction of the Employer and shall be deemed to be included in the Scheduled Rates of the respective items. The dispatch clearance will be issued to the Contractor by the Employer on receipt of the inspection report.

The materials shall be inspected and tested during manufacture by an approved inspection firm or laboratory and be accompanied by appropriate compliance certification as part of the extent of work. The Employer and/or his representatives may also elect to inspect materials from time to time at his own expense. It is the responsibility of the Contractor to advise the Employer that the materials shall be available for inspection.

The passing of such inspection or test will not, however, prejudice the right of the Employer to reject the Plant and any or all of the material if it does not comply with the Specifications or give complete satisfaction in service.

Instruments shall be approved and shall if required by the Employer, be calibrated by the National Physical Laboratory or such other body as may be approved at the expense of the Contractor.

Unless otherwise specified in this Contract, selection of test samples, numbers of specimens and acceptance of results shall be in accordance with the terms of the relevant Indian standard, where applicable. Where no terms exist, the Employer is to instruct details in advance of the inspection and tests in response to the request of the Contractor.

Breakdown test voltages shall be measured by means of a crest or electro-static voltmeter connected to the high voltage side of the transformer or by an instrument connected to the low voltage side of the transformer supplying the test voltage and calibrated in an approved manner by means of a sphere spark gap. Electrical tests, other than impulse tests, shall be carried out at a frequency of 50 Hz.

The following tests shall be carried out at the manufacturer's works:

1.1 Type Tests

All equipment/materials shall conform to type tests, including routine, acceptance and additional tests in accordance with the relevant Standards and Codes. The Bidder shall submit copies of type tests for each equipment along with his bid. The type of tests report submitted shall be of the tests conducted within the last five (5) years prior to the date of Bid opening. In case the type tests reports are of the tests conducted earlier than five (5) years prior to the date of Bid opening, the Contractor shall repeat these test(s) at his cost. If the type tests reports submitted are of tests conducted within five (5) years prior to the date of Bid opening but do not conform to the requirements of the tender and are not considered acceptable to the Employer due to inadequacies/inconsistencies/certificates being from non-qualified agencies or /any other reason, the Contractor has to carry out the Type Tests because of such invalid certificate and/or absence of such certificates, at his own cost without any additional cost to the Employer.

2.0 Conductors

Routine Tests: Samples of individual wires from each length of the finished conductor shall be taken at the option of the Employer and subjected to the tests stated in the specified standards. Where practicable, tests shall be taken on samples of individual wires before stranding and related to the tests taken after stranding. In the event of the sample from any length not passing these tests, a second and third sample shall be taken from the same length, and if one of these also fails under the test, the length from which it has been taken shall be rejected.

3.0 Insulators

Routine Tests: Sample and type tests shall be carried out on all types of insulators used in the Contract. Type tests, including radio interference type tests, would be waived on the production by the Contractor of the requisite certificates by an independent Testing Authority showing that the insulators concerned have successfully passed type tests in accordance with IEC 383 or such other standard as may be approved.

4.0 Insulator Strings

Design Tests: One suspension and one tension string of each type, selected by the Employer, shall be subject to the following tests in accordance with the provisions of IEC 383 or such other standard as may be approved :

(i) Radio interference tests (Grade II): For these tests, single unit RI tests will be required on the insulator discs, which are used to make upp the complete string. The two noisiest discs should be placed at the line end, but otherwise, the order may be random.

(ii) Impulse tests: Dry withstand and dry 50% flashover, positive and negative polarity.

(iii) Power frequency tests: Wet withstand and wet flashover.

Tests shall include vibration dampers and any other fittings attached to the conductors in service and shall be made with and without arc horns.

5.0 Insulator Fittings

Routine and sample mechanical tests shall be carried out on fittings in accordance with the specified standards.

6.0 Tension Clamps and Joints

Two samples each of tension clamps and tension and non-tension joints shall be submitted to mechanical and electrical type tests, galvanising and mechanical routine tests in accordance with the specified standards. The Employer, from time to time. may make further similar tests as may be required to ensure that the quality of the product is being maintained throughout the Contract

7.0 Tests on OPGW and accessories

All tests as required by the Employer shall be carried out by the Bidder as per relevant standards codes both at the factory before dispatch and at the site after installation. The Contractor shall submit a Factory Acceptance Test (FAT) proposal for the OPGW and its hardware, and the tests and inspection shall be carried out as per the approved FAT plan. The FAT plan should be submitted at least two months before the proposed date of carrying out the FAT.

The Bidder shall demonstrate in the field compliance of the values, cable performance, and/ or all other parameters, by tests, with the corresponding guaranteed values indicated in the offer. A transmission loss test, tension test to check the cable's strength, pulley test to survey the change in transmission loss, and electrical property test shall be performed before shipment of the OPGW drums. After receiving the OPGW drums at the site, before stringing the cable, the Bidder shall carry out the OPGW core breakage test. Testing of the optical fibre cables and accessories shall be carried out as per ITU-T recommendation. The tests to be performed shall include but not be limited to the following:

- Mechanical and Optical Parameters

Tests shall be carried out as per the approved Factory Acceptance Test (FAT) plan to determine the following parameters:

a) Recommended maximum allowable tensile stress (N/sq.mm)
b) Recommended maximum allowable Every Day Stress (N/sq.mm)
c) Cable overall diameter
d) Core diameter
e) Mode field diameter
f) Cladding diameter
g) Coating diameter
h) Non-circularity of the core
i) Non-circularity of the cladding
j) Cladding ovality

k) Core-cladding concentricity error
l) Thickness of the PE Sheath
j) Maximum theoretical numerical aperture
m) Attenuation (each type separately, e.g. material, splice, etc.)
n) Bandwidth
o) Dispersion (material and waveguide)
p) Tensile test
q) Crush test
r) Thermal cycle test
s) Diameter of armouring wires
t) Breaking load of armouring wires
u) Attenuation characteristics under tensile stress and temperature change.

Test reports and certificates for OPGW cable and brought-out components shall be submitted for Employer's approval.

8.0 Tests & Inspection of Towers

8.1 General

All standard tests, including quality control tests in accordance with relevant Standards and Codes, shall be carried out in cases of all standard types of towers with their extensions.

In addition to the provisions contained elsewhere, the following shall also apply:

a) The Contractor shall keep the Employer informed in advance of the time of starting and of the progress of manufacture, fabrication and galvanising of various tower parts at various stages so that arrangements can be made for inspection.

b) The acceptance of any batch of items shall in no way relieve the Contractor of any of his responsibilities for meeting all the requirements of the specification. They shall not prevent the subsequent rejection if any item of that batch is later found defective.

The Employer or his representative shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication and galvanising of the steelwork and shall be provided with all reasonable facilities for satisfying himself that the fabrication, galvanising and packing are being done in accordance with the provisions of this specification. Unless specified otherwise, inspection shall be made at the place of manufacture prior to despatch.

Should any fabricated member of the structure be found not to comply with the approved design/drawing or provisions of the specification, it shall be liable to rejection. No member, once rejected, shall be re-offered for inspection, except in cases where the Employer or his authorised representative considers the defect as rectifiable. Defects which may appear during fabrication shall be made good with the consent of and according to the procedure laid down by the Employer.

The Contractor shall supply all gauges and templates necessary for inspecting fabricated material. The correct grade and quality of steel and zinc shall be used by the Contractor. To ascertain the quality of steel/zinc used, the Employer may, at his discretion, get the raw and fabricated material tested at an approved laboratory. Proto-type of normal structures and extensions will be manufactured and assembled for inspection by the employer before the final approval of the drawing and bill of material and mass fabrication.

8.2 Tower Tests at Works

One of each type of tower, complete with the maximum body extensions or as may be advised by the Employer, shall be tested as given below as per IS:802 (Part-III), latest edition, for the following conditions to compare the actual strength with the calculated strength of the towers.

i) Specified ultimate design loads in all of the normal and broken wire conditions,

ii) Destruction under normal conditions

As and when the testing plan is approved by the Employer, the Contractor shall arrange these tests, and the Employer will pay for such tests. The tested tower shall be the property of the Contractor. Proto-type towers, however, will be type tested without step bolts by keeping the holes blank. No part of any tower subject to test shall be supplied against the Contract. To avoid any possibility of such tower members being supplied, the Contractor shall put a special mark, as decided in consultation with the Employer, on each tower part used in the test tower.

The black tower shall be subjected to design and destruction tests by first applying test loads equivalent to the specified ultimate design loads and applied in the manner as approved by the Employer. The tower shall withstand these tests without showing any sign of failure or permanent distortion in any part. Thereafter the tower shall be subjected to destruction by increasing the loads further in an approved manner till it fails. The Contractor shall provide facilities to the Employer or their representatives for inspection of materials during the manufacturing stage of proto assembly and also during testing of the tower.

The Contractor shall submit to the Employer for approval his detailed programme and proposal for testing towers showing the methods of carrying out the tests and manner of applying the tests load. After the Employer has approved the test procedures and programmes, the Contractor will intimate the Employer about the dates for carrying out the tests at least 20 days in advance of the scheduled date of tests, during which the Employer will arrange to depute his representatives to be present at the time of carrying out the tests. Five copies of the test plan and load schedule shall be supplied. No testing shall be done unless the testing plan and load schedules have been approved earlier.

If the Contractor does not have all the facilities for the testing of the tower at his own test bed, the Employer has every right to ask the Contractor to test the tower at such a test bed where all the facilities exist, without any extra charges, whatsoever, beyond the Contract rates.

The testing charges for each type of tower shall be paid only once upon successful testing of the tower to the satisfaction of the Employer. Employer's responsibility for paying against test charges is limited to Contract rates only. Any replacement or modification required in the towers to make them safe up to the specified loads under the specified conditions as a result of the above test shall be done at the Contractor's cost.

The Contractor shall ensure that the specification of materials and workmanship of all towers actually supplied conform strictly to the towers which have successfully undergone the test. If any deviation is detected, the Contractor shall replace such defective tower parts immediately. All expenditure incurred on account of the use of such defective part(s), including its appropriate replacement, and re-testing of tower parts if desired by the Employer, shall be borne by the Contractor. No extension in delivery time shall be allowed on this account.

8.2.1 Tower Testing Procedure

8.2.1.1 Preparatory Work

a) Leg Anchorage

Each type of tower to be tested shall be a full-scale proto-type black tower and shall be erected vertically on the rigid foundation with as much unbraced portion of the stub protruding above ground level as approved in the design. The tower erected on the test bed shall not be out of plumb by more than 1 in 360.

b) Calibration of Measuring Instruments

All measuring instruments shall be calibrated in a systematic manner with the help of standard weights. The calibration shall, before commencing the test on each tower, be done up to the maximum anticipated load to be applied during testing. Calibration curves for the instruments shall be drawn, and the test loads suitably corrected with the help of these curves.

c) The tower shall be tested with blank holes for step bolts on one leg. The tower under test should be so erected that blank step bolt holes are on the compression leg of the tower.

8.2.1.2 Method of Load Application

a) Load shall be applied according to the rigging diagram through normal wire attachments, angles or bent plates. As far as possible, all loads on towers shall be applied through strain gauge dynamometers.

b) The various types of loads, i.e. transverse, vertical and longitudinal, shall be applied in such a way that there is no impact loading on the tower due to jerks from the winches.

c) The application of loads should be such that it simulates nearly the actual load application in the transmission line. For the suspension-type tower, the loads

shall be applied through flexible ropes on plates of the same side used in the design and inclined at 45° attached to the structure.

8.2.1.3 Load and Deflection Measurement

All loads shall be measured through a suitable arrangement of strain devices. Positioning of strain devices shall be such that the effect of pulley frictions is eliminated. In case the pulley friction cannot be avoided, the same shall be measured by means of standard weights and accounted for in the test loads.

Tower deflection under load shall be measured by suitable procedure at the top cross-arm level on the front sides of the transverse and longitudinal faces or front and rear sides of transverse faces. Deflection readings shall be recorded for the "before load", "load on", and "load off" conditions.

8.2.1.4 Testing Procedure

8.2.1.4.1 Bolt Slip Test

In the bolt slip test, the test loads are gradually applied up to 50% of the ultimate design loads under normal conditions and kept constant for two minutes at these loads and then the loads are released gradually.

8.2.2.4.2 Normal Load/Broken Wire Load Tests

All the loads shall be applied gradually up to the ultimate design loads in the following steps of the percentage of limit and shall be released in a similar manner.

50 percent 75 percent 90 percent 95 percent, & 100 percent

8.2.2.4.3 Observation Period

a) Under normal and broken wire load tests, the tower shall be kept under observation for signs of failure for two minutes (excluding the time for adjustment of loads) for all the intermediate steps of loading up to and including 95 per cent of the above design loads.

b) For normal as well as broken wire tests, the tower shall be kept under observation for five minutes (excluding the time for adjustment of loads) after it is loaded up to 100% ultimate design loads. The counting of waiting time shall start when all the loads are fully applied. In this respect the decision of the Employer's representative witnessing the tower test shall be final and binding.

c) While the loading operations are in progress, the tower shall be constantly watched. If it shows any tendency of failure anywhere, the loading shall be immediately stopped, released and then the entire tower shall be inspected. The re-loading shall be started only after corrective measures are taken.

8.2.2.4.4 Recordings

a) The deflections of the tower shall be recorded at each intermediate and final stage of the normal load/broken wire load test by means of the theodolite and graduated scales fitted on the tower.

b) The graduated scales shall be about one metre long with marking up to 5 mm accuracy.

8.2.2.4.5 Check for Mechanical Strength of Tower

The structure is considered to be satisfactory if it is able to support the specified ultimate load for 5 minutes as stipulated herein with no visible local deformation after unloading (such as bending or buckling) and no breakage of elements.

8.3 Material Test

Steel materials used for the tested tower shall be subjected to tensile load or bend test in accordance with Indian standards. The Contractor shall perform the test without any additional cost. The test specimens shall be selected as follows:

i) Two samples were selected from destructed members of each tower.

ii) Two samples were selected from the unrestricted members of each tower.

8.4 Test Report

The report shall include the following:

a) The type of tower tested
b) The name and address of the tower manufacturer
c) The name and address of the Client
d) The dates and location of testing
e) The name of persons present during the test.
f) A list of various assembly and shop drawings relating to the tower tested, including any modification of the drawings referred to.
g) A dimensioned line diagram of the tower showing the various load points and directions of loading to be applied and a table with the specified loads.
h) Diagram showing the rigging arrangement used to apply the test loads.
i) Brief description of the test facility, including the number, location, range and calibration charts of tables of every load transducer, as well as the accuracy of the equipment used to measure the test loads.
j) One table per test showing the loads required at various points on the structure and for the various loading steps.
k) One table per test showing the various deflection values which may have been recorded.
l) In the case of failure.
    i) A table showing the maximum loads applied to the structure just before the collapse
    ii) A brief description of the failure
    iii) The dimensional and mechanical characteristics of the failed elements.

m) A certain number of photographs showing the whole of the structure and details of the failure.
n) Material test reports.

9.0 Tests at Site

Where ordered by the Employer, site investigation tests shall be carried out by the Contractor and such cost is deemed to be included in the schedule of rates for respective items or similar items in the Bill of Quantities. The rates may include all necessary manpower and labour, transport, work, materials instruments and any other costs and expenses entailed in testing to a satisfactory result.

9.1 Concrete Tests

The Contractor shall carry out tests on samples of concrete from the foundation works, as required by the Employer. No separate payment shall be paid for the Concrete test.

The test specimens shall be cubes of 150 mm side, and the mould shall be of metal with the inner face accurately machined. Each mould shall be provided with a metal base having a smooth machined surface. The interior surfaces of the mould and base shall be lightly oiled before concrete is placed in the mould.

Test Specimens shall be moulded by placing the fresh concrete in the mould in 50 mm layers, each layer being thoroughly compacted with a steel bar 380 mm long and having a ramming face 25 mm square and weighing 2.8 kg. The concrete may be compacted by vibration, each layer being vibrated by means of an electric or pneumatic hammer or by means of a suitable vibrating table.

Concrete for test specimens shall be taken at the point of deposit. To ensure that the specimens are representative of the concrete in the foundations, a number of samples shall be taken from different points. Each sample shall be large enough to make one test specimen and shall be taken from one point in the work.

The test specimens shall be stored at the site at a place free from vibration, under damp sacks for 24 hours, plus 1/2 hour, after which time they should be removed from the moulds, marked and stored in water at a temperature between 10° C and 21° C until the test date. Specimens that are to be sent to a laboratory for testing shall be packed for transit in damp sand or other suitable damp material and shall reach the laboratory at least 24 hours before the test. On arrival at the laboratory, they shall be similarly stored in water until the date of the test.

The test shall be made at the age of the concrete corresponding to that for which the strengths are specified. Compression tests shall be made between smooth plane steel plates without end packing, and a load shall be applied axially at the rate of approximately 13.8 N/mm^2 per minute. One compression plate of the testing machine shall be provided above seating in the form of a proportion of a sphere, the centre of which coincides with the central point of the face of the plate. Test specimens shall be placed in the machine in such a manner that the load is applied to the sides of the specimens as cast.

The results shall be handed in triplicate to the Employer as soon as possible after testing.

9.2 Measurement of Galvanizing Thickness

The Contractor shall have available on site for the Employer's use an instrument suitable for the accurate checking of galvanizing thickness. The gauge shall be available from the time of arrival of the first consignment of steelwork until the issue of the taking-over certificate for the last line. The cost of the gauge and other operating expenses shall be deemed to be included in the Contract price, and the gauge shall remain the property of the Contractor.

Other tests on galvanizing shall be carried out as described in chapter 4, clause 10.0, "Galvanising".

9.3 Testing of Rock Anchors

Where rock anchor foundations are used in hard rock, as provided for by the Specification, the Contractor shall type test individual anchors by tensile test loading to failure. The type test shall be considered satisfactory if the foundation fails at or above the design's ultimate strength of steel.

Anchors for type testing shall be installed away from permanent foundation anchors but in the same rock. The frequency of type testing shall depend upon the different types of hard rock encountered, and the number of type tests performed shall be such as to give confidence in the employment of rock anchor foundations and experience of the type of rock suitable for their use.

The frequency of type testing shall, in the case of dispute, be reasonably determined by the Employer. The cost of rock anchor tests shall be included in the Scheduled Price of Hard rock foundation.

9.4 Training

Training shall be provided for up to six (6) design engineers at Contractor's premises, in batches, on the use of PLS-CADD, PLS-TOWER, i-TOWER, tower foundation design software (such as STAAD.Pro (Bentley Systems), SAFE (CSI), SAP2000 (CSI) & PLAXIS 3D), and Civil 3D, with a focus on practical application for designers certified trainers and/or internationally. The area of training and timing shall be mutually agreed during the implementation of the project and all associated costs shall be at contractors account except for the air fares (to and fro Bhutan).

CHAPTER 6

FOUNDATIONS OF TOWERS

1.0 General

Where the design is not in the scope of the contractor, the provisions under this chapter would be limited only to the extent applicable. For this project, the tower and foundation designs will be furnished by the Employer, and accordingly, the design parameters under this chapter may not be applicable. However, all other relevant portions of this chapter would be applicable to ensure that the material, workmanship and other issues under the scope of work are not compromised.

All materials, design, detailing and construction methods for foundations shall be as per the latest revision of relevant Indian Standards except as set out and specified and/or assumed below. In case of incompatibility between Indian Standards and the Specifications herein, the more demanding parameters shall govern.

Reinforced Cement Concrete (RCC) type individual footings shall be preferred foundations for all towers, particularly in the mountains where transport of material is difficult. However, where the same is found to be uneconomical, individual Plain Cement Concrete (PCC) footings may be provided. Footings of all the legs of each tower shall be similar, irrespective of down-thrust and uplift. The Contractor shall submit the detailed designs and drawings for the foundations of all tower types under all soil conditions for the approval of the Employer.

2.0 Classification of Foundations

The following types of foundations for each tower shall be considered for the proposed works:

2.1 Normal Dry Soil / Hard Soil Foundations

Used for locations in normal dry soil with Ground Water Table (GWT) below the founding level and soil is homogeneous up to the full depth of the foundation. Preferably RCC, otherwise PCC, slab and / or pyramid footing with the chimney to be adopted.

2.2 Wet-Type Foundations

To be used for locations where the water table is met at 1.5m or more below the ground line or at locations which are in surface water for long periods with water penetration not exceeding one meter below the ground line (i.e., paddy fields). Preferably RCC, otherwise PCC, slab and / or pyramid footing with the chimney to be adopted.

2.3 Partially Submerged Type

To be used at locations where subsoil water is met at a location between 1.5m and 0.75m below the ground line. Preferably RCC, otherwise PCC slab and / or pyramid footing with the chimney to be adopted.

2.4 Fully Submerged Type

To be used at locations where subsoil water is met at a location between 0.75m and the ground line. Preferably RCC, otherwise, PCC slab and / or pyramid footing with the chimney is to be adopted.

2.5 Soft / Fissured Rock

RCC-type undercutting may be used for the resistance of uplift in the case of RCC foundation for Soft Rock.

2.6 Hard Rock

RCC type, with Rock-Anchors if required, for the resistance of uplift.

2.7 Foundations for Tower Types SP and SSP

The heights and spans of these tower types shall be decided after the topographical survey and tower spotting are over. The foundations for these tower types shall be decided from amongst the other types listed here after completing the Geo-technical Survey. These foundations shall be paid based on measurements of actual quantities, as explained in the Price Schedule.

2.8 Special Foundations

In addition to the above, depending on the site conditions, other types of foundations may be introduced to meet the requirements of the site. Also, depending on the site conditions, the Employer will ask the Contractor to design and adopt footings for soil conditions Intermediate to those stipulated herein to affect more economy. The Employer will decide these by reviewing the results of the Geo-Technical investigation. When asked to do so, the Contractor shall submit a design to suit site conditions for the approval of the Employer. Examples of such intermediate conditions are soils with the water table at another level than those assumed herein, particularly soft rock, soils with properties varying slightly than those assumed herein, etc.

The Contractor shall be responsible for ascertaining that the subsoil is suitable for the type of foundation used and shall provide details of site investigation and relevant tests carried out. The Contractor shall examine the soil investigation results and submit for the Employer's approval a schedule showing the type of foundation proposed at each support. The Employer's decision as to which type of foundation shall be employed at any given location shall be final. The Contractor shall be responsible for any subsidence or failure due, in the opinion of the Employer, to insufficient care having been taken in the preliminary examination of ground conditions. It shall be incumbent on the Contractor to employ adequately technically qualified Employers for the supervision/execution of foundations so as to ensure that the foundation type chosen is satisfactory for the actual soil encountered near the tower legs, since the investigation shall be conducted slightly away from the tower leg, at the center of the tower. The Contractor shall be responsible for properly judging whether the soil encountered at the tower location has the same strength (or higher) as compared to the soil near the tower center, the investigation results of which have been considered in deciding the tower

type. Any failure on this score of soil near the tower leg being weaker than that tested near the tower center shall be the Contractor's responsibility.

3.0 Loads on Foundations

The foundations shall be designed to withstand the reactions at the tower base along the stub angle slopes obtained from the structural stress analysis and increased by 10% as compared to the corresponding towers.

The base reactions shall be composed of the following: -

(a) Maximum tension or uplift
(b) Maximum compression or down-thrust
(c) Maximum horizontal shear or side-thrust

3.1 Stability Analysis

The following primary types of soil resistances shall be assumed to act in resisting the loads imposed on the footings on the earth:

(a) Resistance against Uplift:

The uplift loads will be assumed to be resisted by the weight of the earth in an inverted frustum of a conical pyramid of earth on the footing pad whose sides make an angle equal to the angle of repose of the earth with the vertical. The weight of concrete embedded in the earth and that above the ground will also be considered for resisting the uplift.

Every attempt shall be made to avoid over-lapping of frusta of adjacent footings. In an unavoidable case, where the frusta of earth pyramids of two adjoining legs superimpose each other, the earth frustum of each leg shall be assumed truncated by a vertical plane passing through the center line of the tower base.

The inverted frustum of the earth shall be assumed to be applicable in non-rocky conglomerates only. In rocky soil, other ways of considering uplift resistance, like rock anchors, embedment in rock etc., shall be devised with the approval of the employer.

(b) Resistance against Down thrust:

The down thrust loads will be resisted by bearing the strength of the soil assumed to be acting on the total area of the bottom of the footings.
In the design of the foundation for down-thrust, the weight of concrete in the footing above and below ground level and embedded steel parts shall correctly be accounted for, giving due consideration to the water-table, if present, and displaced earth.

(c) Resistance against Side thrust:

Side thrust shall be resisted by passive pressure acting on the side of the chimney and/or by "at rest" soil pressure acting against the foundation slab and pyramid. If this pressure is inadequate to resist the side thrust, help shall be taken of the friction of the foundation against the ground. In case the passive pressure on the chimney face is less than the side thrust, the effect of the moment at the base of the foundation on the base pressure shall be taken into account in the stability check and subsequently in the design of the foundation. In all cases, the chimney shall be designed as a cantilever, fixed at the foundation top, subjected to the side thrust without any relief from the passive pressure. In the case of backfilling by Rocky Soils, horizontal soil pressures on the chimney and foundation shall be taken as zero.

In the case of Rocky soils, resistance against side thrust shall be developed by casting the footing against the rock.

(d) Resistance against Overturning:

For resisting overturning, the weight of soil shall be assumed to be 50% of the weight of the earth contained in the inverted frustum of the cone. The inverted frustum of the cone shall be the same as that considered for resisting uplift, as given above. The specification provides for the method for calculating the resistance against overturning. It also gives the formula for calculating the volume of soil contained in the inverted frustum of the cone. The following shall be considered during the stability analysis.

i. The increase in ground reaction caused by a moment due to horizontal shear.
ii. The reduction of uplift capacity caused by a moment due to horizontal shear.

The strength design shall ensure safety against all stress resultants (viz. shear, bending and axial stresses) during each of the maximum down thrust and uplift conditions along with accompanying side thrusts, as per the standard civil Engineering practices. Particularly, the base slab shall be checked for stresses due to bending moment and shear force arising during down thrust and uplift conditions, while the chimney portion shall be designed as a composite section for combined action of compression or tension force and associated bending moments due to horizontal shears. The anchoring of stub and cleat shall be done to check anchoring stress in down thrust and uplift cases.

3.2 Properties of Soil & Concrete

For bid purposes, the design of foundations shall follow the assumptions set out in the table given below.

	Units	Hard Soil (Normal Dry Type)	Hard Soil Wet Type **	Soft Rock	Hard Rock	Partially Submerged **
Assumed Mass of Earth for Foundations *	kg/m^3	1500-Min 1800-Max	900-Min 1100-Max	1600-Min 1900-Max	1600-Min 1900-Max	900-Min 1100-Max
Assumed Mass of Rocks for foundations.				1900	2200	

Assumed Mass of Concrete in RCC for Foundations	kg/m³	2400-Min 2600-Max	1400-Min 1600-Max	2400-Min 2600-Max	2400-Min 2600-Max	1400-Min 1600-Max
Assumed Mass of Concrete in PCC for Foundations	kg/m³	2300-Min 2500-Max	1300-Min 1500-Max	2300-Min 2500-Max	2300-Min 2500-Max	1300-Min 1500-Max
Assumed Ultimate Bearing Capacity for Foundations Under Specified Maximum Ultimate Loading.	t/ m²	25	12	50	100	12
Ultimate Shear Stress in Rock.				3.0	7.5	
Assumed Angle to vertical of Frustum of Earth Resisting Uplift (Angle of Repose).	-	30º	15º	-	-	15°
Ultimate Plain Concrete Bearing Stress	Kg/cm²	60	60	60	60	60
Ultimate Adhesion Value between Galvanized Steel and Concrete.	kg/cm²	10.0	10.0	10.0	10.0	10.0
Minimum Portion of Stub Loads to be considered in the Design of Cleats		50%	50%	50%	100%	50%

*Weight of water not included.
** Properties applicable to submerged parts only.

The soil parameters given above shall further be confirmed/modified as per the findings of geotechnical investigations to be carried out by the Contractor as specified after the award of the contract.

3.3 Foundation Depth

For all soils other than Hard Rock, the total depth of foundations below the ground level shall not be less than 1.5 m. The corresponding minimum depth for Hard Rock foundations shall be 0.6m.

The maximum depth of foundations for all types of towers (except special structures and foundations approved by the Employer), shall not be more than 3.5 m below the ground level.

3.4 Design of Foundation

The foundation shall be designed to satisfy all specified loading conditions.

The thickness of concrete in the chimney portion of the tower footing shall provide a minimum cover of not less than 100 mm from any part of the stub angle to the nearest

outer surface of the concrete at all dry locations. The minimum section of the chimney shall be 300 mm square. At all wet locations, the chimney shall have a clearance of 150 mm from any part of the stub angle and a minimum of 450 mm square section.

The chimney top or muffing must be at least 300 mm above ground level, and also the coping shall be extended up to the lowermost joint level between the bottom lattices and the main corner leg of the tower. At least a 50 mm thick lean concrete pad of 1:3:6 nominal mix of the size of the base of the footing will be provided below all foundations. This slab will also be provided in cases where pyramids are provided over concrete slabs, as in the case of submerged-type foundations referred to below. No separate charges shall be paid for this lean concrete pad.

In the case of a submerged type of foundation, at least one base slab, not less than 200 mm, shall be provided. The slab shall be of M20 cement concrete.

The minimum distance between the lowest edge of the stub angle and the bottom surface of the concrete footing shall not be less than 100 mm or more than 150 mm in the case of dry locations and not less than 150 mm or more than 200 mm in the case of wet locations.

The foundation shall be so designed that the Center of Gravity (C.G.) of the tower leg coincides with the C.G. of the chimney & C.G. of the chimney coincides with the C.G. of the base pyramid or slab, whichever is provided. In case this provision is not followed, the resultant eccentricities and additional forces because of eccentricities shall be considered in the design of foundations.

The portion of the stub in the pyramid shall be designed to take full down thrust or uplift loads by the cleats combined with the bond between the stub angle and concrete in the pyramid portion.

(i) Concrete Block (PCC) Type Foundation:

The slope of all concrete pyramid side faces shall not be less than 45° to the horizontal.

The chimney shall be designed as a cantilever, as specified herein, with reinforcement provided in the form of bars at the corners of the chimney, tied by means of stirrups. The detailing of the reinforcement shall be as per the applicable clauses specified for the chimney in RCC Type Foundation below.

(ii) RCC Type Foundation:

The RCC foundations shall be designed in accordance with the Limit State Method prescribed in IS 456 – 1978 employing the same properties of materials, permissible stresses and mode of design as specified therein. The following points shall be taken care of while designing the RCC foundations:

a) The foundation shall not be permitted in pyramid form. Instead, steps of square slabs, each not less than 200 mm thick, shall be adopted. The thickness of the bottom slab in touch with the layer of PCC in blinding shall not be less than 300 mm. The sides of all the slabs shall be vertical only.

b) The reinforcement bars in each step of the upper tier of footing shall be bent 90° near the edge of the step (keeping the minimum cover required) and brought to the bottom of the footing, keeping the minimum cover.

c) The bars in the bottom and upper tiers of footing shall be continuous from one end to the other end. Curtailment of the bars in between is not permitted.

d) The chimney portion shall be designed as a composite section for the combined action of compression or tension force and associated bending moments due to horizontal shear. A minimum of four bars of diameter not less than 12mm shall be provided running throughout the chimney portion to the bottom of the footing and bent there at 90^0 in the bottom tier of footing, keeping the minimum cover required.

e) Only one quality of reinforcement bars shall be used for various footings of one type of tower. However, the size of reinforcement bars used may be different to the extent as below: -

- One size for the base (bottom tier)
- One size for each tier.
- One size for chimney vertical bars.
- One size for chimney stirrups.

For one type of tower, only one combination shall be used. The minimum concrete cover provided shall not be less than 50mm clear in any case.

In no case splicing (horizontal & vertical bars) shall be permitted in foundations.

f) The footings shall be cast monolithically and designed as rectangular or T-beam, as the case may be depending upon the shape of the section being considered.

(iii) Soft Rock Type Foundation:

This type of foundation shall be suitable for locations where soft rock occurs for more than the bottom 50% of the hard soil (normal dry type) foundation depth. Soft rock is defined as a homogeneous weathered rock or a hard rock which has been fissured and stratified or decomposed rock. Generally, this type of rock gives a dull sound when struck with a pickaxe or bar or flakes on exposure to air or water. These rocks can be excavated using normal tools without drilling or blasting. However, before the classification of the material as soft rock, the Contractor shall demonstrate to the satisfaction of the Employer its properties, fabric and compactness.
The size of the excavation shall be no larger than that of the hard soil foundation and shall be undercut at the base.

In the design of soft rock foundations, the following parameters shall be adopted.

(a) The depth of the excavation in soft rock shall be at least half the full depth of the excavation required for a good soil foundation.

(b) The base of the excavation shall be undercut into the soft rock by at least 250 mm all around at an angle between 45° and 60° to the horizontal. The thickness of the slab at the edge will be at least 150 mm.

(c) Uplift resistance may be assumed to comprise:

- The ultimate shear stress in the soft rock applying over the surface area derived from the perimeter of the undercut in plan and the thickness of soft rock in elevation.

- Above the rock surface, the weight of a frustum of the earth has the same plan area at its base as the undercut. The allowance shall be made for loss of uplift resistance due to overlap of frusta where applicable.

- an allowance for the weight of the foundation.

Resistance against sliding shall be generated by casting the foundation against the rock surface, for which the excavation shall be the exact size of the foundation. No payments shall be made for oversize excavation.

Other constructional details shall be as for Concrete Block Foundations.

(iv) Hard Rock Type Foundations:

Hard Rock means a natural aggregate of mineral crystals occurring in large continuous masses which cannot be removed/excavated except by blasting or drilling with mechanical breakers. Material shall not be classified as a rock unless the Contractor demonstrates its continuity and soundness to the satisfaction of the Employer.

Where foundations are installed in rock, the stub leg shall be set at a minimum depth of 0.9 m into a concrete block, and sufficient stub cleats are used to ensure full transfer of load within the foundation. The upper part of the stubs shall be encased in concrete to a height of 225mm above ground level. To ensure adequate uplift resistance, a sufficient number of reinforcing bars shall be grouted into the rock, using an expanding grout, for a minimum depth of 1.2 m from the base of the excavation. The diameter shall not be less than 12mm. The grouting hole shall normally be 20mm greater than the diameter of the bar. The reinforcing bars shall have an adequate bond length within the concrete block. Other constructional details like the design of the chimney etc., shall be as given in the Concrete Block type foundation.

Resistance against sliding shall be generated by casting the foundation against the rock surface, for which excavation shall be the exact size of the foundation. No payments shall be made for oversize excavation. Such foundations shall be approved by the Employer before the erection of the support or stub legs

proceeds. Type testing of rock anchor bars shall be carried out as specified in the clauses on "Inspection and Testing".

4.0 Construction of Tower Foundation & Stub Setting

4.1 Excavation

Except as specifically otherwise provided, all excavation for footings shall be made as per the approved design of the foundation. Contract Rates for all footing sets shall be inclusive of all excavation-related costs. In case of variation of sizes of footings and for Special Foundations, if required, the following shall be considered as the governing Specifications. It shall be deemed to have been considered in the quoted rates. The excavation walls shall be vertical, and the pit dimensions shall be such as to allow a clearance of not more than 150mm on all sides from the foundation pad except for foundations in soft and hard rock. In soft rock and hard rock foundations, excavation paid for will be of the exact size of the foundation, with undercut being paid for extra as per its volume. The rate for undercut shall be as per Schedule Rate for normal excavation. All excavation shall be protected so as to maintain a clean subgrade until the footing is placed, using timbering, shoring or casing, if necessary. Any sand, mud, silt or other undesirable materials that may have accumulated in the excavation shall be removed by the Contractor before placing concrete.

The Contractor shall ensure that excavations are made to the correct depth and width. If excavations are taken too deep, the excess depth shall be backfilled with the same concrete grade of foundation at the Contractor's expense. If excavations are made too wide, such modifications to the design as the Employer may require shall be made at the Contractor's expense.

The soil to be excavated for tower foundations shall be classified as under:

Non-Rocky Soil: Soil consisting of silt, gravel etc., generally removable by means of ordinary pickaxes and shovels. This shall also include Wet Soil, wet soil being the soil where the subsoil water table is encountered within the range of foundation depth. The soil below the water table and submerged soil at locations where pumping or bailing out of water is required due to the presence of surface water will be treated as wet soil. Locations where pumping or bailing out of water is required are likely to be few in number, but the unit rate for excavation in this type of soil shall include pumping of water.

Rocky Soil

Soft Rocks: This will mean a homogenous weathered rock or a hard rock which has been fissured and stratified, or a decomposed rock. Soft Rock will generally be removable by pickaxes and shovels and not require chiseling or drilling, and blasting.

Hard Rocks: Hard rocks will be those which require chiseling or drilling and blasting. The cost of drilling and blasting are included in the quoted rates, as per the guidelines of the following clause.

For excavation in rock, the methods preferred will be chiseling, and drilling, particularly with hydraulic machines. Blasting may be permitted, depending on the situation and arrangement with governmental authorities at the time of construction. In that case, the Contractor shall request the employer for approval to procure the requisite blasting material and shall be responsible for the purchase, transport and storage and use of the blasting material.

Hard rock materials shall be staked at site for measurement. No extra charges shall be admissible for the removal of the fallen earth in the pit, when once excavated.

When rock is encountered, the holes for tower footings shall preferably be drilled, but where blasting is to be resorted to as an economy measure (after obtaining the Employer's approval), it shall be done with the utmost care to minimize the use of concrete for filling up the blasted area. All necessary precautions for handling and use of blasting materials shall be taken. In the case where unnecessarily large quantities are excavated/blasted, resulting in the placement of large volumes of concrete, payment of concrete shall be limited to calculated design volume, the balance cost of concrete and excavation being to the Contractor's account. In the case where drilling is done, the stubs may be shortened suitably with the approval of the Employer.

Shoring pits with shuttering will be admissible when the soil condition is so bad that there is a likelihood of an accident due to the falling of the surrounding earth. However, the Employer shall decide the location where the shoring of pits with shuttering is to be carried out. Oversize excavation on account of shoring shall not be counted as additional excavation.

Benching, wherever required by the Employer, shall be deemed to be included in the quoted rates of foundations unless specifically provided as a separate item in the Price Schedule.

Benching:

When the line passes through hilly/undulated terrain, leveling the ground may be required for casting tower footings. All such activities shall be termed benching and shall include cutting excess earth and removing the same to a suitable point of disposal as required by the Employer. Benching shall be resorted to only after approval from the employer. The maximum offset for benching is 1.5m, however the volume of the earth to be cut shall be measured before cutting and approved by the employer for payment purposes. Further, to minimize benching, unequal leg extensions shall be considered and provided if found economical. The proposal shall be submitted by the Contractor with detailed justification to the Employer.

Unit Rates and Measurement for Foundation:

The indicative shape of foundations is enclosed in this Specification. The bidder is required to quote the unit rates for different foundation activities namely, excavation for different types of soils, concreting, supply and placement of reinforcement steel and stub setting in the Schedule of Price.

The unit rates of excavation for each type of soil shall include excavation along with all associated activities like shoring, shuttering, dewatering till completion of foundation work stock piling, dressing, back filling of foundations after concreting with excavated/borrowed earth (irrespective of lead) and consolidation of earth, carriage of surplus earth to the suitable point of disposal as required by the Employer or any other activity required for to completion of foundation work in all respect. The measurement for excavation shall be made on the basis of design excavation volume arrived at considering dimension of pit leaving 150mm gap around (except for undercut foundations) the base pad and the unit rate of this item as indicated in Letter of Award. The payment for excavation shall be made as per actual type of soil encountered at the time of excavation, but the total payment for excavation portion shall not exceed the amount as payable for excavation considering the soil type same as that of foundation classification. The decision of the Employer shall be final and binding with respect to the classification of soil and foundations. In case of hard rock payment, 15% deduction will be made for void from cage/stack measurements.

Form boxes shall be used for casting of foundations. The unit rate of concreting shall include the cost of supply, fabrication and placement of form boxes, cement, water, coarse and fine aggregates mixing and placing of concrete, curing of concrete and any other activities related / required for completion of concreting works of foundation. The payment for this item shall be made as per the actual volumes of concrete completed but limited to design volume based on unit rates indicated in the letter of award.

4.2 Setting of stubs.

The stub shall be set correctly in accordance with the approved method at the exact location and alignment and in precisely correct levels. Approved stub setting templates shall be used for the proper setting of stubs. Stubs shall be set in the presence of the Employer's representative available at the site, for which adequate intimation shall be given to the Employer by the Contractor.

The Employer's representatives shall approve the setting up of stubs at each location. The approval shall not, however, absolve the Contractor of his responsibility of correct setting of stubs and casting of foundations, who will be required to rectify the faulty work at his own expense.
The Employer reserves the right to uncover the foundations subject to a total maximum of 25% locations, and if any foundation is found faulty, the Contractor shall be required to uncover all foundations within 1.5 km on either side of the faulty foundation and bear all the expenses thereof as well as the expenses of rectifying all inadequate or faulty foundations thereby disclosed and putting all these back in order.

The tolerance limits for adjacent stubs shall be within 5mm vertically, for diagonal stubs within 10mm vertically, and stub slope is limited to 5mm/m or less.

4.3 Concrete

All cement to be used shall be Portland cement meeting the requirements of the relevant Indian Standards (mainly IS 269 – 1989). Cement shall be adequately protected from moisture or contamination during transportation and storage at the site. Cement in bags

shall be limited to within a heap of 13 bags in store and 7 bags at the site. No cement containing lumps or deleterious matter shall be used.

The concrete used for the foundation shall be of M20 grade (i.e., of 20 N/mm^2 cube compression strength at the end of 28 days), with 20 mm downgraded stone metal for the chimney portion and slab portion and 40 mm downgraded stone metal for the pyramid portions. Aggregates shall conform to Specifications for coarse and fine aggregates from natural sources for concrete as per IS: 383 – 1970. The methods used for the preparation of concrete and all its properties regarding its strength under compression, tension, shears, punching and bending etc., as well as workmanship, shall conform to the relevant Indian Standard codes of practice.

The sand used for the concrete shall be composed of hard siliceous materials. It shall be clean and of a sharp angular grit type and free from earthy or organic matter and deleterious salts and screened through a mesh not more than 5mm in the clear.

The aggregates shall be of clean broken hard granite or other stone specified or approved by the Employer. It shall be of hard, closed-grained quality. It shall also be as far as possible cube-like, preferably angular, but not flaky, perfectly clean and free from earth, organic or other deleterious matters. 40 mm aggregate shall be of a size as will pass through a mesh of 40 mm measured in the clear and 20 mm aggregate through 20 mm square mesh measured in clear. All fine and coarse aggregates shall be obtained from sources approved by the Employer.

The water used for mixing concrete shall be fresh, clean and free from oil, acid and alkali organic materials or other deleterious substances. Salty or brackish water should not be used. Potable water is generally satisfactory.

Bumthang experiences cold weather conditions from November to February. For concreting during the extreme cold weather, when the ambient temperature is below the low temperature, concrete covering and heating shall be performed to maintain temperature and ensure concrete quality. Further, hardening admixture can be used at site by the conductor at their cost with prior approval from the employer.

Though not generally expected, sulphate-resisting cement may be necessary in certain areas of the line route, and the cost of this shall be deemed to have been included in the rates entered in the Schedule of Rates for concrete and foundation items. Sulphate-resisting Portland cement shall be in accordance with IS standards and shall be obtained from a source approved by the Employer. The Employer shall decide the locations where it shall be mandatory for the Contractor to use sulphate-resisting cement. The Contractor shall certify that the proposed cement is of the required quality regarding resistance to corrosion due to sulphates. Methods of testing this quality shall be deemed to have been included in the rates quoted. The use of aluminous cement will not be permitted.

4.4 Batching & Mixing of Concrete

It shall be the Contractor's responsibility to carry out tests on samples for the concrete mixture design that the Contractor proposes to employ in foundation concrete. The

procedure for testing is outlined in the appropriate clauses under “Inspection and Testing”. The test result of the proposed mixture, together with data for water-cement ratio and slump, shall be submitted to the Employer for approval at least four (4) weeks before the commencement of concreting operation. The trial mix proportions shall be approved if the average compressive strength of a set of 9 specimens tested at 28 days exceeds 21 N/mm^2, with not more than 3 specimens being less than 20 N/mm^2 and no single specimen being less than 17 N/mm^2.

The Contractor shall be responsible for maintaining the mixture, control and testing of concrete throughout the working period. Neither the mixed proportions nor the source of the supply of materials shall be altered without the prior approval of the Employer.

The minimum cement content, the water-cement ratio, the slump and all other characteristics of concrete shall be demonstrated to conform to the relevant Indian Standards.

The concrete shall be mixed with an approved concrete mixer. In no case shall hand mixing be allowed. The Contractor shall provide the measuring equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering the concrete. The equipment shall be constantly maintained in first-class workable condition during the working period. The concrete mixer shall be cleaned and inspected at suitable intervals in the presence of the Employer.

Each time the work stops, the mixer shall be cleaned out, and while recommended, the first batch shall have 10% additional cement to allow for sticking in the drum.

The cost of all concrete testing shall be deemed to be included in the price of each foundation. In addition, the Employer shall retain the right to undertake slump tests at any time prior to the placement of concrete and reject any batch of concrete that fails such tests, all at the cost of the Contractor.

In a difficult location, where it is impossible to transport the concrete mixer, the Employer may allow hand mixing of concrete. In such cases, 10% additional cement shall be used over and above that being used for such a foundation where the mixer is being used. Additional costs in such cases shall be borne by the Contractor.

Mixing shall be continued until there is a uniform distribution of material and the mix is uniform in colour and consistency, but in no case, the mixing is done for less than 2 minutes. Normally mixing shall be done close to the foundation, but in case it is not possible, the concrete may be mixed at the nearest convenient place. The concrete shall be transported from the place of mixing to the place of final deposit as rapidly as practicable by methods (transit mixers) which shall prevent the segregation or loss of any ingredient. The concrete shall be placed and compacted before the setting commences.

The concrete should be mixed as stiffly as the requirement of placing the concrete in the forms or moulds with ease and the degree to which the concrete resists segregation. Hence the quantity of water used should not be too much.

In the event that the Contractor proposes to use ready mixed concrete for foundation work, approval must first be obtained from the Employer, who will inspect the batching plant and sand, cement and broken stone used in the making of concrete at work. No ready-mixed concrete shall be used in foundation work if it has been mixed in the lorry during its journey to the site more than 45 minutes prior to placing. At the discretion of the employer, ready mixed concrete may be used in the foundation if the journey to the site is in excess of 45 minutes, if the cement is added to the drum at the site and is thoroughly mixed prior to placing. Alternatively, and at the discretion of the employer, if the ready-mixed lorry carries its own water drum, water may be added to the cement and aggregate in the mixing drum during the lorry's journey, provided the concrete is not mixed for more than 45 minutes prior to placing. The Employer's decision to reject any of the above methods of supplying ready mixed concrete shall be final.

Concrete shall not be directly poured from a height of more than 1.5 m to avoid mix segregation.

Proper forms or moulds should be adequately braced to retain proper shape, while concreting should be used for chimneys and pyramid or slab portions. The mould should be watertight so that cement cream should not come out, leaving only sand and jelly, consequently forming honeycombing in the concrete. The form boxes shall be cleaned and oiled before these are used for concrete.

The stub angle shall be free of rust and cleaned thoroughly and painted with cement paste made of 1 part of cement and ¾ part of water (cement slurry) to a thickness of 1.6 mm before the concrete is laid against the stub angle. The painting with cement slurry shall be done each time to such a height before the cement wash becomes dry. Concrete shall, in all cases, be placed in the presence of the Employer. No concrete shall be placed until the Employer has approved the excavated surface, stub setting, an inspection of formwork and completion of all preparation work. Adequate chutes or other approved methods shall be employed to place concrete. All concrete shall be consolidated to the maximum practicable density with a concrete vibrator and make the surface smooth and free from pockets and honeycomb.

The concrete shall be laid in 150 mm layers and consolidated well so that the cement cream works up to the top and no honeycombing is left in the concrete. Concreting is to be done continuously so that the subsequent layers are laid before the final set of the bottom layer begins.

If fresh concrete is to be laid on old concrete less than a week old, the surface of the old set concrete should be chipped and cleaned thoroughly with a wire brush and washed with a layer of thick cement slurry before the new concrete is laid. If, however, the concrete is more than ten days old, the top layer of the set concrete should be chipped and cleaned thoroughly with a wire brush and water, and a layer of cement mortar (1:2) 12 mm thick shall be laid evenly after giving a coat of cement slurry, as specified above to ensure proper bonding between old and new concrete. If a foundation is damaged after stringing, it shall be brought to the notice of the Employer and rectified as directed by him.

After concreting the chimney portion to the required height, the top surface should be finished smoothly, with a slight slope towards the outer edge to drain off the rainwater falling on the coping.

In wet locations, the site must be kept completely de-watered both during the placing of the concrete and for 24 hours after completion. There should be no disturbance of concrete by water during this period.

The forms or mould shall not be removed before a lapse of about 24 hours after the completion of concreting. After removal of the forms, the concrete surface, where required, shall be repaired with a rich cement and sand mortar in the shortest possible time.

For concreting during hot weather, adequate provision shall be made to lower concrete temperature, which shall not increase beyond 40°C at the time of placement of fresh concrete.

After stringing is over, all exposed concrete and tower steel within one meter of the ground or high-water level, whichever is higher, shall be painted with black bituminous paint, Flintcote or approved type.

4.5 Reinforcement

All materials, activities and methods regarding reinforcing steel shall conform to the relevant IS Codes, particularly to IS 432 – 1982 for mild steel bars and wires, IS 1786 – 1985 for High Strength bars and wires and IS 1566 – 1982 for steel wire fabric. The reinforcement steel shall be Fe 500 (= 500 N/mm^2). The Contractor shall provide certificates stating the origin and process of manufacture of reinforcing steel and submit test certificates from the supplier to the Employer. At the discretion of the Employer, samples of reinforcing steel selected by the Employer shall be tested by the Contractor at a local laboratory of the Employer's choice to demonstrate the tensile strength of the steel. The cost of such testing shall be deemed to be included in the Scheduled Rates of Items for supply of reinforcement, and the unit rate of foundation.

The wire shall be 1.25 mm in diameter or heavier black annealed iron wire. Preformed clips or attachments shall be of proper design and strength so that reinforcing bars are rigidly supported/held in position and are not capable of movement during concrete pouring.

Reinforcing steel shall be protected from damage during transportation and during storage. It shall be stacked horizontally with adequate support to prevent distortion. Bars of different lengths and diameters shall be stacked separately and marked for easy identification.

Reinforcing steel shall be cold bent without any application of heat by a slow and regular movement. Bending shall be done accurately to dimensions given in the bar bending schedule or foundation drawings in accordance with IS 2502 – 1963.
Bars having cracks or splits on the bends shall be rejected.

Immediately before placing concrete, it shall be ensured that reinforcing steel is free from dirt, detrimental scale, paint, mortar, oil, or other foreign substances.

Reinforcing steel embedded or partially embedded in the concrete shall remain completely undisturbed for a minimum period of 24 hours, or longer if the Employer so directs, after a unit of concrete placement has been completed.

The steel shall be placed accurately in accordance with the Drawings. It shall be tied securely at each intersection. Metal or concrete chairs and metal spreaders of approved types shall be used where necessary for the support or spacing of steel bars.

Wood supports, or spreaders shall not be used.

Splicing/lapping of bars shall not be permitted.

The unit rate of 'Reinforcement Steel' shall include supply and placement of reinforcement steel, stirrups, wire for binding the reinforcement, chairs, bolsters and spacers etc. as required to complete the foundation work. The payment of reinforcement steel shall be made based on the working drawing corrected to 2nd decimal. Wastage, spacer bars, chairs, stays, hangers and annealed steel wire shall not be measured for the payment and the cost of these items shall be deemed to be included in the rates for reinforcement.

4.6 Backfilling and Removal of Stub Templates

Following the opening of formwork and removal of shoring and shuttering, backfilling shall be started only after repairs, if any, to the foundation concrete and after the approval of the Employer. The backfilling and grading shall be carried up to an elevation of about 75 mm above the finishing ground level to drain out water. After backfilling, a 50 mm high earthen embankment will be made along the sides of excavation pits, and sufficient water will be poured into the back-filled earth for at least ten days.

The fill materials will be subject to the Employer's approval. To the extent available, the selected surplus soils from excavated materials shall be used as backfill. Fill material shall be free from clods of earth, salts, sulphates, organic or other foreign materials. All earth clods shall be broken or removed. Where excavated material is mostly rocks, the boulders shall be broken into pieces not larger than 150 mm in size, mixed with properly graded fine material consisting of the earth to fill up the voids and the mixture used for filling. If any selected fill material is required to be borrowed, the Contractor shall make arrangements for bringing such material from outside borrow pits at his cost. The material, as well as the source, shall be subject to prior approval of the Employer. The approved borrow area shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Topsoil containing salts/sulphates and other foreign material shall be removed. The material so removed shall be burnt or disposed off as directed by the Employer. The contractor shall make the necessary access road to borrow the area and maintain the same, if such access road does not exist, at his cost.

4.7 Compaction of Backfill

As soon as the work of foundations has been accepted and measured, the space around the foundation shall be cleared of all debris and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated before the succeeding layer is laid. Each layer of the earth shall be consolidated by ramming with approved mechanical compaction machines. Special care shall be taken to prevent any wedging action against the footing. The backfill shall be compacted to 95% of the maximum dry density obtainable in the standard Procter density test as specified in relevant standards. The excavation and placing operations shall be such that the material, when compacted, will be blended sufficiently to secure a best practicable degree of compaction, impermeability and stability. The stub setting template shall be opened only after the completion of backfilling.

4.8 Curing

The concrete, after it is 24 hours old, shall be cured by keeping the concrete wet continuously for a period of 10 days after laying. The pit may be backfilled with selected earth sprinkled with the necessary amount of water and well consolidated in layers not exceeding 150 mm of consolidated thickness after a minimum period of 24 hours, and thereafter both the back-filled earth and chimney top shall be kept wet for the remainder of the prescribed period of 10 days. The uncovered concrete chimney above the back-filled earth shall be kept wet by providing empty cloth or hessian bags dipped in the water fully wrapped around the concrete chimney for curing and ensuring that the bags are kept wet by frequently pouring water on them.

4.9 Revetment

At locations, for instance, on slopes, where there are chances of soil erosion due to rainwater, a retaining wall shall be provided around the tower foundation as a revetment. The wall shall consist of broken stone pieces cemented with the help of 1: 5 cement mortar and weep holes and filters. The revetment walls shall be finally pointed with 1:4 cement mortar. The earth shall fill the empty space between revetment and foundation. Alternatively, RCC retaining walls, based on standard civil engineering practices, shall also be permitted. The design of the revetment and foundation shall be developed by the Contractor and approved by the Employer.

For some of the locations in nalas, river bed or undulated terrain etc.. gabion wall, stone bound in G.I mesh 4mm (8SWG) are to be provided after the approval from the Employer. Measurement shall be taken in cubic meters, and 15% deduction will be made for void from cage/stack measurements.

Open Surface Drain should be constructed as per the drawing around the towers (3 sides) with proper slope based on the site condition so that the locations are free of stagnant water.

Note:
RCC or Masonry works other than foundations, e.g. protection works like retaining walls, caissons, well-foundations etc., are not much expected to be encountered at this point in time. Nevertheless, if these are found necessary at the time of execution of the Contract, the same shall be decided upon by the Employer. In that case, the unit rates quoted by the Contractor for items required for such works (e.g. the rates for excavation,

concrete, reinforcing steel etc.) shall remain binding after seeking the approval from the employer. For dry stone and stone masonry revetment, separate rates shall be quoted per cum. of the wall. These rates shall be inclusive of the supply of all materials, items of work involved (like excavation, laying etc.), and all costs of workmanship, labour, etc., necessary to complete revetment works.

No extra payment shall be made for allied works such as excavation for revetment, packed stone at head of weep holes etc. However, no deduction shall be made for the volume enclosed by weep holes.

Bio-engineering based Protection Measures:

Bioengineering measures can be effective in reducing the vulnerability of transmission lines towers to natural hazards which also provides ecological benefits. Grasses with long roots readily available in the vicinity of the tower locations or as instructed by the employer shall be planted in rows or as instructed by the employer.

Crib walls should be constructed with a timer to catch the moving debris as per the approved drawing. The height of the crib walls in any case shall not exceed: Light crib = 1.50 metres and Heavy crib = 5.00 m. Excavation shall be done as per the requirement. Lay the timber section in the trench at right angles to the line of the trench. Lay two long sections of timber on top of the short sections, running parallel to the line of the trench. Fix the long sections with nails/reinforcement bar 16 mm dia, 800 mm long for heavy crib wall and 12 mm dia. 250mm long for light crib wall on each cross. Back fill and compact excavated debris up to the top of the long sections. Repeat the procedure until the required height is obtained. Step each layer into the slope, so that the face of the wall is at an angle of 45º to 60º from horizontal. Backfill above the wall with additional suitable material at 35º to meet the slope as high up as possible. Carry out bioengineering works in the front and at the top.

4.10 De-watering

The contractor shall furnish all materials and equipment and perform all work required for de-watering the footing excavation as required to enable the construction of the concrete footings. During the placing of concrete for the footings, the water level in the excavation shall be kept below the surface of the excavation.

There shall not be any separate item for de-watering in the Schedule of Rates. It shall be assumed that the quoted rate for any item that could require de-watering (e.g., concrete for footings, special works like revetment or excavation for any other purpose etc.) is inclusive of de-watering. Further, the de-watering included in the scheduled rate of the main item shall be inclusive of de-watering equipment, its transport and installation at the site, and all operational costs like skilled and unskilled manpower, fuel, maintenance charges, etc.

Note:

Locations requiring de-watering are expected to be few locations. Nevertheless the Contractor should follow the above Specifications as and when de-watering is required.

CHAPTER 7

ACCC CONDUCTOR

This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of ACSR panther equivalent ACCC conductor along with its associated Hardware Fittings & Accessories for construction of 132 kV D/C Transmission Lines from Wobthang to Garpang substation, Choekhor Gewog, Bumthang..

It is not the intent to specify completely herein all details of the design and construction of conductor. However, the conductor shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation. The Purchaser, who will interpret the meanings of drawings and specification, shall have the power to reject any work or material which in his judgment is not in accordance therewith. The material offered shall be complete with all components necessary for its effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply only, irrespective of whether these are specifically mentioned in his specification and/or the commercial order or not.

The ACCC Conductor shall be strung on the new 132 kV transmission tower in mountainous terrain. The ACCC Conductor shall have the same overall diameter and total mass as that of the ACSR Panther conductor, meeting sag coordination so as to achieve the ground clearances without making modifications of the predesigned towers and foundations as far as possible.

The ACCC conductor shall have a minimum continuous current carrying capacity (ampacity) of 1100 A at a conductor operating temperature of 175°C under specified design ambient conditions.

The conductor shall be capable of operating at a maximum temperature of 180°C, corresponding to its rated ampacity, without any degradation in mechanical or electrical performance.

The above ampacity shall be established under the following reference conditions:

- Ambient temperature: 40°C
- Wind speed: 0.6 m/s
- Solar radiation: 1000 W/m²

The conductor sag shall be calculated at the maximum design temperature of 180°C, under still air (no wind) conditions, at system frequency of 50 Hz for a 132 kV transmission line, and shall ensure compliance with the specified minimum statutory ground clearances at all points along the route.

The maximum permissible conductor temperature for short-term/emergency loading, along with the allowable duration of such operation, shall be clearly indicated by the bidder in the Guaranteed Technical Particulars (GTP).

Current Carrying Capacity / Ampacity Requirements

The ACCC Conductors shall be suitable to carry the thermal ampacity at specified maximum conductor temperature of 50 Hz, at 132 kV under the ambient conditions & maximum conductor sag specified in sag tension (to be provided to successful bidder) while satisfying other specified technical requirements/ parameters. The calculations for Ampacity/Temperature shall be based on the latest IEEE Standard 738.

Sag-Tension Requirements

The ACCC conductor shall conform to the sag and tension requirements corresponding to the pre-established design parameters of ACSR Panther.

Hardware & accessories should be compatible with the supplied ACCC Conductor.

Workmanship

I. All the conductor strands shall be smooth, uniform and free from all imperfections, such as spills and splits, cracks, die marks, scratches, abrasions, rust etc.

II. The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protrusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/ hand pressure and / or unusual bangle noise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc), dirt, grit etc.

Joints in wires

I. Aluminum OR Aluminum Alloy Wires

During stranding no Aluminum/ aluminum Alloy welds shall be made for the purpose of achieving the required conductor length.

No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However, joints are permitted in the inner layer(s) of the conductor are unavoidably broken during stranding provided such breaks are not

associated with either inherently defective wire or with the use of short lengths of Aluminium Alloy wires. Such joints shall not be more than four (4) per conductor length and shall not be closer than 15 meters from joint in the same wire or in any other Aluminium Alloy wire of the completed conductor. A record of such joints for each individual length of the conductor shall be maintained by The Contractor for Owners review.

Joints shall be made by cold pressure butt welding and shall withstand a stress of not less than the breaking strength of individual strands guaranteed.

II. Core Wires

There shall be no joint of any kind in the finished wire entering into the manufacture of the strand. There shall also be no joints or splices in any length of the completed stranded core. Splices of the fibers in composite cores are allowed as long as they conform to the requirements of ASTM B987 for Joints and Splices.

Tolerances

The manufacturing tolerances shall be as per IEC or relevant standards. For composite cores, the manufacturing tolerance shall be +/- 0.05 mm of the stated nominal value.

Materials

The materials used for construction of the conductor shall be such that the conductor meets the specified technical and the performance requirements.

I. Outer Layer

The material of outer layer of ACCC Conductor shall be of annealed aluminium 1350-O temper, high temperature resistant aluminum/ aluminum alloy added with zirconium or any other suitable elements to electrolytic aluminum having purity not less than 99.5% and a copper content not exceeding 0.04%. The Bidder shall guarantee the chemical composition in the GTP and also furnish description of the manufacturing process in the bid. It is to inform that the test shall be carried out as per the relevant standards.

II. Core

The core of this conductor shall be made of hybrid carbon and glass composite core utilizing a high temperature epoxy resin matrix to bind the individual fibers into a unified load bearing tensile member and the central carbon fibre core shall be surrounded by a high-grade boron free glass fibers to improve the flexibility

and toughness. There shall be no galvanic corrosion between the carbon fibre core and the aluminium strands. The composite core shall exhibit an excellent Strength to weight ratio and has a lowest in the industry coefficient of thermal expansion which reduces the conductor sag under the high electrical load/high temperature conditions. The core material shall be of either high strength grade or extra high strength grade as per the latest ASTM B987.

The Bidder shall furnish properties and composition of the core wire strands in the GTP. The composite material for core shall be of such proven quality that its properties are not deteriorated by the normal operating conditions of 132 kV transmission line in aforementioned General Technical Requirements (GTR). The Bidder shall provide adequate details including specifications / test reports / operating experience details/performance certificates etc. in support of the suitability of the offered materials. Care should be taken for internal friction due to different materials having different thermal coefficients of expansion.

The Bidder shall be required to offer a system to confirm the integrity of composite core immediately after conductor stringing and installation. The contractor must submit reports from past field measurement or a third-party report providing that integrity confirmation does work through the proposed system. Further the line(s) where this proposed system has been deployed to confirm the integrity of composite core should have been in satisfactory operation for a period of at least one year in any power utility. The contractor shall submit necessary documentation, training material and manuals to support this system within 30 days from the date of LOA."

Conductor Length

The Bidder shall determine the most appropriate individual conductor lengths to be manufactured & supplied keeping in view of the tower schedules, section lengths, special crossings, etc. The drum drawing as per IS 1778 or any international standard shall be submitted to the purchaser for review and approval. The Bidder shall also indicate the maximum single length of conductor that they can manufacture, in the GTP.

Standards

The conductors & accessories shall comply in all respects to the clauses of this specification as indicated above & with the specified standards.

Stranding

For all constructions, each alternate layer shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the under laying wire or wires. The final layer of wires shall have a right hand lay.

Packing

I. The conductor shall be supplied on a returnable basis (except for conductor to be given as mandatory spares), strong, painted steel drums provided with lagging of adequate strength, constructed to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The Supplier shall select suitable drums for supply of conductor and shall be responsible for any loss or damage to conductor and/or drum during transportation handling and storage due to improper selection of drum or packing.

II. The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5 kN.

III. The Bidder should submit their proposed drum drawings along with the bid.

IV. One conductor length only shall be wound on each drum.

V. The conductor ends shall be properly sealed and secured on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.

VI. The Ownership of the empty conductor drums shall lie with the conductor Supplier who shall ultimately take back the empty conductor drum within 1 month of notification from the Project site(s) from the erection contractor’s designated stores after the running out of conductor from the drum.

VII. No tolerance limit on wastages/damages of drums are allowed and thus compensation on account of the same whatsoever.

Marking

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

(a) Contract/Award letter number.

(b) Name and address of consignee.

(c) Manufacturer's name and address.

(d) Drum number

(e) Size of conductor

(f) Length of conductor in meters

(g) Arrow marking for unwinding

(h) Position of the conductor ends

(i) Distance between outer-most Layer of conductor and the inner surface of lagging.

(j) Barrel diameter at three locations & an arrow marking at the location of the measurement.

(k) Number of turns in the outermost layer.

(l) Gross weight of drum after putting lagging.

(m)Tear weight of the drum without lagging

(n) Net weight of the conductor in the drum.

(o) Dispatch instruction.

The above should be indicated in the packing list also.

Verification of Conductor Length

The BPC reserves the right to verify the length of conductor after unreeling at least ten (10) percent of the drums in a lot offered for inspection.

Tests & Standards

Type Tests

Type tests on Stranded Conductor/ Stranded wire:

The following tests should have been conducted in the last Seven (7) years for which offer is made and should be submitted along with the bid. The bids without valid type test reports are liable for rejection.

All the specified type tests on ACCC Conductor offered by the bidder shall not be required to be carried out if valid test certificate is available i.e., tests conducted within last Seven (7) years from the date of bid opening in an accredited laboratory or witnessed by the representative(s) of a Utility.

In the event of any discrepancy in the test report (i.e., any test report not applicable due to any design/material/manufacturing process change including substitution of components or due to noncompliance with the requirement stipulated in the Technical Specification) the tests shall be conducted by the Contractor at no extra cost to BPC.

Bidders shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratories and the tests can be completed in these laboratories within the time schedule guaranteed by them.

On complete Conductor:

a) DC resistance test on stranded conductor

b) UTS test on stranded conductor

c) Stress- Strain test on stranded conductor and core at room temperature as per IEC 1089

d) Stress-strain test on stranded conductor and core at elevated

e) High temperature endurance & creep test on stranded conductor

f) Sheaves Test

g) Axial Impact Test

h) Crush Strength Test

i) Torsional Ductility Test :

On Conductor Strand/core

a) Bending test on core

b) Compression test on core:

c) Coefficient of linear expansion on core/ core strands:

Acceptance Tests, Routine Tests and Tests during Manufacture shall be taken up as per the standard and requirements. Test reports shall be maintained.

Inspection

I. BPC's representative shall at all times be entitled to have access to the works and all places of manufacture, where conductor shall be manufactured and representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.

II. The Supplier shall keep BPC informed in advance of the time of starting and of the progress of manufacture of conductor in its various stages so that arrangements can be made for inspection.

III. For ACCC conductor stringing supervision, the bidder will submit letter / certificate from offered principal core manufacturer / technology owner, confirming that the personnel which are expert & certified by technology owner in

installation/stringing supervision of ACCC conductor must be deployed during entire duration of installation /stringing of the ACCC conductor

Standards

I. The conductor shall conform to the relevant Indian/International Standards, which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

II. In the event of the supply of conductor conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Supplier and those specified in this document will be provided by the Supplier to establish their equivalence.

Measurements

Payment for conductor (supply & erection) shall be made on the basis of per km (horizontal/linear line length), irrespective of number of tension/suspension towers. No extra payment shall be made for sag, inclined distances between attachment points of conductors of the towers, jumpering, damages,losses, wastages etc. Quoted rates in the relevant price schedule deemed to have included the associated costs. If a contractor resorts to drone stringing, the associated cost is deemed to have included in the relevant price schedule.

CHAPTER 8

OPTICAL GROUND WIRE (OPGW)

1.0 Non-slotted Optical Ground Wire (OPGW) and accessories

The equipment to be supplied includes Non-Slotted Composite Optical Ground Wire (OPGW) and Accessories. The Scope shall include the following:

a) 48 & 24 cores, monomode, 1310nm wavelength armoured Non-Slotted OPGW complete with jointing material and accessories.

b) The minimum drum lengths of OPGW shall be 3.0 km as per the Employer's requirement. The Bidder should indicate the length of OPGW to be contained in each drum.

c) Jointing kits for the above

d) Accessories: Suspension Assembly, Tension Assembly (End Towers), Tension Assembly (both sides), Vibration Dampers (tension-type), Vibration Dampers (suspension type), Cable fixing C- clamps and Bonding Connections.

The Bidder shall furnish detailed Specifications for all accessories like anchor grip and vibration dampers.

2.0 Services to be furnished

The scope shall include supply, testing, stringing/ laying, jointing, installing and commissioning of Optical Ground Wire (OPGW) cable and its accessories. Bidder shall quote unit rates for stringing/laying per km, per joint, including testing and commissioning for OPGW cables.

The rates quoted shall also cover Contractor’s technicians' to-and-fro transport charges, boarding and lodging, daily allowance and local transport, taxes and duties as applicable.

3.0 Installation Tools and Other Equipment

The Bidder shall furnish the list of Tools and Tackles required and/or recommended for the installation and subsequent maintenance of the OPGW and cables, with unit prices. The Employer reserves the right to select any/or all the items offered depending upon the availability of the tools in the Employer's system and without assigning any reason.

The Bidder shall also quote for the other accessories indicated elsewhere in the Specification. The Employer reserves the right to select any/ all or more of the other equipment listed without assigning any reason.

4.0 Drum-Size

The exact number of drums shall, however, be finalized after the route survey.

It shall be the sole responsibility of the Bidder/vendor to ascertain the applicable restrictions on the weight and dimensions of drums for transport in the local area where inland transport is necessary, and Bidder/vendor shall ensure that the drum size and weight will not exceed the permissible limits.

Further, the Bidder shall clearly indicate in the offer all those details and give full justification for the size and weight selected.

5.0 General

For all OPGW equipment, the Bidder shall furnish the following information along with his offer:

Standing of the firm as the manufacturer of OPGW and accessories and experience in OPGW installation, testing and commissioning.

Details of testing facilities at manufacturer's works.

Measurement

Payment for EW/OPGW (supply & erection) shall be made on the basis of per km (linear km is horizontal distance measured between the attachment points of adjacent towers), irrespective of the number of tension/suspension towers. No extra payment shall be made for sag, inclined distances between attachment points of conductors of the towers, jumpering, damages,loss wastages. Quoted rates in the relevant price schedule deemed to have included the associated costs.

6.0 Qualifying Requirements

The recommended makes of OPGW cable and accessories are indicated in the specifications.

The Employer may accept other makers at its own discretion. In case the Bidder offers any other make, the manufacturer shall have at least five years of experience in the successful commercial operation of the cables of the same design and manufactured in the same plant as proposed for this bid; however, though the acceptance/ rejection of these makes is solely at the discretion of the Employer.

The supplier of OPGW shall stand guarantee and depute his representative for Quality Assurance/Quality Control (QA/QC) checks, both during manufacturing and installation. If the Bidder is a licensee and meets the specified qualification requirement, the License agreement shall be valid until the guarantee period on the equipment undersupply is over. The licenser shall approve any design undertaken by the licensee. Manufacture by the licensee shall be done under Quality Assurance Program approved and monitored by the licenser. Licensers must guarantee the sequential and timely supply of equipment to meet the overall project program. Licenser

must guarantee the individual and overall performance of all the equipment supplied under the Contract.

The Employer reserves the right to request any additional information and also reserves the right to reject or accept the proposal of any Bidder if, in the opinion of the Employer, the qualification data is incomplete or the Bidder is found not qualified to perform the Contract satisfactorily.

7.0 Codes and Standards

The equipment shall comply, in all respects, with the requirements of the latest editions of codes and standards of ITU-T- G.652D, Bureau of Indian Standards (BIS) and International Electrotechnical Commission (IEC).

Other National Standards are acceptable if they are established to be equal to or superior to the listed standards. In all such cases, however, copies of English translations of such National Standards shall be attached to the bid. The bids not complying with this requirement are liable for rejection.

In the event of any conflict between the codes and standards referred to elsewhere in this specification and the requirement of the specification, the requirement of this specification will govern.

8.0 Design and Performance Requirements

This section covers the design, performance and testing requirements of the fibre optic systems consisting of the cables, associated joints, accessories etc.

9.0 Fibre Optic Cable System

The fibre optic system will be used for voice and data communication, power circuit teleprotection signaling, Supervisory Control and Data Acquisition (SCADA), Security Management System (SMS) and video applications and Broadband Applications.

The performance requirement of the total loss of the link shall be well within the specified limit. The Optical Time Domain Reflectometer (OTDR) reading along with the trace printout, shall be made available for final acceptance by the Employer.

The Bidder shall indicate the method of manufacture of Optical Fibre i.e. IVD (Inside Vapour Deposition)/ OVD (Outside Vapour Deposition)/ PCVD (Plasma-activated Vapour Deposition)/ AVD (Axial Vapour Deposition)/ MCVD (Modified Chemical Vapour Deposition)

10.0 Cable Specifications

OPGW CABLE

The OPGW shall be of Loose Tube Type: Three (3) Loose Tubes with Eight (8) fibres in each Loose Tube or four (4) Loose Tubes with six (6) fibres in each Loose Tube. The

OPGW shall meet the minimum technical requirements specified in Chapter 11, under Principal Technical Parameters (PTPs).

The fibre shall be colour-coded for identification purposes, and the manufacturer's identification thread shall be applied while sheathing. The length marking should be done every metre on the entire length of the cable. The outer sheath should have been marked as 'F.O.C.' to identify the cable as Fibre Optical Cable. The Bidder shall clearly indicate the identification scheme employed and details of length marking.
The Bidder shall indicate in detail in its offer the various measures taken/ proposed by him to limit the following types of losses to values in conformity with ITU and acceptable to the employer.

a) Wave guide dispersions
b) Microbending losses
c) Material dispersions
d) Ultraviolet absorption
e) Infrared absorption
f) Rayleigh scattering
g) Absorption by OH, Cu, Fe, Cr and/or impurities
h) Splice losses

The cables offered shall have Single Mode Optical Fibre and shall conform to CCITT (now ITU) Rec.G.652D (min.) and any specific requirements covered in these Specifications.

Primary Coating
Each Optical Fibre shall be primarily coated with ultra violet (UV) cured acrylate.

Secondary Coating
Each Optical Fibre shall have a double acrylate tight or loose secondary coating filled with compatible jelly.

Cable Strength Member
A solid non-metallic (Kevlar or FRP material) member in the center core of the cable for strength and flexibility shall be used.

Core
Primary and Secondary coated Optical Fibre shall be stranded around strength members to form the main core of the cable.

Optical Requirement at 20 °C
The change in attenuation for 1km length in the temperature range +0°C to +60°C shall not exceed 0.2dB from the attenuation at 20°C.

The performance of the cable shall be guaranteed for an expected life of above 25 years.

Color coding of optical fibres:

Each fiber is to be color-coded in order to facilitate fiber identification. These coatings shall be color-coded as specified in TIA/EIA-598 and shall not degrade the optical cladding/core either mechanically or optically.

The coloring including marking shall be unambiguous using different colors. It shall be possible to identify all the optical fibers within each loose tube in a 300 mm length of optical cable core, provided that each loose tube is coded.

The coloring shall be permanent; it shall only be possible to remove the coloring by stripping off the coating or by using special solvents. The colors shall not fade inside the cable or as a result of exposure in the joint box or at the terminals. Coloring shall not prejudice any of the properties of the optical fiber or the cable

11.0 Accessories

The Bidder shall include in his offer complete details and jointing instructions of the splices with universal closures to be installed along the routes, pigtails/patch cords for terminating the cable into the interfacing equipment etc. The universal closures shall be provided with cast metal protection sleeves and arrangement for adequate grounding. The loss per splice shall not exceed 0.1 dB.

12.0 Information to be given by the Bidder

In addition to the guaranteed particulars called for in this section and information called for elsewhere in this specification, the Bidder shall give the following information with his offer.

- Cost of all accessories to make the whole system functional.
- Detailed drawings with dimensions of the cable and all accessories, including
  a) Indication of the material used in each type of construction
  b) Branch out joint boxes, enclosures for joint boxes and fibre distribution frame etc.
- Descriptive information regarding cable and accessories and list of installations of similar cables now in service with details of cable performance, outages suffered and cause of the outage.
- Recommended method for location of all types of cable and system faults.
- A complete and up-to-date experience list of the Bidder indicating all pertinent details of optical fibre cable supplied, installed and commissioned.
- Model nos. and detailed catalogues for the offered OPGW cable and all Accessories shall be furnished along with the Technical Bid.
- Notes on preparing OPGW for Splicing with illustrations showing OPGW fibres etc., inside the joint box and splice enclosures/ trays.
- A bar chart clearly indicating installation and commissioning periods at the site with all other details for OPGW.

13. Proposed On Site Training Requirements

S. No.	Item Description	Location	No. of trainees	Duration in working days
1	Training on Overhead Fibre Optic Cabling (OPGW) system including splicing of F.O. cable during installation	Bhutan	8	5

CHAPTER 9

HARDWARE FITTINGS & ACCESSORIES FOR ACCC CONDUCTOR

This section details technical particulars of fittings viz. suspension clamps and compression type dead end clamps for the ACCC Conductor to be supplied by the bidder. Each fitting shall be supplied complete in all respects.

The fittings shall be suitable for attachment to suspension and tension insulator strings along with hardware fittings and shall include 2.5 % extra fasteners and Aluminum filler plugs. Indicative drawings of complete insulator strings along with hardware fittings as well as indicative drawings for suspension clamps and dead end clamps are enclosed with this specification.The supplier shall be responsible for satisfactory performance of the complete conductor system along with fittings offered by them for continuous operation at the maximum temperature specified by them for the conductor.

Corona and RI Performance

Sharp edges and scratches on all the hardware fittings shall be avoided. All surfaces must be clean, smooth, without cuts and abrasions or projections. The Supplier shall be responsible for satisfactory corona and radio interference performance of the materials offered by him.

Maintenance

The hardware fittings offered shall be suitable for employment of hot line maintenance technique so that usual hot line operations can be carried out with ease, speed and safety. The technique adopted for hot line maintenance shall be generally bare hand method & hot stick method.

Split Pins

Split pins shall be used with bolts & nuts.

Suspension Assembly

i. The suspension assembly, the bidder intends to supply, shall be suitable for the ACCC Conductor. The technical details of the conductor shall be as proposed by the bidder.
ii. The suspension assembly shall include either free centre type suspension clamp along with standard preformed armour rods or armour grip suspension clamp
iii. The suspension clamp along with standard preformed armour rods set shall be designed to have maximum mobility in any direction and minimum moment of

inertia so as to have minimum stress on the conductor in the case of oscillation of the same.

iv. The suspension clamp suitable for various types of Conductor along with standard preformed armor rods/armor grip suspension clamp set shall have slip strength between 20 to 29 KN.

v. The suspension clamp shall be designed for continuous operation at the temperature specified by the bidder for the conductor.

vi. The suspension assembly shall be designed, manufactured and finished to give it a suitable shape, so as to avoid any possibility of hammering between suspension assembly and conductor due to vibration. The suspension assembly shall be smooth without any cuts, grooves, abrasions, projections, ridges or excrescence which might damage the conductor.

vii. The suspension assembly/clamp shall be designed so that it shall minimize the static & dynamic stress developed in the conductor under various loading conditions as well as during wind induced conductor vibrations. It shall also withstand power arcs & have a required level of Corona/RIV performance.

viii. The magnetic power loss shall not be more than 4 watts per suspension clamp, at designed rated sub-conductor current of 1400 amperes.

Free Centre Type Suspension Clamp

For the Free Centre Suspension Clamp seat shall be smoothly rounded and curved into a bell mouth at the ends. The lip edges shall have rounded bead. There shall be at least two U-bolts for tightening of clamp body and keeper pieces together.

Standard Preformed Armour Rod Set

i. The Preformed Armour Rods Set shall be used to minimize the stress developed in the sub-conductor due to different static and dynamic loads because of vibration due to wind, slipping of conductor from the suspension clamp as a result of unbalanced conductor tension in adjacent spans and broken wire condition. It shall also withstand power arcs. Chafing and abrasion from suspension clamp and localized heating effect due to magnetic power losses from suspension clamps as well as resistance losses of the conductor.

ii. The preformed armour rods set shall have right hand lay and the inside diameter of the helices shall be less than the outside diameter of the conductor to have gentle but permanent grip on the conductor. The surface of the armour rod when fitted on the conductor shall be smooth and free from projections, cuts and abrasions etc.

iii. The pitch length of the rods shall be determined by the Bidder but shall be less than that of the outer layer of conductor and the same shall be accurately controlled to maintain uniformity and consistently reproducible characteristics wholly independent of the skill of linemen.

iv. The length of each rod shall not be less than 1930 ± 25 mm and diameter shall not be less than 6.35 + 0.10 mm. The tolerance in length of the rods in the complete set should

be within 13 mm between the longest and shortest rod. The ends of the armour rod shall be parrot billed.

v. The number of armour rods in each set shall be eleven. Each rod shall be marked in the middle with paint for easy application on the line.
vi. The armour rod shall not loose their resilience even after five applications.
vii. The conductivity of each rod of the set shall not be less than 40% of the conductivity of the International Annealed Copper Standard (IACS).

Armour Grip Suspension Clamp

i. The armour grip suspension clamp shall comprise of retaining strap, support housing, elastomeric inserts with aluminum reinforcements and AGS preformed rod set.
ii. Elastomeric insert shall be resistant to the effects of temperature up to maximum conductor temperature guaranteed by the bidder corresponding to peak current, Ozone, ultraviolet radiations and other atmospheric contaminants likely to be encountered in service. The physical properties of the elastomer shall be of approved standard. It shall be electrically shielded by a cage of AGS performed rod set. The elastomer insert shall be so designed that the curvature of the AGS rod shall follow the contour of the neoprene insert.
iii. The length of the AGS preformed rods shall be such that it shall ensure sufficient slipping strength and shall not introduce unfavourable stress on the conductor under all operating conditions. However the length of AGS preformed rods shall not be less than 1760 + 16 mm for ACCC Conductor.

Dead end / Tension clamp Assembly

i) The dead end assembly shall be suitable for the proposed ACCC Conductor.
ii) The dead end assembly shall be of compression type with provision for compressing jumper terminal at one end. The angle of jumper terminal to be mounted should be 30° with respect to the vertical line. The area of bearing surface on all the connections shall be sufficient to ensure positive electrical and mechanical contact and avoid local heating due to I2R losses. The resistance of the clamp when compressed on Conductor shall not be more than 75% of the resistance of equivalent length of Conductor.
iii) Die compression areas shall be clearly marked on each dead-end assembly designed for continuous die compressions and shall bear the words ‘COMPRESS FIRST’ suitably inscribed near the point on each assembly where the compression begins. If the dead end assembly is designed for intermittent die compressions it shall bear identification marks ‘COMPRESSION ZONE’ AND ‘NON- COMPRESSION ZONE’ distinctly with arrow marks showing the direction of compressions and knurling marks showing the end of the zones. Tapered aluminum filler plugs shall also be provided at the line of demarcation between compression & non-compression zone. The letters, number and other markings on the finished clamp shall be distinct and legible. The dimensions of dead end assembly before & after compression along with tolerances shall be guaranteed in the relevant schedules of the bid and shall be decided

by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirements stipulated in the specification.

iv) The assembly shall not permit slipping of, damage to, or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

Fasteners: Bolts, Nuts and Washers

i) All bolts and nuts shall conform to IS 6639. All bolts and nuts shall be galvanised as per IS 1367(Part-13)/IS 2629. All bolts and nuts shall have hexagonal heads, the heads being forged out of solid, truly concentric, and square with the shank, which must be perfectly straight.

ii) Bolts upto M16 and having length upto 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grade should be 310 MPa minimum as per IS 12427. Bolts should be provided with a washer face in accordance with IS 1363 (Part-1) to ensure proper bearing.

iii) Nuts should be double chamfered as per the requirement of IS 1363 Part- III 1984. It should be ensured by the manufacturer that nuts should not be over tapped beyond 0.4 mm oversize on effective diameter for size upto M16.

iv) Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.

v) All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but no further. It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and tight to the point where shank of the bolt connects to the head.

vi) Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring washers shall be electro-galvanized. The thickness of washers shall conform to IS: 2016.

vii) The Contractor shall furnish bolt schedules giving thickness of components connected the nut and the washer and the length of shank and the threaded portion of bolts and size of holes and any other special details of this nature.

viii) To obviate bending stress in bolt, it shall not connect aggregate thickness more than three time its diameter.

ix) Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.

x) To ensure effective in-process Quality control it is essential that the manufacturer should have all the testing facilities for tests like weight of zinc coating, shear strength, other testing facilities etc, in-house. The manufacturer should also have proper Quality Assurance system which should be in line with the requirement of this specification and IS-.14000 services Quality System standard.

xi) Fasteners of grade higher than 8.8 are not to be used and minimum grade for bolt shall be 5.6.

Materials

The materials of the various components shall be as specified hereunder. The Bidder shall indicate the material proposed to be used for each and every component of hardware fittings stating clearly the class, grade or alloy designation of the material, manufacturing process & heat treatment details and the reference standards. The details of materials for different components are listed as in Table No-1.

Workmanship

i) All the equipment shall be of the latest design and conform to the best modern practices adopted in the Extra High Voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 66 kV transmission lines and will give continued good performance.

ii) High current, heat rise test shall be conducted by the supplier to determine the maximum temperature achieved in different components of fittings under simulated service conditions corresponding to continuous operation of conductor at rated maximum temperature. The material of the components should be suitable for continued good performance corresponding to these maximum temperatures. The supplier shall submit relevant type/performance test certificates as per applicable standards/product specifications to confirm suitability of the offered material.

iii) The design, manufacturing process and quality control of all the materials shall be such as to give the specified mechanical rating, highest mobility, elimination of sharp edges and corners to limit corona and radio-interference, best resistance to corrosion and a good finish.

iv) All ferrous parts including fasteners shall be hot dip galvanized, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanizing and the threads oiled. Spring washers shall be electro galvanized. The bolt threads shall be undercut to take care of the increase in diameter due to galvanizing. Galvanizing shall be done in accordance with IS 2629 / IS 1367 (Part-13) and shall satisfy the tests mentioned in IS 2633. Fasteners shall withstand four dips while spring washers shall withstand three dips of one minute duration in the standard Peerce test. Other galvanized materials shall have a minimum average coating of zinc equivalent to 600 gm/sq.m., shall be guaranteed to withstand at least six successive dips each lasting one (1) minute under the standard Peerce test for galvanizing.

v) The zinc coating shall be perfectly adherent of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash rust, stains, bulky white deposits and blisters. The zinc used for galvanizing shall be grade Zn 99.95 as per IS: 209.

vi) In case of casting, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc. Pressure die casting shall not be used for casting of components with thickness more than 5 mm.

vii) All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum.

viii) No equipment shall have sharp ends or edges, abrasions or projections and cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under service conditions.

ix) All the holes shall be cylindrical, clean cut and perpendicular to the plane of the material. The periphery of the holes shall be free from burrs.

x) All fasteners shall have suitable corona free locking arrangement to guard against vibration loosening.

xi) Welding of aluminum shall be by inert gas shielded tungsten arc or inert gas shielded metal arc process. Welds shall be clean, sound, smooth, uniform without overlaps, properly fused and completely sealed. There shall be no cracks, voids, incomplete penetration, incomplete fusion, under-cutting or inclusions. Porosity shall be minimized so that mechanical properties of the aluminum alloys are not affected. All welds shall be properly finished as per good engineering practices.

Bid Drawings

i) The Bidder shall furnish full description and illustrations of materials offered.

ii) Fully dimensioned drawings of the hardware and their component parts shall be furnished in two (2) copies along with the bid. Weight, material and fabrication details of all the components should be included in the drawings.

iii) All drawings shall be identified by a drawing number and contract number. All drawings shall be neatly arranged. All drafting & lettering shall be legible. The minimum size of lettering shall be 3 mm. All dimensions & dimensional tolerances shall be mentioned in mm.

iv) The drawings shall include :

a. Dimensions and dimensional tolerance.
b. Material, fabrication details including any weld details & any specified finishes & coatings. Regarding material designation & reference of standards are to be indicated.
c. Catalogue No.
d. Marking
e. Weight of assembly
f. Installation instructions
g. Design installation torque for the bolt or cap screw.

h. Withstand torque that may be applied to the bolt or cap screw without failure of component parts.
i. The compressions die number with recommended compression pressure.
j. All other relevant terminal details.

v) After placement of award, the Contractor shall submit a fully dimensioned drawing including all the components in three (3) copies to BPC for approval.

ACCESSORIES FOR THE ACCC CONDUCTOR

General

This portion details the technical particulars of the accessories for Conductor.

2.5% extra fasteners, filler plugs and retaining rods shall be provided.

The supplier shall be responsible for satisfactory performance of the complete conductor system along with accessories offered by him for continuous operation at temperature specified for the ACCC Conductor.

Mid Span Compression Joint (Not to be used in this line)

Mid Span Compression Joint shall be used for joining two lengths of conductor. The joint shall have a resistively less than 75% of the resistivity of equivalent length of conductor. The joint shall not permit slipping off, damage to or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor. It must be able to withstand the continuous design temperature of the conductor.

The dimensions of mid span compression joint before & after compression along with tolerances shall be guaranteed in the relevant schedules of the bid and shall be decided by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirements stipulated in the specification.

Connector

Connectors of compression type shall be used for jumper connection at tension tower. It shall be manufactured out of 99.5% pure aluminum / aluminum alloy and shall be strong enough to withstand normal working loads as well as able to withstand the continuous maximum operating temperature of the conductor. The connector shall have a resistivity across jumper less than 75% resistivity of equivalent length of conductor. The connector shall not permit slipping off, damage to or failure of complete conductor. The welded portions shall be designed for 30 kN axial tensile load. The leg sleeve of the connector should be kept at an angle of 15 deg. from the vertical and horizontal plane of the conductor in order to minimize jumper pull at the welded portion. The dimensions of connector along with tolerances shall be guaranteed

in the relevant schedules of the bid and shall be decided by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirements stipulated in the specification.

Repair Sleeve

Repair Sleeve of compression type shall be used to repair conductors with not more than two strands broken in the outer layer. The sleeve shall be manufactured from 99.5% pure aluminum / aluminum alloy and shall have a smooth surface. It shall be able to withstand the continuous maximum operating temperature of the conductor. The repair sleeve shall comprise of two pieces with a provision of seat for sliding of the keeper piece. The edges of the seat as well as the keeper piece shall be so rounded that the conductor strands are not damaged during installation. The dimensions of Repair sleeve along with tolerances shall be guaranteed in the relevant schedules of the bid and shall be decided by the manufacturer so as to suit the conductor size & conform to electrical & mechanical requirements stipulated in the specification.

Vibration Damper

Vibration dampers of 4R-stockbridge type are installed in the existing line at suspension and tension points on each conductor in each span along with bundle spacers to damp out Aeolian vibration as well as sub- span oscillations. One damper minimum on each side per sub-conductor for suspension points and two dampers minimum on each side per sub-conductor for tension points has been used for a ruling design span of the line for which replacement of conductor is being carried out.

The bidder shall offer a damping system including Stockbridge type dampers and bundle spacers for ACCC Conductor for its protection from wind induced vibrations which could cause conductor fatigue /strand breakage near a hardware attachment, such as suspension clamps. Alternate damping systems with proven design offering equivalent or better performance also shall be accepted provided the manufacturer meets the qualifying requirements stipulated in the Specifications.

Relevant technical documents including type test reports to establish the technical suitability of alternate systems shall be furnished by the Bidder along with the bid. The damper shall be designed to have minimum 4 nos. of resonance frequencies to facilitate dissipation of vibration energy through inter strand friction of the messenger cable and shall be effective in reducing vibration over a wide frequency range (depending upon conductor dia) or wind velocity range specified above. The vibration damper shall meet the requirement of frequency or wind velocity range and also have mechanical impedance closely matched with the offered ACCC Conductor. The vibration dampers shall be installed at suitable positions to ensure damping effectiveness across the frequency range. The power dissipation of the vibration dampers shall exceed the wind power so that the vibration level on the conductor is reduced below its endurance limit i.e. 150 micro strains. The bidder shall clearly indicate the method for

evaluating performance of dampers including analytical and laboratory test methods. The bidder shall indicate the type tests to evaluate the performance of the offered damping system.

The clamp of the vibration damper shall be made of high strength aluminum alloy of type LM-6. It shall be capable of supporting the damper and prevent damage or chafing of the conductor during erection or continued operation. The clamp shall have a smooth and permanent grip to keep the damper in position on the conductor without damaging the strands or causing premature fatigue failure of the conductor under the clamp. The clamp groove shall be in uniform contact with the conductor over the entire clamping surface except for the rounded edges. The groove of the clamp body and clamp cap shall be smooth, free from projections, grit or other materials which could cause damage to the conductor when the clamp is installed. Clamping bolts shall be provided with self locking nuts and designed to prevent corrosion of threads or loosening in service.

The messenger cable shall be made of high strength galvanised steel/stain less steel with a minimum strength of 135 kg/sq.mm. It shall be of preformed and post formed quality in order to prevent subsequent drop of weight and to maintain consistent flexural stiffness of the cable in service. The messengers cable other than stainless steel shall be hot dip galvanised in accordance with the recommendations of IS: 4826 for heavily coated wires.

The damper mass shall be made of hot dip galvanised mild steel/cast iron or a permanent mould cast zinc alloy. All castings shall be free from defects such as cracks, shrinkage, inclusions and blowholes etc. The surface of the damper masses shall be smooth.

The damper clamp shall be cast over the messenger cable and offer sufficient and permanent grip on it. The messenger cable shall not slip out of the grip at a load less than the mass pull-off value of the damper. The damper masses made of material other-than zinc alloy shall be fixed to the messenger cable in a suitable manner in order to avoid excessive stress concentration on the messenger cables which shall cause premature fatigue failure of the same. The messenger cable ends shall be suitably and effectively sealed to prevent corrosion. The damper mass made of zinc alloy shall be cast over the messenger cable and have sufficient and permanent grip on the messenger cable under all service conditions.

The damper assembly shall be so designed that it shall not introduce radio interference beyond acceptable limits.

The vibration damper shall be capable of being installed and removed from energized line by means of hot line technique. In addition, the clamp shall be capable of being removed and reinstalled on the conductor at the designated torque without shearing or damaging of fasteners.

The contractor must indicate the clamp bolt tightening torque to ensure that the slip strength of the clamp is maintained between 2.5 kN and 5 kN. The clamp when installed on the conductor shall not cause excessive stress concentration on the conductor leading to permanent deformation of the conductor strands and premature fatigue failure in operation.

The damper placement chart shall be submitted for spans ranging from 50 m to 350 m. Placement charts should be duly supported with relevant technical documents and sample calculations.

xii. The damper placement charts shall include the following

1) Location of the dampers for various combinations of spans and line tensions clearly indicating the number of dampers to be installed per conductor per span.
2) Placement distances clearly identify the extremities between which the distances are to be measured.
3) Placement recommendation depending upon type of suspension clamps (viz free centre type/Armour grip type etc.)
4) The influence of mid span compression joints, repair sleeves & armour rods (standard& AGS) in the placement of dampers.

Material and Workmanship

i. All the equipment shall be of the latest proven design and conform to the best modern practice adopted in the extra high voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 66 kV transmission line applications with ACCC Conductor and will give continued good performance at all service conditions.

ii. The design, manufacturing process and quality control of all the materials shall be such as to achieve requisite factor of safety for maximum working load, highest mobility, elimination of sharp edges and corners, best resistance to corrosion and a good finish.

iii. High current heat rise test shall be conducted by the supplier to determine the maximum temperature achieved in different components of fittings under simulated service conditions corresponding to continuous operation of conductor at rated maximum temperature. The material of the components should be suitable for continued good performance corresponding to these maximum temperatures. The supplier shall submit relevant type/ performance test certificates as per applicable standards/product specifications to confirm suitability of the offered material.

iv. All ferrous parts shall be hot dip galvanised, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electro galvanised as per grade 4 of IS-1573. The bolt threads shall be undercut to take care of increase in diameter due to galvanising. Galvanising shall be done in accordance with IS:2629/ IS- 1367 (Part-13) and satisfy the tests mentioned in IS-2633. Fasteners shall withstand four dips while spring washers shall withstand three dips. Other galvanised materials shall have a minimum average coating of Zinc equivalent to 600gm/sq.m and shall be guaranteed to withstand at least six dips each lasting one minute under the standard Peerce test for galvanising unless otherwise specified.

v. The zinc coating shall be perfectly adherent, of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanising shall be of grade Zn 99.95 as per IS: 209.

vi. In case of castings, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc.

vii. All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum and localized heating phenomenon is averted.

viii. No equipment shall have sharp ends or edges, abrasions or projections and shall not cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under all service conditions.

ix. Particular care shall be taken during manufacture and subsequent handling to ensure smooth surface free from abrasion or cuts.

x. The fasteners shall conform to the requirements of IS: 6639-1972. All fasteners and clamps shall have corona free locking arrangement to guard against vibration loosening.

Compression Markings

Die compression areas shall be clearly marked on each equipment designed for continuous die compressions and shall bear the words ‘COMPRESS FIRST’ ‘suitably inscribed on each equipment where the compression begins. If the equipment is designed for intermittent die compressions, it shall bear the identification marks ‘COMPRESSION ZONE’ and ‘NON-COMPRESSION ZONE’ distinctly with arrow marks showing the direction of compression and knurling marks showing the end of the zones. The letters, number and other markings on finished equipment shall be distinct and legible.

4.10 BidDrawings

The Bidder shall furnish detailed dimensioned drawings of the equipment and all component parts as per the standard.

Tests and Standards

Type Tests, acceptance tests and routine tests on the accessories shall be carried out as per the standard.

Inspection

The BPC’s representative shall at all times be entitled to have access to the works and all places of manufacture, where the material and/or its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Contractor’s, sub-

Contractor's works raw materials. Manufacturer's of all the material and for conducting necessary tests as detailed herein.

The material for final inspection shall be offered by the Contractor only under packed condition. The engineer shall select samples at random from the packed lot for carrying out acceptance tests.

The Contractor shall keep BPC informed in advance of the time of starting and of the progress of manufacture of material in its various stages so that arrangements could be made for inspection.

Material shall not be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by BPC in writing. In the latter case also the material shall be dispatched only after all tests specified herein have been satisfactorily completed.

The acceptance of any quantity of material shall in no way relieve the Contractor of his responsibility for meeting all the requirements of the Specification, and shall not prevent subsequent rejection, if such materials are later found to be defective.

Packing and Marking

All material shall be packed in strong and weather resistant wooden cases/crates. The gross weight of the packing shall not normally exceed 200 Kg to avoid handling problems.

The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

Suitable cushioning, protective padding, spacers shall be provided to prevent damage or deformation during transit and handling.

Bolts, nuts, washers, cotter pins, security clips and split pins etc. shall be packed duly installed and assembled with the respective parts and suitable measures shall be used to prevent their loss.

Each component part shall be legibly and indelibly marked with the trade mark of the manufacturer and year of manufacture.

All the packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate shall have all the markings stenciled on it in indelible ink.

Standards

The Hardware fittings; conductor and earth wire accessories shall conform to the following Indian/International Standards which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.

In the event of the supply of hardware fittings; conductor and OPGW accessories conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the Standards proposed by the Contractor and those specified in this document will be provided by the Contractor to establish their equivalence.

Accessories

The Bidder after his survey of the existing line shall determine the quantity and type of the accessories required for the turnkey job, which are to be supplied by them. These accessories should be suitable for the supplied conductor for its entire operating range without degradation of mechanical, metallurgical and electrical properties. The steady state temperature of hardware and accessories must not exceed 90°C during no wind and 50°C ambient temperature at minimum 650 Amp load. The contractor shall be responsible for satisfactory performance of complete conductor, hardware and accessories, offered by him, for continuous operation at temperatures corresponding to various conditions stipulated at Clause 3 of this technical specification.

SECTION-VII
INSULATOR

SECTION-VII

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SECTION-VII

INSULATOR

1.0 **Technical Description of Disc Insulators**

1.1 **Details of Disc Insulators with Zinc Sleeve**

1.1.1 The Insulator strings shall consist of Standard discs for a three phase, 50 Hz, effectively earthed 400 kV, 220 kV, 132 kV, and 66 kV transmission system in a moderately polluted atmosphere. The discs shall be cap and pin, ball and socket type. The zinc to be used for making sleeves shall be 99.95 % pure.

1.1.2 Supplier shall quote porcelain disc insulator. The insulator shall be anti-fog type, designed with a view to service in a humid alpine climate.

1.1.3 The size of disc insulator shall be IEC 305, minimum creepage distance, the number to be used in different type of strings, their electromechanical strength and mechanical strength of insulator string along with hardware fittings shall be as follows: -

Sl No.	Particulars	Single 'I' Suspension Pilot	Single Tension	Double tension	Triple tension
1.	No of Insulator Disc	1 x 26	1x 26	2 x 25	3 x 25
2.	Size of Disc (maximum Nominal diameter X Nominal Spacing)	280 x 145	280 x 145	330x170	330x170
3.	E&M Strength of each disc KN	120	120	160	160
4.	Size and Designation of pin ball shank (mm)	16	16	20	20
5.	Creepage distance of each disc (mm) for anti-fog	440	440	590	590

Note: The table above is for illustrative purposes only. The insulators shall conform, in all respects, to high standards of engineering, design, and workmanship, as well as to the latest revisions of the relevant standards in force at the time of the offer. The Employer shall have the right to reject any work or material that, in their judgment, does not fully comply with these requirements.

1.2 **Pin and Cap**

1.2.1 Insulator shall be straight head design. The Pin and Cap design shall conform to IS 1865 / EN 10083 suitable for Zero & Sub-zero temperature to transmit the mechanical stresses to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric, of such design that it will not yield or distort under load conditions.

The cap and ball pin should conform to IS 1865 / EN10083 suitable for zero and Sub-zero temperatures.

Sl.no	Name of Item	Materials	Reference standard	Impact Energy
1	Steel Forgings (including insulator pin)	AISI 4130	ASTM A29	27 joules @-30 deg C
		24CrMo4	EN 10083	
2	Insulator Cap (spheroidal graphite cast iron)	SG350/22L	IS 1865	12 joules @-30 deg C
		SG 400/18L		

1.2.2 The pin ball shall move freely in the cap socket but without danger of accidental uncoupling during erection or in position. The design of the disc should be such that stresses due to expansion or contraction in any part of the insulator shall not lead to deterioration.

1.3 **Zinc Sleeve**

1.3.1 Cap and pin insulator units shall where specified be fitted with zinc sleeve pins to prevent cracking due to pin corrosion caused by the effects of pollution and high humidity, with the zinc sleeve metallurgically bonded to the insulator pin, the exposed portion having a minimum mass of 5 grams, and not less than 50% of the sleeve remaining exposed, corresponding to a minimum exposed length of 5 mm and total length of zinc sleeve should be minimum 10mm

1.4 **Security clip**

1.4.1 Stainless steel security clip for use with ball and socket coupling shall be of R-shaped hump type which shall provide positive locking of the coupling as per IS: 2486-(Part-Ill)/IEC 372. The legs of the security clips shall be spread after installation to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position. Under no circumstances shall locking device allow separation of insulator units or fittings.

1.4.2 The hole for the security clip shall be countersunk and the clip shall be of such design that the eye of clip may be engaged by a hot line clip puller to provide for disengagement under energised conditions. The force required to pull the security clip into its unlocked position shall not be less than 50N (5 kg) or more than 500N (50 kg).

1.5 **Ball and Socket Designation**

The dimensions of the balls and sockets shall be of following designation for different disc insulators in accordance with the standard dimensions stated in IS:2486(Part II)/IEC:120:

Sl. No.	Rating of Insulators	Designation of Ball as per IEC 305 & socket as per IEC: 120
i)	70kN (U70BLP), 90kN (similar with U70BLP) & 120kN (U120BP)	16 mm
ii)	160 kN (U160BLP)	20 mm

1.6 **Dimensional Tolerance of Insulator Disc (Standard)**

It shall be ensured that the dimensions of the disc insulators are within the limits specified below:

a)	Diameter of Disc (mm)			
		Standard	Maximum	Minimum
	70 kN & 90 kN (U70BLP)	255	As per IEC/IS	As per IEC/IS
	120 kN Disc (U120BP)	280	As per IEC/IS	As per IEC/IS
	160 kN Disc(U160BLP)	330	As per IEC/IS	As per IEC/IS
b)	Ball to ball spacing between discs (mm)			
		Standard	Maximum	Minimum
	70 kN & 90 kN (U70BLP) & similar for 90kN	145	As per IEC/IS	As per IEC/IS
	120 kN Disc (U120BP)	145	As per IEC/IS	As per IEC/IS
	160 kN Disc (U160BLP)	170	As per IEC/IS	As per IEC/IS

1.7 **Interchangeability**

The disc insulators inclusive of the ball and socket fittings shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant Indian/International Standards.

1.8 **Corona and RI Performance**

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subject to excessive localised pressure. The metal parts and porcelain shall be so designed and manufactured that it shall not generate any Radio Interference beyond specified limit and not produce any noise generating corona under the operating conditions.

1.9 **Maintenance**

1.9.1 The disc insulators offered shall be suitable for the employment of hot line maintenance techniques so that the usual hot line operations can be carried out with ease, speed, and safety.

1.9.2 Bidders shall indicate the methods generally used in the routine hot and dead line maintenance of EHV Lines for which similar disc insulators have been supplied by them. Bidders shall also indicate the recommended periodicity of such maintenance.

1.10 **Materials**

1.10.1 **Porcelain**

The porcelain used in the manufacture of shells shall be sound, free from defects thoroughly vitrified and smoothly glazed with minimum 35% Alumina content.

1.10.2 **Glaze**

The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed parts of the insulator and shall have a good luster, smooth surface and good performance under the extreme weather conditions of a tropical climate. It shall not crack or chip by ageing under the normal service conditions. The glaze shall have the same coefficient of expansion as of the porcelain body throughout the working temperature range.

1.10.3 **Cement**

Cement used in the manufacture of the insulator shall not cause fracture by expansion or loosening by contraction. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as small and uniform as possible. Proper care shall be taken to correctly centre and locate individual parts during cementing.

1.10.4 **Pins and Caps**

Pins and Caps shall be made of drop forged steel and malleable cast iron/spheriodal graphite iron/drop forges steel respectively, duly hot dip galvanised and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.

1.10.5 **Security Clips**

Security clips shall be made of good quality stainless steel or phosphor bronze as per IS 1385. 2.5% extra Security clip shall be provided without additional cost.

1.10.6 **Zinc Sleeve**

Zinc sleeve shall have a total impurity not greater than 0.2 percent and shall comply with the requirements of BS EN 1179 or equivalent. The zinc sleeve shall not be porous and all mould lines shall be removed. The cement level shall be approximately at the mid-point of the sleeve.

1.11 **Workmanship**

1.11.1 All the material shall be of the latest design and conform to the best modern practices adopted in the field of extra high voltage transmission. Suppliers shall offer only such insulators as are guaranteed by them for satisfactory performance on Transmission lines and will give continued good service.

1.11.2 The design, manufacturing process, and material control at various stages shall be such as to achieve maximum working load, highest mobility, best resistance to corrosion, and good finish. Also, to eliminate sharp edges and corners to limit corona and radio interference voltages.

1.11.3 The design of the insulator shells shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

1.11.4 Metal caps shall be free from cracks, seams, shrinks, air holes, burrs and rough edges. All surfaces of the metal parts shall be perfectly smooth with no projecting points or irregularities which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Pins shall not show any microscopically visible cracks, inclusions, and voids.

1.11.5 All ferrous parts shall be hot dip galvanised to give a minimum average coating of Zinc mass of 700 gm/sq.m, corresponding to an approximate minimum coating of thickness 100 micron and shall be in accordance with the requirement of IS:2629 and shall satisfy the tests mentioned in IS 2633. The zinc used for galvanising shall be of Grade Zn 99.95 as per IS 209. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from impurities such as flux, ash, rust stains, bulky white deposits and blisters. The galvanised metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard Preece test.

1.11.6 Before ball fittings are galvanised, all die flashing on the shank surface of the ball shall be carefully removed without reducing the dimensions below the design requirements.

1.11.7 The design of the insulators shall be such that the shell shall not engage directly with hard metal. The design shall also be such that when units are coupled together there is no contact between the shell of one unit and metal of the next adjacent unit. The design of the shell ribs shall be such that the security clip of the insulator can be engaged and disengaged easily with hot stick without damaging the shell ribs.

1.11.8 Insulator units after assembly shall be concentric and co-axial within limits as permitted by the relevant Indian Standards and/or International Standards.

2.0 **Equipment Marking**

2.1 Each insulator disc unit shall be legibly and indelibly marked with the trade mark of the manufacturer, name of Employer and month & year of manufacture. The guaranteed combined mechanical and electrical strength shall be indicated in kilo Newton followed by the word 'kN' to facilitate easy identification and to ensure proper use.

2.2 For porcelain insulator, the marking shall be on porcelain. The marking shall be printed, not impressed and shall be applied before firing. For toughened glass insulators the marking shall be on the metal parts.

3.0 **Bid Drawings**

3.1 The Bidder shall furnish full description and illustration of the material offered.

3.2 The Bidder shall furnish along with the bid the outline drawing (4 copies) of each insulator unit including a cross-sectional view of the insulator shell. The drawing

shall include but not limited to the following information:

(a) Shell diameter and ball to ball spacing with manufacturing tolerances

(b) Minimum Creepage distance with positive tolerance

(c) Protected creepage distance

(d) Eccentricity of the disc

(i) Axial run out

(ii) Radial run out

(e) Unit mechanical and electrical characteristics

(f) Size and weight of ball and socket parts

(g) Weight of unit insulator disc units

(h) Materials

(i) Identification mark

(j) Manufacturer's catalogue number

3.3 After placement of award, the Supplier shall submit full dimensioned insulator drawings containing all the details as given in Clause No. 4.11.2 above, in four (4) copies to Employer for approval. After getting approval from Employer and successful completion of all the type tests, the Supplier shall submit 4 more copies of the same drawing to the Employer for further distribution and field use at Employer's end.

3.4 After placement of award, the Supplier shall also submit a fully dimensioned insulator crate drawing for different type of insulators.

3.5 After placement of award, the Supplier shall submit a fully dimensioned manufacturing drawing of insulator cap, pin and insulator shell in four (4) copies to theEmployer for reference and record.

4.0 Standard Technical Particulars

4.1 The guaranteed technical particulars to be adhered by the contractor/ manufacturer are furnished in **Annexure-B** of this section.

5.0 **Tests and Standards**

5.1 **Type Tests**

All equipment/materials shall conform to type tests, including routine, acceptance and additional tests in accordance with the relevant Standards and Codes. The Bidder shall submit copies of type tests for each equipment along with his bid. The type of tests reported shall be of the tests conducted within the last ten (10) years prior to the date of Bid opening. In case the type tests reports are of the tests conducted earlier than ten (-10) years prior to the date of Bid opening, the Contractor shall repeat these test(s) at his cost. If the type tests reports submitted are of tests conducted within ten (10) years prior to the date of Bid opening but do

not conform to the requirements of the tender and are not considered acceptable to the Employer due to inadequacies/inconsistencies/certificates being from non-qualified agencies or /any other reason, the Contractor has to carry out the Type Tests because of such invalid certificate and/or absence of such certificates, at his own cost without any additional cost to the Employer.

All manufacturers shall ensure that insulators have been type tested, or are type tested, at internationally accredited laboratories outside the country of origin.

The following type tests shall be conducted on a suitable number of individual standard disc insulators units, components, materials or complete strings:

5.1.1 **On unit disc Insulators**

a)	Verification of dimensions	As per IEC :60383
b)	Power frequency voltage withstand and flashover test under (i) dry & (ii) wet condition	As per IEC : 60383
c)	Impulse voltage withstand and flashover test (dry)	As per IEC : 60383
d)	Visible Discharge test (dry)	As per IS:731, Cl. 10.2
e)	RIV test (dry)	As per IEC:60437
f)	Impact Test (For Disc Insulators only)	As per Annexure-A
g)	Thermal mechanical performance test	As per Annexure-A
h)	Residual strength Test (For Disc Insulators only)	As per Annexure-A
i)	Steep wave front Test (For Disc Insulators only)	As per Annexure-A
j)	Zinc Sleeve test	IEC 60383-1 + IEC 60068-2-11
k)	Head design test	IEC 60383-1 + IEC 61211
l)	Power arc test	IEC 61467

5.1.2 **On the complete Insulator String with Hardware Fittings**

a)	Power frequency voltage withstand test with corona control rings/grading ring and arcing horns under wet condition	As per IEC:383
b)	Switching surge voltage withstand test under wet condition (for 400 kV & above voltage level line only)	As per IEC:383
c)	Impulse voltage withstand test under dry condition	As per IEC:383
d)	Impulse voltage flashover test under dry condition	As per IEC:383
e)	Voltage distribution test (for disc insulators only)	As per Annexure-A
f)	Corona and RIV test under dry condition	As per Annexure-A
g)	Mechanical Strength test	As per Annexure-A

h)	Vibration test	As per Annexure-A
i)	Power Arc Test	As per Annexure-A

Note:

1) All the type test given in Clause No. 5.1.2 shall be conducted on i) single 'I' suspension and ii) double tension and iii) triple insulator string along with hardware fittings.

2) All the type tests given in Clause No. 5.1.1 (a) to (g) shall be conducted on i) single 'I' suspension pilot, ii) single tension, double tension and iii) triple tension insulator string along with hardware fittings.

5.1.3 Type tests specified under Clause 5.1.1 (a) to (f) and 5.1.2 shall not be required to be carried out if a valid test certificate is available for a similar design. The test certificate shall be considered valid if,

i) Tests conducted earlier is either conducted in globally accepted laboratory namely:

- KEMA Laboratories in the Netherlands
- Powertech High Power Laboratories in Canada
- Kinectrics, Canada
- IREQ Montreal in Canada
- CESI in Italy
- STRI & Vattenfall in Sweden
- Veiki VNL in Hungary

ii) Tests mentioned at 5.1.2 (e) to (h) and have been conducted within 10 (ten) years prior to the date of bid opening.

In case the tests have been conducted earlier than the above stipulated period or in the event of any discrepancy in the test report (i.e., any test not applicable due to any design/manufacturing change including substitution of components or due to non-compliance with the requirement stipulated in the Technical Specifications), the tests shall be conducted by the Supplier at no extra cost to the Purchaser.

Further, combination tests are mandatory if test reports for same combination are not available. If there is change of vendor for insulators and hardware the combination test has to be repeated.

Note: All manufacturers have to get the insulators tested at laboratory outside country of Origin.

5.2 **Acceptance Tests**

5.2.1 **For Disc Insulators (porcelain)**

a)	Visual examination	As per IEC: 60383
b)	Verification of dimensions	As per IEC: 60383
c)	Temperature cycle test	As per IEC: 60383
d)	Galvanising test	As per IEC: 60383
e)	Mechanical performance test	As per IEC:60575Cl 4.0
f)	Test on locking device for ball and socket coupling	As per IEC:60372
g)	Eccentricity test	As per IEC:60383
h)	Residual Strength Test	As per IEC:797 Clause 4.4 & 4.5
i)	Metallurgical Test (For metal fittings only in black condition)	As per Annexure-A
	i) Grain size	
	ii) Inclusion rating	
	iii) Chemical analysis	
	iv) Microstructure	
j)	IR Measurement	As per Annexure-A
k)	Impact Test	As per Annexure-A
l)	Steep Wave front test	As per Annexure-A
m)	Thermal Mechanical performance test	As per Annexure-A

Note: *Residual strength test / Thermal mechanical performance test and Steep wave front test has to be carried for every lot offered under factory acceptance test. The sample for these testing should be governed by E1+E2 samples as per the sampling plan mentioned in IEC 60383.*

5.2.2 **For Porcelain disc Insulators**

a)	Electro-mechanical strength test	As per Annexure-A
b)	Porosity test	As per IEC: 60383
c)	Puncture test	As per IEC: 60383

5.3 **Routine Tests**

5.3.1 **For Disc Insulators**

a)	Visual Inspection	As per IS:731, Cl. 10.13
b)	Mechanical routine test	As per IS:731 Cl. 10.14
c)	Electrical routine test (for porcelain disc insulator only)	As per IS:731 Cl. 10.15
d)	Thermal shock routine test (for glass insulator only)	As per IEC:60383

5.4 Tests During Manufacture

On all components as applicable

a)	Chemical analysis of zinc used for galvanising	As per Annexure-A
b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.	As per Annexure-A
c)	Chemical analysis hardness tests and magnetic particle inspection for forgings	As per Annexure-A
d)	Hydraulic Internal Pressure tests on disc insulator shells	As per Annexure-A
e)	Autoclave Test on Cement	As per Annexure-A

5.5 **Testing Expenses**

5.5.1 For Type Tests which involves the tests on the complete insulator string with hardware fitting, similar hardware fittings shall be arranged by insulator supplier at his own cost.

5.5.2 In case of failure in any type test the bidder, whose material has failed is either required to modify the design of the material & successfully carryout all the type tests as has been detailed out in Clause 5.1.1 or 5.1.2 of these specifications or to repeat that particular type test at least three times successfully at his own expenses.

5.5.3 Supplier shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratory and the tests can be completed in these laboratories within the time schedule guaranteed by them in the appropriate schedule.

5.5.4 The entire cost of testing for acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted Ex-works/CIF Price.

5.5.5 In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector/ Purchaser's representative shall be deducted from the contract price. Also if on receipt of the Supplier's notice of testing, the Purchaser's representative does not find 'plant' to be ready for testing the expenses incurred by the Purchaser for re-deputation shall be deducted from contract price.

5.5.6 The Supplier shall intimate the Purchaser about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance (in case of Domestic Supplier) and at least 6 weeks advance (in case of foreign Supplier) of the scheduled date of testing during which the Purchaser will arrange to depute his representative to be present at the time of carrying out the tests.

5.6 **Sample Batch for Type Testing**

5.6.1 The Supplier shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Employer. The Supplier shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Employer.

5.6.2 Before sample selection for type testing, the Supplier shall be required to conduct all the acceptance tests successfully in presence of Employer's representative.

5.7 Schedule of Testing

5.7.1 The Bidder has to indicate the schedule of following activities in their bids:

a) Submission of drawing for approval.

b) Submission of Quality Assurance Programme for approval.

c) Offering of material for sample selection for type tests.

d) Type testing.

5.8 **Additional Tests**

5.8.1 The Employer reserves the right of having at his own expenses any other test(s) of reasonable nature carried out at Supplier's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.

5.8.2 The Employer also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Supplier's premises or at any other test centre. In case of evidence of noncompliance, it shall be binding on the part of the Supplier to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Employer.

5.9 Guarantee

Performance of the string is directly proportional to the performance of insulators

and hardware. If either is non-performing it will impact the stability of the string.

5.10 Test Reports

5.10.1 Copies of type test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by the Employer only after which the commercial production of the concerned material shall start.

5.10.2 Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy shall be returned duly certified by the Employer, only after which the material shall be dispatched.

5.10.3 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Employer's representative.

5.10.4 Test certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Employer.

5.11 **Inspection**

5.11.1 The Employer's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub- Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

5.11.2 The tests sampling for Factory Acceptance Tests (FAT) shall be as per IEC 60383.

5.11.3 The Supplier shall keep the Employer informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

5.11.4 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Employer in writing. In the latter case also, the material shall be dispatched only after satisfactory testing for all tests specified herein have been completed.

5.11.5 The acceptance of any quantity of material shall be no way relieve the Supplier of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such material is later found to be defective.

5.12 **Packing and Marking**

5.12.1 All insulators shall be packed in strong seasoned wooden crates. The gross weight of the crates along with the material shall not normally exceed 200 Kg to avoid handling problem. For marine transportation crates shall be palleted.

5.12.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

5.12.3 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.

5.12.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each

wooden case/crate shall have all the markings stencilled on it in indelible ink.

5.13 **Standards**

The insulator strings and its components shall conform to the following Indian/ International Standards which shall mean latest revision, with amendments/ changes adopted and published, unless specifically stated otherwise in the Specification.

5.13.1 In the event of supply of insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

Sl. No.	**Indian Standard**	**Title**	**International Standard**
1.	IS:209-1992	Specification for zinc	BS:3436
2.	IS:406-1991	Method of Chemical Analysis of Slab Zinc	BS:3436
3.	IS:731-1991	Porcelain insulators for overhead Power lines with a nominal voltage greater than 1000 V	BS:137- (I&II) IEC:60383
4.	IS:2071 Part (I) – 1993 (Part(II)- 1991 Part(III)- 1991	Methods of High Voltage Testing	IEC:60060-1
5.	IS:2486 Part- I-1993 Part- II-1989 Part-III-1991	Specification for Insulator fittings for Overhead Power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	 BS:3288 IEC:60120 IEC:60372
6.	IS:2629-1990	Recommended Practice for Hot, Dip Galvanisation for iron and steel	ISO-1461 (E)
7.	IS:2633-1992	Testing of Uniformity of Coating of zinc coated articles	
8.	IS:3188-1988	Dimensions for Disc Insulators	IEC:60305
9.	IS:6745-1990	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	BS:433-1969 ISO:1460-1973
10.	IS:8263-1990	Methods of RI Test of HV insulators	IEC:60437 NEMA Publi-cation No.07/ 1964/ CISPR

11.	IS:8269-1990	Methods for Switching Impulse test on HV insulators	IEC:60506
12.		Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
13.		Salt Fog Pollution Voltage Withstand Test	IEC:60507
14.		Residual Strength of String Insulator Units of Glass or Ceramic Material for Overhead	IEC:60797
		Lines after Mechanical Damage of the Dielectric	
15.		Guide for the selection of insulators in respect of polluted conditions	IEC:60815
16.		Tests on insulators of Ceramic material or glass or glass for overhead lines with a nominal voltage greater than 1000V	IEC:60383
17.		Standard Test Method for Autoclave Expansion of Portland Cement	ASTM C151-93-a
18.		American National Standard for Insulators wet process porcelain and toughened glass suspension type	ANSI C29-2-1992

The standards mentioned above are available from:

Reference Abbreviation	**Name and Address**
BS	British Standards, British Standards Institution 101, Pentonvile Road, N - 19-ND UK
IEC/CISPR	International Electro technical Commission, Bureau Central de la Commission, electro Technique international, 1 Rue de verembe, Geneva SWITZERLAND
BIS/IS	Beureau Of Indian Standards. Manak Bhavan, 9, Bahadur Shah Zafar Marg, New Delhi - 120001. INDIA

ISO	International Organisation for Standardization. Danish Board of Standardization Danish Standardizing Sraat, Aurehoegvej-12 DK-2900, Heeleprup, DENMARK.
NEMA	National Electric Manufacture Association, 155, East 44th Street. New York, NY 10017 U.S.A.
ASTM	American Society for Testing and Materials, 1916 Race St. Phelledelphia, PA19103 USA

ANNEXURE-A

1. Tests on Complete Strings with Hardware Fittings

1.1 Voltage Distribution Test (For Disc Insulator strings only)

The voltage across each insulator unit shall be measured by the sphere gap method. The result obtained shall be converted into percentage. The voltage across any disc shall not exceed the values specified as per IS/ IEC standards.

1.2 Corona Extinction Voltage Test (Dry)

The sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than the values specified as per IS/ IEC standards. There shall be no evidence of corona on any part of the sample. The atmospheric condition during testing shall be recorded and the test results shall be accordingly corrected with suitable correction factor as stipulated in IEC: 383.

1.3 RIV Test (Dry)

Under the conditions as specified under (1.2) above, the insulator string along with complete hardware fittings shall have a radio interference voltage level below 500 micro volts at one MHz when subjected to 50 Hz AC voltage of 1.1 times maximum time to ground voltage under dry condition. The test procedure shall be in accordance with IS: 8263/IEC: 437.

1.4 Mechanical Strength Test

The complete insulator string along with its hardware fitting excluding arcing horn, corona control ring, grading ring and suspension

assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to, remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.5 Vibration Test

The suspension string shall be tested in suspension mode, and tension string in tension mode itself in laboratory span of minimum 30 metres. In the case of suspension string a load equal to 600 kg shall be applied along the axis of the suspension string by means of turn buckle. The insulator string along with hardware fittings and specified no. of sub-conductors each tensioned at 25 % of UTS of the conductor shall be secured with clamps. The system shall be suitable to maintain constant tension on each sub-conductors throughout the duration of the test. Vibration dampers shall not be used on the test span. Both the sub-conductors shall be vertically vibrated simultaneously at one of the resonance frequencies of the insulators string (more than 10 Hz) by means of vibration inducing equipment. The peak-to-peak displacement in mm of vibration at the antinode point, nearest to the string, shall be measured and the same shall not be less than 1000/f1.8 where f is the frequency of vibration in cycles/sec. The insulator string shall be vibrated for not less than 10 million cycles without any failure. After the test the insulators shall be examined for looseness of pins and cap or any crack in the cement. The hardware shall be examined for looseness, fatigue failure and mechanical strength test. There shall be no deterioration of properties of hardware components and insulators after the vibration test. The insulators shall be subjected to the following tests as per relevant standards:

Sr.no	**Test Percentage of**	**Units of Disc insulators to be tested**
a)	Temperature cycle test followed by mechanical performance test	60
b)	Puncture test/steep wave front test	40

1.6 Power - Arc Test

This test shall be performed on the complete string in accordance with IEC Technical Report IEC: 61467-1997 with the following test series:

Test circuit	Short circuit current	Number and duration of test
B	$I_n = I_{sys} = 40$ KA	Two of $t_n = 0.2$s and one of $t_n = 0.5$s

The acceptance criteria after the completion of test series shall be following.

a) Insulator separation not permitted.

b) Burning/melting of metal components, breakage of insulator sheds, glaze removal are permitted.

c) The complete insulator string along with its hardware fitting excluding arching horn, corona control ring/grading ring shall withstand 80% of UTS.

2. On Disc Insulator Units

2.1 Steep Wave Front Test (For Disc Insulator)

Test following test shall be performed on 10 insulator units in case of disc insulators selected at random from the lot offered for selection of sample for type test.

a) Each insulator unit shall be subjected to five successive positive and negative impulse flashovers with a wave having minimum effective rate of rise of 2500 kV per microseconds.

b) Each unit shall then be subjected to three dry power frequency voltage flashovers.

Acceptance Criteria

An insulator shall be deemed to have met the requirement of this test if, having been successfully subjected to the ten impulse flashovers, the arithmetic mean of the three subsequent dry/power frequency voltage flashover values equals or exceeds 95% of the rated dry power frequency flashover voltage.

An insulator shall be deemed to have failed to meet the requirement of above testing if,

(a) It has not flash over when the oscillogram or peak voltage indicator shows a marked reduction in voltage.

or

(b) Any one of the subsequent three dry power frequency voltage flashover value is less than 80% of the value specified.

Failure of any one unit either in the steep wave front or subsequent low frequency voltage test shall cause for testing on double number

of units.

2.2 **Hydraulic Internal Pressure Test on Shells (only for Disc Insulator)**

The test shall be carried out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the Supplier and Employer in Quality Assurance Programme.

2.3 **Thermal Mechanical Performance Test**

Thermal Mechanical Performance Test shall be performed in accordance with IEC-60383-1 Clause 20 with the following modifications:

(1) The applied mechanical load during this test shall be 70% of the rated electromechanical or mechanical value

(2) The acceptance criteria shall be

(a) X greater than or equal

to R + 3S. Where

X = Mean value of the individual mechanical failing load.

R = Rated electro-mechanical / mechanical failing load.

S = Standard deviation.

(b) The minimum sample size shall be taken as 20 for disc insulator units.

(c) The individual electromechanical failing load shall be at least equal to the rated value. Also puncture shall not occur before the ultimate fracture.

2.4 **Electromechanical/Mechanical Failing Load Test**

This test shall be performed in accordance with clause 18 and 19 of IEC 383 with the following acceptance

(i) X greater than or equal

to R + 3S Where

X = Mean value of the electro-mechanical/mechanical/ failing load.

R = Rated electro-mechanical / mechanical failing load.

S = Standard deviation.

(ii) The minimum sample size shall be taken as 20 for disc insulators units. However, for larger lot size, IEC 591 shall be applicable.

(iii) The individual electro-mechanical/mechanical failing load shall be at least equal to the rated value. Also electrical puncture shall not occur before the ultimate fracture.

2.5 **Residual Strength Test (For Disc Insulators only)**

The above test shall be performed as per clause 4.4 and 4.5 of IEC 797 preceded by the temperature cycle test, on both glass and porcelain disc insulators. The Sample size shall be 25 and the evaluation of the results and acceptance criteria shall be as per clause No. 4.6 of IEC: 797.

2.6 **IR Measurements**

IR measurement shall be carried out by the instrument operating at ±5/10 kV DC. IR value when measured under fair weather condition, shall not be less than 2000 M-ohm.

2.8 **Impact Test**

The Impact Test shall be carried out in accordance with ANSI-C-29.2 Clause 8.2.8 with the following modification.

The breaking point of the pendulum shall be so adjusted that, when released the copper nose will strike the outer rim of the shell or the most protruded rim of the shell squarely in a direction parallel to the axis of the unit and towards the cap.

The test specimen shall receive an impact of 7 N-m for 120 kN Disc & 10N-m for 160 kN Disc by releasing the pendulum.

3. **Tests on All components (As applicable)**

3.1 **Chemical Analysis of Zinc used for Galvanizing**

Samples taken from the zinc ingot shall be chemically analysed as per IS: 209-1979. The purity of zinc shall not be less than 99.95%.

3.2 Test for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognised procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Employer in Quality Assurance Programme.

3.3 Test on Castings

The chemical analysis, mechanical and metallographic tests and magnetic, particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier andEmployer in Quality Assurance Programme.

3.4 Autoclave Test

For cement used in the assembly of the insulators six samples from different batches shall be tested in accordance with ASTM C-151. The cement shall have an expansion less than 0.12%.

Annexure-B

1.0 **Standard Technical Particulars for insulator & insulator strings for transmission lines.**

1.1 **Typical Standard Technical Particulars for Standard Disc Insulators**

Sl.	Description	Unit	Standard Technical Particular value			
			70 KN Disc Insulator	90 KN Disc Insulator	120 KN Disc Insulator	160 KN Disc Insulator
1.0	**General**					
a)	Size and Designation of pin ball shank	mm	16 as per IS 2468/ IEC 120	16 as per IS 2468/ IEC 120	20 as per IS 2468/ IEC 120	20 as per IS 2468/ IEC 120
2.0	**Dimensions**					
a)	Diameter of disc	mm	255	255	280	280
b)	Tolerance on Diameter	± mm	11	11	11/13	13
c)	Ball to ball spacing between Disc	mm	145	145	145	170
d)	Tolerance on spacing	± mm			4.0	5.0
e)	Minimum nominal creepage distance of single disc	mm	440	440	590	590
3.0	**Materials**					
a)	Colour of glaze of finished porcelain insulator		Brown	Brown	Brown	Brown
4.0	Electromechanical Strength of disc	kN	70	90	120	160
5.0	**Minimum electrical values**					
a)	Power frequency flashover voltage of (dry)	kV(rms)	85	85	90	95
b)	Power frequency flashover voltage of (Wet)	kV(rms)	50	50	55	55
c)	Impulse flashover test voltage 1.2 x 50 μs positive (Dry)	kV (peak)	135	135	140	145
d)	Impulse flashover test voltage 1.2 x 50 μs negative (Dry)	kVpeak)	130	130	135	140

e)	Power frequency withstand voltage of (dry)	kV(rms)	80	80	85	90
f)	Power frequency withstand voltage of (Wet)	kV(rms)	45	45	50	50
g)	Impulse withstand test voltage 1.2 x 50 μs positive (Dry)	kV(peak)	125	125	130	135
h)	Impulse withstand test voltage 1.2 x 50 μs negative (Dry)	kV(peak)	125	125	130	135

Sl.	**Description**	**Unit**	**Standard Technical Particular value**	
			120 KN Disc Insulator	**160 KN Disc Insulator**
i)	Steepness of impulse voltage (steep wave front test)	kV/us	2500.0	2500.0
6.0	Power frequency puncture voltage	kV(rms)	120.0	125.0
7.0.	Minimum Visible discharge voltage of single disc (dry)	kV(rms)	18.0	18.0
8.0	Maximum RIV at 1 MHZ and 10kV AC (rms) voltage of single disc	Micro-volts	50.0	50.0
9.0	Eccentricity of disc			
a)	Max. radial run out (% of dia)	%	3	3
b)	Max. axial run out (% of dia)	%	4	4
10.0	**Galvanising**			
a)	Minimum thickness of zinc coating	micron	100	100
b)	Minimum no. of one minute dips in the standard preece test	Nos.	6 dips	6 dips
c)	Minimum purity of zinc used for galvanizing	%	99.95	99.95

*** All these values shall be considered with the altitude correction factor, if applicable.**

1.2 **Typical Standard Technical Particulars of insulator strings with Standard Insulators, along with hardware fittings for transmission lines.**

			Standard Technical Particular value

Sl. No.	Description	Unit	Single Suspension Pilot string	Single Tension string	Double Tension string	Triple Tension string
1.0	Power frequency withstand volt-age of string with arcing horns, corona control rings/grading rings under wet condition	kV (rms)	680	680	680	680
2.0 a)	Switching withstand voltage (dry) Positive	kV(Peak)	1050	1050	1050	1050
b)	Negative	kV(peak)	1050	1050	1050	1050
3.0 a)	Impulse withstand voltage (dry) Positive	kV (Peak)	1550	1550	1550	1550
b)	Negative	kV (Peak)	1550	1550	1550	1550
4.0 a)	Impulse flashover voltage (dry) Positive	kV (Peak)	1615	1615	1615	1615
b)	Negative	kV (Peak)	1615	1615	1615	1615
5.0	Minimum corona extinction voltage under dry condition	kV (rms)	320	320	320	320
6.0	RIV at 1 MHZ when string is energised at 305 kV (rms) under dry condition	Micro volts	1000 (max.)	1000 (max.)	1000 (max.)	1000 (max.)
7.0	Mechanical strength of complete insulator string along with hardware fittings	kN	120	120	2 x 160	3 x 160
8.0	Maximum voltage distribution across any disc of line to earth voltage (applicable for string with disc insulators only)	%	9	10	10	10

CHAPTER 11

ERECTION, TESTING & COMMISSIONING WORKS

1.0 Tower Erection and Installation of Line Material

1.1 General

The details of the scope of erection work shall include the cost of labor, all tools and plants like tension stringing equipment and all other incidental expenses in connection with erection work.

The Contractor shall be responsible for transportation of all the materials to be provided by the Contractor as per the scope of work to the site, proper storage and preservation at his own cost till such time the erected line is taken over by the Employer. Similarly, the Contractor shall be responsible for proper storage, safe custody, loss or damage of all Employer-supplied items for incorporation in the works and shall maintain and render proper account for all such materials at all times. The Contractor shall reimburse the cost of any of the materials lost or damaged during storage and erection at prevailing market cost plus 15% extra to the Employer.

The contractor shall set up the required number of stores along the line, and the exact location of such stores shall be discussed and agreed to between the Contractor and the Employer.

1.2 Treatment of Joints

Before starting assembly, the surface at joints shall be cleaned and, if required, applied with a coat of zinc-rich paint.

1.3 Assembly

1.3.1 Assembly of Towers

Towers shall be erected by a member-by-member method on the foundations, not earlier than 14 days after concreting and after such time that the concrete has acquired its full strength. The towers shall be erected in workman like manner and its members shall not be strained or bent during the course of erection. Care shall be taken to see that the jointing surfaces are clean and free from dirt or grit. The tower erection shall be done in strict accordance with the approved drawings. After initial erection all tower bolts shall be checked to ascertain that all nuts are fully tight. The Contractor shall adopt suitable means to ensure that none of the nuts have been left out. The bolt threads shall be punched to avoid the nuts becoming loose.

Punching of bolts shall be made by chamfering the threads with a centre punch in at least three places equally spaced on the contact surface of bolts and nuts. The Contractor shall be entirely responsible for the correct erection of all towers as per the approved drawings and their correct setting on an alignment approved by the Employer. If the stubs or superstructures after the erection are found to differ from approved drawing or to be out

of alignment, the Contractor shall dismantle and re-erect them correctly at his own cost without extension of time. The towers must be truly vertical after erection, and no straining will be permitted to bring them alignment. The tolerance allowed for verticality will be 1 in 360 of tower height.

While erecting the towers the following points shall be taken care of.

a) Straining of the members shall not be permitted for bringing them into the position. However, if it is necessary to match hole positions at joints, tummy bars not more than 450 mm long may be used.
b) Before starting erection of an upper section, the lower section shall be completely braced and all bolts provided in accordance with approved drawings.
c) All plan diagonals relevant to a section of the tower shall be placed in position before the assembly of the upper section is taken up.

1.4 Tightening and Punching of Bolts and Nuts

All nuts shall be tightened properly using the correct size spanners. Before tightening, it will be seen that filler washers and plates are placed in relevant gaps between members and bolts of proper size and length are used with flat washers. The tightening shall progressively be carried out from the top downwards; care being taken that all bolts at every level are tightened simultaneously.

The threads of bolts projecting outside the nuts shall be punched at three positions on the diameters to ensure that the nuts are not loosened in the course of time. If, during tightening, a nut is found to be slipping or running over the bolt threads, the bolt together with the nut shall be replaced.

1.5 Replacement

If any replacements are to be affected after stringing and tensioning or during maintenance, leg members and main bracings shall not be taken out without reducing the tension on the tower with proper guying or releasing the conductor. If the replacement of cross-arms becomes necessary after stringing, the conductor shall be suitably tied to the tower at tension points or transferred to suitable roller pulleys at suspension points.

2.0 Miscellaneous Fittings

2.1 Tower Earthing

Steel supports need not be fitted with a separate earth bond and earthing continuity and will therefore depend upon the surface contact of bolted members and the contact between OPGW fittings and the structure steel. At suspension and tension towers, OPGWs shall be made electrically continuous by jumpers or other approved means and shall be bonded to the tower steelwork and to any concrete foundation reinforcing steel.

Each tower shall be earthed. The tower footing resistance shall not exceed 10 ohms. The Contractor shall measure the tower footing resistance (TFR) of each tower during dry weather after it has been erected and before the stringing of the earth wire. Pipe-type

earthing and counter-poise-type earthing shall be done as required in accordance with the following standards:

IS: 3043 Code of Practice for Earthing.

IS: 5613 Code of practice for Design, Installation and maintenance (Part-II/Section-2) of overhead power lines.

The drawings for pipe & counterpoise-type earthing are enclosed with these specifications.

Pipe-type earthing shall be provided on one of the legs of the tower, if required as per the recommendation of the Employer.

For counterpoise-type earthing, the earthing will vary depending on soil resistivity. For soil resistivity less than 1500 ohms-meter, earthing shall be established by providing four lengths of 30m counterpoise wire. Otherwise, for soil resistivity greater than 1500 ohms meter earthing shall be established by providing four lengths of 70m counterpoise wire.

The provisional quantities for pipe-type earthing and counterpoise earthing are indicated in the SCHEDULE OF PRICE. The bidders are required to quote unit rates for the same in an appropriate schedule of SCHEDULE OF PRICE. The quoted price shall include fabrication, supply and installation of earthing material, including supply of coke, salt etc. In the case of counterpoise-type earthing, the unit rates shall correspond to 120 meters of counterpoise wire per tower.

3.0 Anti-Climbing Devices (Not applicable)

All towers shall be fitted with barbed wire type anti-climbing devices.

The anti-climbing devices shall be made with galvanized barbed wire of 8 SWG gauge and arranged on the tower at a suitable height in a suitable manner as approved by the Employer so as to have three circles of wire in the form of an umbrella on the outer side of the tower and a similar number on the inner side of the tower. The cost of supply and erection of the device shall be deemed to be included in the unit rate (unless provided as separate items in the Price Schedules) of the respective tower (or per tonne rate for SP and SSP type towers) and the rate shall further be deemed to include all costs of the umbrella of barbed wire put on the outer side and the inner side of the tower, including the M.S. angle supports with bolts and nuts to form the umbrella etc. along with all materials, labour and incidentals complete.

4.0 Climbing Step-bolts

Each tower shall be provided with step-bolts of an approved type on one corner leg at not more than 380 mm centres starting immediately above the anti-climbing device and continuing to the OPGWs
They shall conform to IS: 10238 – 1982.
Holes for removable step bolts below the anti-climbing guards shall be provided at not more than 380 mm centres on the legs to which the permanent step bolts are fitted.

5.0 Danger, Number, Phase and Circuit Plate

The Danger Plate shall be of mild steel 2 mm thick vitreous enameled at back and front, 250 mm x 200 mm rectangular shape and inscribed thereon shall be in single red the word "DANGER" with its Bhutanese translation and also with the inscription of bone and skull symbol and the voltage of the line, i.e. "66000 / 132000 / 220000 Volts". This shall conform to IS 2551 - 1963. There shall be two 16 mm x 40 mm fixing HRH, M.S. bolts with galvanized nuts and four nos. 2 mm thick lead washer on both ends of the plate. Matching holes shall be provided in the towers for the fixing of these plates

The Number Plate shall be of mild steel 2 mm thick vitreous enameled at back and front, 200 mm x 150 mm rectangular shape and inscribed thereon shall be the number of the tower location preceded by the letters corresponding to the short name of the line and the type of tower. There shall be two 16 mm x 40 mm fixing HRH, M.S. bolts with nuts and a 2 mm thick lead washer on both ends of the plate. The dimensions and details of the number plate shall be as per IS 5613: 1976. Matching holes shall be provided in the towers for the fixing of these plates.

The Phase Plates shall be of mild steel 16 gauge vitreous enameled at the back and front, circular in shape and diameter 75 mm. One set of phase plates shall consist of three plates coloured red, yellow and blue on the front to indicate the phase of the conductor.

There shall be one fixing HRH bolt on each plate of size 16 mm x 40 mm long with nut and 2 nos. 2mm thick lead washers. Matching holes shall be provided on the tower. The dimensions and details of the number plate shall be as per IS 5613: 1976.

Circuit Plates shall be provided and installed for the Double Circuit Towers.

6.0 Aviation Signal

Aviation requirements conforming to IS 5613 shall be in the scope of Contractor, wherever indicated in Schedule of Prices.

The river crossing towers and any other towers in the vicinity of the airport shall be painted and the crossing span shall be provided with markers to caution the low flying air-craft. The obstruction lights shall also be provided on towers.

The length of the towers above 45 m shall be painted over the galvanized surface in contrasting bands of orange or red and white as per aviation requirements and with the approval of the Employer. The band shall be horizontal. The width of the colour band shall be as per the relevant aviation regulation clause, prevalent at the time of execution of the project.

a) Surface Preparation

The etching of galvanized surface of erected tower members with suitable etching or wash primer is to be done as per IS 1477 to enhance the adhesion of subsequent

applied paint coating. After etching of the galvanized surface of the tower, one coat of zinc primer is to be applied.

b) Painting of Towers

Two coats of international orange or red and white paint at alternate intervals (bands) as explained above are to be applied. The painting of towers shall generally conform to relevant provisions of IS 1477 (Part- I& II). The paints to be used for painting shall be in accordance with IS 2074 with the latest amendments.

c) Line/span Markers

Sphere type span marker of 600 mm diameter shall be provided on the earthwire. The sphere shall be divided into two parts and one half shall be painted orange and one half in white. These markers shall be suspended from earthwire at intervals of approx. 200 meters. The design of the markers and their fixing arrangements should be such that they can withstand the wind pressure and shall not induce excessive amounts of vibrational strain on earthwire. Details of this arrangement shall be submitted by the Contractor along with Bid.

Night Markers (Obstruction lights)

The scope of night markers covers the design, manufacture, testing at manufacturers works, if any, supply, delivery, erection, testing and commissioning of medium intensity, low intensity, lights along with storage battery & solar panel, control panel, cables, clamps other accessories etc. as per the provision of IS-5613 (Part-II/section-I),1989, amendment no. 1, July'94 regarding night & day visual aids for denoting transmission line structures as per the requirement of the directorate of flight safety.

The detail of each component of medium intensity, low intensity lights & associated accessories to be provided on the towers shall be as per the technical specifications given in the preceding clauses and IS/ICAO, International Standards recommended practices.

One set of Aviation Lights shall consist of one medium intensity light along with all accessories such as solar panel, control panel, batteries, cables etc.

a) Medium Intensity Light

Medium Intensity light shall be provided on the top of each tower. The medium light should have night time intensity as per ICAO requirements in International Standards Recommended Practices. The light on top of the structure should flash at the rate of 20 sequences per minute. The effective intensity during nighttime for the medium flashing light shall be 1600 CD. The light shall conform to ICAO requirements/BS 3224a and shall have weather protection conforming to IP-55.

The above lights conforming to ICAO specifications flashing red lights shall be DC operated through a suitably sized battery bank at the operating voltage 12V/24V DC. The burning life of the lamps shall be maximum possible in view of the maintenance hazard of H.T. live but in no case, it should be less than 15,000 burning hours. In case of failure of the lamp before 15,000 burning hours, the same shall have to be replaced by the Contractor free of cost. The light shall be equipped with radio suppression facility conforming to BS800 in order to avoid any interference with signals of PLCC etc.

b) Low Intensity Lights

Two/four (as applicable) nos. of low intensity lights are required to be put on each of the towers. Placement drawing for the same shall be submitted by the bidder Contractor.

The light shall be a stationary lamp with minimum effective intensity of 10 CD. of red light. The lamps shall conform to the ICAO requirement/relevant BS and shall have weather protection of minimum IP-55 class.
Two/four nos. of L.I. lamps required for each tower shall be operated through a suitable size common battery bank solar panel as per the requirement of operating voltage and load current of the type of lamps being offered.

The burning life of the lamps shall be maximum possible in view of the maintenance hazard of H.T live line, but in no case, it should be less than 15,000 burning hours. In case of failure of the lamp before 15,000 hrs. the same shall have to be replaced by the Contractor free of cost even if the pendency of contract expires. Performance certificate of the lamps to be offered shall be furnished by the Contractor.

The low intensity lamp shall not generate any R.F. which can interfere with the PLCC signals.

c) Storage Battery

Storage Battery required for the above purpose shall be sealed maintenance free, valve regulated lead acid and suitable for mounting on the top of the transmission line towers. Contractors shall offer the most optimum capacity of the Battery Bank at 120-hour discharge rate (considering 80 % percentage usage) matching with the load requirement of the type of lamps being offered including any power loss in the associated cables. The battery sizing shall conform to JISC 8707/relevant Indian Standard or any other internationally recognized standard. The battery shall be hermetically sealed explosion proof and self-resealing type and free from orientation constraints. The working temperature ranges shall be minimum 0 degree centigrade and maximum 50 degree centigrade. Performance certificate of the offered batteries shall be submitted by the Contractor.

d) Battery Box

The battery box suitable for mounting on power transmission towers shall be robust constructed to accommodate the desired number of SOLAR BATTERIES WITH proper clearance between the batteries. The sides and the top of the battery box shall be made from MS sheets not less than 14 SWG thickness duly mounted on MS angle frame. The bottom of the battery box shall have suitably designed MS structure to freely hold the total weight of the batteries. The batteries should be placed on an insulated base with proper drainage holes. Lifting lugs shall be provided. Dust and vermin proof lockable doors shall be provided for safety and easy access to the batteries for the maintenance. The battery box should incorporate the design for a proper ventilation system in order to prevent a gas concentration inside the box. The ventilation opening shall be protected against rain/splash water and dust. The inside of the battery box shall be lined with insulating polyurethane plating and the exterior painted with weather proof polyurethane paint. The cable entry into the battery box shall be through suitable cable glands.

e) Solar Modules

The solar module required for the system shall be suitable for mounting on the transmission line towers and shall be designed for high performance, maximum reliability and minimum maintenance and shall be installed below bottom cross arms levels. The solar modules shall be IP 55 grade protection class. These should be highly resistant to water, abrasion, nail, impact and other environmental factors.

These should be placed on the tower at a most optimum angle so as to harness the maximum solar energy and facilitate self cleaning and shall conform to relevant Indian/International Standards.

Module mounting frames shall be weather proof suitable for mounting on tall towers. Details of mounting frames shall be furnished by the Contractor.

Junction box shall be provided with weather proof hinged lid with provision for cable glands entry and protections grade of class IP-55.

The Contractor shall submit the basis of selecting the numbers of solar modules.

The provision for design, supply & erection of mounting arrangements for photovoltaic modules on the transmission towers in a suitable manner to harness maximum solar energy shall be in the scope of the Contractor.
Provision for design, supply & erection of resting platform for the erection of battery bank in a closed enclosure with safety arrangement on the transmission towers shall also be in the scope of the Contractor the design and load consideration for safety of towers due to additional plate form shall be kept in view while designing, selecting the above.

f) Control Panels

Control panels shall consist of solar charge controller, flasher unit, sensor, isolator, MCB, Voltmeter, Ammeter and other control gears. Panel enclosure shall be fabricated out of 14 SWG CRCA sheets and thoroughly treated and painted. A suitable neoprene rubber gasket and pad locking device shall be provided and the protection class shall be of IP-55 class.

The Solar charge controller shall be the most efficient and preferably fully solid state. It shall be provided with protection to load against the increase in temperature. Surge, automatic low voltage and automatic disconnection and reconnection during high inrush current and normalcy respectively.

The flash regulator shall be provided for regulating light flashing. The same shall be completely solid state and provided with flash rate set points. Protection against overload currents shall also be provided.

Necessary sensor/timer shall be provided in the system to "switch on" the light automatically in the evening and poor visibility period and switch off the same during daytime and normal visibility period.

g) Cables, Cable Glands, Conduits and Accessories

The cable to be supplied and erected shall be of multi strands copper conductor, weatherproof, PVC insulated PVC sheathed, armoured 1.1 KV grade. The same shall conform to IS:1554.

All the cable accessories such as thimble, glands etc. shall be in the scope of supply and erection of the Contractor.

Supply and erection of all the PVC conduits and accessories shall be in the scope of the contract. All the conduit and accessories shall be as per the relevant ISS or ISI brand.

The inter-connection cable/conduit will be clamped in a secured manner with the tower members and any interconnection should be made only inside the environmentally protected junction box.

Employers will obtain clearance from the competent authority for erecting such towers, which require aviation signals. The Contractor shall provide any type of aviation signals as will be suggested by the Aviation Authority in addition to those, if any, suggested above.

7.0 Erection Equipment

The Contractor shall supply the following erection equipment as part of the Contract:

Hand-operated hydraulic compressors suitable for making all compression joints specified in Clause 2.4. Each compressor shall be complete with all dies. Repair and maintenance tools and spare parts, including oil seals, shall be included, together with an

operation, repair and maintenance manual. Each compressor and accessory shall be housed in a robust lockable case-

Portable earthing kits for 220 kV lines comprising 3 phase set of earth and line and clamps, 10-metre flexible leads and 2.5 m fibreglass operation pads.

- Comealong clamps for the conductor.
- Dead-end stocking for the conductor.
- Midspan stocking for the conductor.

The cost of supplying the above erection equipment shall be deemed included in the contract, and no separate payment will be applicable.

7.0 **Final checking, Testing & Commissioning**

After completion of the Works, final checking of the line shall be undertaken to ensure that all the foundation works, tower erection, stringing etc., have been done and clearance provided strictly according to the Specifications and as approved by the Employer.

Before testing and commissioning, the following points shall be checked:

- Sufficient backfilled earth is lying over each foundation pit, and it is adequately compacted.
- Concrete chimneys and other copings are in good and finally shaped conditions.
- All the tower members are correctly used and in accordance with the final approved drawings and are free from any defect or damage whatsoever.
- All bolts are properly tightened and punched/bolted.
- The stringing of conductors and OPGW has been done as per approved sag and tension calculations, and the required clearance is clearly available.

Tests shall be conducted at selected points along the routes as required by the Employer to check that the total and tentative sags of the conductor and OPGW are within specified tolerances. After satisfactory testing of the line and on approval by the Employer, the line shall be energized at full operating voltage.

CHAPTER 12

PRINCIPAL TECHNICAL PARAMETERS (PTPs)

This Chapter covers Principal Technical Parameters for towers, conductors, OPGW, insulators, hardware and complete accessories required for 66 kV, 132 kV and 220 kV transmission lines. However, the Bidders shall furnish all the Guaranteed Technical Particulars (GTPs) of all the equipment/materials offered by him as per the format provided in the relevant Schedule of this Specification for the specified bid. All the equipment/materials offered by the Bidder shall conform to the following Principal Technical Parameters:

1.0 System Particulars

Particulars	Nominal System Voltage(kV)		
	66	**132**	**220**
System Voltage (kV)	66	132	220
Highest System Voltage (kV)	72.5	145	245
Frequency (Hz)	50	50	50
Neutral	Effectively grounded	Effectively grounded	Effectively grounded
Basic Insulation level (BIL) kV (Peak)	325	550	1050
Power frequency withstand voltage (kV)	140	230	460
Short-circuit level (kA)	50	50	50

2.0 Transmission Towers

Design Spans

The design of the circuits shall provide for the following Basic Spans, Wind Spans and Weight Spans:

Basic Span

Nominal Voltage System(kV)	Basic Span(meters)
66	250
132	335
220	350

Wind Span and Weight Span for Non-Snow Towers

The design shall be based on the following tower types and Wind and Weight Span.

(a) 66 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
B	Small Angle (Strain)	0 - 15°	250	750	450	750	450
C	Medium Angle (Strain)	15 - 30°	250	750	450	750	450
D (*)	Heavy Angle (Strain)	30 - 60°	250	750	450	750	450
SP	Special (Strain)						

(b) 132 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
B	Small Angle (Strain)	0 - 15°	335	1000	600	1000	600
C	Medium Angle (Strain)	15 - 30°	335	1000	600	1000	600
D (*)	Heavy Angle (Strain)	30 - 60°	335	1000	600	1000	600
SP	Special (Strain)						

(c) 220 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
B	Small Angle (Strain)	0 - 15°	350	1000	600	1000	600
C	Medium Angle (Strain)	15 - 30°	350	1000	600	1000	600
D (*)	Heavy Angle (Strain)	30 - 60°	350	1000	600	1000	600
SP	Special (Strain)						

Wind Span and Weight Span for Snow Towers

The design shall be based on the following tower types and Wind and Weight Span.

(a) 66 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
SB	Small Angle (Strain)	0 - 15°	250	750	450	750	450
SC	Medium Angle (Strain)	15 - 30°	250	750	450	750	450
SD	Heavy Angle (Strain)	30 - 60°	250	750	450	750	450
SSP	Special (Strain)						

(b)132 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
SB	Small Angle (Strain)	0 - 15°	300	900	900	540	540
SC	Medium Angle (Strain)	15 - 30°	300	900	900	540	540
SD	Heavy Angle (Strain)	30 - 60°	300	900	900	540	540
SSP	Special (Strain)						

(c) 220 kV line

ID	Tower Type	Line Angle	Wind Span (metres)	Weight Span (metres)			
				+ve		-ve	
				NC	BWC	NC	BWC
SB	Small Angle (Strain)	0 - 15°	300	900	900	540	540
SC	Medium Angle (Strain)	15 - 30°	300	900	900	540	540
SD	Heavy Angle (Strain)	30 - 60°	300	900	900	540	540
SSP	Special (Strain)						

Shielding Angle (Degree) : 30 Degrees

Max. Tower Footing Resistance (Ohm)	:	10
Max. length of conductor for counterpoise earthing	:	30 m (approx. per leg)

3.0 ACSR CONDUCTOR

The Employer has standardized the use of conductors in various voltage levels. ACSR WOLF Conductor shall be used for 66kV voltage level, ACSR PANTHER Conductor shall be used for 132kV voltage level and ACSR ZEBRA Conductor shall be used for 220kV voltage level.

3.1 ACSR WOLF Conductor

1. Conductor Code Name	:	'Wolf' ACSR
2. IS applicable	:	IS-398 (part-II)-1996
3. Wire diameter		
Aluminium	:	30/ 2.59mm.
Steel	:	7/ 2.59 mm.
4. Requirement of Grease (Yes / No)	:	No

3.2 ACSR PANTHER Conductor

1. Conductor Code Name	:	'Panther' ACSR
2. IS applicable	:	IS-398 (part-II)-1996
3. Wire diameter		
Aluminium	:	30/3.00 mm.
Steel	:	7/3.00 mm.
4. Requirement of Grease (Yes / No)	:	No

3.3 ACSR DOG Conductor

1. Conductor Code Name	:	'DOG' ACSR
2. IS applicable	:	IS-398 (part-II)-1996
3. Wire diameter		
Aluminium	:	6/4.72 mm.
Steel	:	7/1.57 mm.
4. Requirement of Grease (Yes / No)	:	No

4.0 Optical Ground Wire (OPGW)

I. Mechanical Properties (As per tower design):

a) For 66 / 132 kV

Overall Diameter	:	<11.85mm
Weight	:	<0.426 kg/m
Breaking Load	:	>5600 kg
Short time current rating (1 sec)	:	≥ 6.32 kA
Modulus of Elasticity	:	12674 kg /sq.mm
Cross Sectional Area	:	74 sq.mm
Coefficient of Linear Expansion (/^{o}C)	:	14.3 x 10^{-6}

b) For 220 kV

Overall Diameter	:	<16.75mm
Weight	:	<0.595 kg/m
Breaking Load	:	>8005 kg
Short time current rating(1 sec)	:	≥ 16 kA
Modulus of Elasticity	:	8,588 kg /sq.mm
Cross Sectional Area	:	159 sq.mm
Coefficient of Linear Expansion	:	18.7 x 10^{-6}

II. Fibre Details

Type of fibre	:	Monomode
Number of cores	:	24 nos.
Number of tubes	:	3 Nos.
Wave band optimised	:	1310 nm
Mode field diameter	:	9.5 µmtr + 10%
Cladding diameter	:	125 µmtr + 2.4%
Non-Concentricity Core/cladding	:	< 1µmtr at 1300 nm
Non-circularity of cladding	:	< 2.5µmtr
Cut-off wavelength	:	1285 nm
Total dispersion	:	3.5 ps/nm-km
Attenuation at 1300 nm	:	< 1.0 dB/km
Attenuation at 1500 nm	:	< 0.5 dB/km
Moisture Proof	:	Required

4.1 OPGW Hardware

4.1.1 Suspension Clamps

i)	Type	Preformed Armour Grip Suspension Clamps
ii)	Material for Armour rods	Aluminium Alloy
iii)	Slip strength	Not less than 12 kN and not more than 17 kN
iv)	Minimum failing load	25 kN
v)	Galvanization spring washers	Electrogalvanised
vi)	Other ferrous parts	Hot-dip galvanised

4.1.2 Dead End Assembly

i)	Type		Bolted type / helical preformed type
ii)	Material		
	a)	Body	Forged steel
	b)	Bolts & Nuts	Galvanised steel
iii)	Minimum slip strength		Not less than 0.95 times the OPGW rated tensile strength
iv)	Galvanisation		
	a)	Spring washers	Electrogalvanised
	b)	Other ferrous parts	Hot-dip galvanised

4.1.3 Grounding Wire for Clamps

i)	Material	All Aluminium/Aluminium Alloy Conductor
ii)	Wire diameter	Equivalent size of OPGW
iii)	Length	1500mm Long
iv)	Connecting lugs suitable for	One for 12mm dia bolt and other for 16mm dia bolt

4.1.4 Structural Attachment Clamp Assemblies

No. of Grooves	:	2 (One on either side of connecting bolts and suitable for locating OPGW on the inside of the tower).	

Galvanising

a)	Spring washers	:	Electrogalvanised
b)	Other ferrous parts	:	Hot dip Galvanised

4.1.5 Vibration Dampers

i)	Type		4R Stockbridge
ii)	Material		
	a)	Clamp	Aluminium alloy
	b)	Messenger cable	High strength Galvanised steel or stainless steel with a minimum strength not less than 135 kg/sq mm.
	c)	Weights	Hot dip galvanised mild steel/ Cast iron.
iii)	Galvanisation		
	Spring washers		Electrogalvanised as per IS:1573-1970
	Other ferrous parts		Hot-dip galvanised
	Castings		As per BS:729-1961
	Wires		As per IS:4826-1968
	Bolts & Nuts		As per IS:5358-1969
iv)	Maximum permissible dynamic strain on the groundwire with the damper.		+/-150 micro strains
v)	Minimum no. of cycles for fatigue performance		Ten Million
vi)	Amplitude for fatigue test frequency in Hz		25/f, where f is the highest resonant

4.1.6 Shield Wire Joint Boxes

1. Sturdy, all-weather-proof units

2. Complete all necessary hardware to retain, terminate, protect and splice the fibers.

3. Suitable clamps for fixing the tower without drilling holes in the tower structure.

5.0 Long Rod Polymer Insulators

Sl. No.	Description	Unit	Requirement
1	Insulator type		Long rod polymer insulator
2	Size & designation of ball & socket assembly	mm	16
3	Core diameter	mm	18 ±0.5
4	Nominal length (Section length)	mm	870 ±28
5	Dry Arcing distance	mm	738
6	Shed Profile		Aerodynamic
7	Shed profile (Regular or alternating)		Alternate
8	Shed diameter – Big/small	mm	140/110, tolerance as per IEC
9	Minimum creepage distance	mm	2248, No negative tolerance
10	Guaranteed mechanical strength	kN	90
11	Routine mechanical load	kN	45
12	Rated system Voltage	kV	66
13	Highest system voltage	kV	72.50
14	Rated frequency	Hz	50
15	**Insulator material:**		
	a. FRP Rod		ECR Grade Boron Free
	b. Shed with % contents of silicone		30%
	c. Housing		Silicone Rubber
	d. End Fittings - Ball	Ball	Gr. EN8 D-Forged
	e. End Fittings - Socket	Socket	SG Iron - Cast
	f. Grading Rings		-
16	Minimum thickness of sheath covering over the core	mm	3
17	Power frequency withstand voltage (Wet/Dry)	kV_{rms}	140/160
18	Impulse withstand voltage (Dry)		
	a. Positive	$kV_{(peak)}$	350
	b. Negative	$kV_{(peak)}$	350
19	Galvanizing – Minimum mass of zinc coating	gms/sq.mt	620
20	Packing		Corrugate tube

21	Applicable standard for manufacturing and testing		As per IEC 61109

5.1 Standard Disc Insulator

Differential insulation will be employed and insulator strings assemblies of all types such as Single and Double String Tension and Single Pilot Suspension assemblies shall consist of the following number of insulator discs:

Nominal System Voltage(kV)	**Single Suspension/ Pilot String**	**Double Suspension String**	**Single Tension String**	**Double Tension String**
66	1 x 7	2 x 7	1 x 7	2 x 7
132	1 x 9	2 x 9	1x 10	2 X 10
220	1 x 16	2 x 16	1 x 16	2 x 16

Insulator units shall comply with the following minimum requirements:

	Value		
Parameters	**66 kV**	**132 kV**	**220 kV**
Disc diameter(mm)	280	280	280
Unit spacing(mm)	145	145	145
Creepage distance(mm)	440	440	440
Minimum Mechanical Failing Load(kN)	70	90	120

Physical Characteristics

a)	Type	Ball and Socket
b)	Colour (Porcelain insulator)	Brown
c)	Surface	Glazed
d)	Locking device	R type security clip

Chapter 17

Technical Specifications of Bird Diverters

1. Scope and System Overview

The project entails the design, manufacture, supply, and installation of **spiral (helical) bird diverters** specifically for use on **Optical Ground Wire (OPGW)**. The installation environment is characterized by challenging mountainous terrain, prone to snow, high winds, and frequent fog. The contractor is responsible for the entire lifecycle of the project, including transportation, testing, and final commissioning.

2. Technical and Material Specifications

To ensure durability and safety, the diverters must adhere to the following physical and material standards:

1. Design**:** The diverters must be performed spiral types that are self-retaining and clamp-free, with no moving parts **(**Dynamic, flapper, or rotating type diverters shall not be accepted).
2. Material: They must be constructed from UV-stabilized HDPE or Polypropylene. The material must be non-metallic, non-corrosive, and resistant to ozone, moisture, and ice.
3. Dimensions: Each unit should have a length between 1.2 and 1.5 meters, an outer diameter of 300 to 400 mm, and a weight not exceeding 1.2 kg.
4. Electrical Compatibility: The units must be non-conductive to ensure no interference with the OPGW and to prevent issues like corona or Radio Interference Voltage (RIV).

3. Performance and Visibility Standards

The diverters are engineered for high-visibility and extreme weather resilience:

1. Visibility: To protect avian life, the diverters must use alternating orange and white colors with UV-reflective pigmentation and integrated photoluminescent properties for visibility in low light, fog, and snow.
2. Weather Resistance: They must function within a temperature range of -15°C to +40°C and withstand wind speeds of at least 160 km/h without slipping.
3. Longevity: The color must be UV-stabilized for 35 years, matching the overall 35-year service life guarantee required for the product.

4. Installation and Spacing Requirements

Installation is strictly manual and must be performed without special tools to prevent damage to the OPGW strands. The spacing of the diverters is determined by the risk level of the terrain:

1. Standard Spans: 10-meter spacing.
2. Critical Zones: 5-meter spacing is required in high-risk areas such as valleys, river crossings, and fog-prone zones or as directed by the Engineer.
3. Arrangement: Diverters shall be installed continuously along the OPGW with alternating orientations.

5. Testing and Quality Assurance

Before acceptance, the diverters must undergo rigorous testing, including UV aging, impact resistance, and low-temperature performance. Reasons for rejection during the 12-month defect liability period include poor fit, color fading, or any damage caused to the OPGW

ANNEX B

LIST OF STANDARDS & CODES RELATED TO TRANSMISSION LINE

The list of Standards and Codes given below (or latest version) shall be applicable for materials, process of manufacture, design, testing and erection of power transmission line, unless otherwise mentioned in the Specifications.

1.0 TOWER & TOWER ACCESSORIES

Sl.#	IS Standards	Title
1	IS 2-1960	Rules for rounding off numerical values
2	IS 209-1979	Specification for Zinc
3	IS 278-1978	Specification for Galvanized steel barbed wire for fencing
4	IS 432-1982	Mild steel & Medium tensile steel bars & hard drawn steel wire for concrete Reinforcement
5	IS 456-1978	Code of practice for plain & Reinforced concrete
6	IS 802 (Part-1)	Code of practice for the use of structural steel in overhead transmission line Towers: Material, Loads and permissible stresses
	Section-1-1995	Materials & Loads
	Section-2-1992	Permissible stress
7	IS 802 (Part II) Latest Edition	Code of practice for the use of structural steel in overhead transmission lines: Fabrication, galvanizing, inspection and packing
8	IS 802-(Part-III) Latest Edition	Code of practice for the use of structural steel in overhead transmission line: Testing
9	IS 808-1976	Specification for hot rolled steel beams, channels & Angle sections
	Part-V Part-VI	Equal Leg angles Unequal Leg angles
10	IS 1200-1974	Method of measurement of Building and civil works
11	IS 1367-1967	Technical supply conditions for threaded fasteners
12	IS 1573-1986	Specification for Electroplated coatings for zinc on iron and steel
13	IS 1893-1975	Criteria for earthquake resistant design of structures
14	IS 2016-1967	Specification for Plain washers
15	IS 2062-1992	Specification for steel for general purpose
16	IS 2551-1982	Danger Notice plates
17	IS 2629-1966	Recommended practice for hot dip galvanizing of iron and steel
18	IS 2633-1972	Method of testing uniformity of coating on zinc coated articles
19	IS 3063-1972	Specification for Single coil rectangular section spring washers for bolts, nuts and screws
20	IS 3757-1985	High strength structural bolts
21	IS 4091-1979	Code of practice for design and construction of foundations for transmission line towers and poles
22	IS 4759-1984	Specification for Hot dip zinc coating on structural steel and other allied products
23	Is 5358-1969	Specification for Hot dip galvanized coating on fasteners
24	Is 5613-1985	Code of practice for design, installation and maintenance of

Sl.#	IS Standards	Title
	(Part-2/Sec-1)	overhead power Lines : Designs
25	IS 5613-1985 (Part-2/Sec-2)	Code of practice for design, installation and maintenance of overhead power Lines : Installation and maintenance
26	IS 6610-1972	Specification for Heavy washers for steel structures
27	IS 6639-1972	Specification for Hexagonal bolts for steel structures
28	IS 6745-1972	Specification for Methods for determination of weight of zinc coating of zinc coated iron and steel articles
29	IS 7215-1974	Specification for Tolerance for Fabrication of steel structures
30	IS 8500-1992	Specification for welded structural steel (Medium and High Strength Quantity)
31	IS 10238-1982	Step bolts for steel structures
32	IS 12427-1988	Transmission tower bolts
33		Indian Electricity Rules, 1956
34	Publication No.19/N/700/1963	Regulation for electrical crossings for Railway tracks.

2.0 ERECTION, TESTING & COMMISSIONING

Except where otherwise specified or implied, the erection, testin,g and commissioning shall conform to the provisions of IS: 5613 (part 2 / Section-2) -1985 (as amended up to date).

3.0 MATERIALS & PROCESSES USED IN EXECUTING THE WORK

Sl.#	IS Standards	Title
1	IS: 383-1970	Course and Fine Aggregates from Natural Sources for Concrete
2	IS:1200-(Part I)-1974	Method of Measurement of Building and Civil Engineering Works: Earthwork
3	IS:456-1978	Code of Practice for Plain and Reinforcement Concrete
4	IS:2502-1963	Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement
5	IS:3043-1966	Code of Practice for Earthing
6	IS:3764-1966	Safety Code for Excavation Work
7	IS:4081-1967	Safety Code for Blasting and Related Drilling Operation
8	IS:4091-1967	Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
9	IS:5613(Part2-1985)	Code of Practice for Design Installation and Maintenance of overhead power lines
10	IS: 269-1970	Specification for ordinary rapid hardening and low-heat Portland cement
11	IS: 383-1970	Specification for coarse and fine aggregate from natural sources for concrete

Except where otherwise specified or implied, the concrete shall conform to the provisions of IS:456-2000.

4.0 CONDUCTORS

Sl.#	IS Standards	Title	International Standards
1	IS:209-1979	Specification for Zinc	BS-3436-1961
2	IS:398-1996	Specification for aluminium conductors for Overhead Transmission purposes Part-II: Aluminium conductors galvanised steel reinforced	IEC-209-1966 BS-215 (Part-II) 1970
3	IS:1521-1972	Method of Tensile Testing of Steel Wire	ISO/R89-1959
4	IS:1778-1980	Reels and Drums for Bare Conductors	BS-1559-1949
5	IS:1841-1978	E.C.Grade Aluminium rod produced by rolling	
6	IS:2629-1966	Recommended practice for Hot Dip Galvanising of iron and steel	
7	IS:2633-1986	Method of testing uniformity of coating of zinc coated articles	
8	IS:4826-1968	Galvanised coatings on round steel wires	ASTM A472-729 BS-443-1969
9	IS:5484-1978	E.C.Grade Aluminium rod produced by continuous casting and rolling	
10	IS:6745-1972	Methods of determination of the weight of z coating	BS-443-1969
11	IS:8263-1976	Method of radio-interference tests on high voltage installations	IEC:437-1973 NEMA:107-1964

5.0 OPTICAL GROUND WIRE(OPGW)

Sl.#	Indian Standard	Title	International Standards
1		The International Telegraph and Telephone Consultative Committee (CCITT) Recommendations	G.652 D
2		International Electrotechnical vocabulary	IEC:50-1975
3		Optic Fibres Part 1: Generic specification	IEC: 793-1
4		Optic Fibre Cables Part-1: Generic specification	IEC: 794 – 1
5		Aluminium Alloy Redraw rods.	IEC: 104 – 1987
6		Aluminium-clad steel wires for electrical purposes	IEC: 1232-1993
7		Fibre Optic Test Procedure Series	EIA-RS-445 EIA-RS-455 (FOTP.S)

Sl.#	Indian Standard	Title	International Standards
8	IS: 2121	Specification for conductor and Earthwire Accessories for Overhead Power lines	
9		Standard construction of composite fibre optic Groundwire (OPGW) for use on electric utility power lines	IEEE P1138-1990
10	IS: 398	Standard conductor for overhead lines	IEC:1089 – 1993

6.0 INSULATOR & INSULATOR STRINGS & HARDWARE FITTINGS

Sl.#	IS Standards	Title	International Standards
1	IS 209-1966	Specification for Zinc	BS:3436-1986
2	IS 2071-1974	Method of high voltage testing, general definitions and test requirements: Part-I 1974 General Definitions and test requirements Part-II Test Procedure Part-III Measuring devices.	BS:137-1982 (I & II) IEC:274-1968 IEC:383-1993 (Parts I&II)
3	IS 731-1974	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V	IEC 383 -1993 (Part I&II)
4	IS:2121-1981	Specification for Conductors and earthwire accessories for overhead power lines Part-I : Armour Rods, Binding Wires and Tapes for Conductors Part-II: Mid-Span Joints and Repair Sleeves for Conductor	
5	IS:2486	Specification for Insulator Fittings for overhead power lines with a nominal voltage greater than 1000V Part-I:1971 General Requirements and Tests Part-II: 1974 Dimensional requirements Part-III: 1975 Locking Devices	IEC:120-1984 BS:3288-1979 IEC:372-1984
6	IS:2629-1985	Recommended practice for hot dip galvanising of iron and steel	
7	IS:2633-1986	Method for testing of uniformity of coating of zinc-coated articles	
8	IS:3138-1966	Hexagonal bolts and nuts	ISO/R947 ISO/R272
9	IS:3188-1980	Dimensions for disc insulators	IEC:305-1978

Sl.#	IS Standards	Title	International Standards
10	IS:4218-1976	ISO metric screw threads	ISO/R68-1969, R-26-1963,-1969, R965-1969
11	IS:6745-1972	Determination of weight of zinc coating on zinc-coated iron and steel articles	BS:433-1969 ISO:1460(E)
12	IS:8263-1976	Methods of RI test on HV insulators	IEC:437-1973 NEMA PUBLICATION NO.107/1964 CISPR
13	IS:8269-1976	Methods for switching impulse test on HV insulators	IEC:506-1975
14		Thermal mechanical performance test and mechanical performance test on string insulator units Sampling rules	IEC:575 IEC:591-1978
15	IS:6639-1972	Hexagonal bolts for steel structures	ISO/R272-1968
16		Ozone test on Elastomer	ASTM-D1171
17	IS:406	Methods of Chemical Analysis of Slab Zinc	

ANNEX D

TENTATIVE TOWER SCHEDULE

This is the tentative tower schedule based on the walk on survey data.

Sl.No.:	Tower Location	Span	Tower Type
		100	
1	AP-01	698.53	DD+9
2	AP-02	449.20	DC+9
3	AP-03	415.58	DD+9
4	AP-04	414.53	DDS+9
5	AP-05	545.68	DC+9
6	AP-06	468.71	DD+9
7	AP-07	267.42	DB+6
8	AP-08	510.33	DB+6
9	AP-09	229.90	DD+9
10	AP-10	129.87	DBS+9
11	AP-11	304.37	DB+3
12	AP-12	288.26	DB+6
13	AP-13	380.96	DB+6
14	AP-14	263.51	DB+9
15	AP-15	139.66	DBS+6
16	AP-16	196.62	DBS+6
17	AP-17	173.99	DBS+6
18	AP-18	190.07	DB+6
19	AP-19	141.03	DB+9
20	AP-20	324.97	DB+3
21	AP-21	83.27	DC+6
22	AP-22	382.48	DD+6
23	AP-23	382.86	DB+9
24	AP-24	236.05	DB+6
25	AP-25	121.64	DB+6
26	AP-26	338.79	DCS+9
27	AP-27	171.10	DBS+9
28	AP-28	201.11	DBS+6
29	AP-29	355.98	DC+9
30	AP-30	131.14	DC+6
31	AP-31	592.65	DD+9
32	AP-32	173.33	DC+9
33	AP-33	212.70	DBS+6
34	AP-34	171.05	DBS+3
35	AP-35	493.90	DB+9

36	AP-36	566.51	DC+9
37	AP-37	207.55	DDS+9
38	AP-38	157.39	DDS+9
39	AP-39	318.35	DDS+9
40	AP-40	173.95	DD+9
41	AP-41	319.85	DC+9
42	AP-42	91.55	DB+9
43	AP-43	215.87	DB+9
44	AP-44	533.66	DB+9
45	AP-45	508.02	DC+9
46	AP-46	420.45	DCS+9
47	AP-47	253.22	DB+9
48	AP-48	246.89	DCS+9
49	AP-49	484.11	DBS+9
50	AP-50	390.12	DC+9
51	AP-51	421.90	DD+9
52	AP-52	292.48	DB+9
53	AP-53	376.08	DD+9
54	AP-54	445.13	DDS+9
55	AP-55	160.56	DD+9
56	AP-56	194.05	DB+9
57	AP-57	100.00	DD+9
Total Length:		**17.559**	km

Summary:

Sl.No.:	Tower Type	Nos.
1	DB	28
2	DC	13
3	DD	16
TOTAL		**57**

ANNEX C

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS (GTPs)

The Bidder shall fill up the Schedules for Guaranteed Technical Particulars (GTPs) for all items under each Schedule. The GTPs should also be provided in the prescribed formats in SOFT COPY also.

1. GTP OF GALVANISED STEEL TOWERS(GENERAL)			Bidder	
			Item No.	
Name and country of tower fabricator			1	
			2 (if any)	
Location of tower fabricating plants			1	
			2 (if any)	
Location of tower test facility				
Description		Applicable Standard		Make and country of origins
		Structural steel	High strength structural steel	
MATERIAL	Rolled shapes			
	Plates			
	Connection bolts & nuts			
	Lock nuts			
	U-bolts or shackles			
	Step bolts & nuts			
	Ladders			
	Spring washers			
GALVANISING	TOWER	Standard		
		Weight of zinc coating g/m^2	Thickness 6 mm and below average…..minimum……	Thickness over 6 mm average…..minimum.
	BOLTS ,NUTS AND LOCK NUT	Standard		
		Weight of zinc coating g/m^2	average…..minimum……	average…..minimum.
		Method of coating for bolt	□ hot-dipped □ other (state)……	
		Method of coating for nuts and lock nuts	□ hot-dipped □ other (state)……	

	SPRING WASHERS	Retapping of nuts after galvanized	□ yes □ no	
		Standard		
		Method of coating	□ hot-dipped □ other (state)……	
		Weight of zinc coating g/m^2	Thickness≤4.76 mm	4.76mm≤thickness≤6.35mm
			average…..minimum……	average…..minimum.
D E SI G N	DESIGN METHOD	□ Three –dimensional indeterminate method : Computer program …….. Developed by ……. □ Other method : …….		

1. GTP OF GALVANISED STEEL TOWERS (TOWER WEIGHT) **2. Indicate 66, 132 or 220kV :** **3. Indicate Single or Double Circuit Towers**	Bidder Item No.

TOWER TYPE	WEIGHTS IN KILOGRAMS												
		BODY EXTENSION					SINGLE LEG EXTENSION						
	BASIC BODY	3m	6m	9m	12m	15m	1.5m	3.0m	4.5m	6.0m			
B													
C													
D													
SP													
SB													
SC													
SD													
SSP													

TOTAL ESTIMATED WEIGHT TO BE SUPPLIED FOR THIS PROJECT													
Complete tower = Basic Body + Body Extension (if required) + 4 Leg Extensions (if required)													
THIS SCHEDULE IS NOT APPLICABLE, WHERE THE TOWER DESIGN IS NOT IN BIDDER'S SCOPE.													

2.GTP OF OVERHEAD CONDUCTOR		Bidder	
		Item No.	
Make and Country of origin			
STRANDED WIRE	**Conductor Code Name**		
	Sectional area	Nominal mm^2	Calculated mm^2
	Steel strand	Number	Diam.mm
	Minimum breaking strength	Kg	
	Outside diameter	Mm	
	Standard weight	kg/km	
	Modulus of elasticity	Initial kg/mm^2	Final Kg/mm^2
	Coefficient of linear expansion	per ^{o} C	
	Lay ration and directed of lay		
COMPONENT WIRE	Diameter and tolerance	Mm	
	Ultimate tensile strength, average	kg/mm^2	
	Elongation in 610 mm	%	
	Galvanizing weight of zinc coating		
DRUM DETAILS	Reel designation		
	Reel capacity	m^3	
	Flange diameter	Mm	
	Drum diameter	Mm	
	Reel width	Inside mm	Outside Mm
	Arbor hole diameter	Mm	
	Thickness of lagging wood	Mm	
	Steel hub thickness	Mm	
	Steel strab width and thickness	mm x mm	
	Number and size of flange fixing bolts		
	Kind of wood and preservation	Kind of wood	Preservation
	Length per reel and tolerance	M	
	Weight of each reel and tolerance	Net Kg	Gross Kg

3.GTP OF OPTICAL GROUNDWIRE(OPGW)		Bidder Item No.	
Make and Country of origin			
OPGW	Standard according to which cable is manufactured		
	Method of manufacturing		
	Standard weight	kg/km	
	Minimum bending radius		
	No. of strands and diameter of individual strands		
	Conductor's Ultimate tensile stress	kg/mm^2	
	Conductor's Maximum tensile stress	kg/mm^2	
	Conductor's Everyday tensile stress at 32 °C	kg/mm^2	
	Maximum short time current rating	(kA for 1sec)	
	Ambient temperature rang		
	Fibre loss	(dB/km)	
	Splice loss	(dB)	
	Repair splice loss	(dB)	
	Cable attenuation end to end - 34.6 km	 (dB)	
	Maximum fibre attenuation per km. at 1300 nm for temperature range 0°C to 60°C		
	Theoretical System loss for 1300 nm	(dB)	
	Optical fibre material		
	Cladding material		
	Diameter of fibre core	(mm)	
	Mode field diameter	(mm)	
	Coating material		
	Maximum dispersion per km.	(ps/nm/km)	
	Maximum numerical aperture at 1300 nm Bandwidth of optical fibre		
	Details of buffer fitting compound		
	Details of Tensile Strength Reinforcing		
	Core identification scheme and length marking		
DRUM DETAILS	Reel designation		
	Reel capacity	m^3	
	Flange diameter	Mm	
	Drum diameter	Mm	
	Reel width	Inside mm	Outside Mm
	Arbor hole diameter	Mm	
	Thickness of lagging wood	Mm	
	Steel hub thickness	Mm	

	Steel strab width and thickness	mm x mm	
	Number and size of flange fixing bolts		
	Kind of wood and reservation	Kind of wood	Preservation
	Length per reel and tolerance	M	
	Weight of each reel and tolerance	Net Kg	Gross Kg

	Bidder

4. **GTP OF INSULTATOR DISC**				Item No.	
Make and country of origin					
Type of insulator Porcelain Glass Ball and socket				ANSI class	ANSI class
Ref. Drawing No. and/or Catalog No.					
Disc outside diameter and tolerance			mm		
Unit spacing			mm		
Surface area of insulator		Top	cm^2		
		Bottom	cm^2		
Coupling type					
Leakage distance			mm		
Projected area			cm^2		
Combined mechanical and electrical strength			min.kg		
Mechanical impact strength			min m kg		
Tension proof test load			min.kg		
Time load			min.kg		
Low-frequency flashover voltage		Dry	kV		
		Wet	kV		
Critical impulse voltage		Positive	kV		
		Negative	kV		
Low-frequency puncture voltage			kV		
Low-frequency test voltage, rms to ground			kV		
Maximum RIV at 1,000 kHz			kV		
Steep front wave impulse		Positive	min.kV/ps		
		Negative	min.kV/ps		
Unit weight of disc			kg		
MATERIAL	Insulator shell				
	Cap and pin				
	Cotter key				
	Cement				
Galvanising weight of coating		Cap	$min.g/m^2$		
		Pin	$min.g/m^2$		
Glaze or insulator shell colour					
QUALITY CONFORMANCE	Combined mechanical and electrical test	X_L	kg		
		S	kg		
		X_L	kV		

VAL UES	Puncture test	X kV		
		R kV		

5. **GTP OF INSULATOR STRINGS**		Bidder
		Item No.
S U	Make and country of origin	

SPENSION INSULTAION STRING	Type of insulator strings			Single	By-pass	Double	V
	Ref. Drawing No. and/or Catalog No.						
	Working voltage		kV				
	Number of discs per string						
	Low-frequency flashover voltage	Dry	kV				
		Wet	kV				
	Critical impulse voltage (Positive wave)		kV				
	Arcing horn gap		mm				
	Breaking strength of complete set		kg				
	Weight of insulator set		kg				
TENSION INSULATOR STRINGS	Make And country of origin						
	Type of insulator strings			Single	By-pass	Double	V
	Ref. Drawing No. and/or Catalog No.						
	Working voltage		kV				
	Number of discs per string						
	Low-frequency flashover voltage	Dry	kV				
		Wet	kV				
	Critical impulse voltage (Positive wave)		kV				
	Arcing horn gap		mm				
	Breaking strength of complete set		kg				
	Weight of insulator set		kg				
COUN	EQUIP	Make and country of origin					

TERWEIGHT	MENT	Type of counter weight	
		Ref. Drawing No. and/or Catalog No.	
		Overall height cm	
	COUNTERWEIGHT	Make and country of origin	
		Ref. Drawing No. and/or Catalog No.	
		Material	Galv. Concrete
			Cast Iron
		Diameter and thickness mmxmm	
		Weight per piece kg	

6.GTP OF VIBRATION DAMPER		Bidder	
		Item No.	Item No.
		Conductor	Earthwire (OPGW)
Maker and country of origin			
Ref. Drawing No. and/or Catalog No.			
Type of vibration damper			
Conductor diameter	mm		
Total weight of each damper	kg		
Diameter of weights	mm		

Length of weights		mm		
Weight of weights		kg		
Tolerance in weights		%		
Slip strength of steel messenger wire		kg		
Frequency response range of the damper		c/s		
Peak natural resonant frequency of the damper				
a)	upper	c/s		
b)	lower	c/s		
Free loop length		m		
at a)	wind velocity	m/s		
b)	tension in conductor	kg		
c)	temperature	^{o}C		
Maximum safe bending amplitude peak to peak				
a)	for the conductor	mil		
b)	for vibration damper clamp	mil		
Maximum bending				
	for the conductor with damper(s)	mil		

NUMBER AND LOCATION OF DAMPER(S)

1. **ACSR TWIN MOOSE Conductor(For 400kV lines)**

NUMBER AND LOCATION OF DAMPER(S) PER SPAN	
	Type of span

Span (m)	Suspension-Suspension		Suspension-Tension		Tension-Tension	
	No's	Location	No's	Location	No's	Location

2. **ACSR ZEBRA Conductor(For 220kV Lines)**

NUMBER AND LOCATION OF DAMPER(S) PER SPAN						
Span (m)	Type of span					
	Suspension-Suspension		Suspension-Tension		Tension-Tension	
	No's	Location	No's	Location	No's	Location

3. **ACSR PANTHER Equivalent Conductor (For 132kV lines)**

NUMBER AND LOCATION OF DAMPER(S) PER SPAN

Span (m)	Type of span					
	Suspension-Suspension		Suspension-Tension		Tension-Tension	
	No's	Location	No's	Location	No's	Location

4. **ACSR WOLF Conductor(For 66kV lines)**

NUMBER AND LOCATION OF DAMPER(S) PER SPAN						
Span (m)	Type of span					
	Suspension-Suspension		Suspension-Tension		Tension-Tension	
	No's	Location	No's	Location	No's	Location

5. **OPTICAL GROUNDWIRE (OPGW)**

NUMBER AND LOCATION OF DAMPER(S) PER SPAN						
Span (m)	Type of span					
	Suspension-Suspension		Suspension-Tension		Tension-Tension	
	No's	Location	No's	Location	No's	Location

Notes :

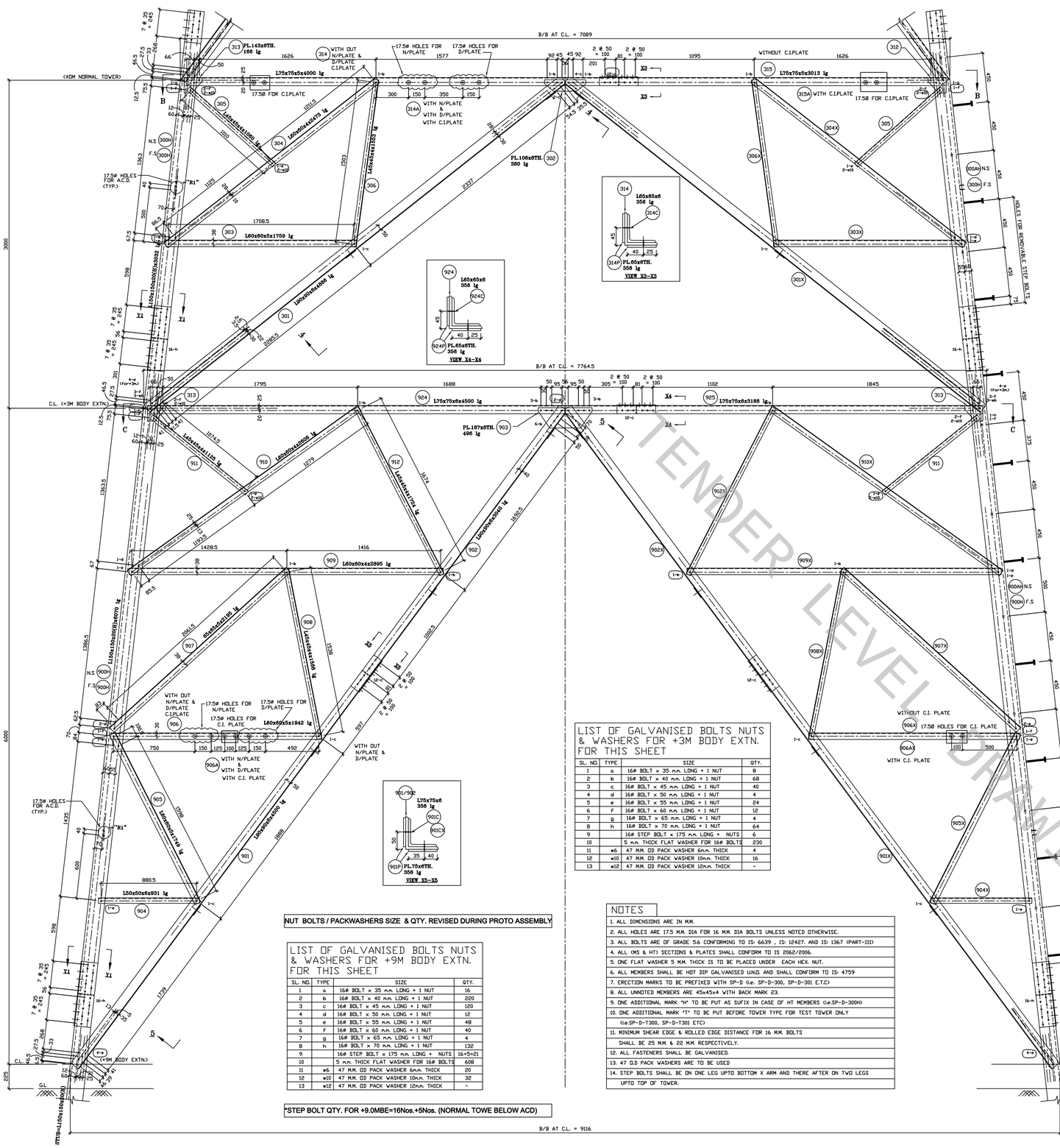
1. Location is to specify the suspension end or the tension end of the span in which the vibration damper is installed.
2. The number of vibration dampers to be installed meet the requirement in the Specifications.

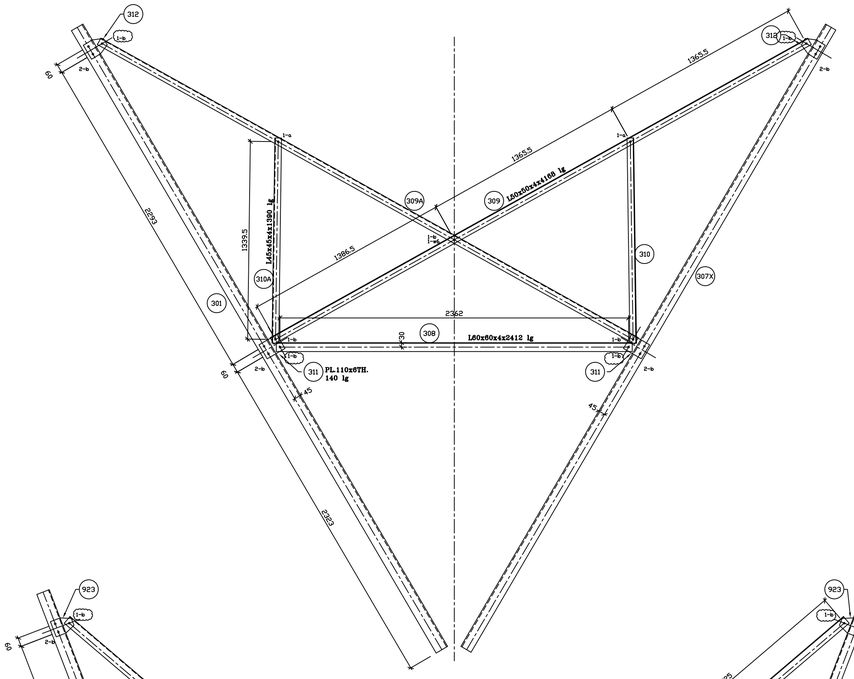
7.GTP OF EARTHING MATERIAL		Bidder
		Item No.
ST AN DA	Make and country of origin	

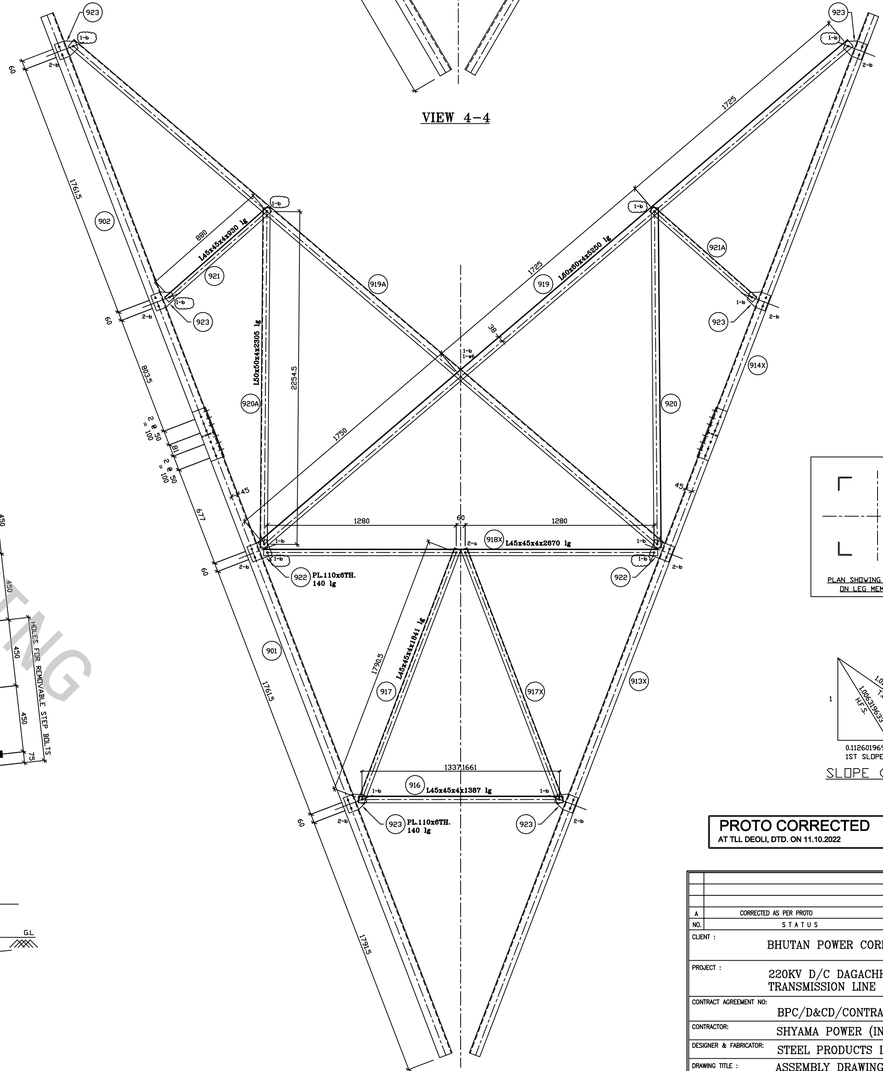
RD GR OU ND RO D	Nominal size and length	16mmx18m	19mmx18m	16mmx3.0m	19mmx3.0m
	Drawing No. and/or catalog No.				
	Material				
	Method of production	□ Molten-welded □ Electro-deposited		□ Molten-welded □ Electro-deposited	
	Thickness of coating and tolerance mm				
	Outside diameter and tolerance mm				
	Length and tolerance mm				
SE CTI ON AL GR OU ND RO D	Make and country of origin				
	Nominal size and length	16mmx18m	19mmx18m	16mmx3.0m	19mmx3.0m
	Drawing No. and/or catalog No.				
	Material				

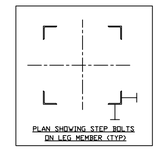
	Method of production		□ Molten-welded □ Electro-deposited		□ Molten-welded □ Electro-deposited	
	Thickness of coating and tolerance mm					
	Outside diameter and tolerance mm					
	Length and tolerance mm					
	Drawing No. and/or Catalog No.of coupling					
	Weight per piece					
GROUND ROD CLAMP	Make And country of origin					
	Drawing No. and/or Catalog No.					
	Type of clamp					
	Material	Clamp				
		U-bolt and nut				
GROUND CONNECTOR	Make And country of origin					
	Drawing No. and/or Catalog No.					
	Type of connector					
	Material	Connector body				
		Bolt and nut				
GROUND CONNECTRING AND COUNTERPOISE	STRANDED WIRE	Make and country of origin				
		Nominal size and stranding				
		Material				
		Conductivity %IACS				
		Length per reel and tolerance m				
		Weight per reel and tolerance kg				
	SOLID WIRE	Make and country of origin				
		Nominal size and stranding				
		Material				
		Conductivity %IACS				
		Length per reel and tolerance m				
		Weight per reel and tolerance kg				

GROUND ROD DRIVING EQUIPMENT	Make and country of origin	
	Drawing No. and/or Catalog No.	











SLOPE (BOTTOM)

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +9M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	16
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	220
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	120
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	12
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	48
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	40
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	132
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	16+5=21
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	608
11	w6	47 M.M. OD PACK WASHER 6m.m. THICK	20
12	w10	47 M.M. OD PACK WASHER 10m.m. THICK	32
13	w12	47 M.M. OD PACK WASHER 12m.m. THICK	-

*STEP BOLT QTY. FOR +9.0MBE=16Nos.+5Nos. (NORMAL TOWE BELOW ACD)

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +3M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	8
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	68
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	40
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	4
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	24
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	12
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	64
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	6
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	230
11	w6	47 M.M. OD PACK WASHER 6m.m. THICK	4
12	w10	47 M.M. OD PACK WASHER 10m.m. THICK	16
13	w12	47 M.M. OD PACK WASHER 12m.m. THICK	-

NOTES

1. ALL DIMENSIONS ARE IN M.M.
2. ALL HOLES ARE 17.5 M.M. DIA FOR 16 M.M. DIA BOLTS UNLESS NOTED OTHERWISE.
3. ALL BOLTS ARE OF GRADE 5.6 CONFORMING TO IS: 6639 , IS: 12427, AND IS: 1367 (PART-III)
4. ALL (MS & HT) SECTIONS & PLATES SHALL CONFORM TO IS 2062/2006.
5. ONE FLAT WASHER 5 M.M. THICK IS TO BE PLACED UNDER EACH HEX. NUT.
6. ALL MEMBERS SHALL BE HOT DIP GALVANISED U.N.O. AND SHALL CONFORM TO IS: 4759
7. ERECTION MARKS TO BE PREFIXED WITH SP-D (i.e. SP-D-300, SP-D-301 E.T.C)
8. ALL UNNOTED MEMBERS ARE 45x45x4 WITH BACK MARK 23.
9. ONE ADDITIONAL MARK 'H' TO BE PUT AS SUFIX IN CASE OF HT MEMBERS (i.e.SP-D-300H)
10. ONE ADDITIONAL MARK 'T' TO BE PUT BEFORE TOWER TYPE FOR TEST TOWER ONLY (i.e.SP-D-T300, SP-D-T301 ETC)
11. MINIMUM SHEAR EDGE & ROLLED EDGE DISTANCE FOR 16 M.M. BOLTS SHALL BE 25 M.M. & 22 M.M. RESPECTIVELY.
12. ALL FASTENERS SHALL BE GALVANISED.
13. 47 O.D PACK WASHERS ARE TO BE USED
14. STEP BOLTS SHALL BE ON ONE LEG UPTO BOTTOM X ARM AND THERE AFTER ON TWO LEGS UPTO TOP OF TOWER.

TRANSVERSE FACE

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

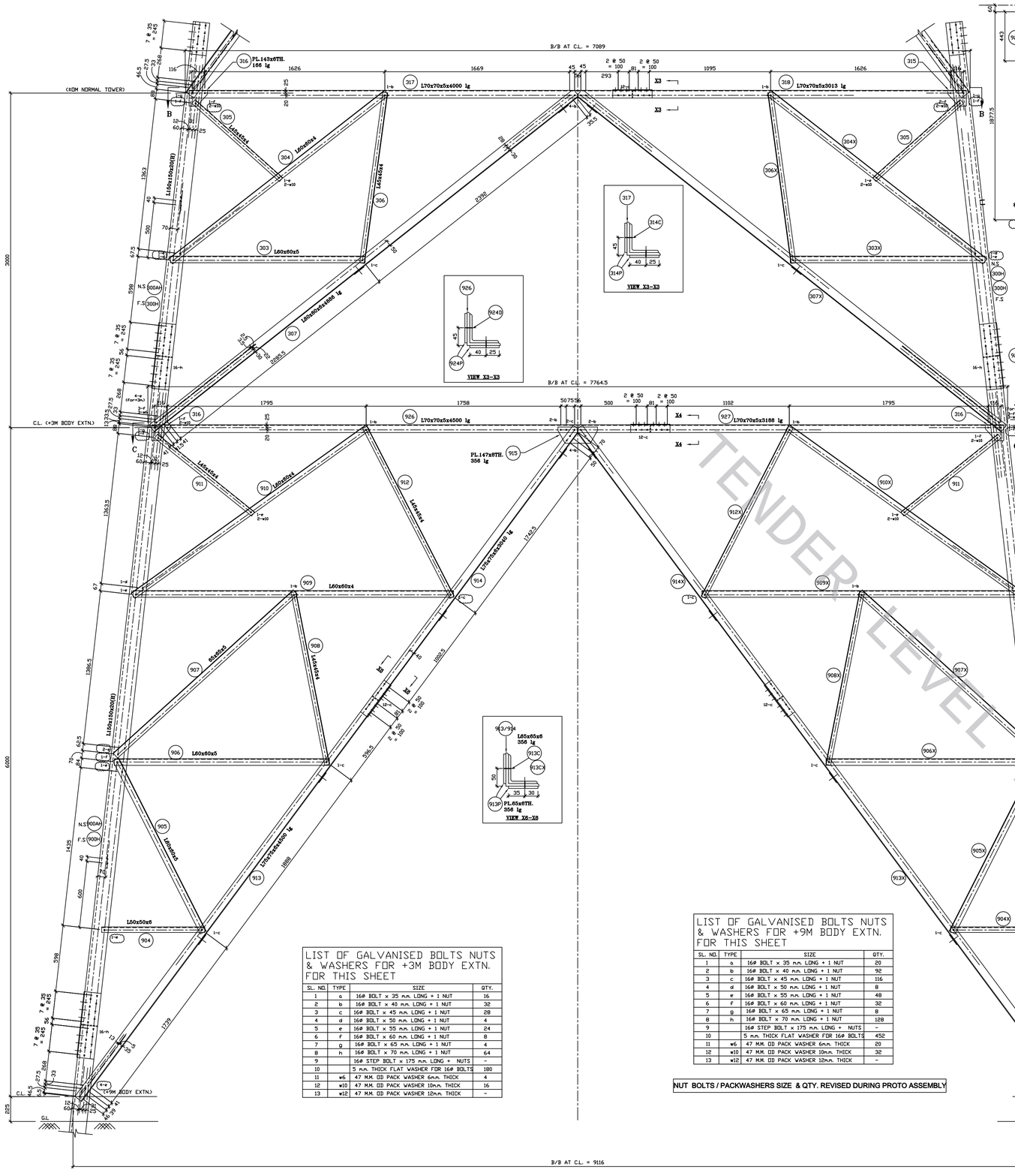
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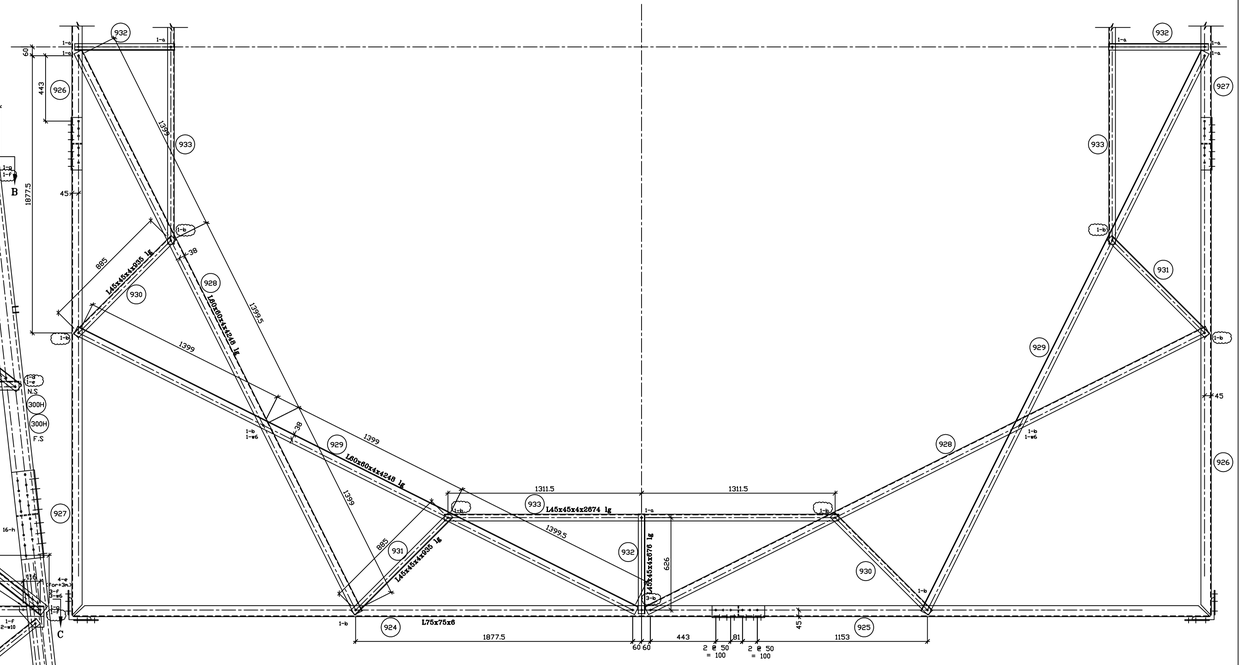
SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D-DE-03 | NO OF SHEETS: 1 OF 2 | SIZE : A0 | SCALE : 1 : 15 | REVISION NO. A

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

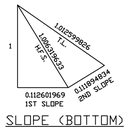
TENDER LEVEL DRAWING





PLAN C–C

PLAN B–B



SLOPE (BOTTOM)

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +3M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16# BOLT x 35 m.m. LONG + 1 NUT	16
2	b	16# BOLT x 40 m.m. LONG + 1 NUT	32
3	c	16# BOLT x 45 m.m. LONG + 1 NUT	28
4	d	16# BOLT x 50 m.m. LONG + 1 NUT	4
5	e	16# BOLT x 55 m.m. LONG + 1 NUT	24
6	f	16# BOLT x 60 m.m. LONG + 1 NUT	8
7	g	16# BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16# BOLT x 70 m.m. LONG + 1 NUT	64
9		16# STEP BOLT x 175 m.m. LONG + NUTS	-
10		5 m.m. THICK FLAT WASHER FOR 16# BOLTS	180
11	w6	47 M.M. OD PACK WASHER 6m.m. THICK	4
12	w10	47 M.M. OD PACK WASHER 10m.m. THICK	16
13	w12	47 M.M. OD PACK WASHER 12m.m. THICK	-

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +9M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16# BOLT x 35 m.m. LONG + 1 NUT	20
2	b	16# BOLT x 40 m.m. LONG + 1 NUT	92
3	c	16# BOLT x 45 m.m. LONG + 1 NUT	116
4	d	16# BOLT x 50 m.m. LONG + 1 NUT	8
5	e	16# BOLT x 55 m.m. LONG + 1 NUT	48
6	f	16# BOLT x 60 m.m. LONG + 1 NUT	32
7	g	16# BOLT x 65 m.m. LONG + 1 NUT	8
8	h	16# BOLT x 70 m.m. LONG + 1 NUT	128
9		16# STEP BOLT x 175 m.m. LONG + NUTS	-
10		5 m.m. THICK FLAT WASHER FOR 16# BOLTS	452
11	w6	47 M.M. OD PACK WASHER 6m.m. THICK	20
12	w10	47 M.M. OD PACK WASHER 10m.m. THICK	32
13	w12	47 M.M. OD PACK WASHER 12m.m. THICK	-

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

LONGITUDINAL FACE

FOR GENERAL NOTES REF.SHEET NO–1 OF 2

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

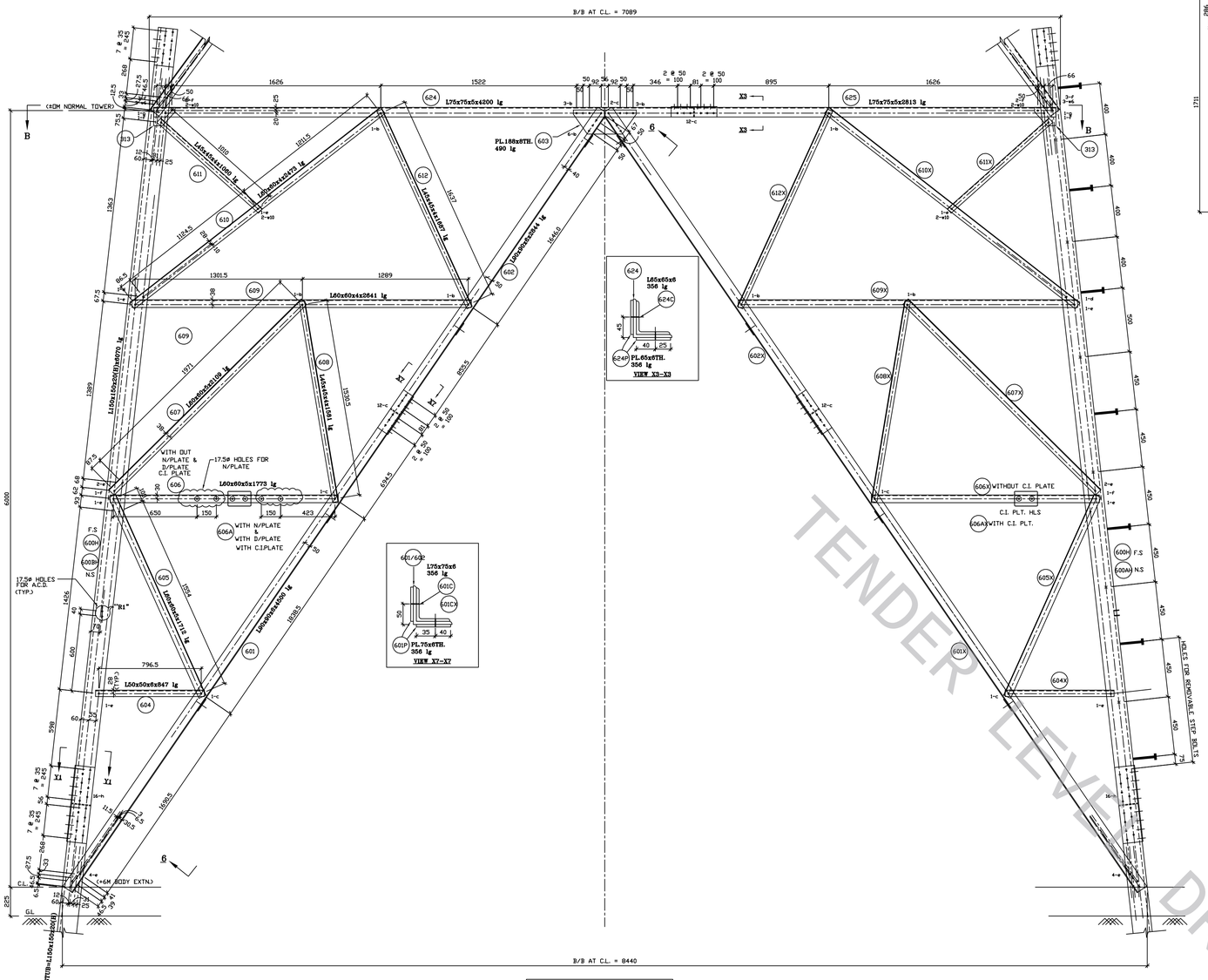
DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)"/ DEAD END (+3M & 9M BODY EXTENSION)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

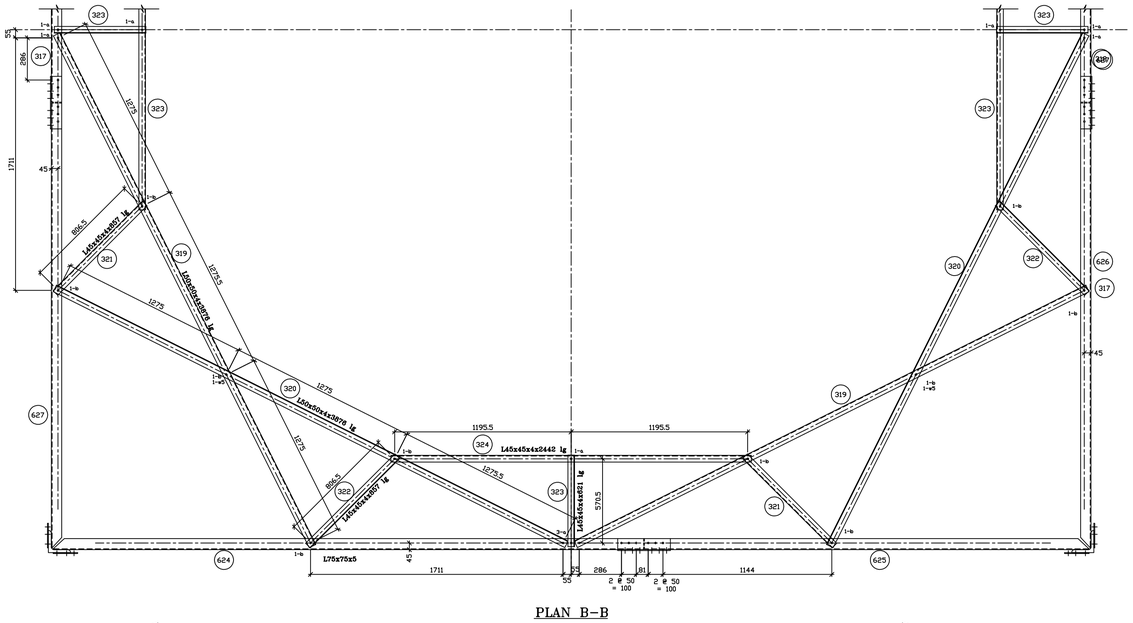
DRG NO: BPCL/SP/SPL/D-DE-03 | NO OF SHEETS: 2 OF 2 | SIZE : A0 | SCALE : 1 : 15 | REVISION NO. A

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

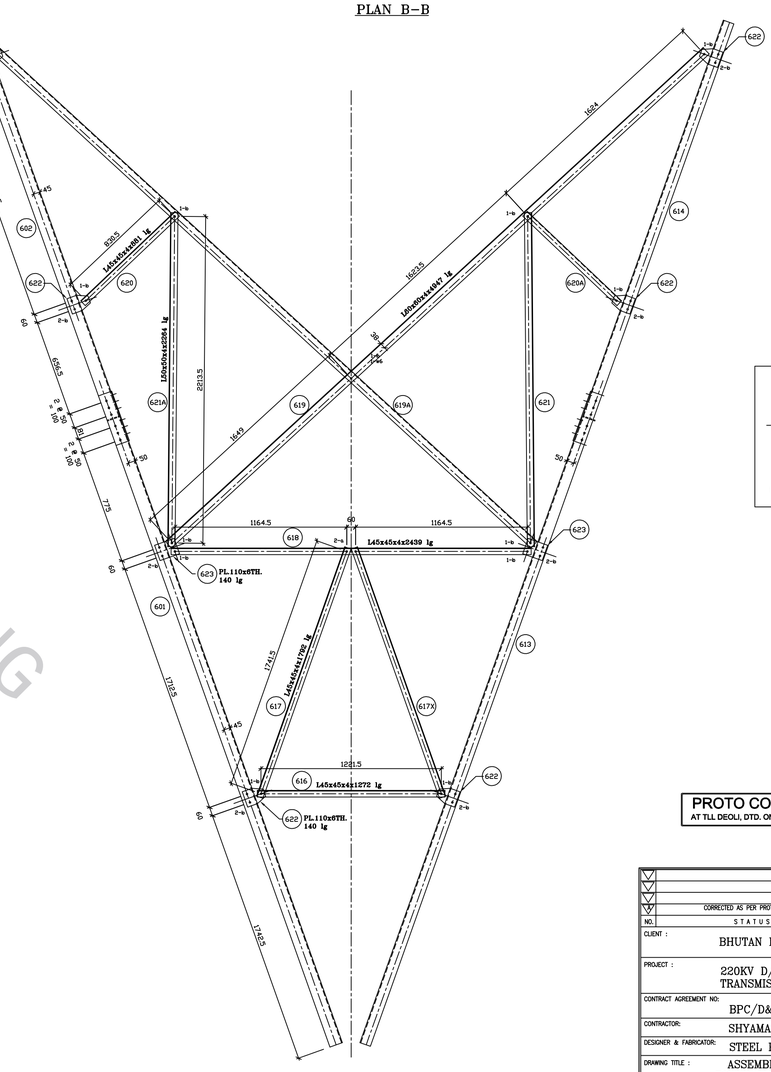
TENDER LEVEL DRAWING



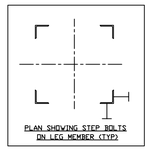
TRANSVERSE FACE



PLAN B-B



VIEW 6-6



PLAN SHOWING STEP BOLTS ON LEG MEMBER (TYP.)



SLOPE (BOTTOM)

NOTES

1. ALL DIMENSIONS ARE IN M.M.
2. ALL HOLES ARE 17.5 M.M. DIA FOR 16 M.M. DIA BOLTS UNLESS NOTED OTHERWISE.
3. ALL BOLTS ARE OF GRADE 5.6 CONFORMING TO IS: 6639 , IS: 12427. AND IS: 1367 (PART-III)
4. ALL (MS & HT) SECTIONS & PLATES SHALL CONFORM TO IS 2062/2006.
5. ONE FLAT WASHER 5 M.M. THICK IS TO BE PLACED UNDER EACH HEX. NUT.
6. ALL MEMBERS SHALL BE HOT DIP GALVANISED U.N.D. AND SHALL CONFORM TO IS: 4759
7. ERECTION MARKS TO BE PREFIXED WITH SP-D (i.e. SP-D-600, SP-D-601 E.T.C)
8. ALL UNNOTED MEMBERS ARE 45x45x4 WITH BACK MARK 23.
9. ONE ADDITIONAL MARK "H" TO BE PUT AS SUFIX IN CASE OF HT MEMBERS (i.e.SP-D-600H)
10. ONE ADDITIONAL MARK "T" TO BE PUT BEFORE TOWER TYPE FOR TEST TOWER ONLY (i.e.SP-D-T600, SP-D-T601 ETC)
11. MINIMUM SHEAR EDGE & ROLLED EDGE DISTANCE FOR 16 M.M. BOLTS SHALL BE 25 M.M. & 22 M.M. RESPECTIVELY.
12. ALL FASTENERS SHALL BE GALVANISED.
13. 47 O.D PACK WASHERS ARE TO BE USED
14. STEP BOLTS SHALL BE ON ONE LEG UPTO BOTTOM X ARM AND THERE AFTER ON TWO LEGS UPTO TOP OF TOWER.

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +6M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	24
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	172
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	84
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	4
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	40
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	28
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	64
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	15
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	435
11	w5	47 M.M. OD PACK WASHER 5m.m. THICK	4
12	w6	47 M.M. OD PACK WASHER 6m.m. THICK	16
13	w10	47 M.M. OD PACK WASHER 10M.M. THICK	16

*STEP BOLT QTY. FOR +6.0MBE=10Nos.+5Nos. (NORMAL TOWE BELOW ACD)

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 28.11.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
V	CORRECTED AS PER PROTO	28.11.22	MANISH	NASHK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

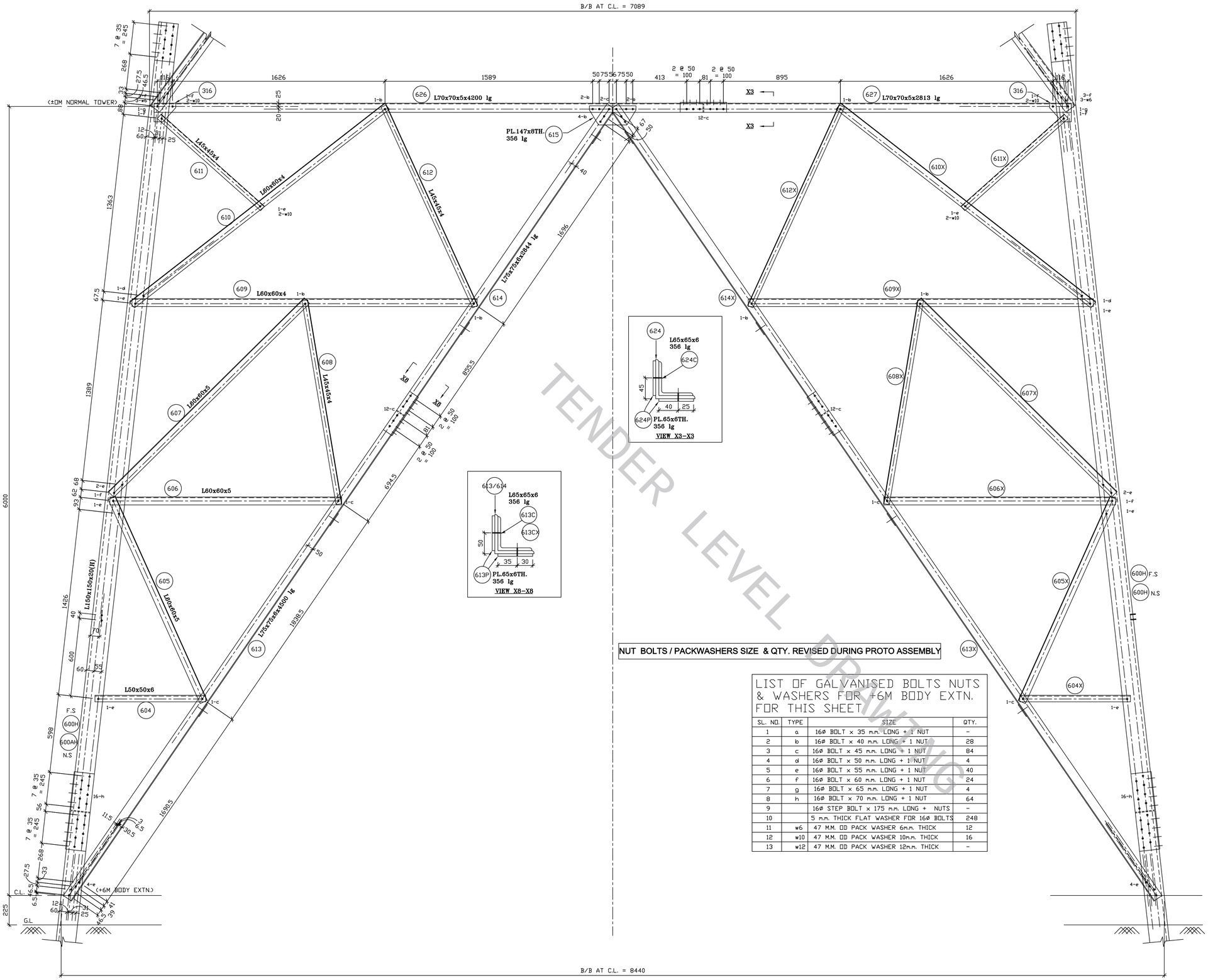
DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)"/ DEAD END (+6M BODY EXTENSION)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D-DE-04 | NO OF SHEETS: 1 OF 2 | SIZE : A0 | SCALE : 1 : 15 | REVISION NO. A

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

TENDER DRAWING

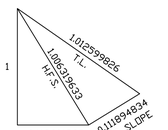


TENDER LEVEL DRAWING

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR +6M BODY EXTN. FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	-
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	28
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	84
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	4
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	40
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	24
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	64
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	-
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	248
11	w6	47 M.M. OD PACK WASHER 6m.m. THICK	12
12	w10	47 M.M. OD PACK WASHER 10m.m. THICK	16
13	w12	47 M.M. OD PACK WASHER 12m.m. THICK	-



SLOPE (BOTTOM)

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 28.11.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
	CORRECTED AS PER PROTO	28.11.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)"/ DEAD END (+6M BODY EXTENSION)

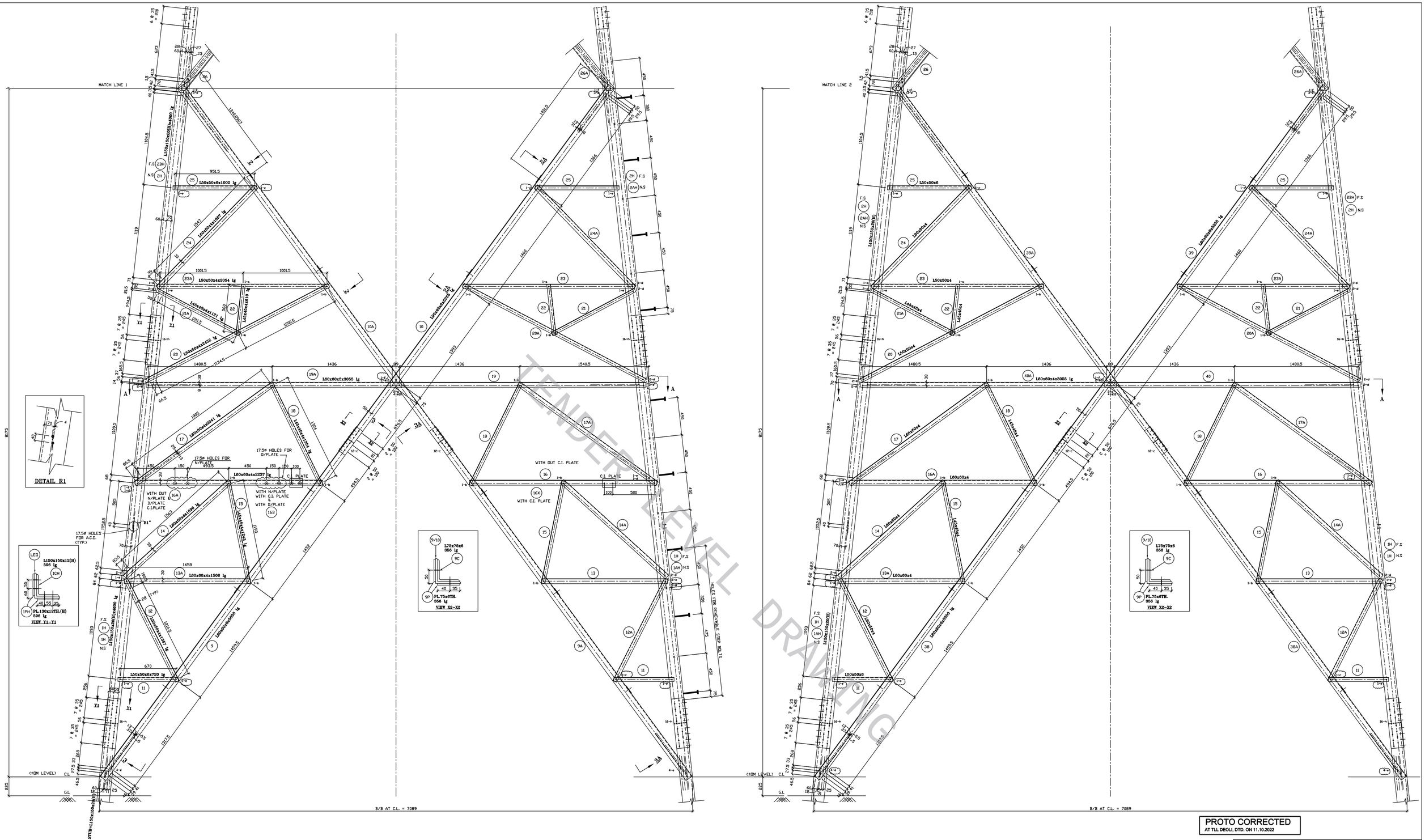
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	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D-DE-04	NO OF SHEETS: 2 OF 2	SIZE : A1	SCALE : 1 : 15	REVISION NO. 0 A

LONGITUDINAL FACE

FOR GENERAL NOTES REF.SHEET NO-1 OF 2

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE



TENDER DRAWING
REVEL DRAWING

TRANSVERSE FACE

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	8
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	48
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	112
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	80
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	104
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	12
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	8
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	256
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	12
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	645
11		w10 47 M.M. OD PACK WASHER 10m.m. THICK	24

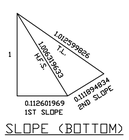
NOTES

1. ALL DIMENSIONS ARE IN M.M.
2. ALL HOLES ARE 17.5 M.M. DIA FOR 16 M.M. DIA BOLTS UNLESS NOTED OTHERWISE.
3. ALL BOLTS ARE OF GRADE 5.6 CONFORMING TO IS: 6639 , IS: 12427. AND IS: 1367 (PART-III)
4. ALL (MS & HT) SECTIONS & PLATES SHALL CONFORM TO IS 2062/2006.
5. ONE FLAT WASHER 5 M.M. THICK IS TO BE PLACED UNDER EACH HEX. NUT.
6. ALL MEMBERS SHALL BE HOT DIP GALVANISED U.N.O. AND SHALL CONFORM TO IS: 4759
7. ERECTION MARKS TO BE PREFIXED WITH SP-D (i.e. SP-D-1, SP-D-2 E.T.C)
8. ALL UNNOTED MEMBERS ARE 45x45x4 WITH BACK MARK 23.
9. ONE ADDITIONAL MARK "H" TO BE PUT AS SUFIX IN CASE OF HT MEMBERS (i.e.SP-D-1H)
10. ONE ADDITIONAL MARK "T" TO BE PUT BEFORE TOWER TYPE FOR TEST TOWER ONLY (i.e.SP-D-T1, SP-D-T2 ETC)
11. MINIMUM SHEAR EDGE & ROLLED EDGE DISTANCE FOR 16 M.M. BOLTS SHALL BE 25 M.M. & 22 M.M. RESPECTIVELY.
12. ALL FASTENERS SHALL BE GALVANISED.
13. 47 O.D PACK WASHERS ARE TO BE USED
14. STEP BOLTS SHALL BE ON ONE LEG UPTO BOTTOM X ARM AND THERE AFTER ON TWO LEGS UPTO TOP OF TOWER.

PLAN SHOWING STEP BOLTS ON LEG MEMBER (TYP) (BELOW WAIST LEVEL)

PLAN SHOWING STEP BOLTS ON LEG MEMBER (TYP) (ABOVE WAIST LEVEL)

LONGITUDINAL FACE



PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

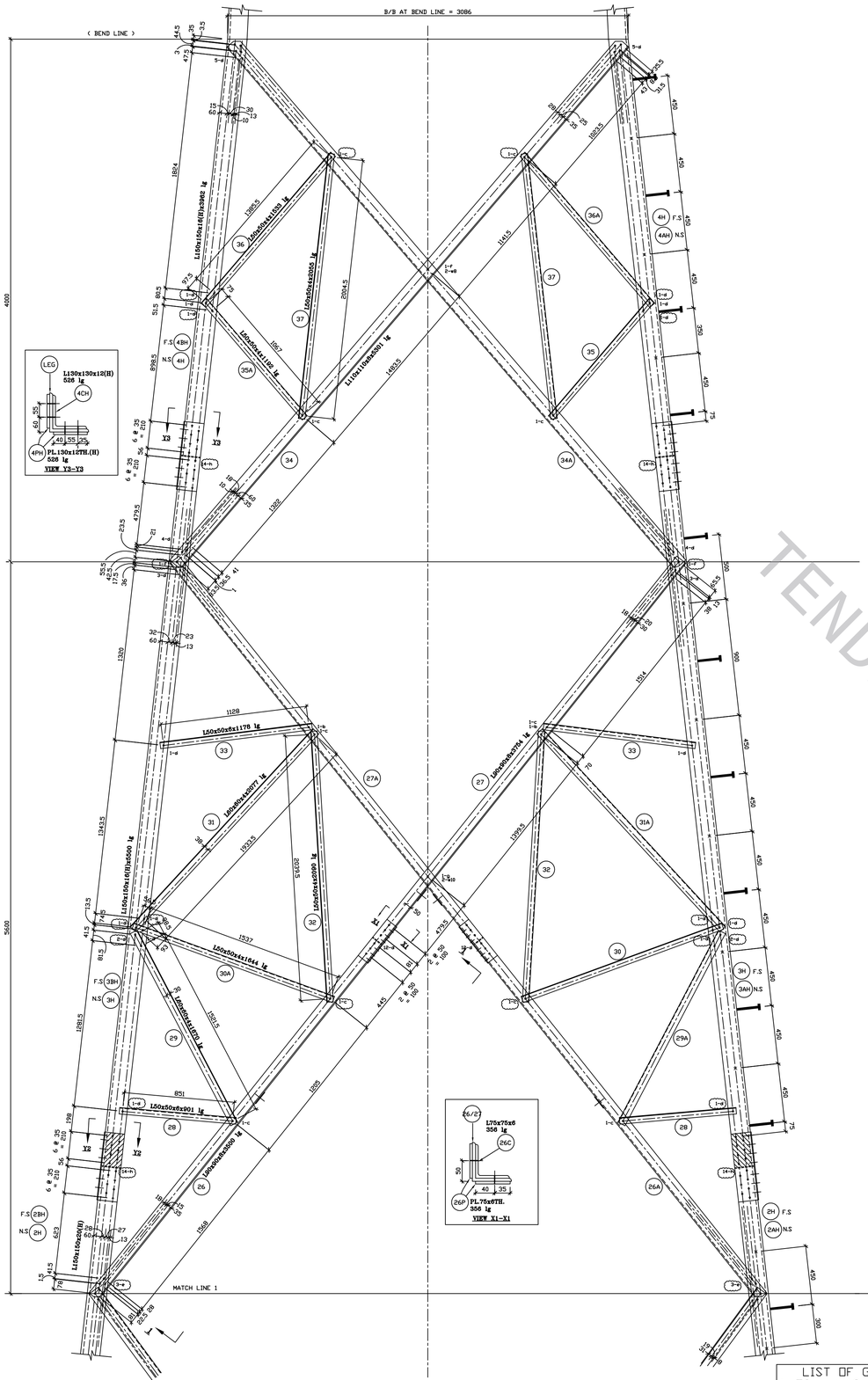
DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)"/ DEAD END (BOTTOM PART)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D-DE-02	NO OF SHEETS: 1 OF 6	SIZE : A0	SCALE : 1 : 15	REVISION NO. A

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE



TRANSVERSE FACE

LONGITUDINAL FACE

VIEW 1-1

SLOPE (BOTTOM)

FOR GENERAL NOTES REF.SHEET NO-1 OF 6

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	-
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	60
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	40
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	264
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	24
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	12
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	4
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	224
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	18
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	646
11	w6	47 MM. OD PACK WASHER 6mm. THICK	4
12	w8	47 MM. OD PACK WASHER 8mm. THICK	10
13	w10	47 MM. OD PACK WASHER 10mm. THICK	8

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NISHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

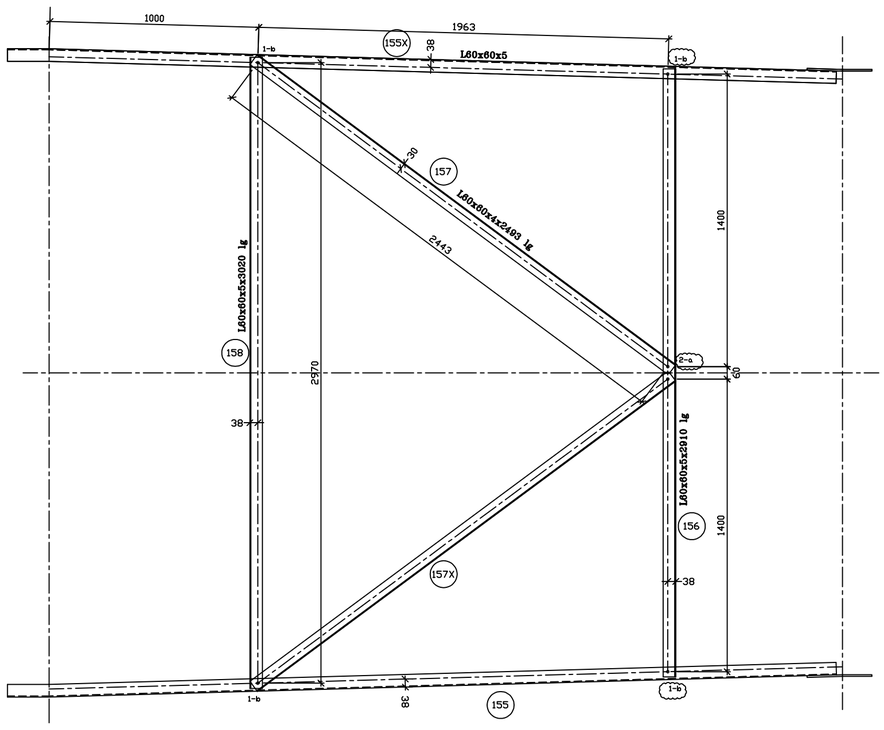
CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)" / DEAD END (BOTTOM PART)

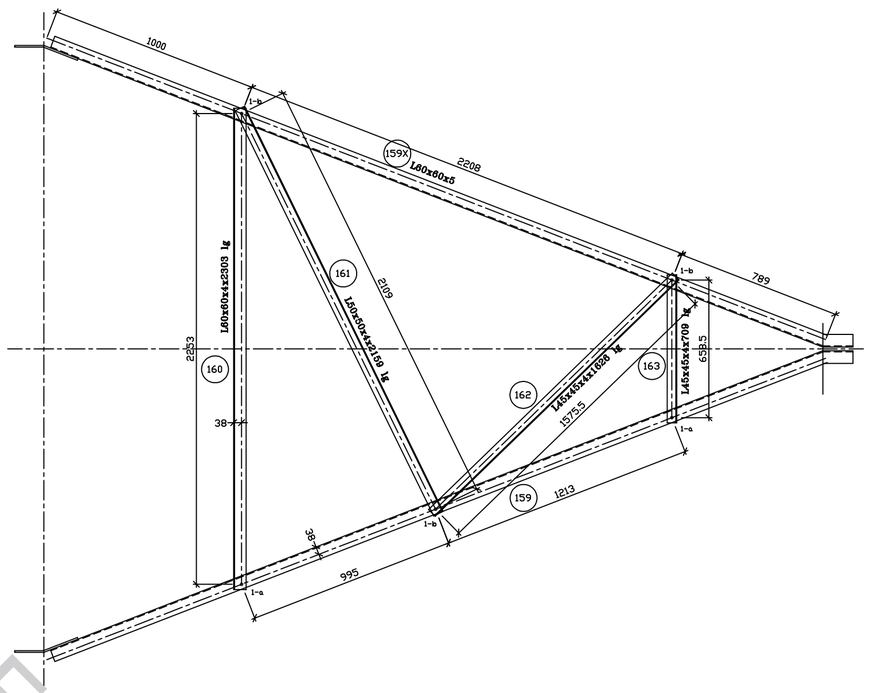
SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D-DE-02	NO OF SHEETS: 2 OF 6	SIZE : A0	SCALE : 1 : 15	REVISION NO. A



BOTTOM TIE PLAN–LEFT

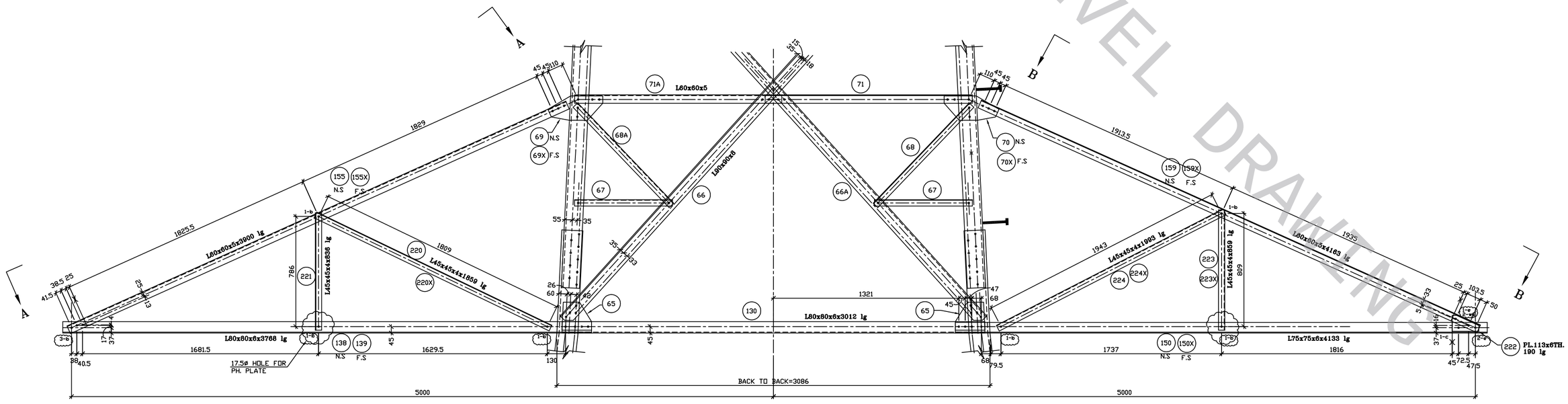
VIEW A–A



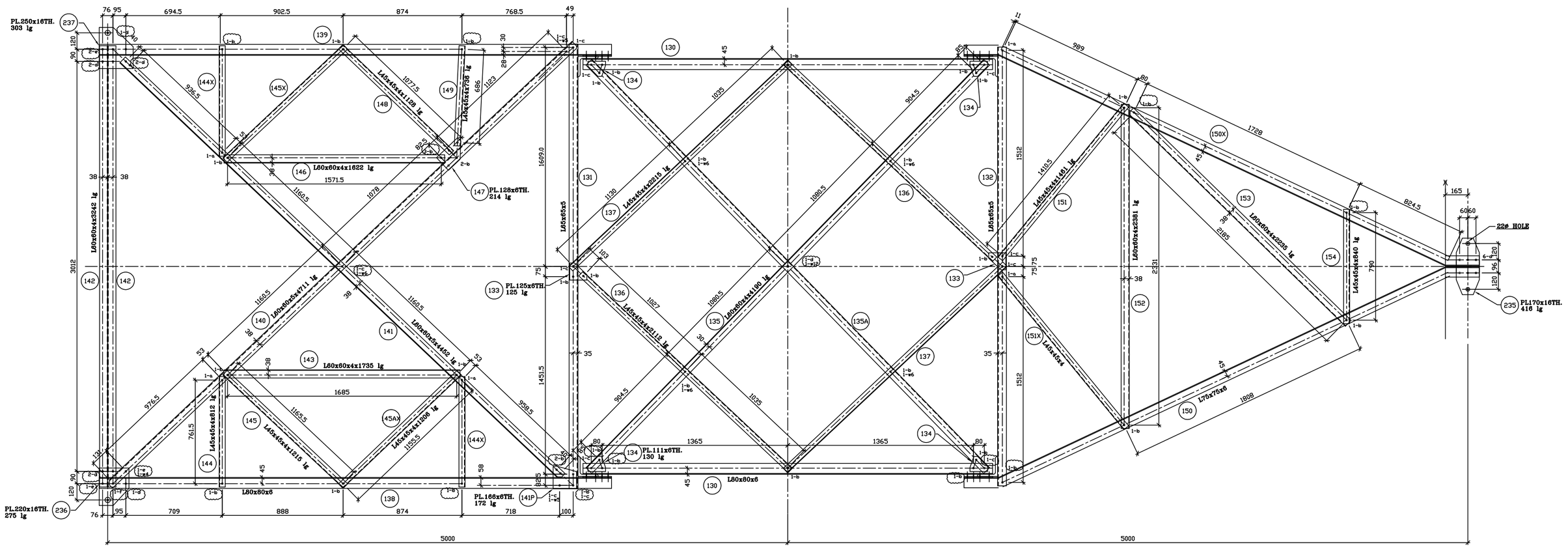
BOTTOM TIE PLAN–RIGHT

VIEW B–B

TENDER LEVEL DRAWING



BOTTOM X–ARM ELEVATION



BOTTOM X–ARM PLAN

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	8
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	66
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	13
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	15
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	7
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	1
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	–
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	–
9		16ø STEP BOLT x 175 m.m. LONG + NUTS	–
10		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	110
11	w4	47 M.M. OD PACK WASHER 5m.m. THICK	1
12	w5	47 M.M. OD PACK WASHER 5m.m. THICK	2
13	w6	47 M.M. OD PACK WASHER 6m.m. THICK	7
14	w8	47 M.M. OD PACK WASHER 8m.m. THICK	–
15	w10	47 M.M. OD PACK WASHER 10m.m. THICK	–
16	w12	47 M.M. OD PACK WASHER 12m.m. THICK	1

FOR GENERAL NOTES REF.SHEET NO–1 OF 6

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT–01/2009

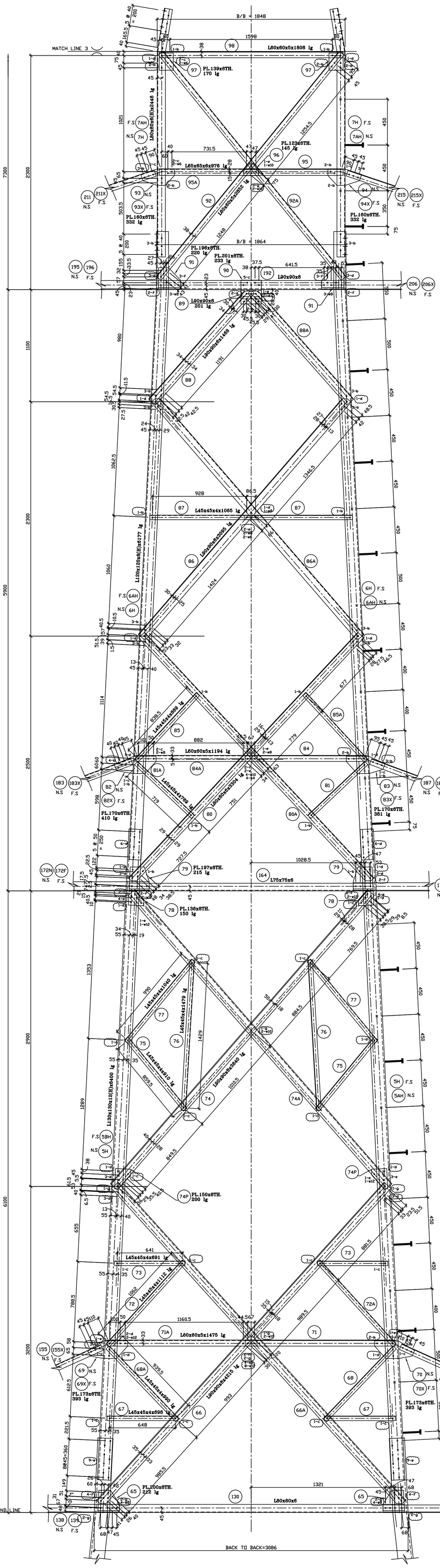
CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

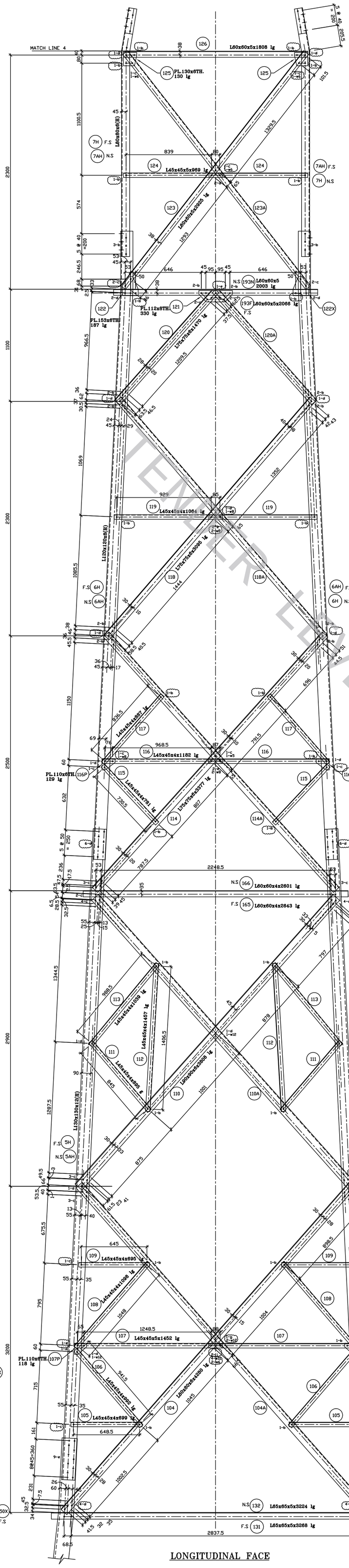
DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°–60°)" / DEAD END (BOTTOM CROSS ARM)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

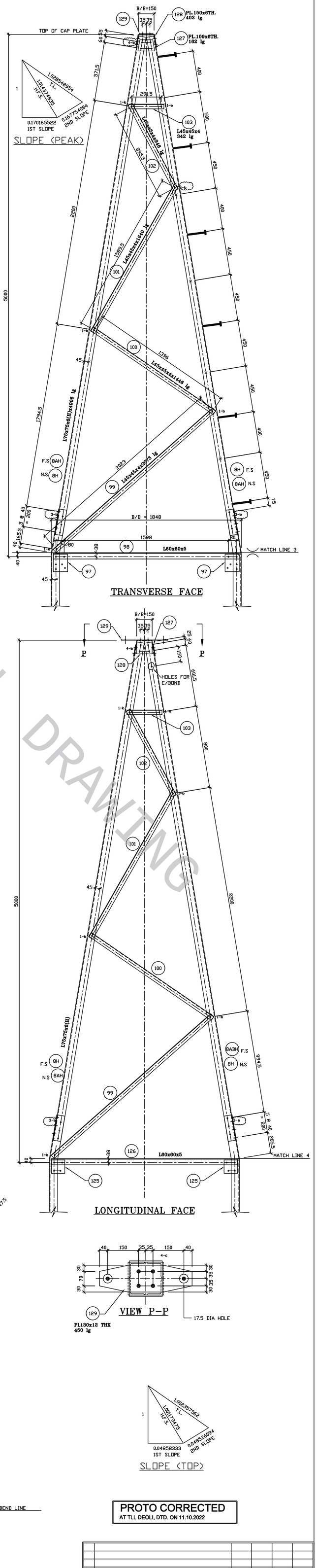
DRG NO: BPCL/SP/SPL/D–DE–02	NO OF SHEETS: 5 OF 6	SIZE : A0	SCALE : 1 : 15	REVISION NO. A



TRANSVERSE FACE



LONGITUDINAL FACE



LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	-
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	314
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	164
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	196
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	136
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	56
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	36
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	4
9	j	16ø BOLT x 75 m.m. LONG + 1 NUT	4
10		16ø STEP BOLT x 175 m.m. LONG + NUTS	80
11		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	990
12	w4	47 M.M. OD PACK WASHER 4m.m. THICK	8
13	w5	47 M.M. OD PACK WASHER 5m.m. THICK	2
14	w6	47 M.M. OD PACK WASHER 6m.m. THICK	22
15	w8	47 M.M. OD PACK WASHER 8m.m. THICK	58
16	w10	47 M.M. OD PACK WASHER 10m.m. THICK	34
17	w12	47 M.M. OD PACK WASHER 12m.m. THICK	36
18	w16	47 M.M. OD PACK WASHER 16m.m. THICK	-

FOR GENERAL NOTES REF.SHEET NO-1 OF 6

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT-01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

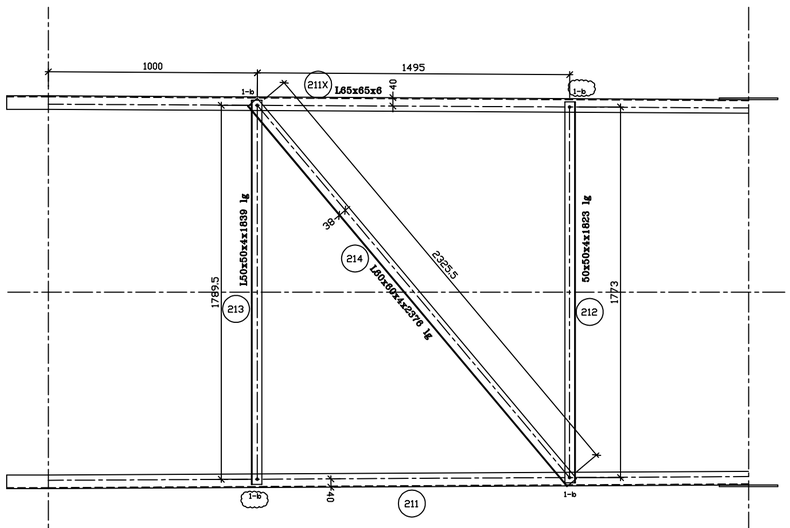
DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°-60°)" / DEAD END (CAGE AND PEAK)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

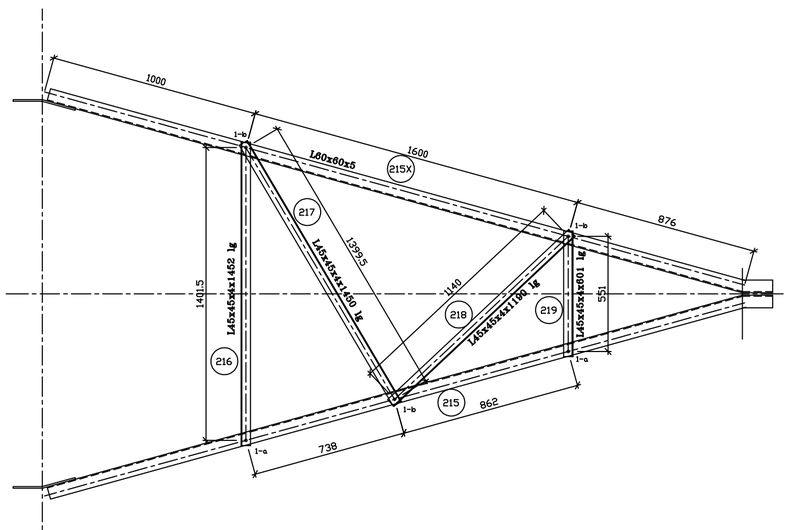
DRG NO: BPCL/SP/SPL/D-DE-02	NO OF SHEETS: 4 OF 6	SIZE : A0	SCALE : 1 : 15	REVISION NO. A

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

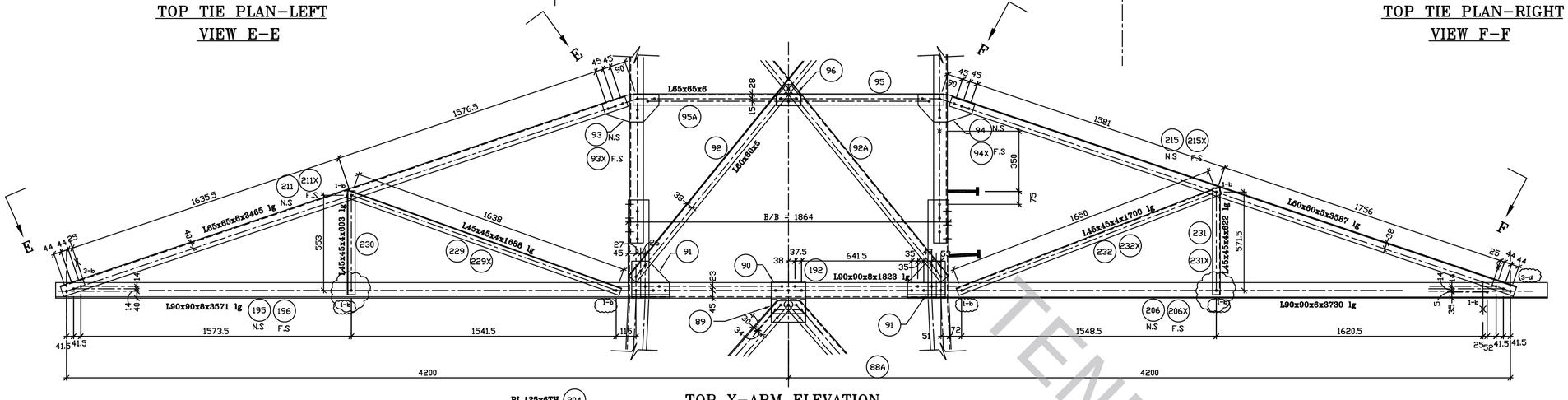
TENDER LEVEL DRAWING



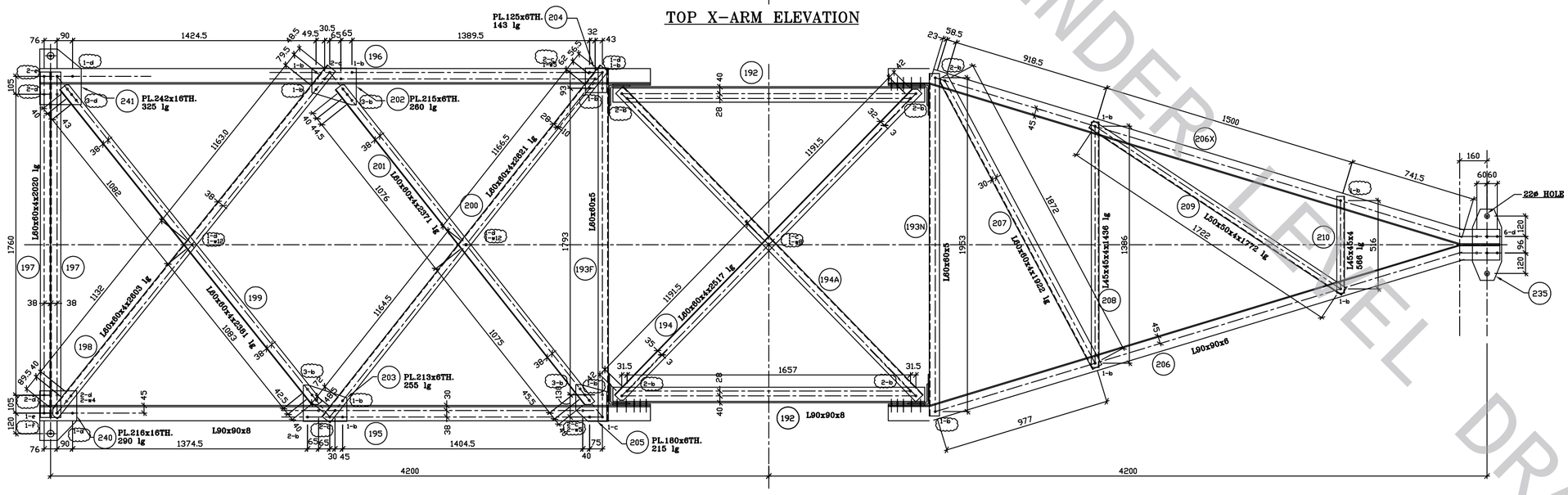
TOP TIE PLAN–LEFT
VIEW E–E



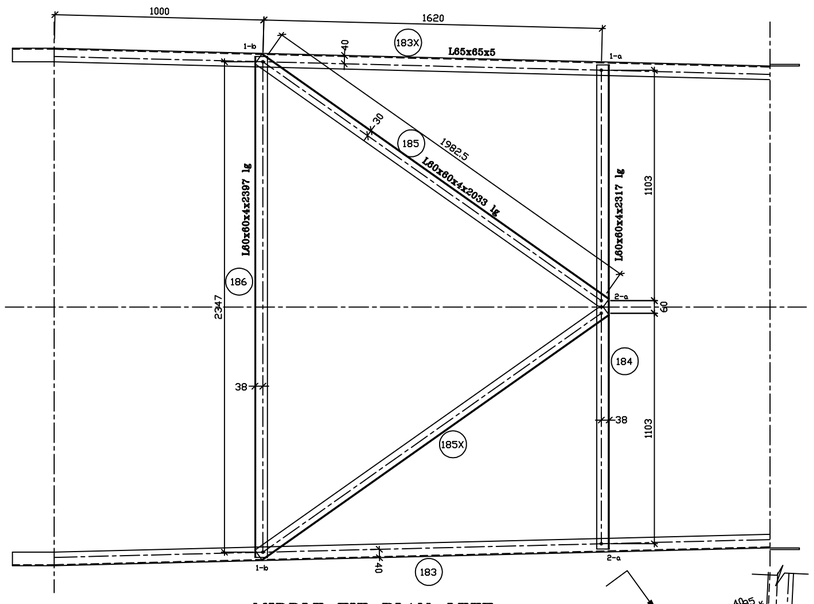
TOP TIE PLAN–RIGHT
VIEW F–F



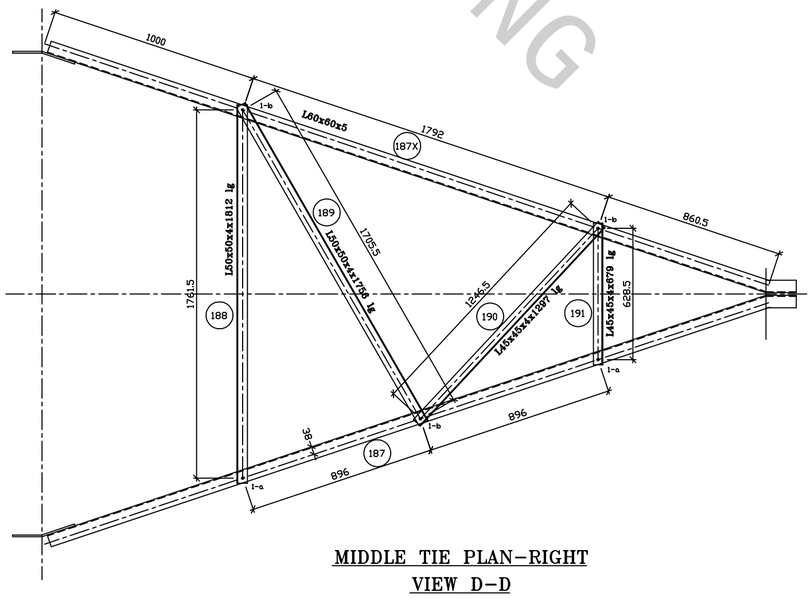
TOP X–ARM ELEVATION



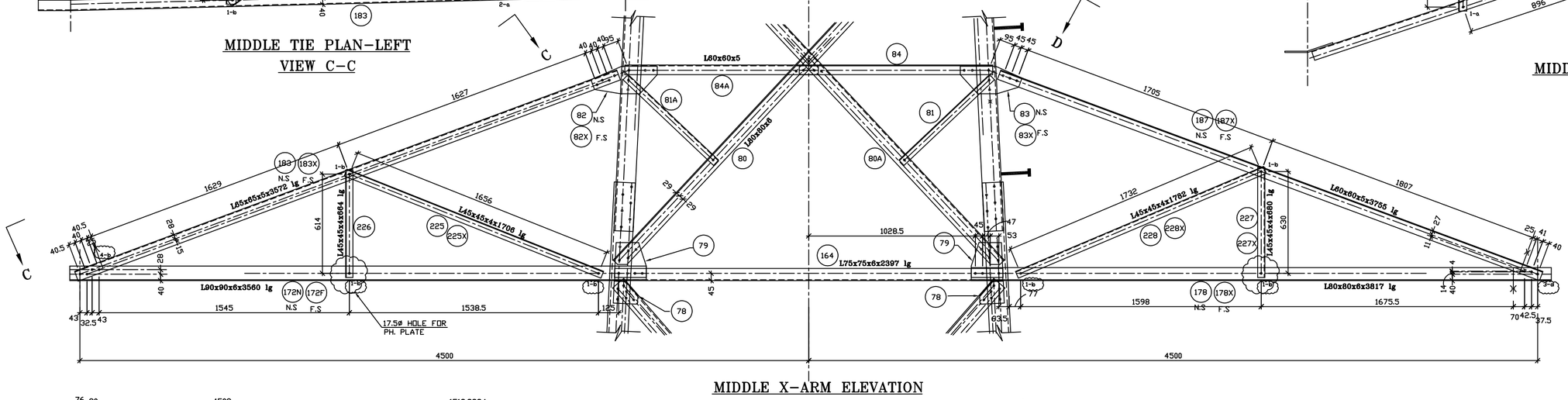
TOP X–ARM PLAN



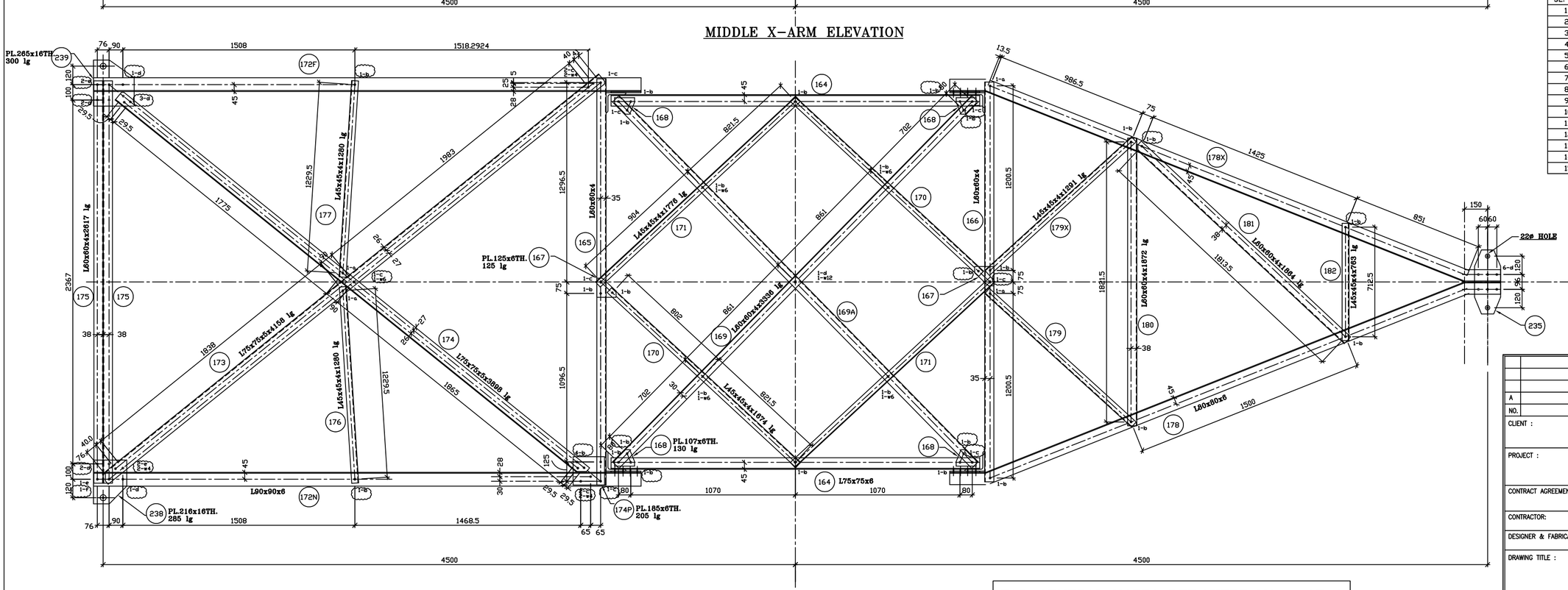
MIDDLE TIE PLAN–LEFT
VIEW C–C



MIDDLE TIE PLAN–RIGHT
VIEW D–D



MIDDLE X–ARM ELEVATION



MIDDLE X–ARM PLAN

TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET			
SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	12
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	114
3	c	16ø BOLT x 45 m.m. LONG + 1 NUT	23
4	d	16ø BOLT x 50 m.m. LONG + 1 NUT	42
5	e	16ø BOLT x 55 m.m. LONG + 1 NUT	8
6	f	16ø BOLT x 60 m.m. LONG + 1 NUT	2
7	g	16ø BOLT x 65 m.m. LONG + 1 NUT	–
8	h	16ø BOLT x 70 m.m. LONG + 1 NUT	–
9		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	201
10	w4	47 M.M. OD PACK WASHER 4m.m. THICK	8
11	w5	47 M.M. OD PACK WASHER 5m.m. THICK	3
12	w6	47 M.M. OD PACK WASHER 6m.m. THICK	5
13	w8	47 M.M. OD PACK WASHER 8m.m. THICK	3
14	w10	47 M.M. OD PACK WASHER 10m.m. THICK	–
15	w12	47 M.M. OD PACK WASHER 12m.m. THICK	3

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT–01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

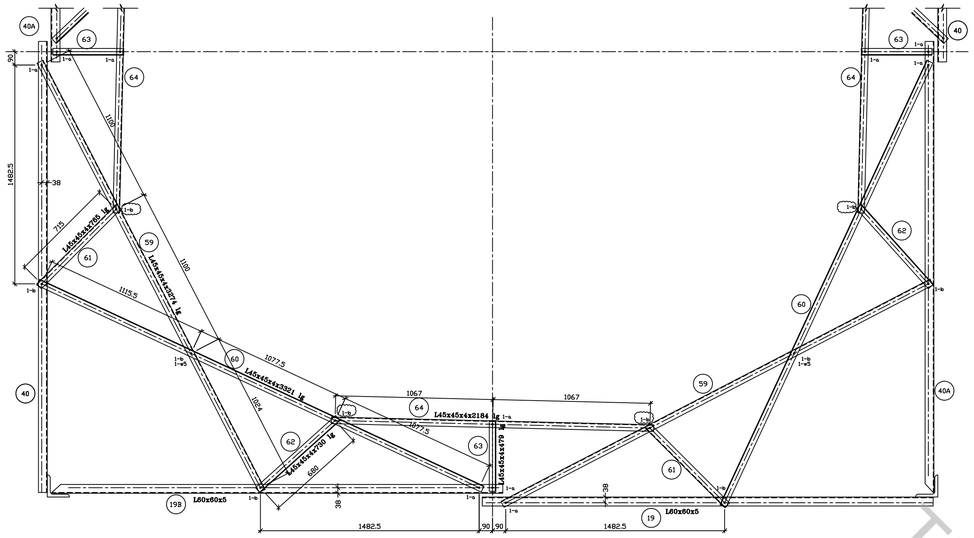
DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°–60°)" / DEAD END (MIDDLE AND TOP CROSS ARM)

SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

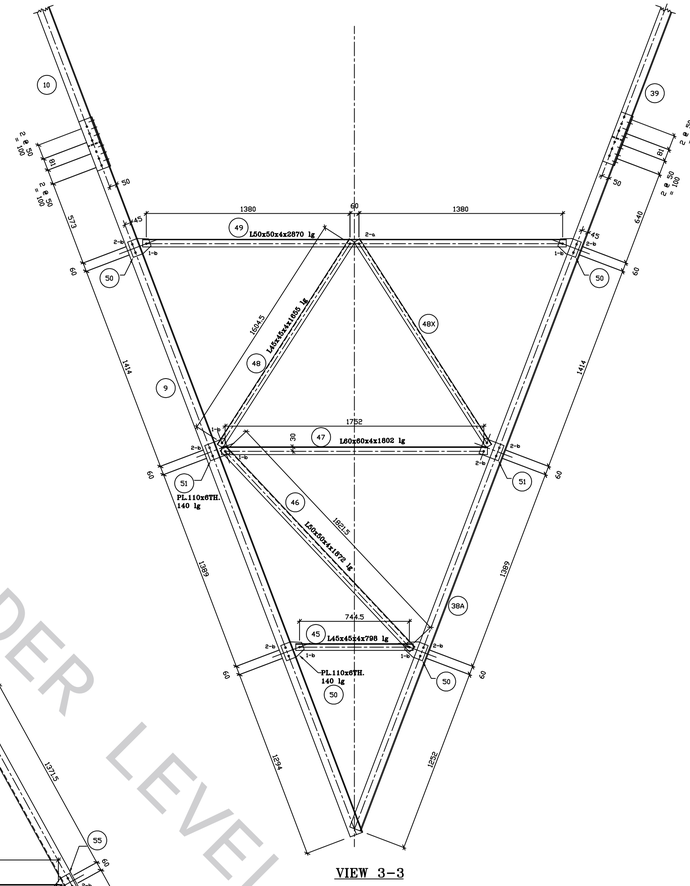
DRG NO: BPCL/SP/SPL/D–DE–02	NO OF SHEETS: 6 OF 6	SIZE : A0	SCALE : 1 : 15	REVISION NO. A

FOR GENERAL NOTES REF.SHEET NO–1 OF 6

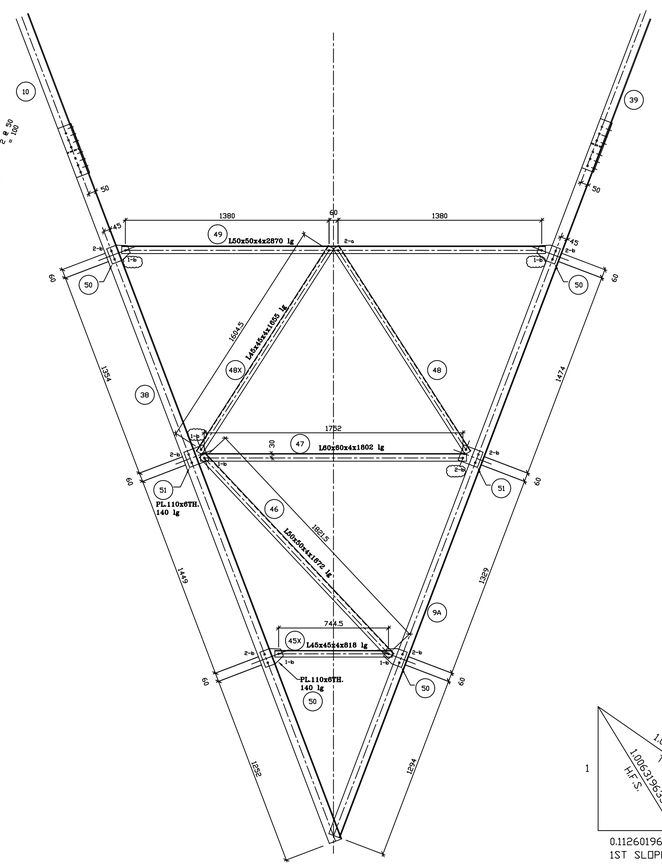
UNDER LEVEL DRAWING



PLAN A–A



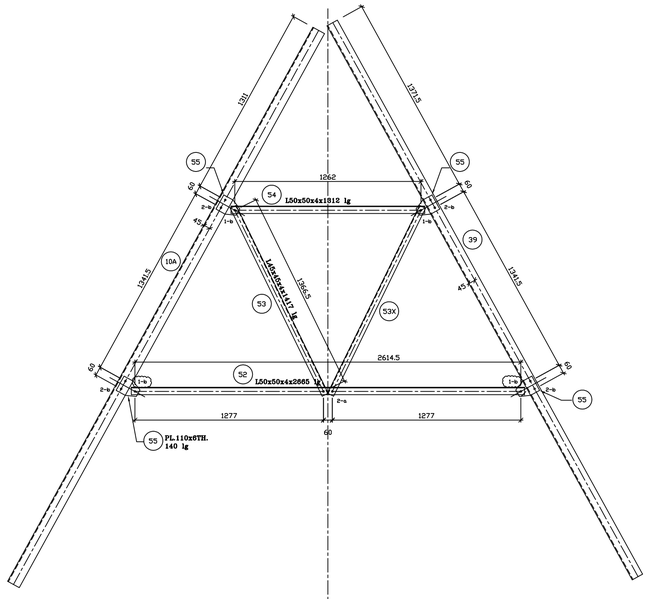
VIEW 3–3



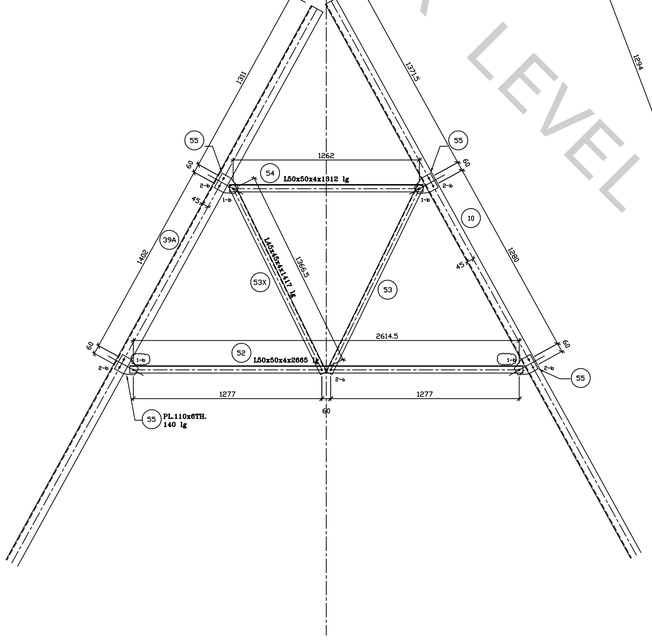
VIEW 3A–3A



SLOPE (BOTTOM)



VIEW 2–2



VIEW 2A–2A

FOR GENERAL NOTES REF.SHEET NO–1 OF 6

PROTO CORRECTED
AT TLL DEOLI, DTD. ON 11.10.2022

LIST OF GALVANISED BOLTS NUTS & WASHERS FOR THIS SHEET

SL. NO.	TYPE	SIZE	QTY.
1	a	16ø BOLT x 35 m.m. LONG + 1 NUT	32
2	b	16ø BOLT x 40 m.m. LONG + 1 NUT	148
3		5 m.m. THICK FLAT WASHER FOR 16ø BOLTS	180
4	w5	47 M.M. OD PACK WASHER 5m.m. THICK	4

NUT BOLTS / PACKWASHERS SIZE & QTY. REVISED DURING PROTO ASSEMBLY

NO.	STATUS	DATE	DRN BY	DATE	CHK'D BY
A	CORRECTED AS PER PROTO	11.10.22	MANISH	NASHIK	CSM

CLIENT : BHUTAN POWER CORPORATION LIMITED

PROJECT : 220KV D/C DAGACHHU – JIGMELING TRANSMISSION LINE (VIA TSIRANG)

CONTRACT AGREEMENT NO: BPC/D&CD/CONTRACT–01/2009

CONTRACTOR: SHYAMA POWER (INDIA) LTD.

DESIGNER & FABRICATOR: STEEL PRODUCTS LIMITED

DRAWING TITLE : ASSEMBLY DRAWING OF 220KV D/C TOWER TYPE "D (30°–60°)"/ DEAD END (VIEWS & PLAN OF BOTTOM PART)

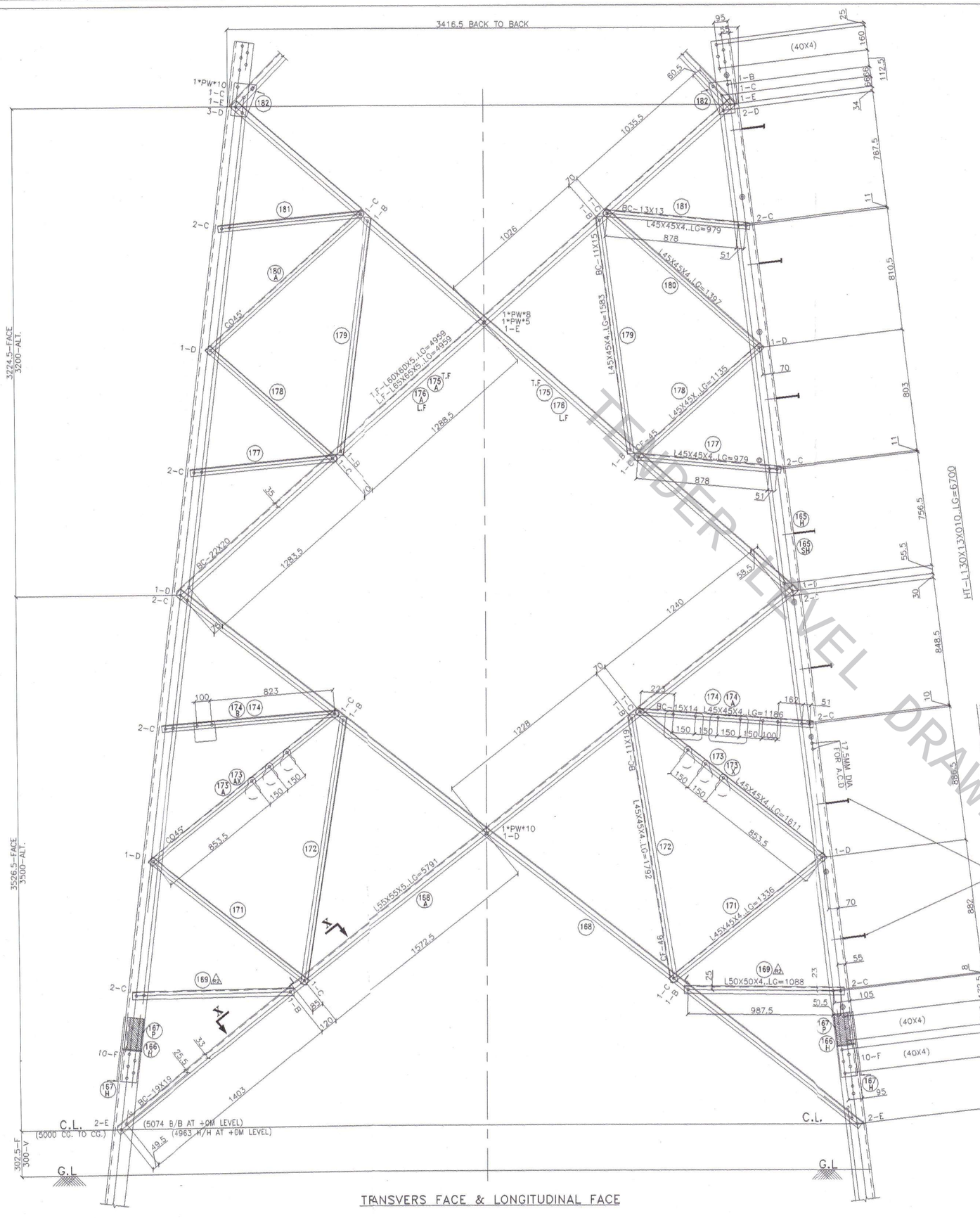
SCALE :	DRAWN BY: SKC	CHECKED BY: ABI	APPROVED BY: MKB
	DATE : 12/03/2010	DATE : 12/03/2010	DATE : 12/03/2010

DRG NO: BPCL/SP/SPL/D–DE–02	NO OF SHEETS: 3 OF 6	SIZE : A1	SCALE : 1 : 15	REVISION NO. Ø A

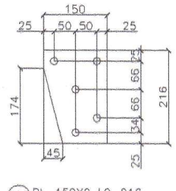
TO BE USED AS 132KV SPECIAL TOWER FOR WOBTHANG TRANSMISSION LINE

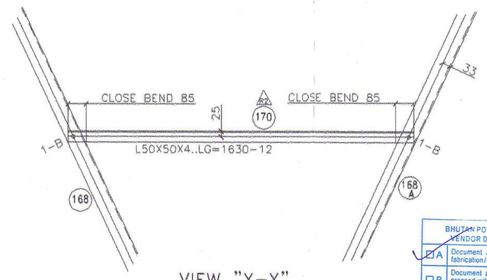
TENDER LEVEL DRAWING

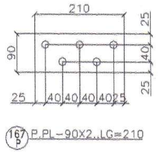
BODY VERTICAL SLOPE		
TAN β	=	0.123702
2TAN β	=	0.247404
FACE	=	1.007622
DEV.	=	1.015187
IN FACE SLOPE		
TAN β	=	0.122766
SEC β	=	1.007508

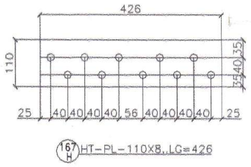


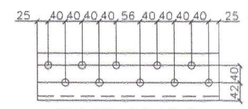
TRANSVERS FACE & LONGITUDINAL FACE











166 H HT-L110X110X10.,LG=426

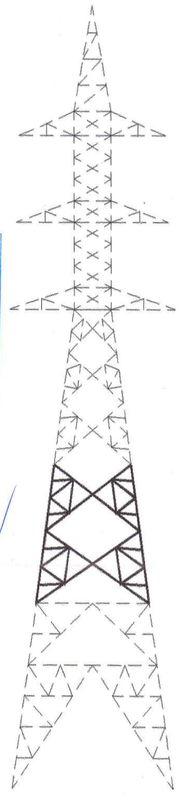
LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	44
C	#16 x 40mm long	120
D	#16 x 45mm long	48
E	#16 x 50mm long	28
F	#16 x 55mm long	80
G	#16 x 60mm long	–
H	#16 x 65mm long	–
J	#16 x 70mm long	–
K	#16 x 75mm long	–
L	#16 x 80mm long	–
M	#16 x 85mm long	–
SPRING WASHERS		120
ø16X175 STEP BOLTS		10
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		4
6 THK WASHER		–
8 THK WASHER		4
10 THK WASHER		8

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted on the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on the document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter/..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, fixtures, performance requirements and conformity of supplies with normal / all laws as may be applicable, nor does it modify the Purchaser's rights under the contract.

Signed: Date: 11/05/16



GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS. IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø18mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY (SHEET 4 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1.2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

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PROTO CORRECTED | MARK Nos. :- 165 TO 182

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMMITED
MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.- BAGHPAT
JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			26/9/15
CHKD			
APPD			

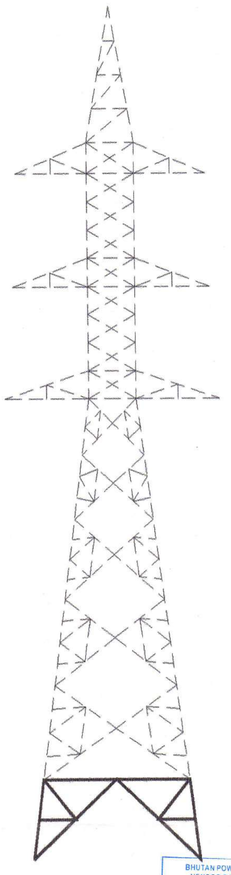
TITLE : 132KV D/C TOWER TYPE 'B' "± 0 BASE"
SCALE 1:15
PROJECTION
DRG. No: BPC/EDCD/SPIL/B/STR/01
NO OF SHEETS : 5 OF 9
SIZE A1
REV. 3

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER PROTO ASSEMBLY.			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			31/10/15

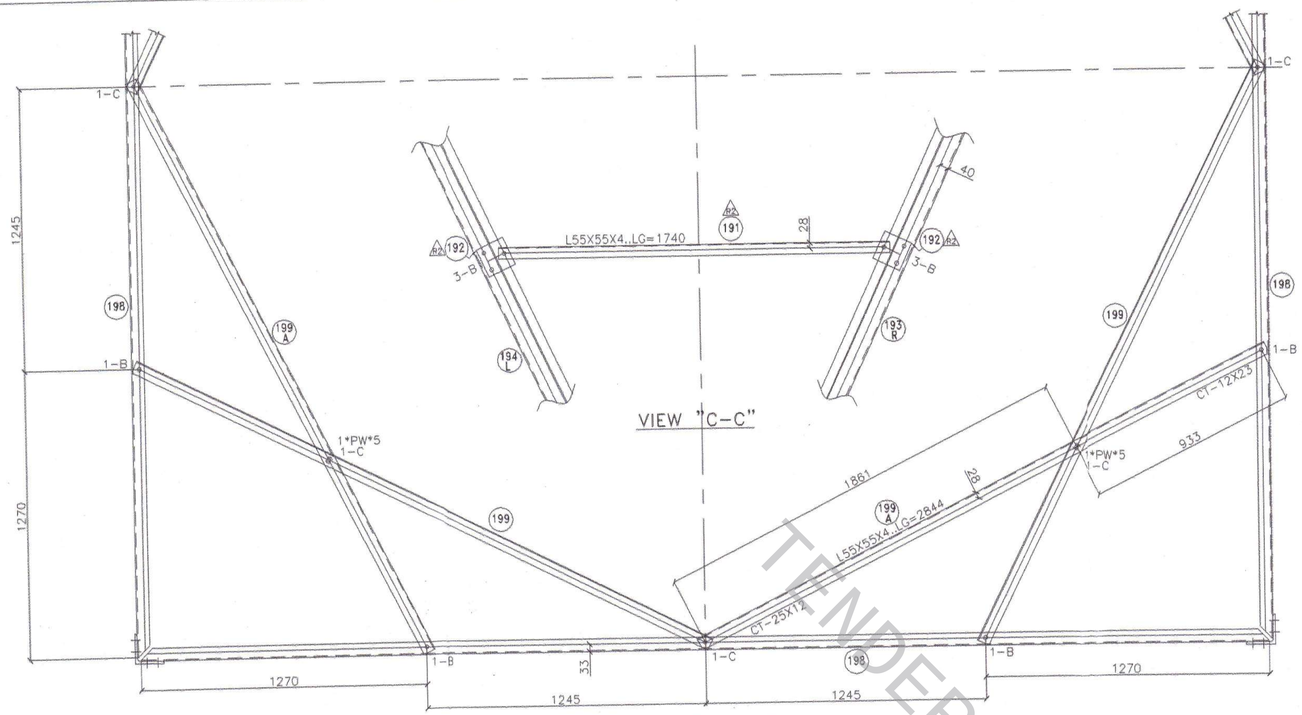
TO BE USED FOR WOBTHANG TRANSMISSION LINE

BODY VERTICAL SLOPE	
TAN β	= 0.123702
2TAN β	= 0.247404
FACE	= 1.007622
DEV.	= 1.015187
IN FACE SLOPE	
TAN β	= 0.122766
SEC β	= 1.007508

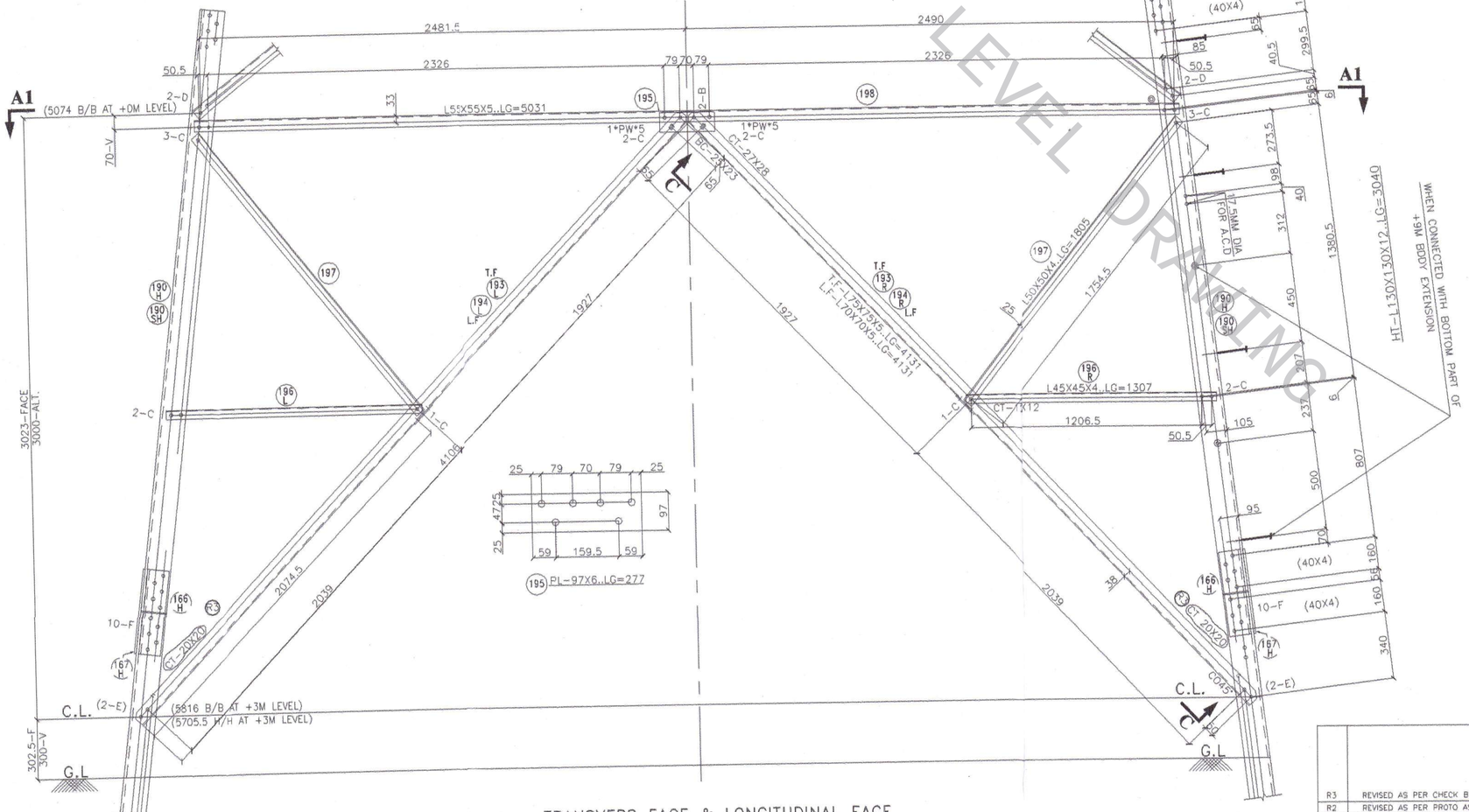
LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	+3M EXT.	PLAN
B	ø16 x 35mm long	32	8
C	ø16 x 40mm long	64	8
D	ø16 x 45mm long	16	–
E	ø16 x 50mm long	–	–
F	ø16 x 55mm long	80	–
G	ø16 x 60mm long	–	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		192	16
ø16X175 STEP BOLTS		6	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		8	4
6 THK WASHER		–	–
8 THK WASHER		–	–
10 THK WASHER		–	–

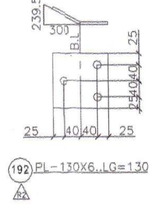


VIEW "C-C"



VIEW "A1-A1"





TRANSVERS FACE & LONGITUDINAL FACE

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER PROTO ASSEMBLY.			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			31/10/15

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A Document approved as submitted, proceed with fabrication/construction
- ☐ B Document approved subject to comments noted proceed with fabrication / construction considering our comments.
- ☐ C Our comments are noted on the enclosed marked-up print.
- ☐ D Our comments are noted in the memo attached to this transmittal.
- ☐ E Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F Correct original of the document to reflect our comments and resubmit for records.
- ☐ G Documents of this category are for information only and not for approval. Information furnished on the document is noted.
- ☐ H Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I Document returned without review.

Approval conveyed hereis vide letter# ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction weights, quantities, design details, assembly fits, system performance requirements and conformity of supplies with the national laws as may be applicable, nor does it constitute Purchaser's acceptance under the contract.

Signed: ..... Date: .....

TRANSMISSION CONSTRUCTION DEPARTMENT

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR ± 0 BASE (SHEET 5 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 18MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

PROTO CORRECTED MARK Nos. :- 190 TO 199

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BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

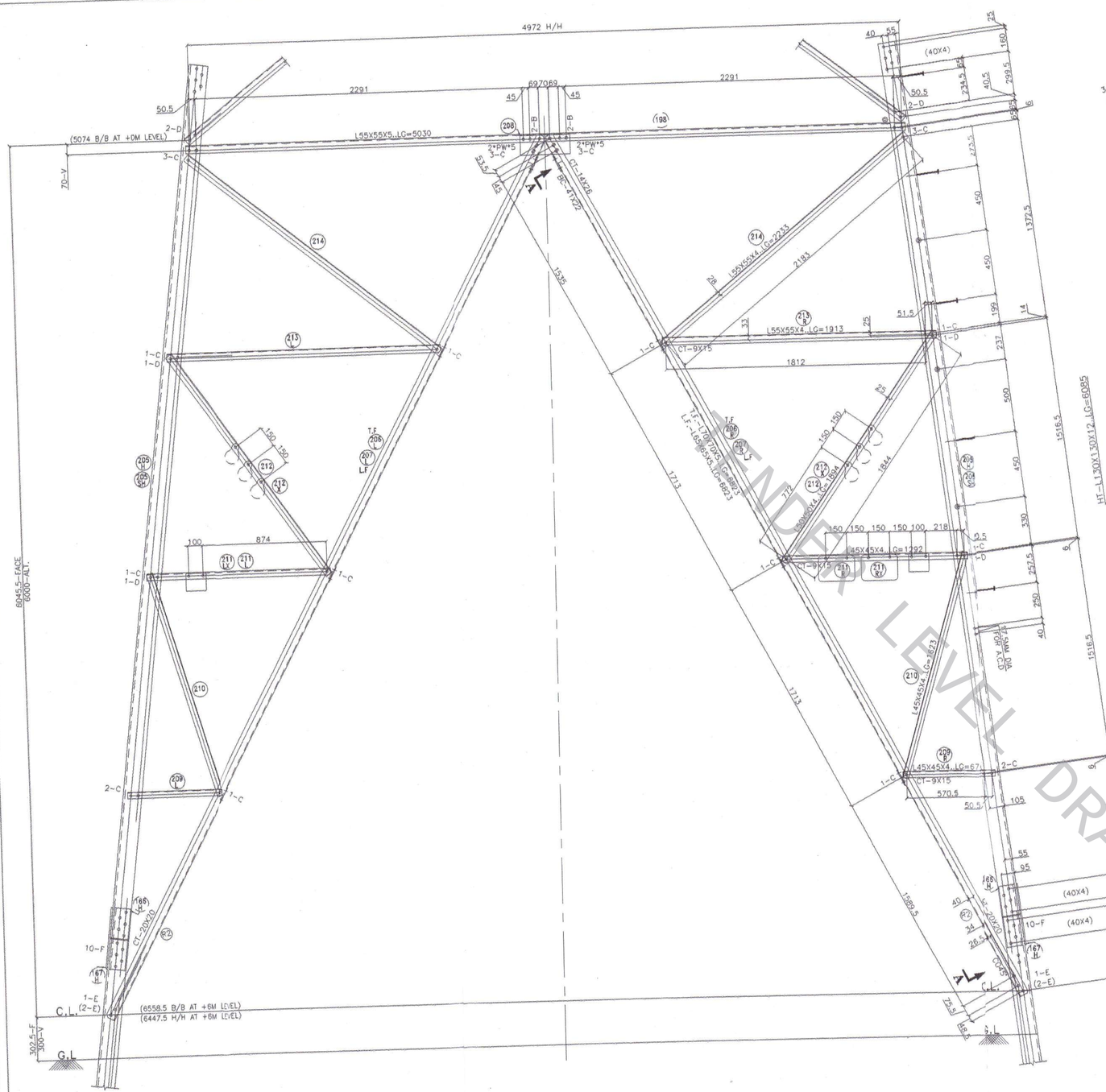
	NAME	SIGN	DATE
DSGN & DRWN.			26/9/15
CHKD			
APPD			

TITLE : TOWER TYPE 'B'
"+3M BODY EXTENSION & COMMON PLAN"
PLAN VIEW FOR +3M & +6M BODY EXTN..
(TOP PART OF +9M BODY EXTENSION)

SCALE 1:15
PROJECTION

DRG. No: BPC/EDCD/SPIL/B/STR/01
NO OF SHEETS : 5 OF 9
SIZE A1
REV. 3

TO BE USED FOR WOBTHANG TRANSMISSION LINE



BODY VERTICAL SLOPE

TAN β	=	0.123702
2TAN β	=	0.247404
FACE	=	1.007622
DEV.	=	1.015187

IN FACE SLOPE

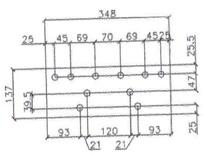
TAN β	=	0.122766
SEC β	=	1.007508

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A — Document approved as submitted; proceed with fabrication / construction
- ☐ B — Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
- ☐ D — Our comments are noted in the memo attached to this transmittal.
- ☐ E — Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F — Correct original of the document to reflect our comments and resubmit for records.
- ☐ G — Documents of this category are for information only and not for approval. Information furnished on the documents is noted.
- ☐ H — Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I — Document returned without review.

Approval conveyed herein vide letter# _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed _____ Date 11/03/2016



208 PL-137X6, LG=34B

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+6M EXT.	PLAN
B	ø16 x 35mm long	96	12
C	ø16 x 40mm long	140	16
D	ø16 x 45mm long	32	–
E	ø16 x 50mm long	8	–
F	ø16 x 55mm long	80	–
G	ø16 x 60mm long	–	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		356	28
ø16X175 STEP BOLTS		12	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		18	–
6 THK WASHER		–	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS. IF NOT SATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4139.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. + ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø18mm STEP BOLT.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BKTS.
17. FOR _____ REFR DRG. NO. BPC/EDCD/B/STR/01
18. FOR _____ REFR DRG. NO. BPC/EDCD/B/STR/01
19. FOR _____ REFR DRG. NO. _____
20. FOR _____ REFR DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETR "B-1.2 ETC."
22. STEP BOLTS OF 18MM DIAMETER AND 175MM LNG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	RVD.	CHKD.	DATE
R2	REVISED AS PER CLIENT COMMENTS DURING TOWER TESTING			31/10/15
R1	REVISED AS PER CLIENT COMMENTS			

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MARK Nos. :- 166 TO 167 & 205 TO 221

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01	NAME	SIGN	DATE
DSGN & DRWN			01/10/15
CHKD			
APPD			

TITLE : TOWER TYPE "B" "+6M BODY EXTENSION"

SCALE 1:15

PROJECTION

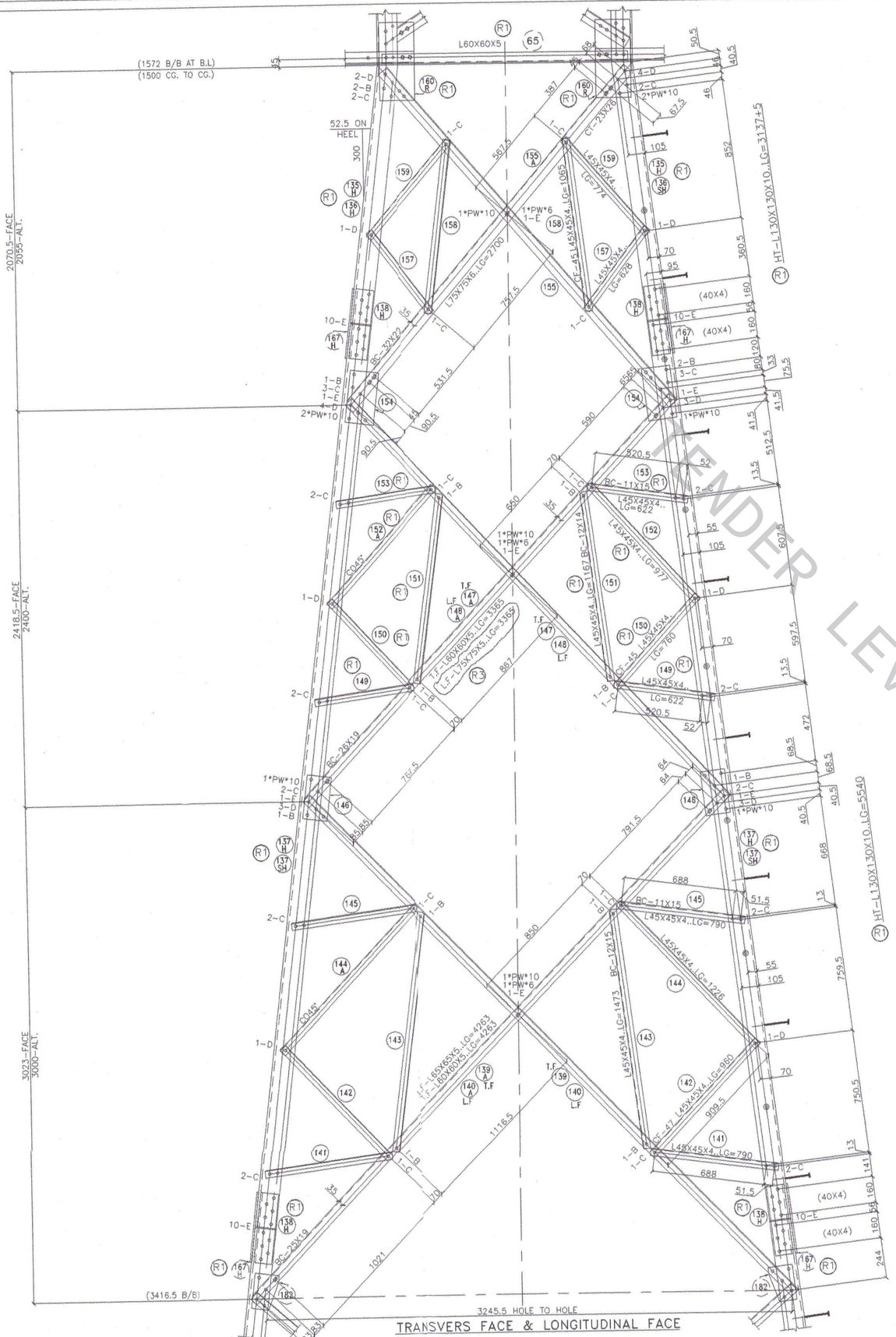
DRG. No: BPC/EDCD/SPIL/B/STR/01

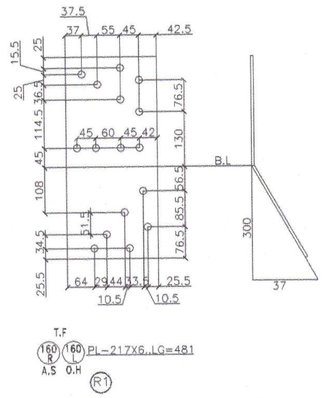
NO OF SHEETS : 7 OF 9

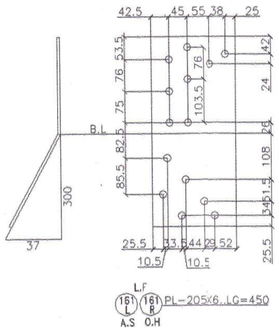
SIZE A1

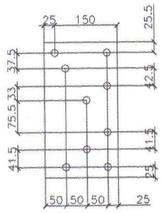
REV. 1

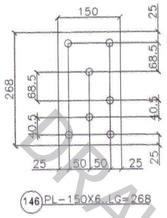
TO BE USED FOR WOBTHANG TRANSMISSION LINE

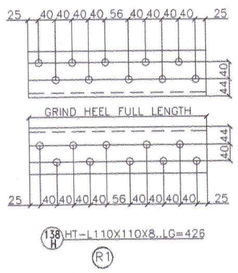












BODY VERTICAL SLOPE	
TAN B	= 0.123702
2TAN B	= 0.247404
FACE	= 1.007622
DEV.	= 1.015187
IN FACE SLOPE	
TAN B	= 0.122766
SEC B	= 1.007508

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
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Signed 11/05/2016

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	ø16 x 35mm long	60
C	ø16 x 40mm long	168
D	ø16 x 45mm long	100
E	ø16 x 50mm long	188
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
SPRING WASHERS		516
ø16X175 STEP BOLTS		15
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		–
6 THK WASHER		12
8 THK WASHER		–
10 THK WASHER		40

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS. IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR ± 0 BASE (SHEET 5 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1.2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

PROTO CORRECTED

OMIT MARK NO. 156
MARK Nos. :- 135 TO 161

This is the private property of EDCD, BPCL, THIMPHU, BHUTAN. and without their consent must under no circumstances be shown or given to third parties. all legal rights reserved.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER PROTO ASSEMBLY			08/12/16
R1	REVISED AS PER CLIENT COMMENTS			31/10/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT.LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN.			26/9/15
CHKD			
APPD			

TITLE : 132KV D/C TOWER TYPE "B" "BODY"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/B/STR/01

NO. OF SHEETS : 4 OF 9

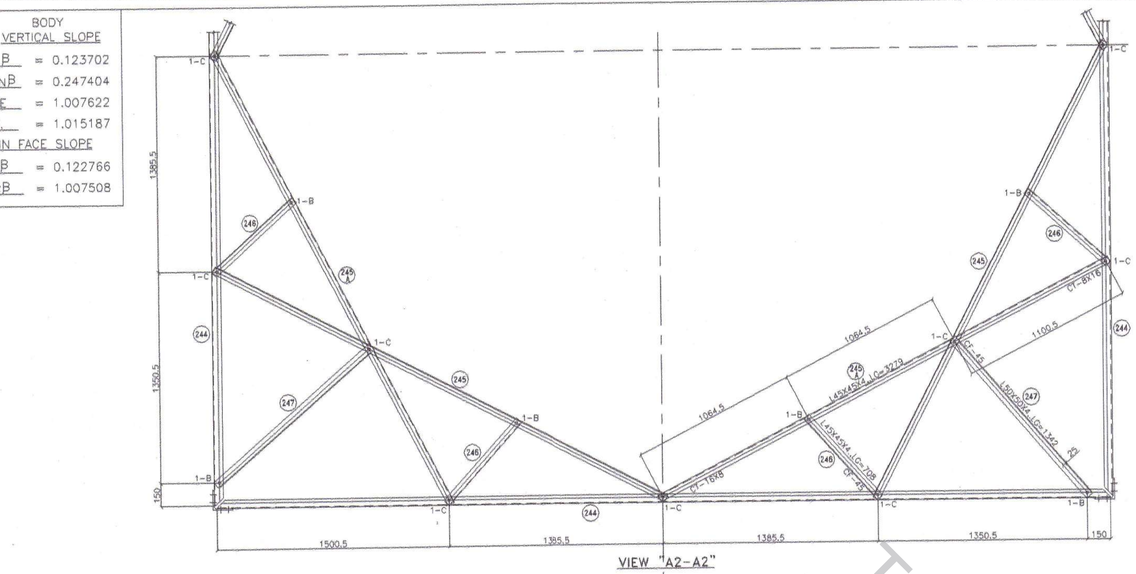
SIZE A1

REV. 3

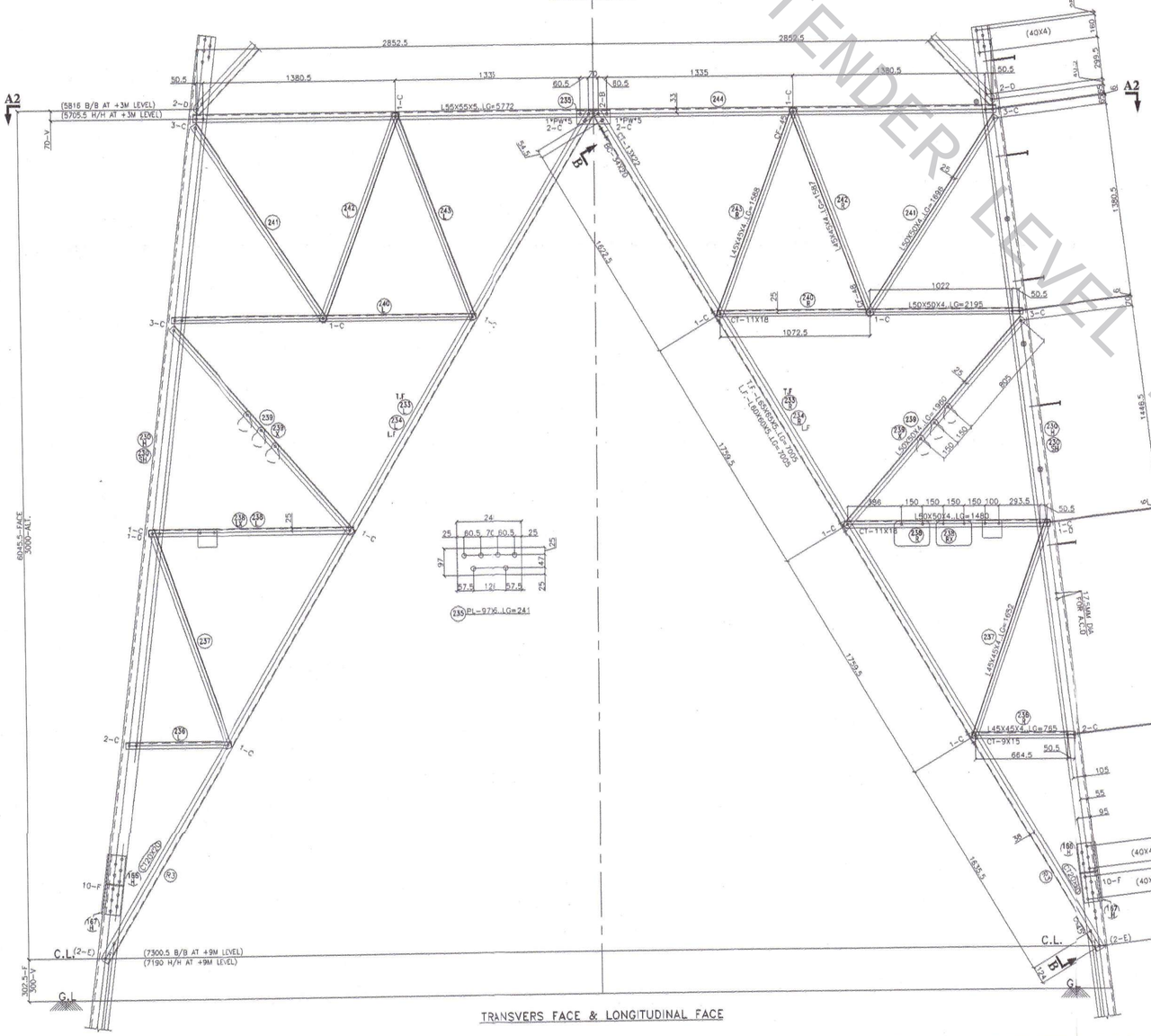
TENDER LEVEL DRAWING

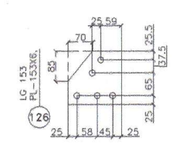
TO BE USED FOR WOBTHANG TRANSMISSION LINE

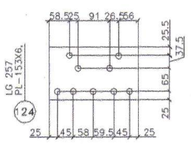
BODY VERTICAL SLOPE	
TAN β	= 0.123702
2TAN β	= 0.247404
FACE	= 1.007622
DEV.	= 1.015187
IN FACE SLOPE	
TAN β	= 0.122766
SEC β	= 1.007508

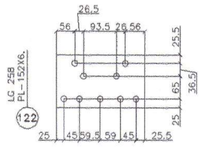


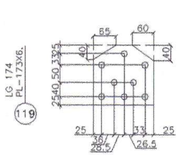
VIEW "A2-A2"

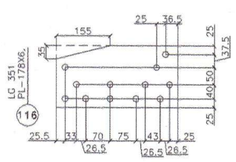

A2
A2
(5816 B/B AT +3M LEVEL)
(5705.5 H/H AT +3M LEVEL)
(7300.5 B/B AT +9M LEVEL)
(7190 H/H AT +9M LEVEL)
2852.5
2852.5
1380.5
1335
1335
1380.5
50.5
60.5
80.5
L50X55X5,LG=5772
1*PW*5
2-C
CT-13X22
BC-3X20
CT-11X18
CT-9X15
L45X45X4,LG=1588
L45X45X4,LG=1605
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L50X50X4,LG=1379
L45X45X4,LG=709
L45X45X4,LG=709
HT-L130X130X12,LG=6985
1522.5
1729.5
1729.5
1835.5
1072.5
1022
1448.5
1516.5
807
664.5
293.5
150 150 150 150 100
(40X4)
10-F
2-D
2-E
3-C
1-C
1-B
2-C
1-C
1-C
1

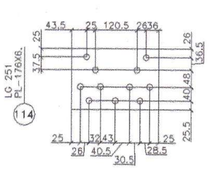


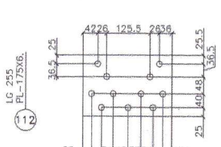


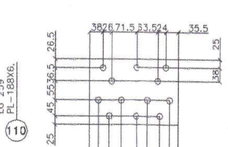


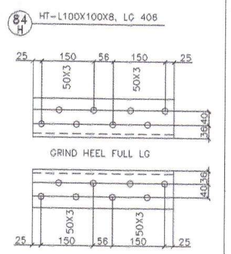


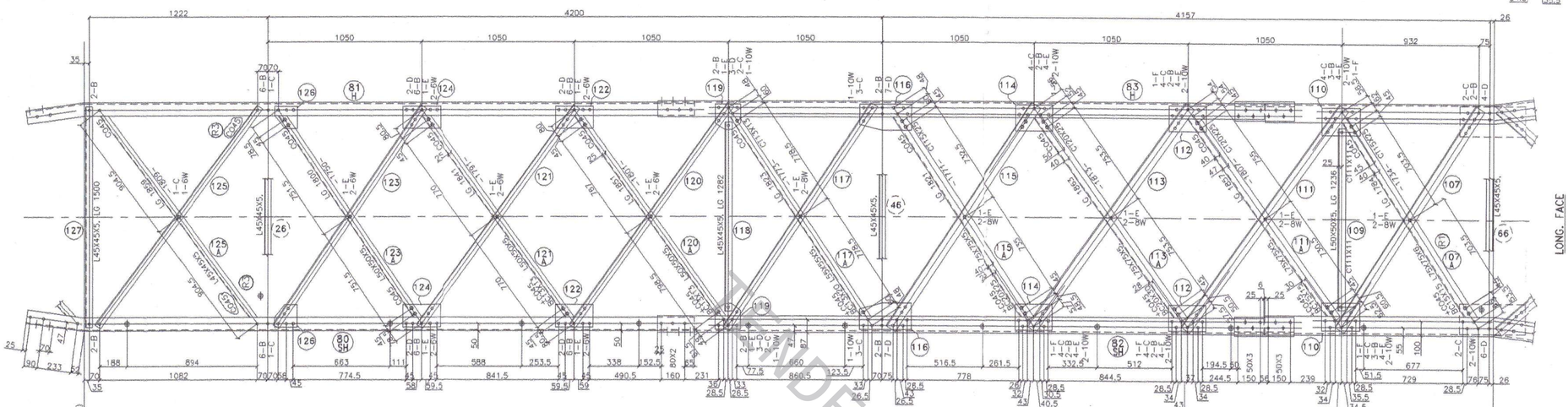


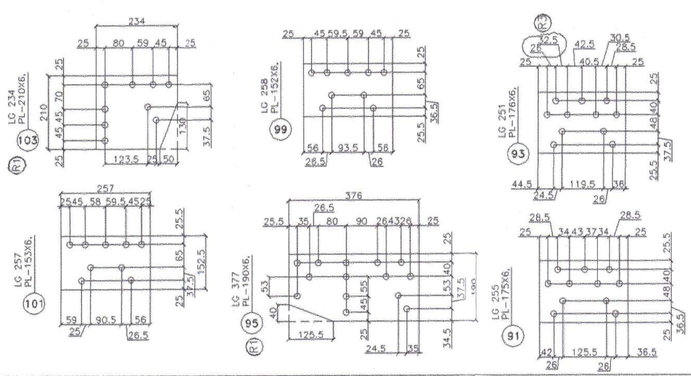








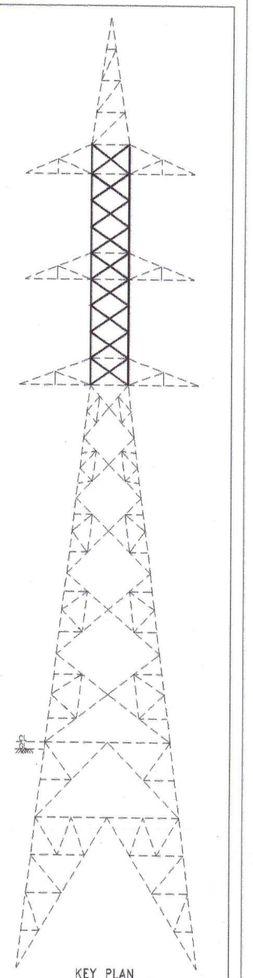




GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR PEAK & TOP X-ARM (SHEET 1 O' 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR BODY (SHEET 4 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 75MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15



LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY
B	ø16 x 35mm long	254
C	ø16 x 40mm long	188
D	ø16 x 45mm long	146
E	ø16 x 50mm long	238
F	ø16 x 55mm long	54
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
	SPRING WASHERS	880
	STEP BOLTS	42
	30mm O.D. PACK WASHERS ø17.5mm	
	5 THK WASHER	–
	6 THK WASHER	76
	8 THK WASHER	44
	10 THK WASHER	94

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on this document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# _____ dated _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it constitute Purchaser's right under the contract.

Signed _____ Date _____

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU::BHUTAN

PROTO CORRECTED

MARK NOS 80 TO 127
OMMITED MARK NOS 106, 108

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED,

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : CAGE FOR 132KV D/C TOWER TYPE B

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/B/STR/01

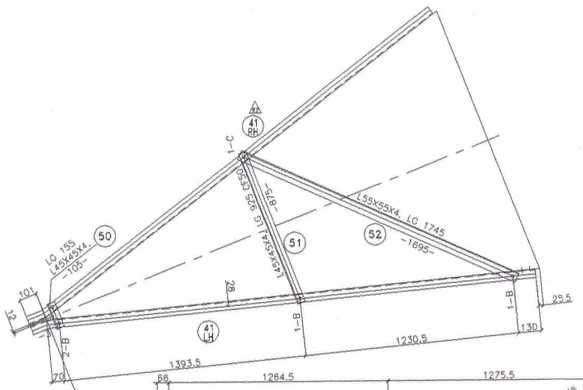
NO OF SHEETS : 3 OF 9

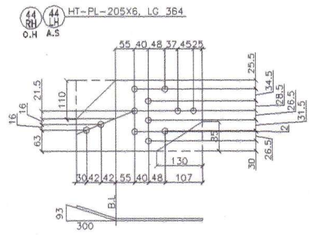
SIZE A1

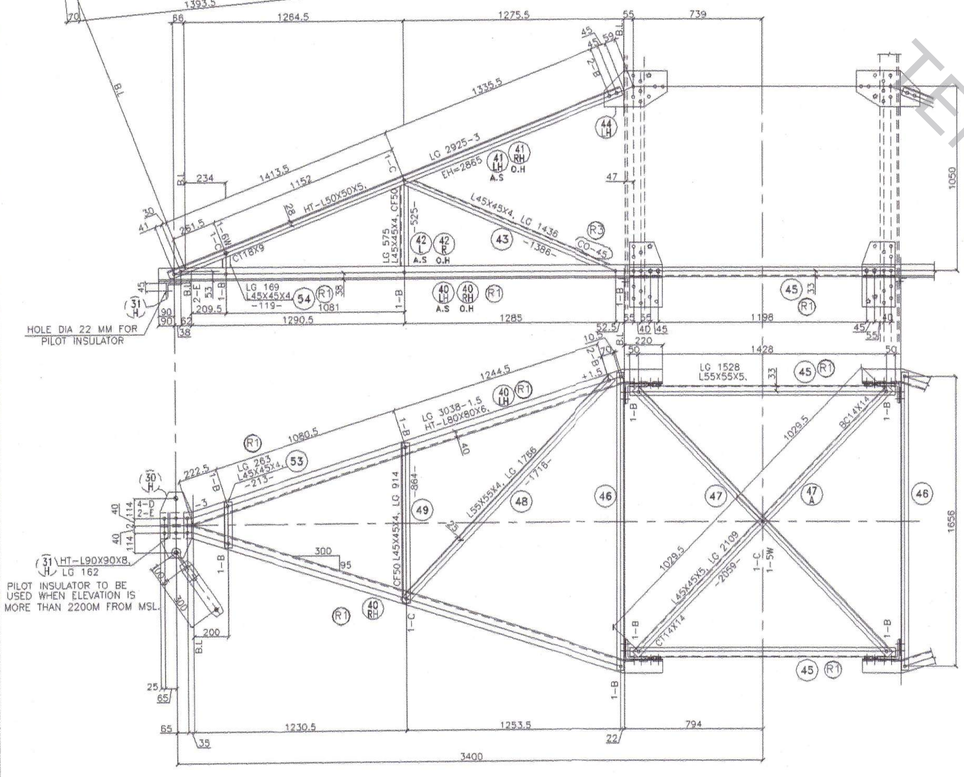
REV. 3

PROTO DRAWING

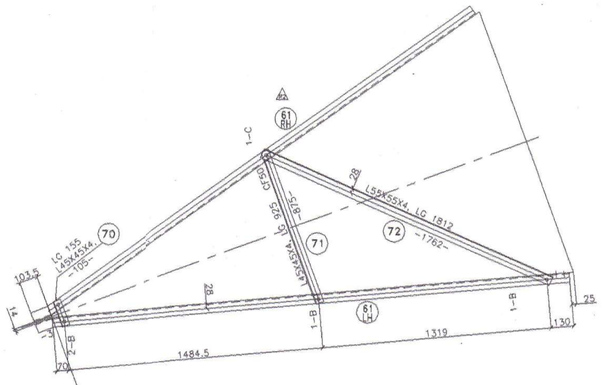
TO BE USED FOR WOBTHANG TRANSMISSION LINE

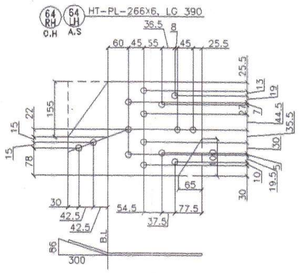


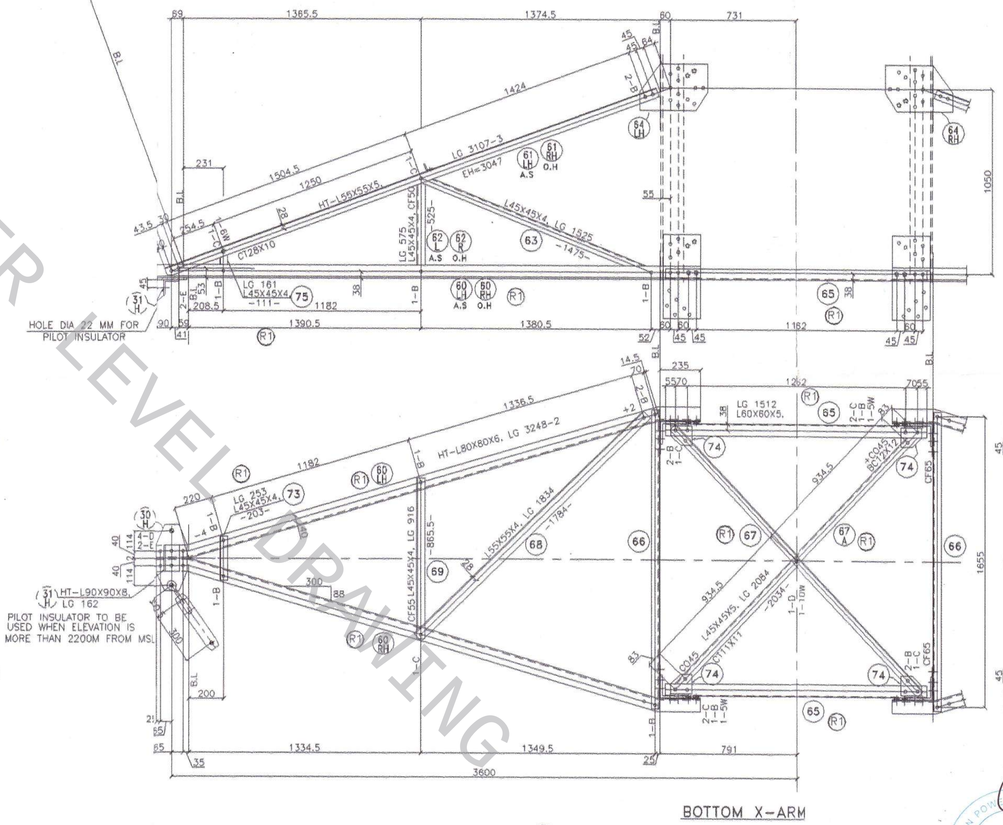




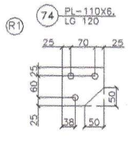
MIDDLE X-ARM

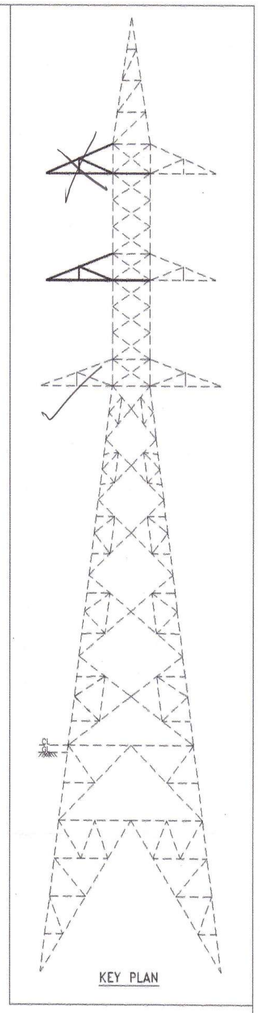






BOTTOM X-ARM





LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	92
C	ø16 x 40mm long	31
D	ø16 x 45mm long	17
E	ø16 x 50mm long	24
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		164
STEP BOLTS		–
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		01
6 THK WASHER		08
8 THK WASHER		–
10 THK WASHER		01

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm IOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm IOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm ITEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY.			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted, proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments
☐ C	Our comments are noted on the enclosed marked-up print
☐ D	Our comments are noted in the memo attached to this transmittal
☐ E	Correct original of the document to reflect our comments and resubmit for approval
☐ F	Correct original of the document to reflect our comments and resubmit for records
☐ G	Documents of this category are for information only and not for approval. Information furnished on the documents is noted
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor
☐ I	Document returned without review

Approval conveyed herein vide letter/ _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international law/ jaws may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed _____ Date 11/02/2016

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU BHUTAN

PROTO CORRECTED

MARK NOS 40 TO 54, 60 TO 75

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED.

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			21/9/15
CHKD			
APPD			

TITLE : MIDDLE X-ARM & BOTTOM X-ARM FOR 132KV D/C TOWER TYPE "B"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/B/STR/01

NO OF SHEETS : 2 OF 9

SIZE A1

REV. 3

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE

PEAK SLOPE

Tan B	=	0.13846154
2 Tan B	=	0.27692308
Face	=	1.00954029
Dev	=	1.01899126

In Face Slopes

Tan B	=	0.13715306
Sec B	=	1.00936166

L70X70X5, LG 4876

58.6 ON HEEL

(1550 B/B AT BEND LINE)

TRANS. FACE

LONG. FACE

PILOT INSULATOR TO BE USED WHEN ELEVATION IS MORE THAN 2200M FRIM MSL.

TOP X-ARM

KEY PLAN

HOLE DIA 22MM FOR PILOT INSULATOR

BHUTAN POWER CORPORATION LIMITED VENDOR DOCUMENT / REVIEW STATUS	
☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of this document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on the document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it alter the Purchaser's rights under the contract.

Signed: ..... Date: 11/03/2016

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU (BHUTAN)

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY
B	ø16 x 35mm long	83
C	ø16 x 40mm long	37
D	ø16 x 45mm long	8
E	ø16 x 50mm long	12
F	ø16 x 55mm long	-
G	ø16 x 60mm long	-
H	ø16 x 65mm long	-
J	ø16 x 70mm long	-
K	ø16 x 75mm long	-
L	ø16 x 80mm long	-
M	ø16 x 85mm long	-
N	ø16 x 90mm long	-
SPRING WASHERS		140
STEP BOLTS		22
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		01
6 THK WASHER		04
8 THK WASHER		-
10 THK WASHER		-

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIS CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVI.	CHKD.	DATE
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY.			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15

PROTO CORRECTED

MARK NOS 1 TO 11, 20 TO 36

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED.,GURGAON

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN.			18/9/15
CHKD			
APPD			

TITLE : PEAK & TOP X-ARM FOR 132KV D/C TOWER TYPE "B"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/B/STR/01

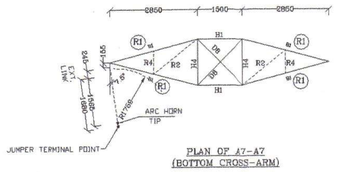
NO OF SHEETS : 1 OF 9

SIZE A1

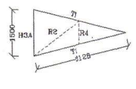
REV. 3

TENDER LEVEL DRAWING

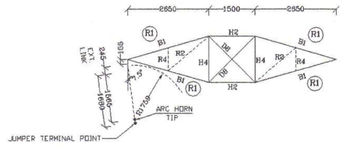
TO BE USED FOR WOBTHANG TRANSMISSION LINE



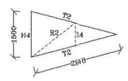
PLAN OF A7-A7
(BOTTOM CROSS-ARM)



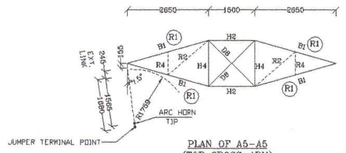
PLAN OF A10-A10
(BOTTOM CROSS ARM)



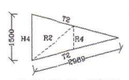
PLAN OF A6-A6
(MIDDLE CROSS-ARM)



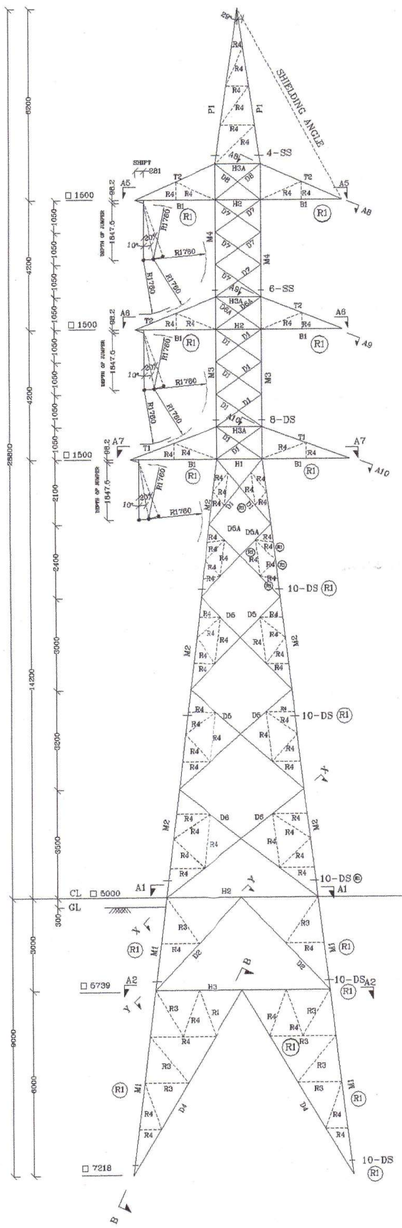
PLAN OF A9-A9
(MIDDLE CROSS-ARM)



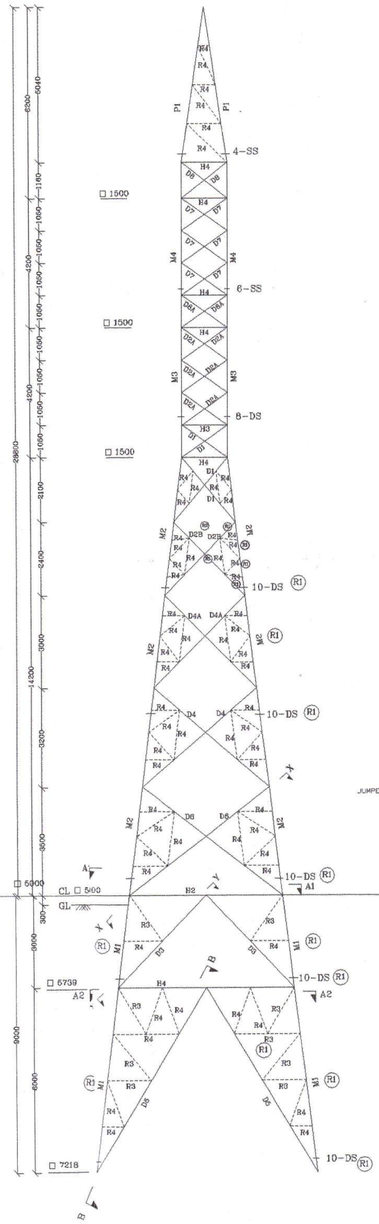
PLAN OF A5-A5
(TOP CROSS-ARM)



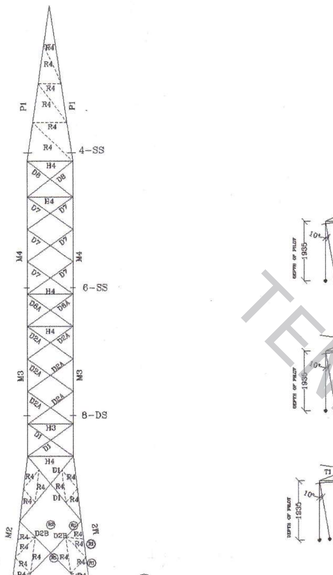
PLAN OF A8-A8(TOP
CROSS-ARM)



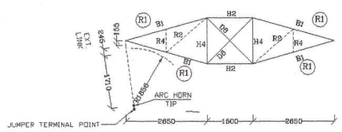
TRANSVERSE FACE



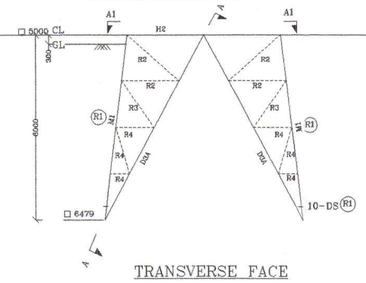
LONGITUDINAL FACE



FOR ELEVATION
MORE THAN 2200M FROM
MSL

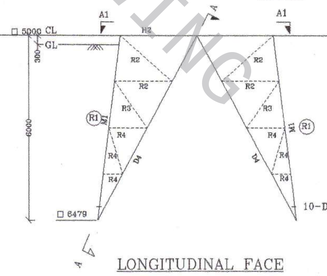


PLAN OF A6-A6
(MIDDLE CROSS-ARM)
FOR ELEVATION
MORE THAN 2200M FROM MSL

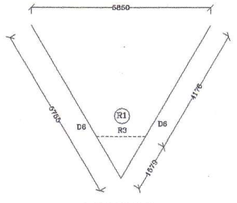


TRANSVERSE FACE

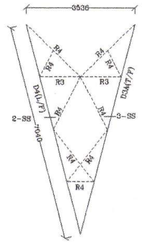
+6M BE



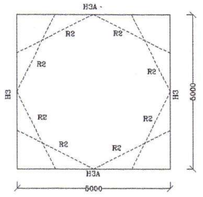
LONGITUDINAL FACE



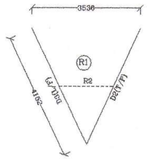
PLAN OF X-X



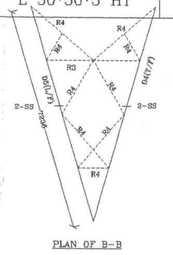
PLAN OF A-A



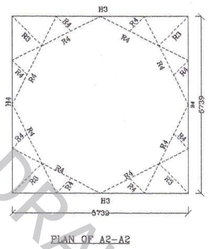
PLAN OF A1-A1



PLAN OF Y-Y



PLAN OF B-B



PLAN OF A2-A2

MEMBER CODE	SECTION	QTY. NOS.	MEMBER CODE	SECTION mmxmmxmm	QTY. NOS.	
HORIZONTAL MEMBER			MAIN LEG MEMBERS			
H1	L 60*60*5	2	M1	L 130*130*12HT	10-DS	(R1)
H2	L 55*55*5	2	M2	L 130*130*10HT	10-DS	(R1)
H3	L 50*50*5	1	M3	L 110*110*10 HT	8-DS	
H3A	L 50*50*5	2	M4	L 90*90*6 HT	6	
H4	L 45*45*5	1	PEAK MEMBER			
H4A	L 45*45*5	2	P1	L 70*70*5	4	
REDUNTANT MEMBER			DIAGONAL MEMBERS			
R1	L 60*60*4	2	D1	L 75*75*6	4	
R2	L 55*55*4	1	D2	L 75*75*5	2	
R3	L 50*50*4	1	D2A	L 75*75*5	4	
R4	L 45*45*4	1	D2B	L 75*75*5	3	(R2)
ARM TOP MEMBERS			D3	L 70*70*5	2	
T1	L 55*55*5 HT	2	D3A	L 70*70*5	3	
T2	L 50*50*5 HT	2	D3B	L 70*70*5	4	
			D4	L 65*65*5	2	
			D4A	L 65*65*5	3	
			D5	L 60*60*5	2	
			D5A	L 60*60*5	3	
			D6	L 55*55*5	2	
			D6A	L 55*55*5	3	
			D7	L 50*50*5	3	
			D8	L 45*45*5	1	
			MAIN ARM MEMBERS			
			B1	L 80*80*6 HT	4	(R1)

NOTE:-

1. ALL DIMENSION ARE IN MM.
2. ELECTRICAL CLEARANCE IS AS PER SPECIFICATION.
3. DOTTED MEMBERS INDICATE REDUNDAND MEMBERS .
4. UNDER COLUMN SHEAR,DS INDICATE DOUBLE SHEAR.
5. MATERIAL USED -MILD STEEL-IS 2062:2006 GR-250
   HIGH TENSILE STEEL - IS 2062:2006 GR-350
   BOLT AND NUTS - IS 12427:2001 GRADE -5.6/5
6. ALL STRAIN PLATE SHALL HAVE PROVISION FOR PILOT INSULATOR STRING.
7. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.
8. TWO HOLES OF 17.5MM ABOUT 50MM APART SHALL BE DRILLED ON EACH TOWER LEG FOR EARTHING PURPOSE .
9. PILOT INSULATOR TO BE USED WHEN ELEVATION IS MORE THAN 2200M FROM MSL.
10. ANTI-CLIMBING DEVICE SHALL BE PROVIDED 2500MM ABOVE THE GROUND LEVEL.

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A Document approved as submitted, proceed with fabrication / construction
- ☐ B Document approved subject to comments noted; proceed with fabrication / construction considering our comments
- ☐ C Our comments are noted on the enclosed marked-up print.
- ☐ D Our comments are noted in the memo attached to this transmittal.
- ☐ E Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F Correct original of the document to reflect our comments and resubmit for records.
- ☐ G Documents of this category are for information only and not for approval. Information furnished on the document is noted.
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Signed _____ Date _____

BHUTAN POWER CORPORATION LTD.
TRANSMISSION CONSTRUCTION DEPARTMENT
TRIMPHY - THIMPHU

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STANDARD TOWER +9M BE

STUB -L 130*130*12 HT

SYM.	REVISIONS	REVD.	CHKD.	DATE
(R2)	CHANGE IN MEMBER AS PER CLIENT COMMENT			
(R1)	REVISION AS PER CLIENT COMMENT			

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			31/8/15
CHKD			
APPD			

TITLE : SINGLE LINE DIAGRAM OF TOWER TYPE "B"

SCALE 1:100

PROJECTION

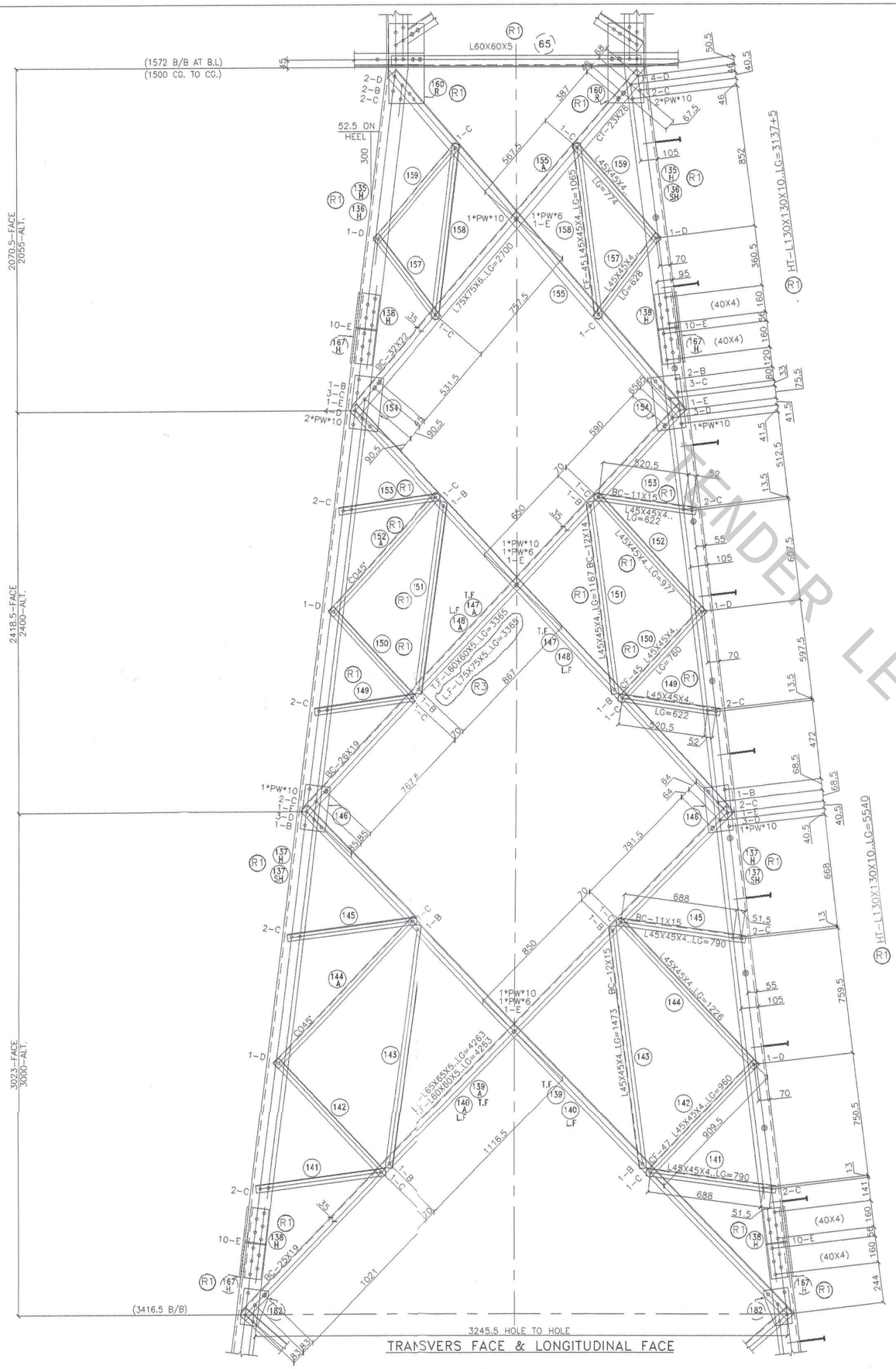
DRG. No: BPC/EDCD/SPL/B/SLD/01

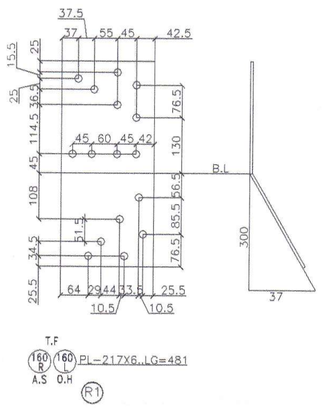
NO OF SHEETS : 1 of 1

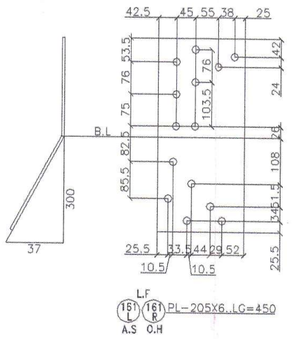
SIZE A1

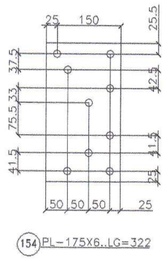
REV 2

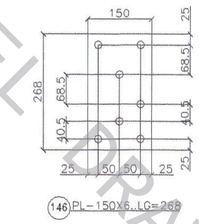
TO BE USED FOR WOBTHANG TRANSMISSION LINE

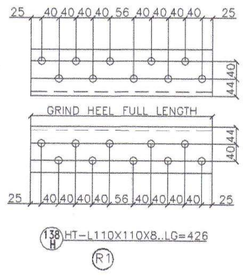












LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	ø16 x 35mm long	60
C	ø16 x 40mm long	168
D	ø16 x 45mm long	100
E	ø16 x 50mm long	188
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
SPRING WASHERS		516
ø18X175 STEP BOLTS		15
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		–
6 THK WASHER		12
8 THK WASHER		–
10 THK WASHER		40

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted, proceed with fabrication/construction.
☐ B	Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on the documents noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter dated _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed _____ Date 05.11.16

BODY VERTICAL SLOPE

TAN β	=	0.123702
2TAN β	=	0.247404
FACE	=	1.007622
DEV.	=	1.015187

IN FACE SLOPE

TAN β	=	0.122766
SEC β	=	1.007508

BHUTAN P.C. CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT BHUTAN

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
18. FOR ± 0 BASE (SHEET 5 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

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PROTO CORRECTED

OMIT MARK NO. 156
MARK Nos. :- 135 TO 161

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT.LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			26/9/15
CHKD			
APPD			

TITLE : "BODY" FOR 132kv D/C TOWER TYPE "DBS" (X-ARM STRENGTHENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/BS/STR/01

NO OF SHEETS : 4 OF 5

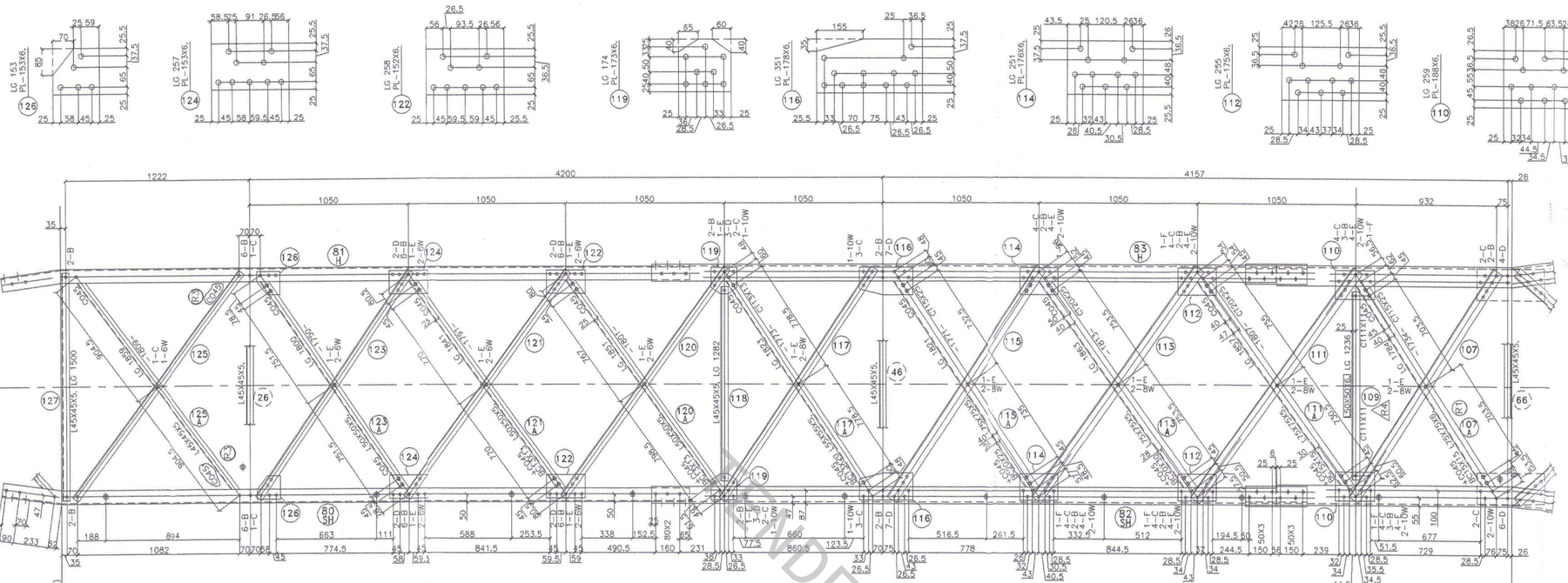
SIZE A1

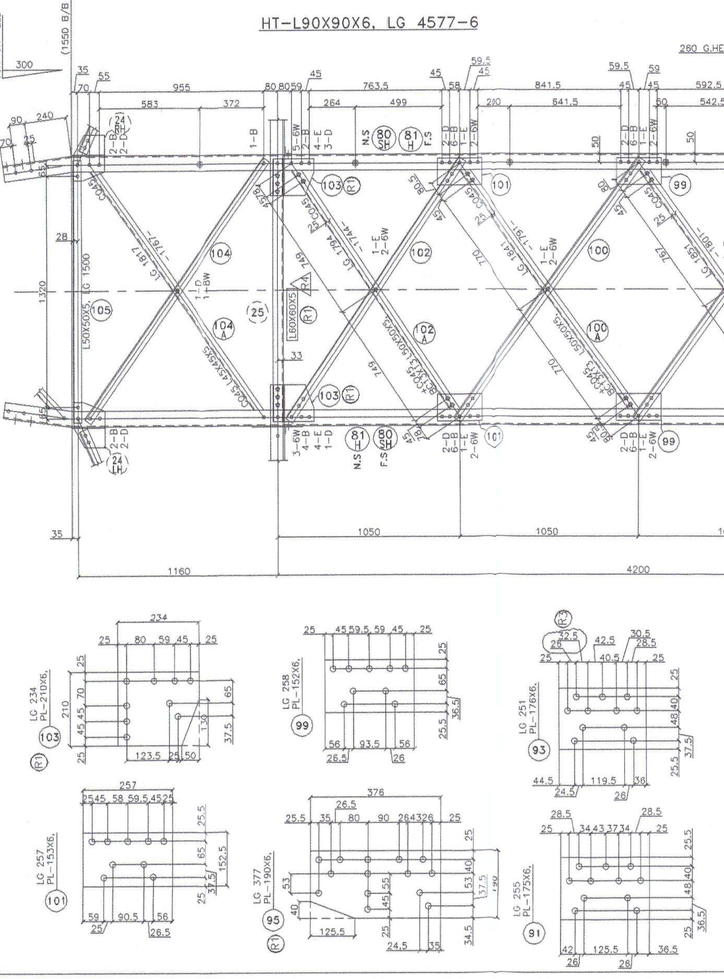
REV. 4

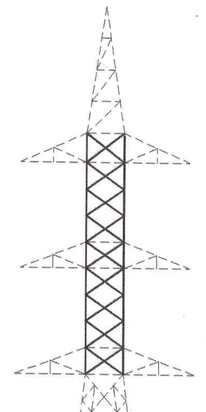
SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02/06/16
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER PROTO ASSEMBLY			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			31/10/15

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE







KEY PLAN

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY
B	ø16 x 35mm long	254
C	ø16 x 40mm long	188
D	ø16 x 45mm long	146
E	ø16 x 50mm long	238
F	ø16 x 55mm long	54
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		880
STEP BOLTS		42
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		–
6 THK WASHER		76
8 THK WASHER		44
10 THK WASHER		94

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☑ A	Document approved as submitted, proceed with fabrication/construction
☐ B	Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on this document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter ref. ..... neither relieves Vendor / Supplier of his contractual obligations and responsibilities for correctness of dimensions, materials construction weights, quantities, design details, assembly system / performance requirements and conformity of goods with international laws as may be applicable nor prejudice the Purchaser's rights under the contract.

Signed ..... Date 05/04/16

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU:BHUTAN

PROTO CORRECTED

MARK NOS 80 TO 127
OMMITED MARK NOS 105, 108

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR PEAK & TOP X-ARM (SHEET 1 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
18. FOR BODY (SHEET 4 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02.08.16
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED.

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : CAGE FOR 132KV D/C TOWER TYPE "DBS" (X-ARM STRENGHTENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/BS/STR/01

NO OF SHEETS : 3 OF 5

SIZE A1

REV. 4

UNDER DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE

PEAK SLOPE		
Tan B	=	0.13846154
2 Tan B	=	0.27692308
Face	=	1.00954029
Dev	=	1.01899126

In Face Slopes		
Tan B	=	0.13715306
Sec B	=	1.00936166

L70X70X5, LG 4876

TRANS. FACE

LONG. FACE

TOP X-ARM

KEY PLAN

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	83
C	ø16 x 40mm long	37
D	ø16 x 45mm long	8
E	ø16 x 50mm long	12
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		140
STEP BOLTS		22
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		01
6 THK WASHER		04
8 THK WASHER		–
10 THK WASHER		–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR LONGER WEIGHT SPAN			02.06.16
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY.			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15

BHUTAN POWER CORPORATION LIMITED
TRANSMISSION LINE DIVISION, NEW DELHI

- ☑ A — Document approved for fabrication / construction incorporating our comments.
- ☐ B — Document approved subject to comments noted, proceed with fabrication / construction considering ourcomments.
- ☐ C — Our comments are noted on the enclosed marked up print.
- ☐ D — Our comments are noted in the memo attached to this transmittal.
- ☐ E — Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F — Correct original of the document to reflect our comments and resubmit for records.
- ☐ G — Documents of this category are for information only and not for approval. Information furnished on the documents is noted.
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- ☐ I — Document returned without review.

Approval conveyed herein vide letter#_____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed_____ Date 6/5/16

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU:BHUTAN

PROTO CORRECTED

MARK NOS 1 TO 11, 20 TO 36

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED.,GURGAON

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : PEAK & TOP X-ARM FOR 132KV D/C TOWER TYPE "DBS" (X-ARM STRENGHTENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/BS/STR/01

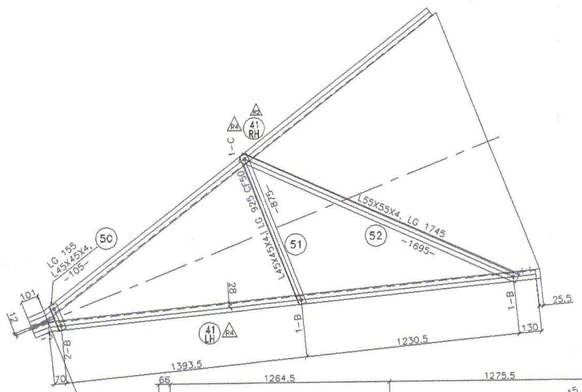
NO OF SHEETS : 1 OF 5

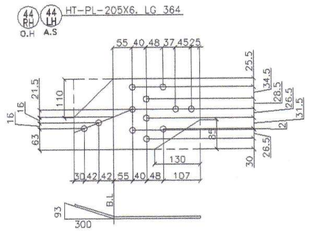
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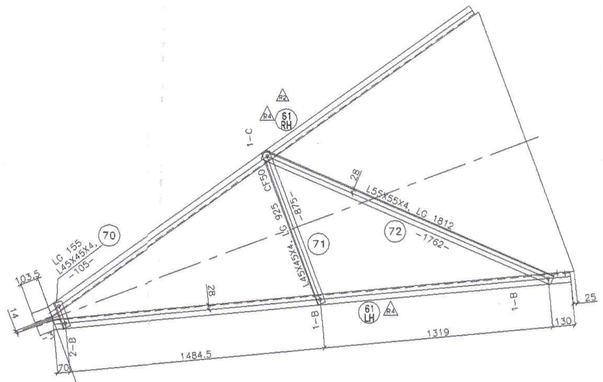
REV. 4

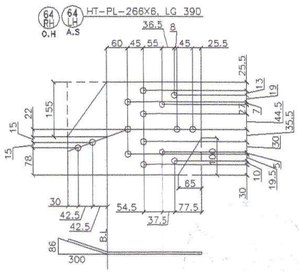
TENDER LEVEL DRAWING

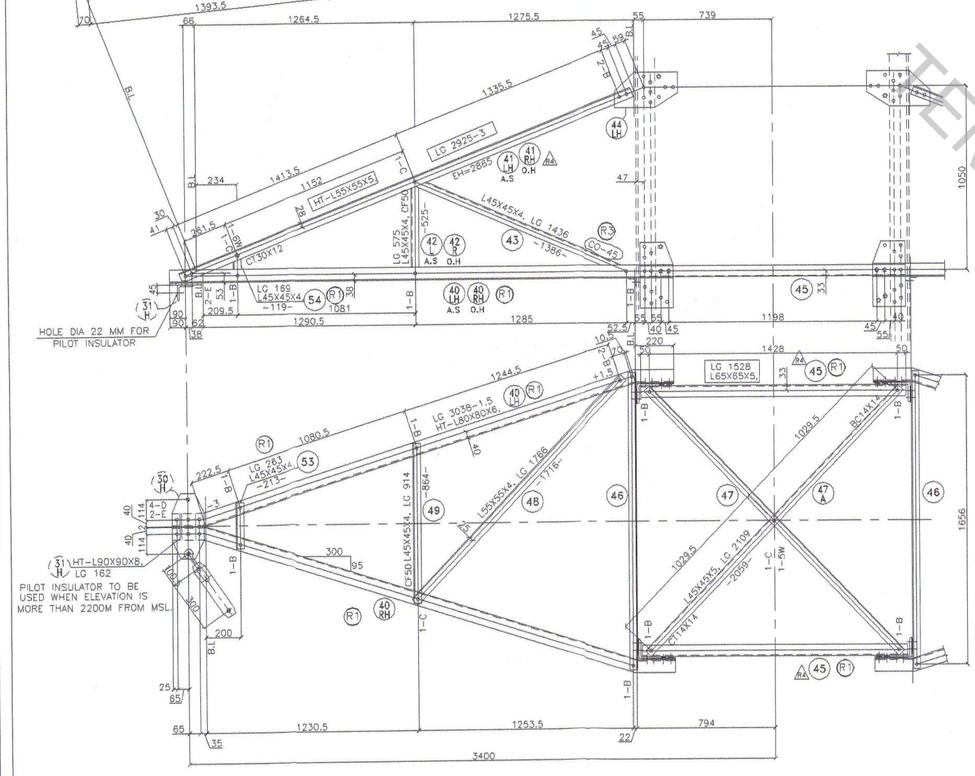
TO BE USED FOR WOBTHANG TRANSMISSION LINE



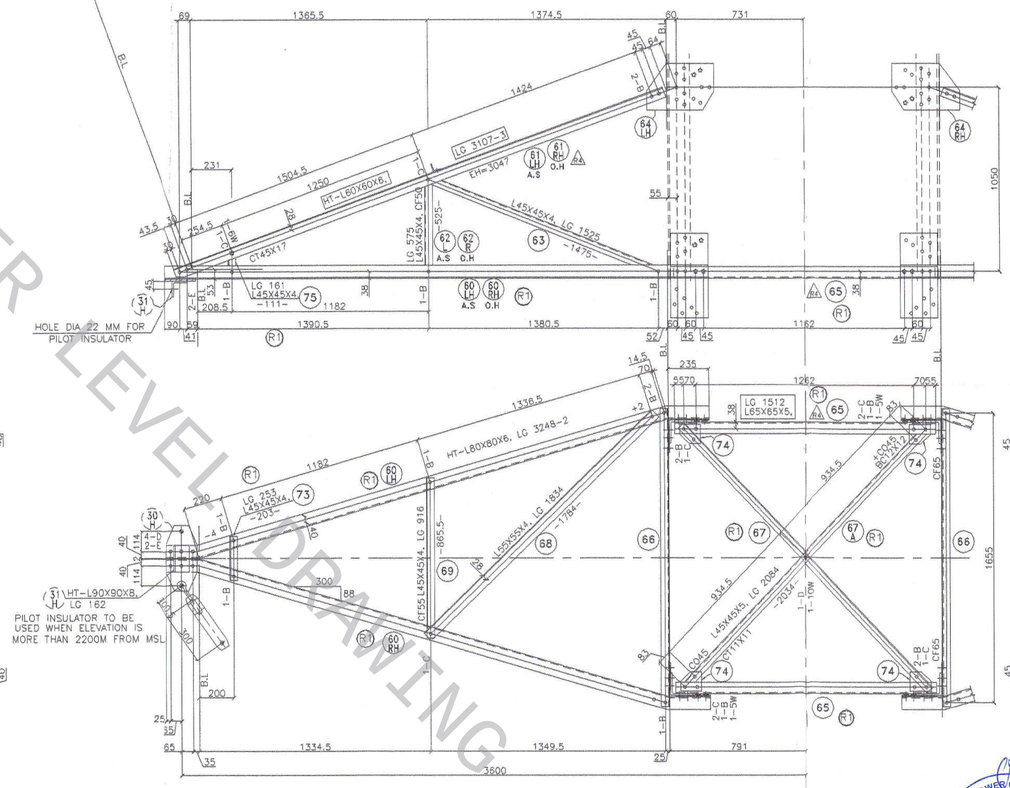




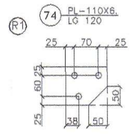


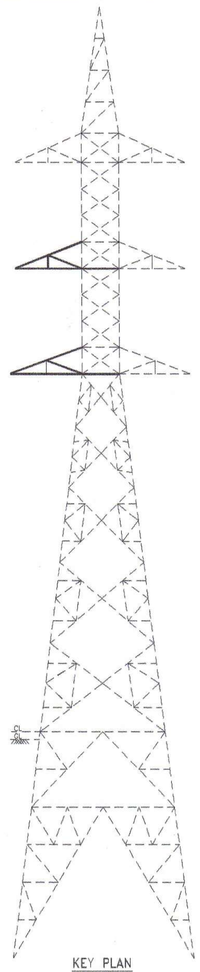


MIDDLE X-ARM



BOTTOM X-ARM





LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	92
C	ø16 x 40mm long	31
D	ø16 x 45mm long	17
E	ø16 x 50mm long	24
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		164
STEP BOLTS		–
30mm O.D. PACK WASHERS		ø17.5mm
5 THK WASHER		01
6 THK WASHER		08
8 THK WASHER		–
10 THK WASHER		01

GENERAL NOTES:-

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2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
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7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ⊕ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR LONGER WEIGHT SPAN			02.06.16
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER PROTO ASSEMBLY.			08.12.15
R1	REVISED AS PER CLIENT COMMENTS.			31.10.15

BHUTAN POWER CORPORATION LTD. DOCUMENT REVIEW STATUS

- A: This cert approved as submitted, proceed with fabrication/construction
- B: Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
- C: Our comments are noted on the enclosed marked up print.
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Approval conveyed herein vide letter/..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of [illegible] with international laws as may be applicable, nor [illegible] under the contract.

05/07/16

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU:BHUTAN

PROTO CORRECTED

MARK NOS 40 TO 54, 60 TO 75

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED.

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN.			
CHKD			
APPD			

TITLE : MIDDLE X-ARM & BOTTOM X-ARM FOR 132KV D/C TOWER TYPE "DBS" (X-ARM STRENGTHENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/BS/STR/01

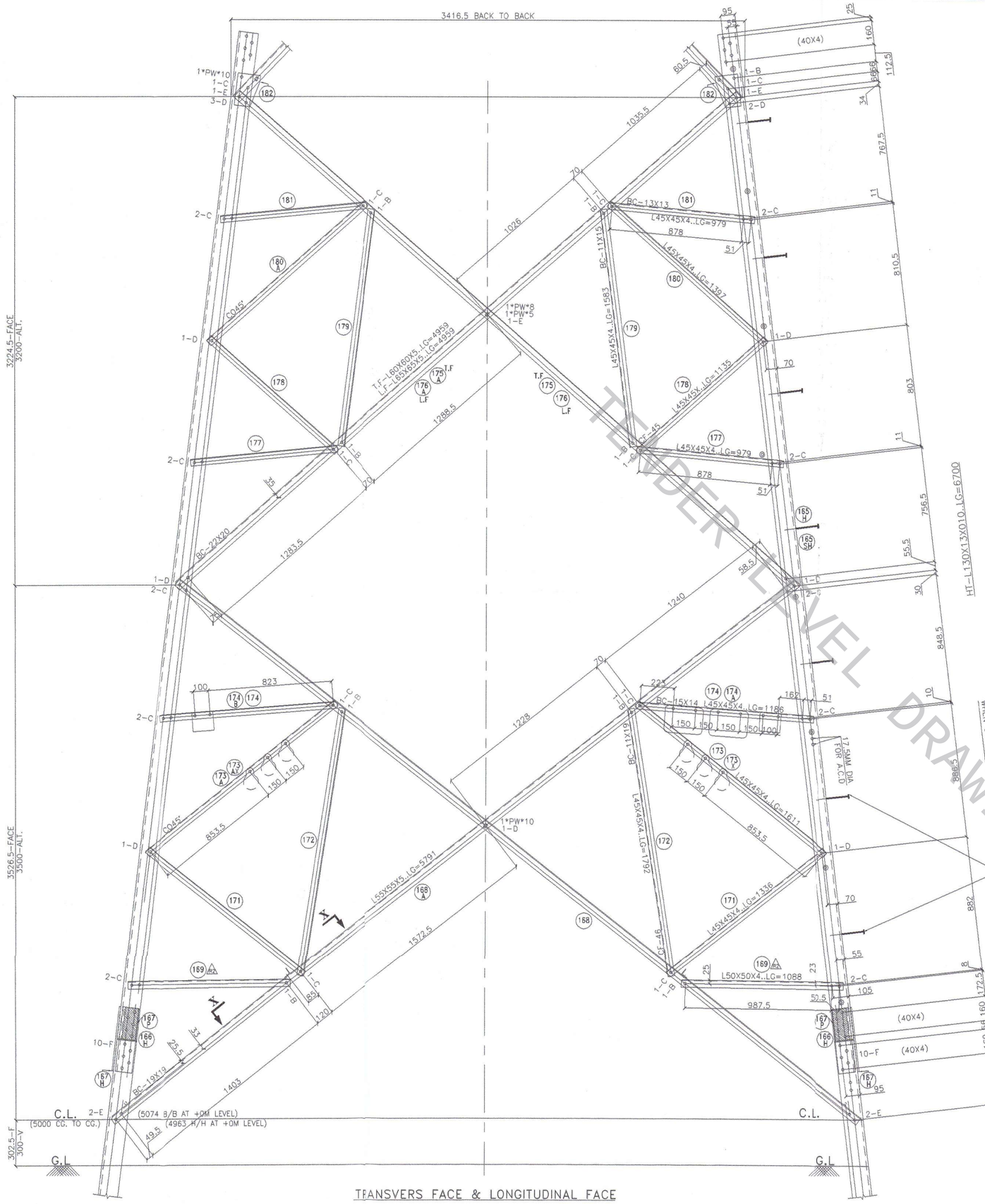
NO OF SHEETS : 2 OF 5

SIZE A1

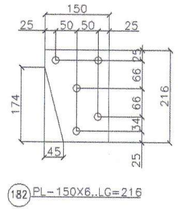
REV. 4

TENDER LEVEL DRAWING

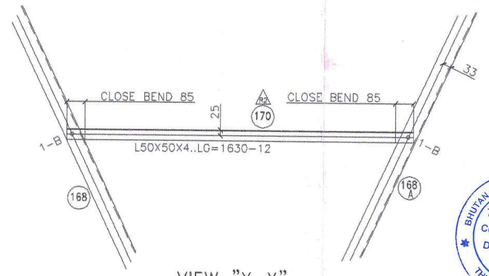
TO BE USED FOR WOBTHANG TRANSMISSION LINE



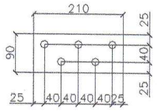
TENDER LEVEL DRAWING



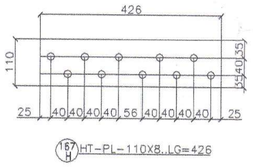
182 PL-150X6..LG=216



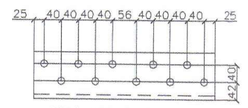
VIEW "X-X"



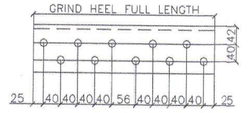
167 P.PL-90X2..LG=210



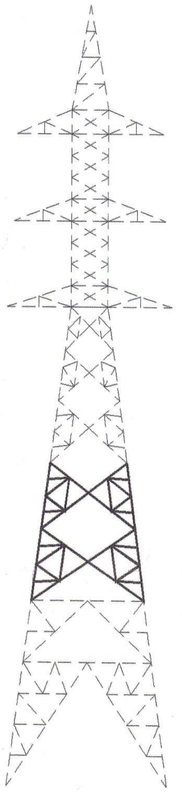
167 HT-PL-110X8..LG=426



GRIND HEEL FULL LENGTH



166 HT-L110X110X10..LG=426



BHUTAN POWER CORPORATION LIMITED
REVIEW DOCUMENT REVIEW STATUS

- ☑ A — Document approved as submitted, proceed with fabrication/construction.
- ☐ B — Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
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- ☐ I — Document returned without review.

Approval conveyed herein vide letter# ..... dated ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, mounting, fit, system / performance requirements and non-conformity of supplies with international laws as may be applicable, nor does it relieve Purchaser of rights under the contract.

Signed ..... Date 05/09/16

BODY VERTICAL SLOPE

TAN β	=	0.123702
2TAN β	=	0.247404
FACE	=	1.007622
DEV.	=	1.015187

IN FACE SLOPE

TAN β	=	0.122766
SEC β	=	1.007508

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU:BHUTAN

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY.
B	ø16 x 35mm long	44
C	ø16 x 40mm long	120
D	ø16 x 45mm long	48
E	ø16 x 50mm long	28
F	ø16 x 55mm long	80
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
SPRING WASHERS		320
ø16X175 STEP BOLTS		10
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		4
6 THK WASHER		–
8 THK WASHER		4
10 THK WASHER		8

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY (SHEET 4 OF 5) REFER DRG. NO. BPC/EDCD/SPIL/BS/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/B/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "BS-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

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SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENTHENING IS DONE FOR LONGER WEIGHT SPAN			02/08/16
R3	REVISED AS PER CHECK BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER PROTO ASSEMBLY.			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			31/10/15

PROTO CORRECTED | MARK Nos. :- 165 TO 182

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMMITED
MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.- BAGHPAT
JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : "±0 BASE" FOR 132KV D/C TOWER TYPE 'DBS' (X-ARM STRENGTHENED)

SCALE 1:15 | PROJECTION

DRG. No: BPC/EDCD/SPIL/BS/STR/01 | NO OF SHEETS : 5 OF 5 | SIZE A1 | REV. 4

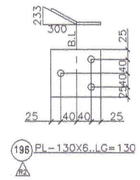
TO BE USED FOR WOBTHANG TRANSMISSION LINE

BODY VERTICAL SLOPE	
TAN β	= 0.1307171
2TAN β	= 0.2614341
FACE	= 1.0085073
DEV.	= 1.0169434
IN FACE SLOPE	
TAN β	= 0.1296144
SEC β	= 1.0083649

VIEW "C-C"

VIEW "A1-A1"

TRANSVERS FACE & LONGITUDINAL FACE



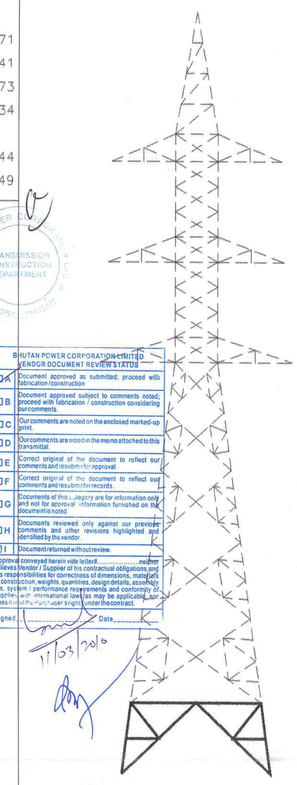
LIST OF BOLTS NUTS & WASHERS			
TYPE	SIZE	+3M EXT.	PLAN
B	ø16 x 35mm long	32	8
C	ø16 x 40mm long	32	8
D	ø16 x 45mm long	48	–
E	ø16 x 50mm long	–	–
F	ø16 x 55mm long	–	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		192	16
ø16X175 STEP BOLTS		6	–
30mm O.D. PACK WASHES ø17.5mm			
5 THK WASHER		8	4
6 THK WASHER		–	–
8 THK WASHER		–	–
10 THK WASHER		–	–

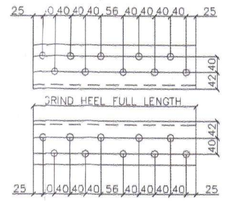
BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

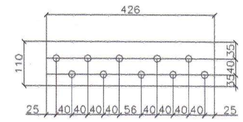
- ☒ A — Document approved as submitted, proceed with fabrication / construction
- ☐ B — Document approved subject to comments noted; proceed with fabrication / construction considering the comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
- ☐ D — Our comments are noted in the memo attached to this transmittal.
- ☐ E — Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F — Correct original of the document to reflect our comments and resubmit for records.
- ☐ G — Documents of this category are for information only and not for approval. Information furnished on the document is noted.
- ☐ H — Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I — Document returned without review.

Approval conveyed herein vide letter dated _____. Neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, material of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it authorize out of scope supplies under the contract.

Signed _____ Date 11/03/2016







GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY-II (SHEET 5 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR +9M.(BOTTOM PART)(SHEET 8OF9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR STUB & TEMPLATE (SHEET 9OF9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

PROTO CORRECTED MARK Nos. :- 185 TO 196

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BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN.			28/9/15
CHKD			
APPD			

TITLE : TOWER TYPE "C" "+3M BODY EXTENSION & COMMON PLAN" PLAN VIEW FOR +3M & +6M BODY EXTN., (TOP PART OF +9M BODY EXTENSION)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/STR/06

NO OF SHEETS : 6 OF 9

SIZE A1

REV. 3

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE

BODY VERTICAL SLOPE	
TANβ	= 0.1307171
2TANβ	= 0.2614341
FACE	= 1.0085073
DEV.	= 1.0169434
IN FACE SLOPE	
TANβ	= 0.1296144
SECβ	= 1.0083649

TRANSVERS FACE & LONGITUDINAL FACE

VIEW "A3–A3"

LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	+6M EXT.	PLAN
B	ø16 x 35mm long	88	8
C	ø16 x 40mm long	188	8
D	ø16 x 45mm long	48	–
E	ø16 x 50mm long	–	–
F	ø16 x 55mm long	–	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		404	16
ø16X175 STEP BOLTS		13	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		16	4
6 THK WASHER		4	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 G–350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR–250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:187.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & S:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ✦ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY–II (SHEET 5 OF 9) REFER DRG. O. BPC/EDCD/C/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. O. BPC/EDCD/C/STR/01
19. FOR _____ REFER DRG. O. _____
20. FOR _____ REFER DRG. O. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C–1 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACING 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL ID ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER

MARK Nos. :– 193, 194 & 203 TO 225

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO ASSEMBLY			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C TRANSMISSION LINE FROM KANGLUNG–PHUNTSHOTHANG & 132 KV D/C TRANSMISSION LINE FROM MOTANGA TO NGANGLAM

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			28/9/15
CHKD			
APPD			

TITLE : TOWER TYPE "C" "+6M BODY EXTENSION"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/STR/07

NO OF SHEETS : 7 OF 9

SIZE A1

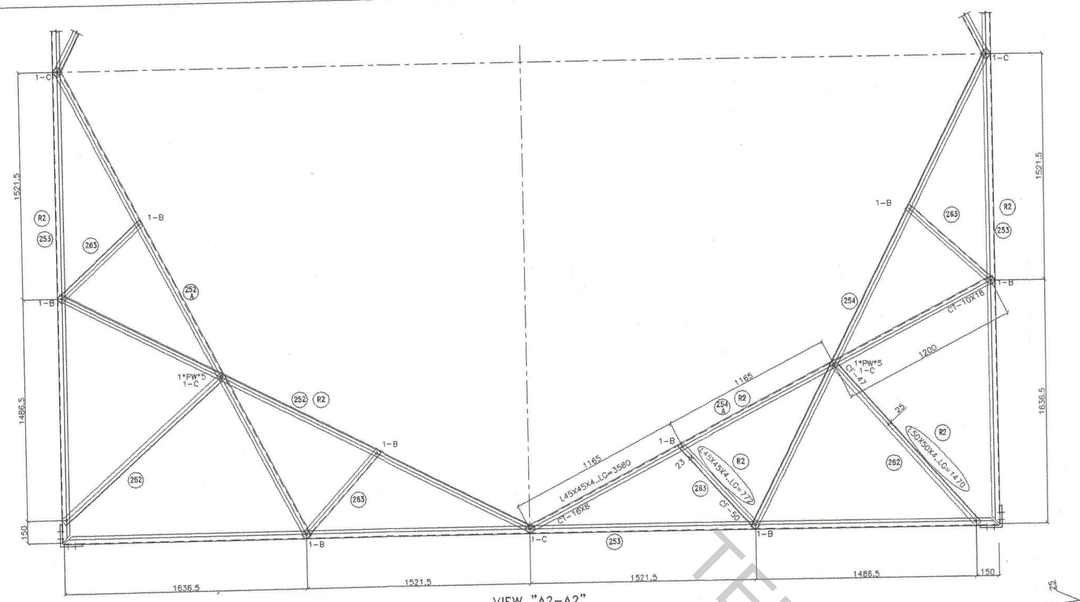
REV. 1

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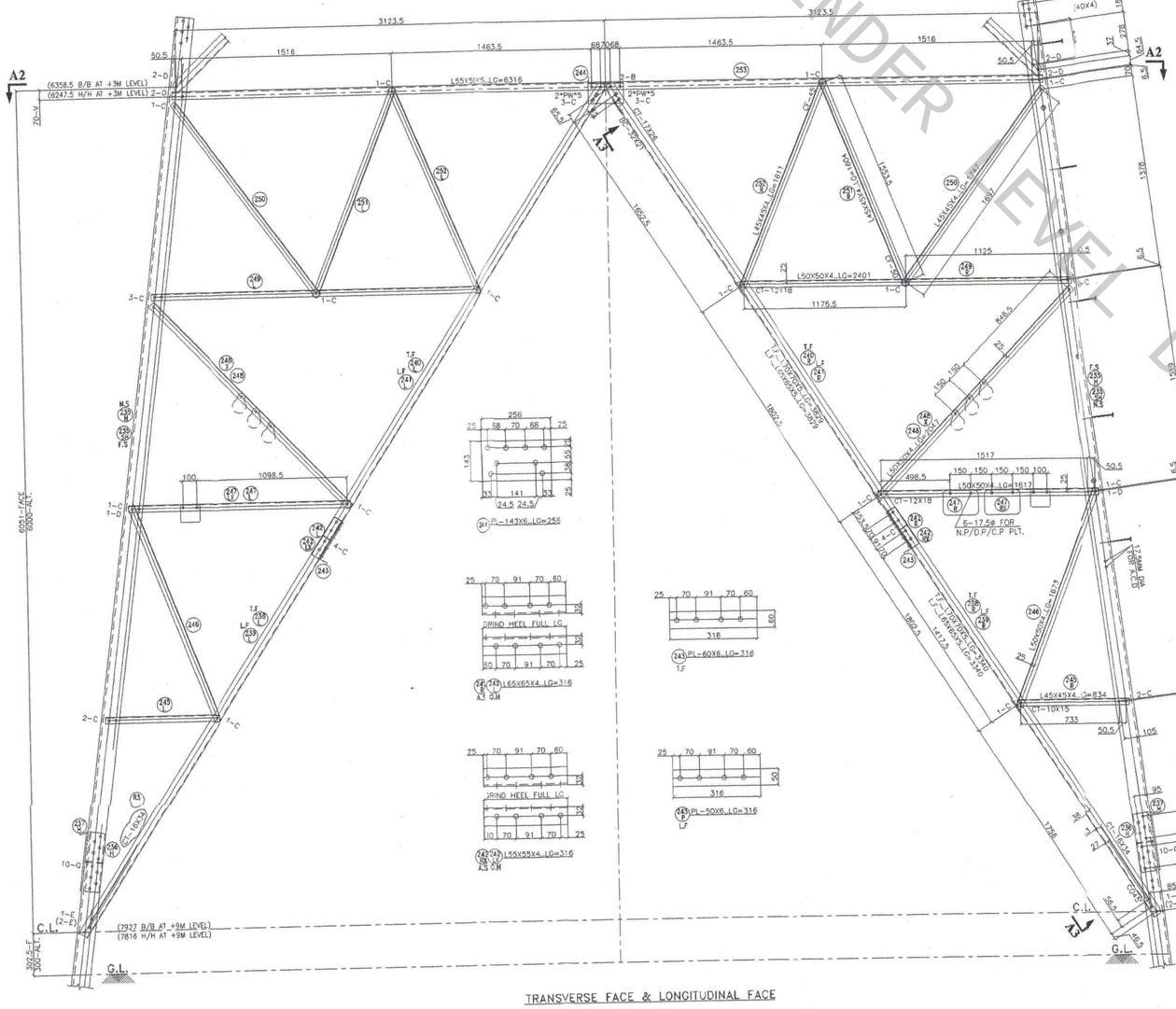
TENDER DRAWING

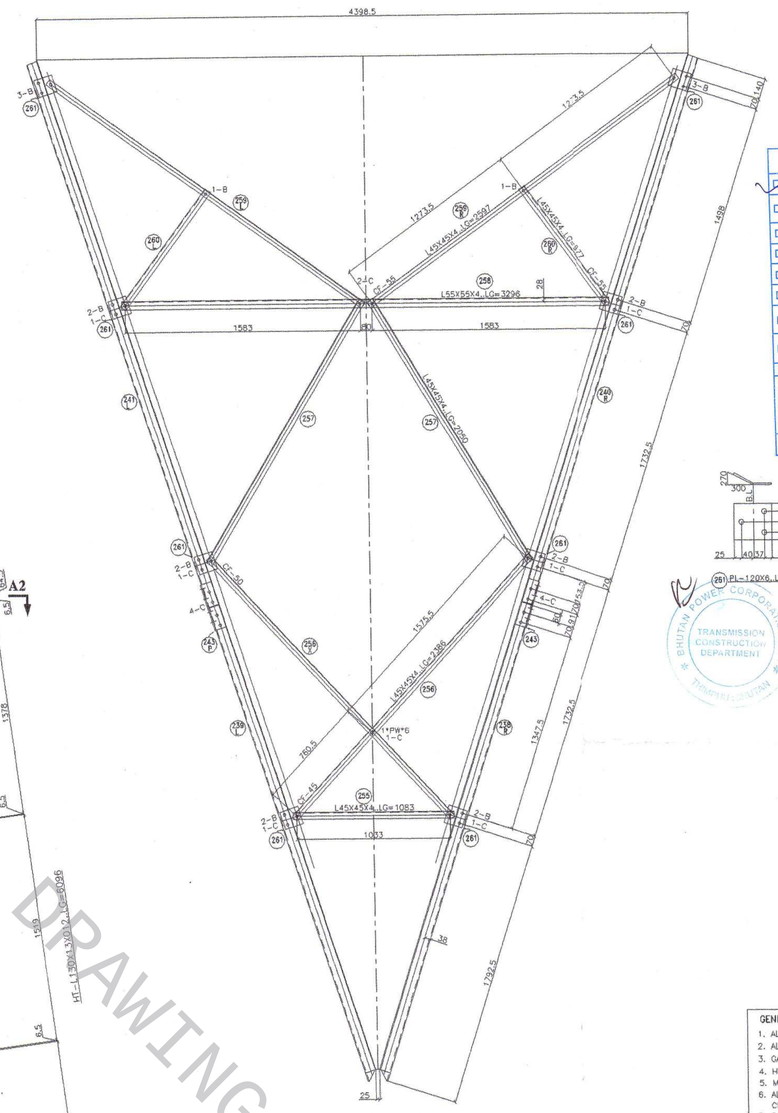
TO BE USED FOR WOBTHANG TRANSMISSION LINE

BODY VERTICAL SLOPE	
TAN β	= 0.1307171
2TAN β	= 0.2614341
FACE	= 1.0085073
DEV.	= 1.0169434
IN FACE SLOPE	
TAN β	= 0.1296144
SEC β	= 1.0083649

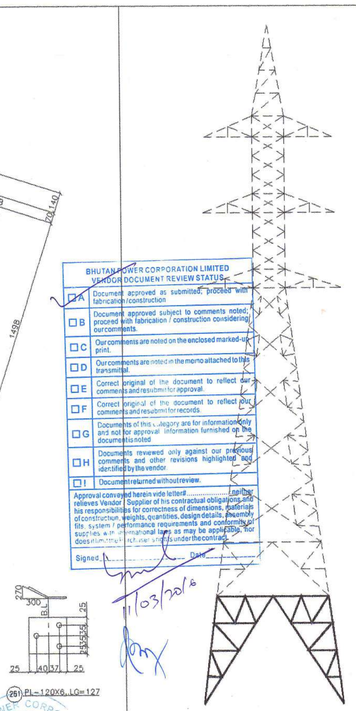


VIEW "A2-A2"





VIEW "A4-A4"



BHUTAN POWER CORPORATION LIMITED VENDOR DOCUMENT REVIEW STATUS	
☐ A	Document approved as submitted, proceed with fabrication/construction
☐ B	Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect your comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on this document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# ..... neither relieves Vendor/ Supplier of his contractual obligations and his responsibilities for correctness of dimensions, particulars of construction, weights, quantities, design details, assembly, fits, system / performance requirements and conformity of supplies with national laws as may be applicable, nor does it authorize deviations under the contract.

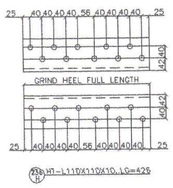
Signed ..... Date .....

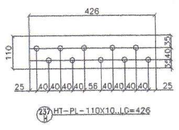
11/03/2016

LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	+6M EXT.	PLAN
B	ø16 x 35mm long	88	16
C	ø16 x 40mm long	220	8
D	ø16 x 45mm long	40	–
E	ø16 x 50mm long	8	–
F	ø16 x 55mm long	–	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		436	16
ø16X175 STEP BOLTS		9	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		16	4
6 THK WASHER		4	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR +3M (TOP PART +9M) (SHEET 6OF9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.





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PROTO CORRECTED MARK Nos. :– 235 TO 263

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.–BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			26/9/15
CHKD			
APPD			

TITLE : TOWER TYPE "C" "BOTTOM PART OF +9M BODY EXTENSION" (ATTACHED TO +3M BODY EXTENSION)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/STR/08

NO OF SHEETS : 8 OF 9

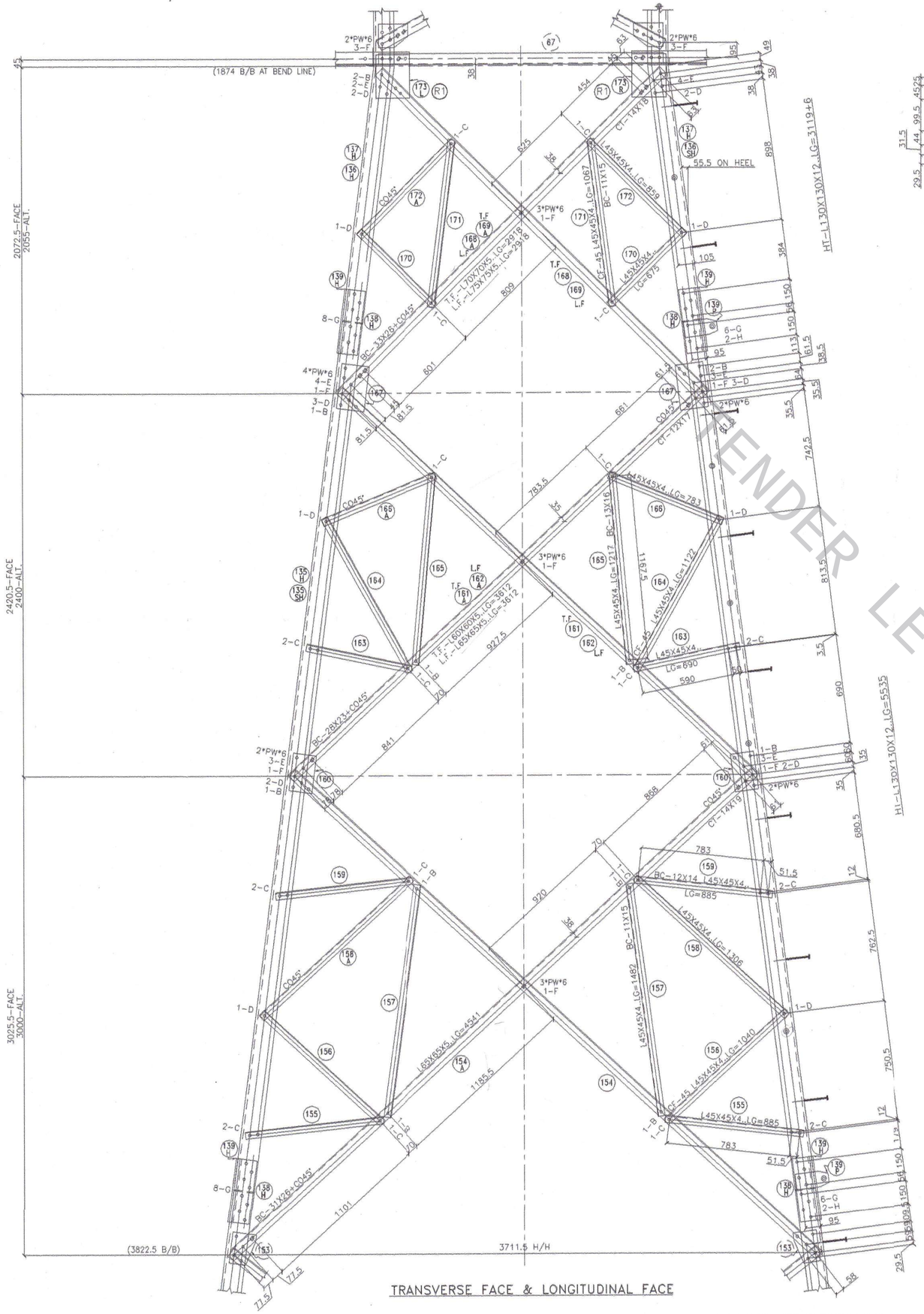
SIZE A1

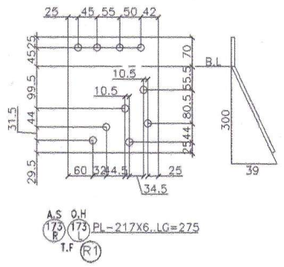
REV. 3

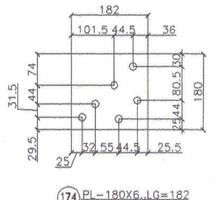
SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17/01/15
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO ASSEMBLY			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

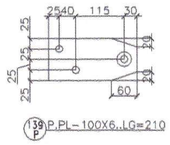
TENDER LEVEL DRAWING

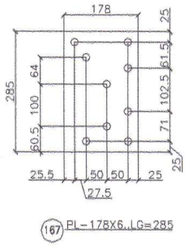
TO BE USED FOR WOBTHANG TRANSMISSION LINE

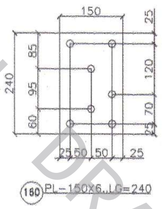












BODY VERTICAL SLOPE		
TAN β	=	0.1307171
2TAN β	=	0.2614341
FACE	=	1.0085073
DEV.	=	1.0169434
IN FACE SLOPE		
TAN β	=	0.1296144
SEC β	=	1.0083649

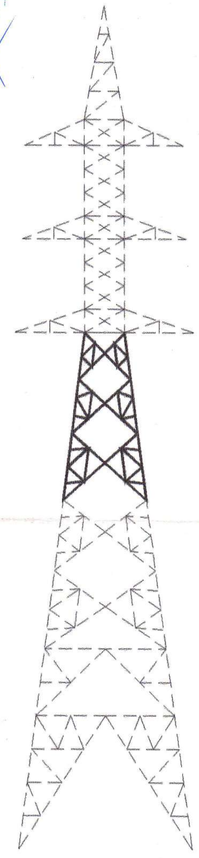
BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print
☐ D	Our comments are noted in the memo attached to this transmittal
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on this document is noted
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor
☐ I	Document returned without review.

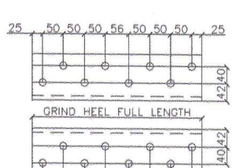
Approval conveyed herein vide letter# _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies to international used and buy be applicable, nor does it relieve the owner of rights under the contract.

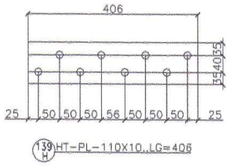
Signed _____ Date 11/03/2016

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU, BHUTAN



LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	BODY-I	PLAN
B	ø16 x 35mm long	52	–
C	ø16 x 40mm long	96	–
D	ø16 x 45mm long	80	–
E	ø16 x 50mm long	76	–
F	ø16 x 55mm long	52	–
G	ø16 x 60mm long	124	–
H	ø16 x 65mm long	4	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		484	–
ø16X175 STEP BOLTS		14	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		–	–
6 THK WASHER		92	–
8 THK WASHER		–	–
10 THK WASHER		–	–





GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ✸ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR BODY-II (SHEET 5 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

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PROTO CORRECTED

MARK No. :- 135 TO 139 & 154 TO 174

SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			01/11/15
R2	REVISED AS PER CLIENT COMMENTS DURING TOWER TESTING			01/11/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			07/8/15
CHKD			
APPD			

TITLE : TOWER TYPE "C" 'BODY'

SCALE 1:15

PROJECTION

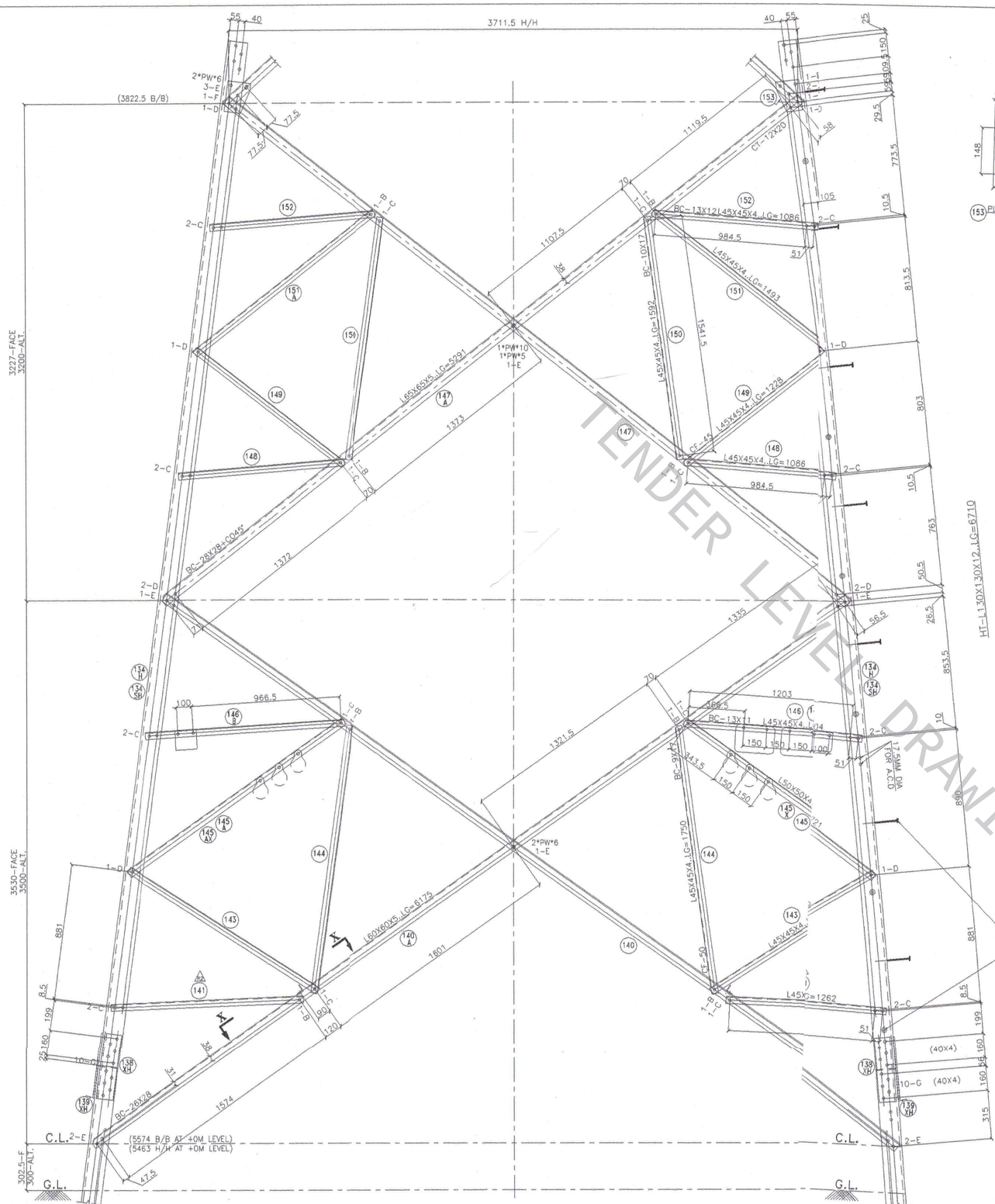
DRG. No: BPC/EDCD/SPIL/C/STR/04

NO OF SHEETS : 4 OF 9

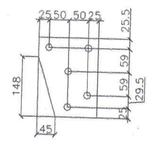
SIZE A1

REV. 3

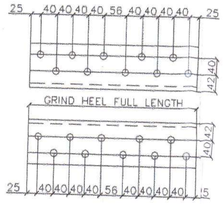
TO BE USED FOR WOBTHANG TRANSMISSION LINE



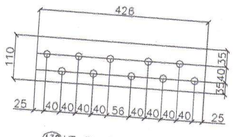
TRANSVERS FACE & LONGITUDINAL FACE



(153) PL-150X6..LG=198

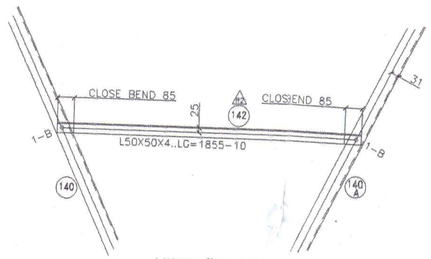


(138) XH HT-L110X110X10..LG=426

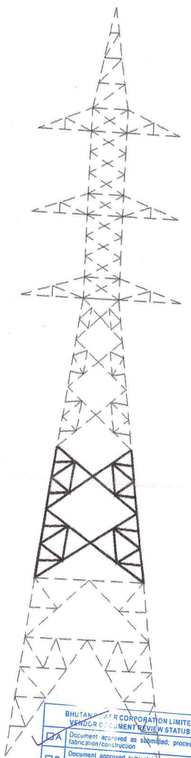


(139) XH HT-PL-110X10..LG=426

BODY VERTICAL SLOPE	
TAN β	= 0.1307171
2TAN β	= 0.2614341
FACE	= 1.0085073
DEV.	= 1.0169434
IN FACE SLOPE	
TAN β	= 0.1296144
SEC β	= 1.0083649



VIEW "X-X"



GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT ED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4;
4. HT INDICATES HIGH TENSILE STEEL AS PER IS:20806 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 ODIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITI
9. STD. SPRING WASHER TO BE SUPPLIED WITH A BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP 'S.
16. ⊖ INDICATES MEMBERS BEING USED AS STERLTS.
17. FOR BODY-I (SHEET 4 OF 9) REFER DNO. BPC/EDCD/SPIL/C/STR/01
18. FOR +3M. BODY EXTN (SHEET 6OF9) REFDRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR STUB & TEMPLATE (SHEET 9OF9) REFDRG. NO. BPC/EDCD/SPIL/C/STR/01
20. FOR ER DRG. NO.
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH ER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MMNG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO Y LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOF TOWER.

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	BODY-I	PU
B	ø16 x 35mm long	44	–
C	ø16 x 40mm long	96	–
D	ø16 x 45mm long	26	–
E	ø16 x 50mm long	52	–
F	ø16 x 55mm long	8	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		306	–
ø16X175 STEP BOLTS		10	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		4	–
6 THK WASHER		16	–
8 THK WASHER		–	–
10 THK WASHER		4	–

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BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐A Document approved as submitted, proceed with fabrication/construction
- ☐B Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
- ☐C Our comments are noted on the enclosed marked-up print.
- ☐D Our comments are noted in the memo attached to this transmittal.
- ☐E Correct original of the document to reflect our comments and re-submit for approval.
- ☐F Correct original of the document to reflect our comments and resubmit for records.
- ☐G Documents of this category are for information only and not for approval. Information furnished on the document is noted
- ☐H Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐I Document returned without review.

Approval conveyed herein vide letter/ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction weights quantities, design details, assembly fits, system performance requirements and conformity of supplied with laws & rules as may be applicable, nor does it relieve him of any engineering under the contract.

Signed Date 11/07/2016

PROTO CORRECTED

MARK Nos. :- 134, & 138 TO 153

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

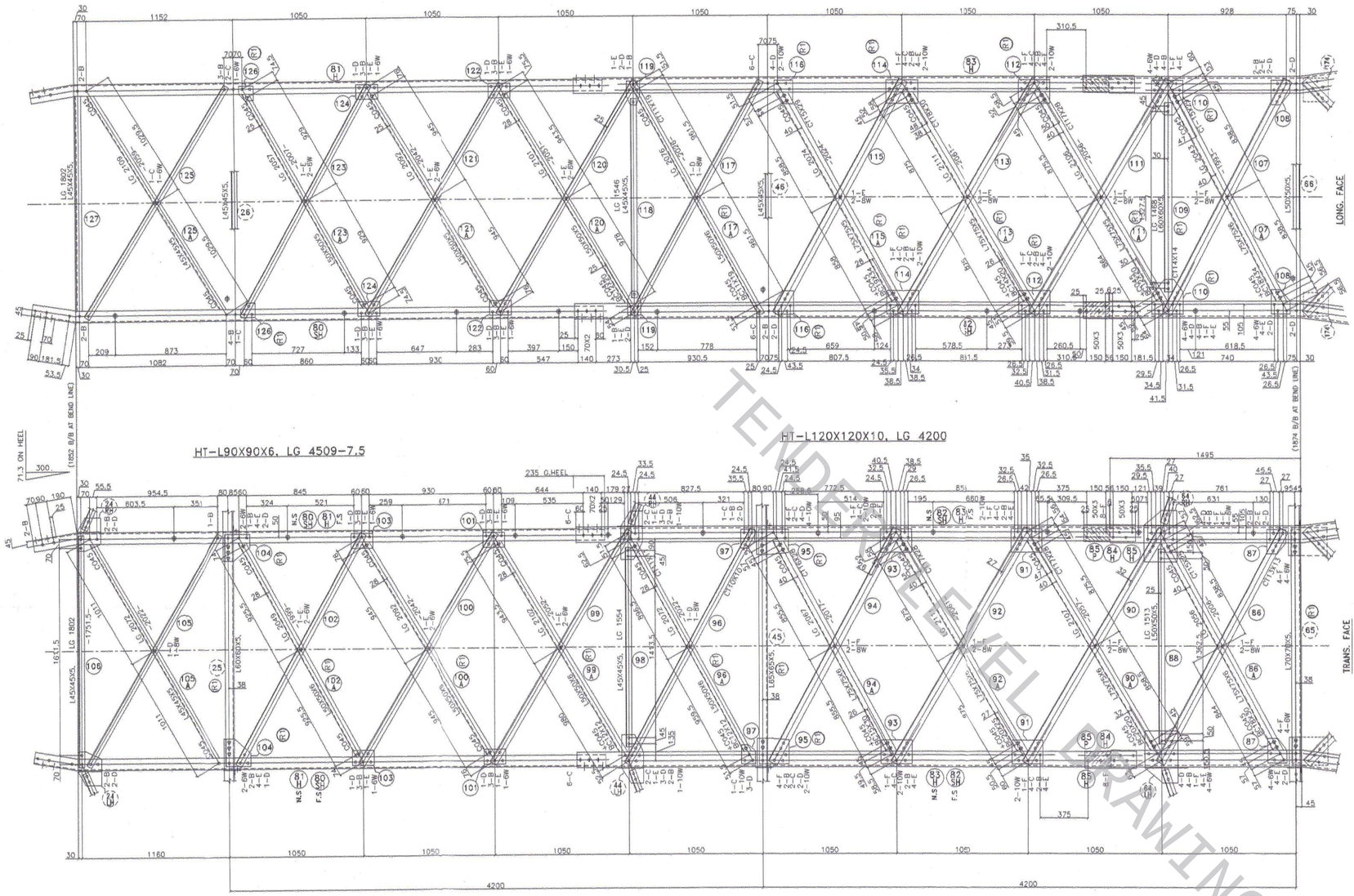
PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT
JOB NO: 2011/01

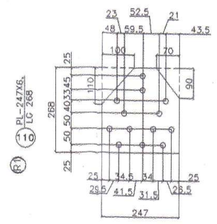
	NAME	SIGN	DATE
DSGN & DRWN			07/5/15
CHKD			
APPD			

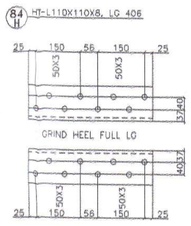
TITLE : TOWER TYPE "C" "±0M BASE"
SCALE 1:15
PROJECTION
DRG. No: BPC/EDCD/SPIL/C/STR/05
NO OF SHEETS : 5 OF 9
SIZE A1
REV. 3

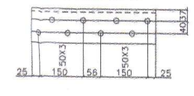
SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPION			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

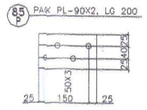
TO BE USED FOR WOBTHANG TRANSMISSION LINE

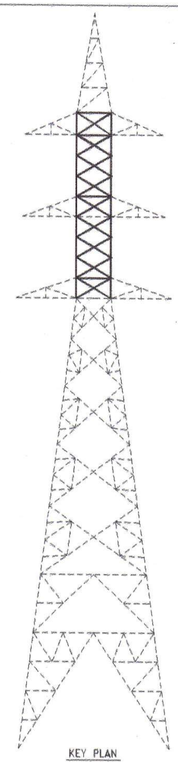




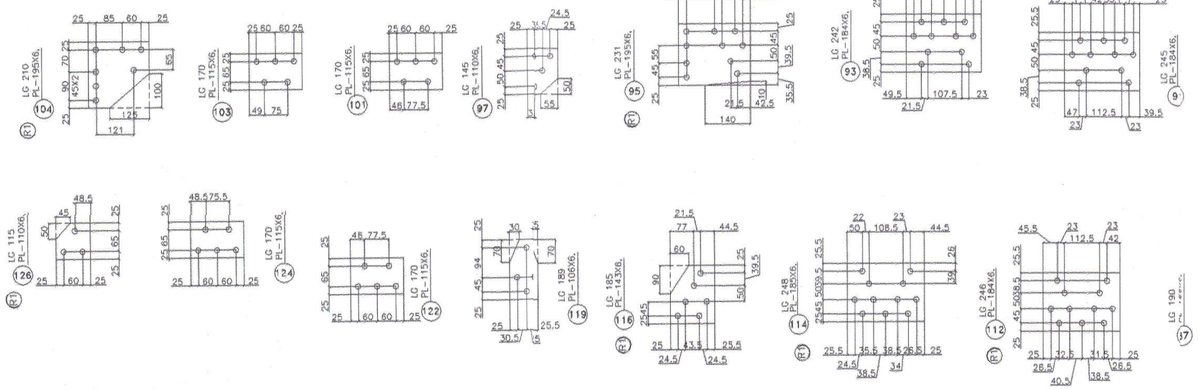








LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	178
C	ø16 x 40mm long	132
D	ø16 x 45mm long	140
E	ø16 x 50mm long	178
F	ø16 x 55mm long	124
G	ø16 x 60mm long	"
H	ø16 x 65mm long	"
J	ø16 x 70mm long	"
K	ø16 x 75mm long	"
L	ø16 x 80mm long	"
M	ø16 x 85mm long	"
N	ø16 x 90mm long	"
SPRING WASHERS		752
STEP BOLTS		20
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		"
6 THK WASHER		114
8 THK WASHER		38
10 THK WASHER		56



BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication /construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on the document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it relieve him of all other responsibilities under the contract.

Signed ..... Date .....

BHUTAN POWER CORPORATION TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU

11/03/2016

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊟ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR PEAK & TOP X-ARM REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR MIDDLE & BOTTOM X ARM REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR BODY REFER DRG. NO. BPC/EDCD/SPIL/C/STR/11
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."

SYM.	REVISIONS	R&D.	CHKD.	DATE
R1	REVISED AS PER CLIENTS COMMENT BEFORE TOWER TESTING			17.1.16
R1	REVISED AS PER CLIENTS COMMENTS DURING PROTO ASSEMBLY			8.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			1.11.15

PROTO CORRECTED | MARK NOS 80 TO 126

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			26/9/15
CHKD			
APPD			

TITLE : CAGE FOR 132KV D/C TOWER TYPE "C"

SCALE 1:15

PROJECTION

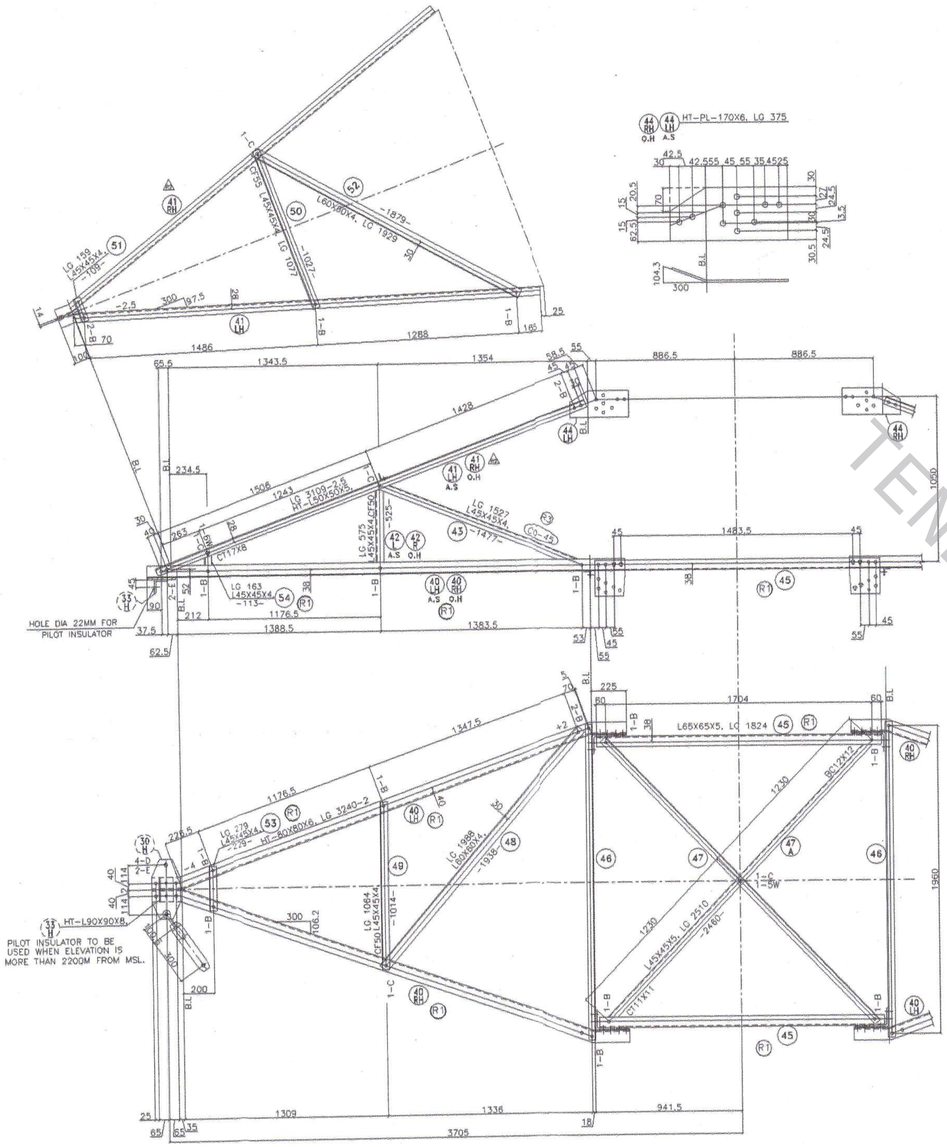
DRG. No: BPC/EDCD/SPIL/C/STR/01

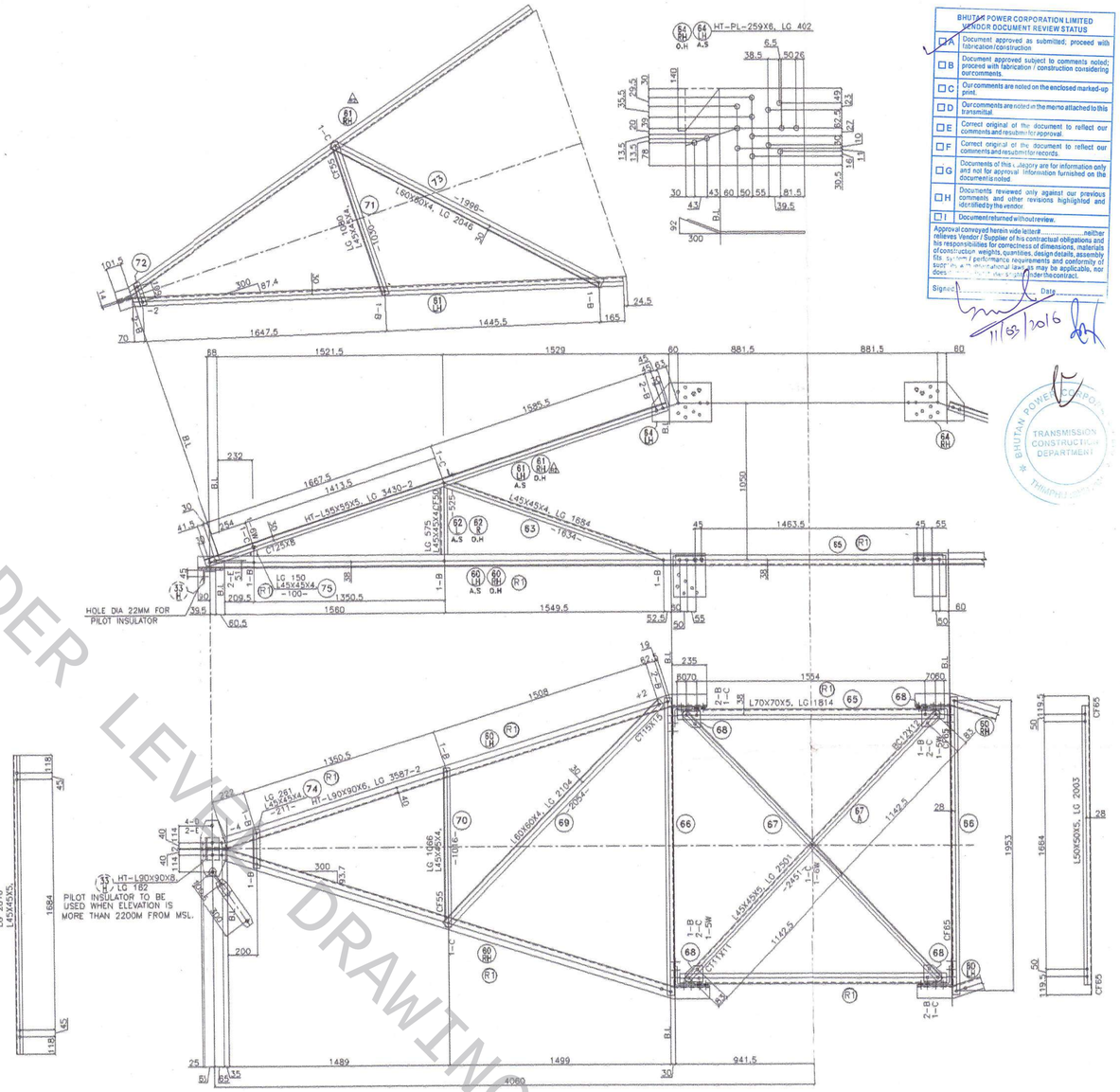
NO OF SHEETS : 3 OF 9

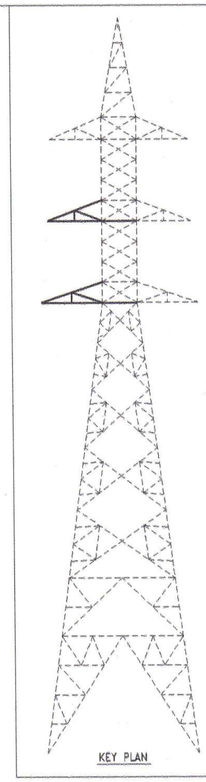
SIZE A1 | REV. 3

TENDER DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE







BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
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☐ G	Documents of this category are for information only and not for approval. Information furnished on the document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and described by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, functional performance requirements and conformity of such to all the applicable laws as may be applicable, nor does it relieve him of his other obligations under the contract.

Signed: ..... Date: 11/05/2016

BHUTAN POWER CORPORATION TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU BHUTAN

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	92
C	ø16 x 40mm long	34
D	ø16 x 45mm long	16
E	ø16 x 50mm long	24
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		188
STEP BOLTS		–
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		01
6 THK WASHER		09
8 THK WASHER		–
10 THK WASHER		–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			01.11.15

PROTO CORRECTED

MARK NOS 40 TO 54, 60 TO 75

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INIDA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			7/9/15
CHKD			
APPD			

TITLE : MIDDLE & BOTTOM X-ARM FOR 132KV D/C TOWER TYPE "C"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/STR/02

NO OF SHEETS : 2 OF 9

SIZE A1

REV. 3

TENDER LEVEL DRAWING

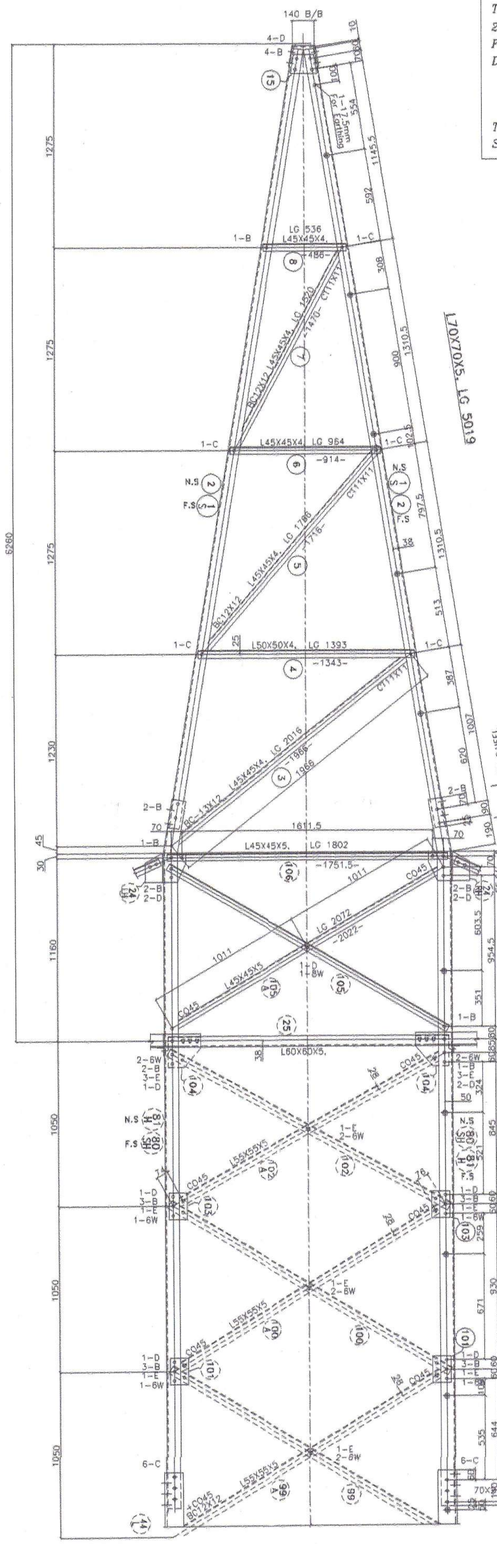
TO BE USED FOR WOBTHANG TRANSMISSION LINE

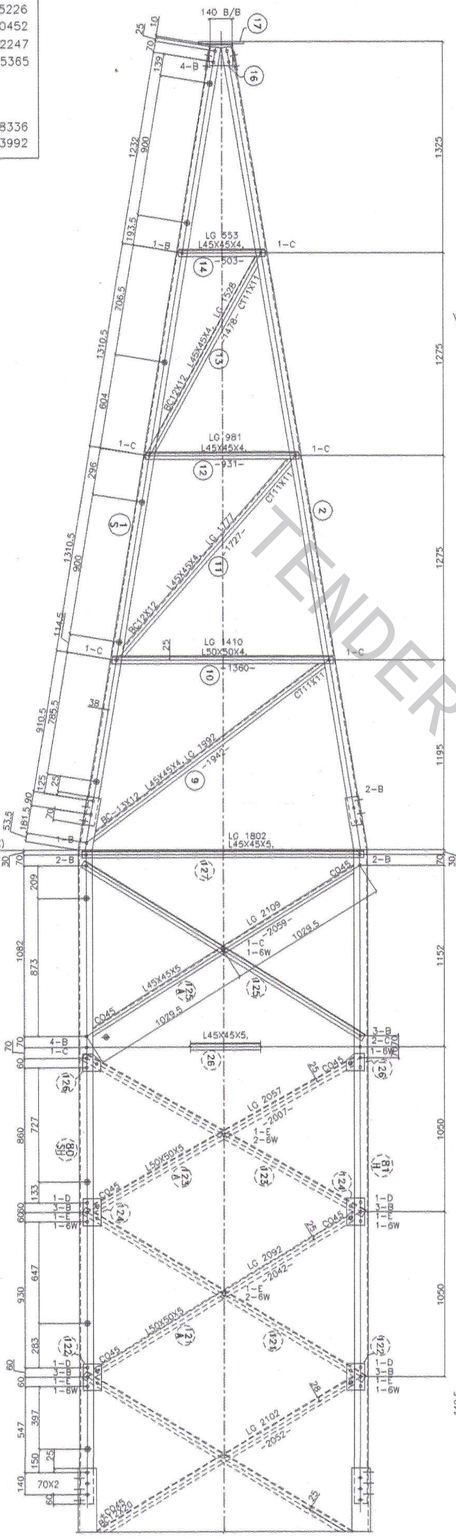
PEAK SLOPE

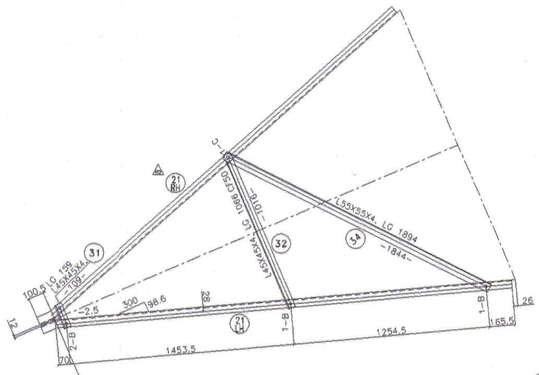
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2 Tan B	=	0.33610452
Face	=	1.01402247
Dev	=	1.02785365

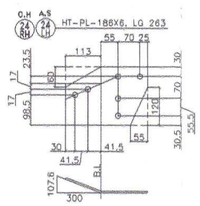
In Face Slopes

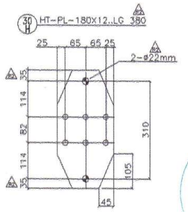
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Sec B	=	1.01363992

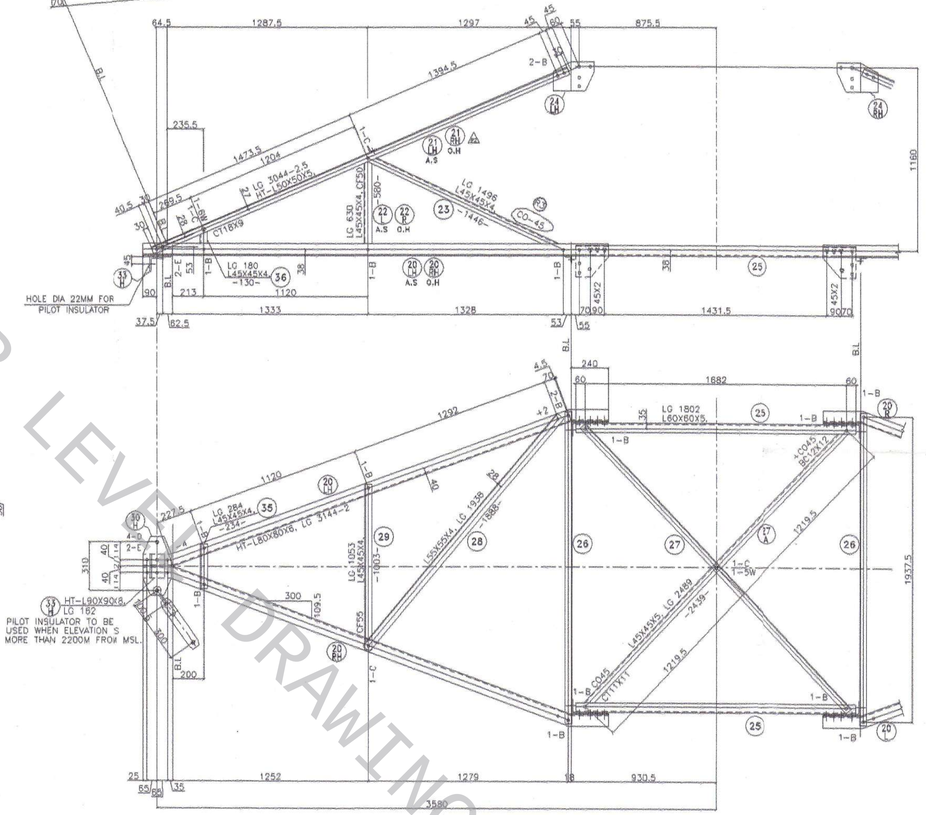


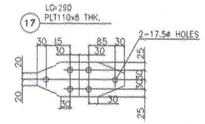


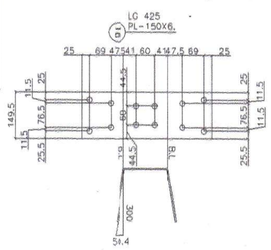


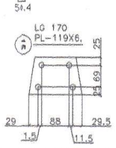




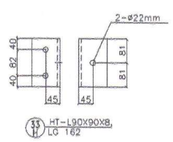








TOP X-ARM



PILOT INSULATOR TO BE USED WHEN ELEVATION S MORE THAN 2200M FROM MSL.

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⇔ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			01.11.15

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY
B	ø16 x 35mm long	84
C	ø16 x 40mm long	34
D	ø16 x 45mm long	12
E	ø16 x 50mm long	12
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		142
STEP BOLTS		22
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		01
6 THK WASHER		04
8 THK WASHER		–
10 THK WASHER		–

KEY PLAN

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☑ A	Document approved as submitted; proceed with fabrication/construction.
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
☐ G	Documents of this category are for information only and not for approval. Information furnished on the document is noted.
☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter# _____ dated _____ relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the rights under the contract.

Signed _____ Date 11/03/16

PROTO CORRECTED

MARK NOS 1 TO 17, 20 TO 36

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT(UP)

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			7/9/15
CHKD			
APPD			

TITLE : PEAK & TOP X-ARM FOR 132KV D/C TOWER TYPE "C"

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/STR/01

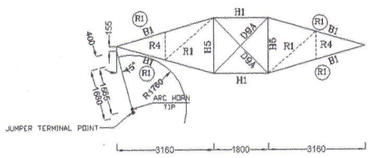
NO OF SHEETS : 1 OF 9

SIZE A1

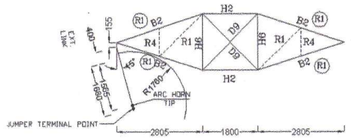
REV. 3

TENDER LEVEL DRAWING

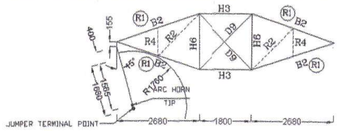
TO BE USED FOR WOBTHANG TRANSMISSION LINE



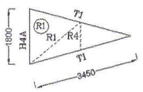
PLAN OF A5-A5



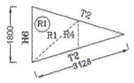
PLAN OF A6-A6



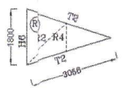
PLAN OF A7-A7



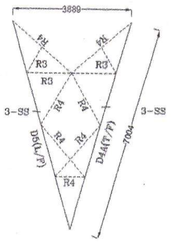
PLAN OF A8-A8



PLAN OF A9-A9

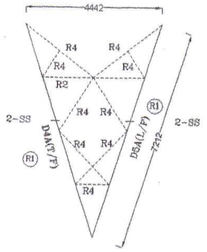


PLAN OF A10-A10

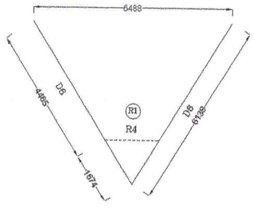


PLAN OF A3-A3

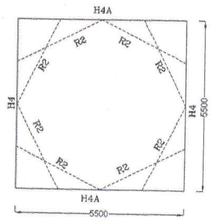
MEMBER CODE	SECTION	QTY. NOS.	MEMBER CODE	SECTION mmxmmxmm	QTY. NOS.
ARM TOP MEMBERS			MAIN LEG MEMBERS		
(R1) T1	L 55*55*5 HT	2	M1	L 130*130*12 HT	8-DS
(R1) T2	L 50*50*5 HT	2	M1A	L 130*130*12 HT	10-DS (R1)
HORIZONTAL MEMBERS			M2	L 120*120*10 HT	8-DS
H1	L 70*70*5	2	M3	L 90*90*6 HT	6
H2	L 65*65*5	2	PEAK MEMBER		
H3	L 60*60*5	2	P1	L 70*70*5	4 (R1)
H4	L 55*55*5	1	DIAGONAL MEMBERS		
H4A	L 55*55*5	2	D1	L 75*75*6	2
H5	L 50*50*5	1	D1A	L 75*75*6	4
H5A	L 50*50*5	2	D2	L 75*75*5	2
H6	L 45*45*5	1	D2A	L 75*75*5	4
H6A	L 45*45*5	2	D3	L 70*70*6	4
REDUNDANT MEMBERS			D4	L 70*70*5	2
R1	L 60*60*4	1	D4A	L 70*70*5	3
R2	L 60*60*4	2	D4B	L 70*70*5	4
R3	L 55*55*4	1	D5	L 65*65*5	2
R4	L 55*55*4	2	D5A	L 65*65*5	3
R5	L 50*50*4	1	D6	L 60*60*5	2
R6	L 50*50*4	2	D6A	L 60*60*5	3
R7	L 45*45*4	1	D7	L 55*55*5	2
R8	L 45*45*4	2	D7A	L 55*55*5	3
MAIN ARM MEMBERS			D8	L 50*50*5	2
(R1) B	L 90*90*6 HT	4	D8A	L 50*50*6	2 (R1)
(R1) B2	L 80*80*6 HT	4	D8B	L 50*50*6	3 (R1)
			D9	L 45*45*5	1
			D9A	L 45*45*5	2



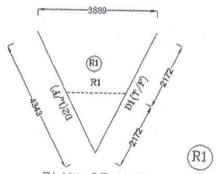
PLAN OF A4-A4



PLAN OF X-X

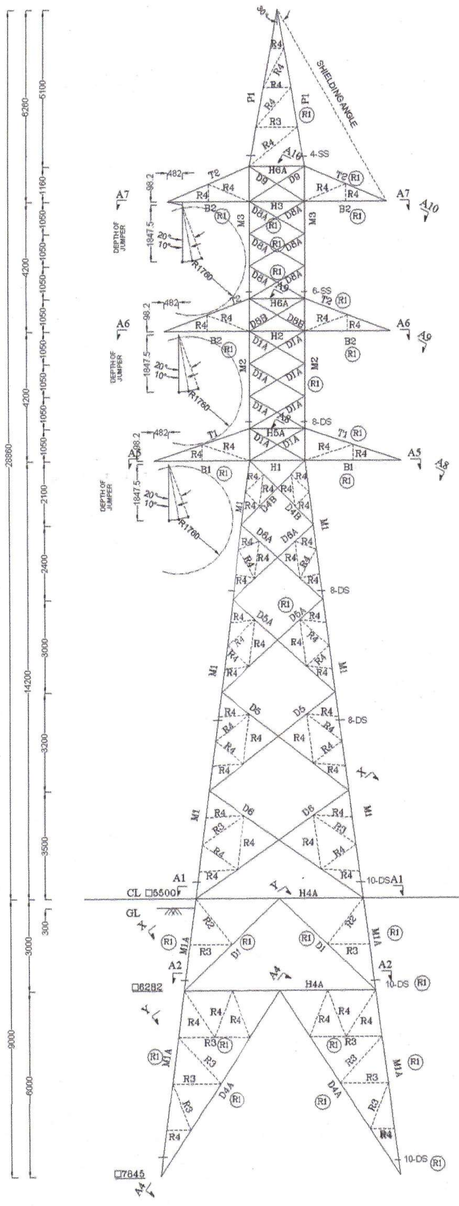


PLAN OF A1-A1

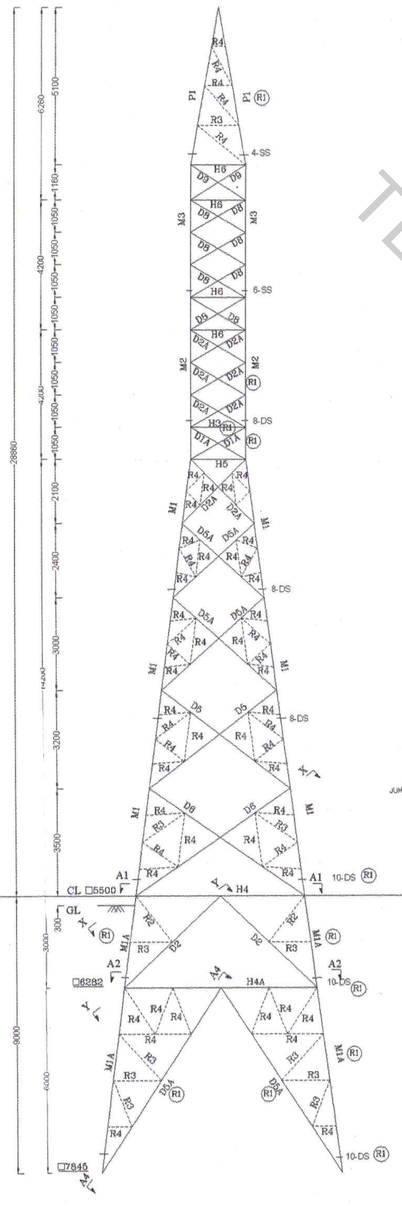


PLAN OF Y-Y

PLAN OF A2-A2

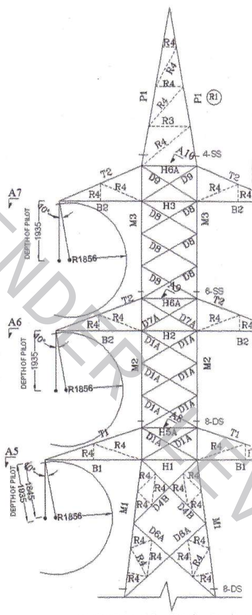


TRANSVERSE FACE

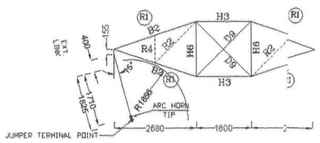


LONGITUDINAL FACE

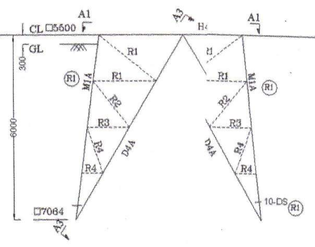
STANDARD TOWER +9M B.E.



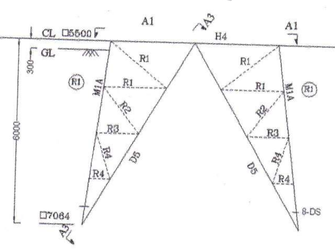
CLEARANCE FOR ELEVION MORE THAN 2200M FRM MSL



PLAN OF A7-A; FOR ELEVATION MORE TH 2200M

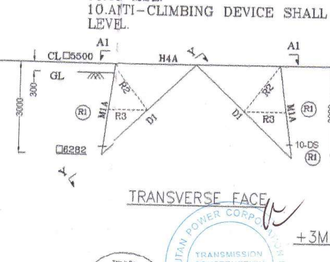


TRANSVERSEE



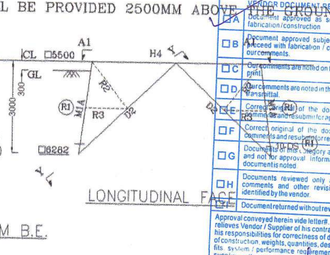
LONGITUDINAL FACE

+6M B.E.



TRANSVERSE FACE

+3M B.E.



LONGITUDINAL FACE

STUB -L 130*)*12 HT

NOTE:-

1. ALL DIMENSION ARE IN MM.
2. ELETRICAL CLEARANCE IS AS PER SPECIFICATION.
3. DOTED MEMBERS INDICATE REDUNDAND MEMBERS .
4. UNIER COLUMN SHEAR,DS INDICATE DOUBLE SHEAR.
5. MATERIAL USED -MILD STEEL-IS 2062:2006 GR-250
   HIGH TENSILE STEEL - IS 2062:2006 GR-350
   BOLT AND NUTS - IS 12427:2001 GRADE -5.6/5
6. ALL STRAIN PLATE SHALL HAVE PROVISION FOR PILOT INSULATOR STRING.
7. STIF BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.
8. TWO HOLES OF 17.5MM ABOUT 50MM APART SHALL BE DRILLED ON EACH TOWER LEG FOR EARTHING PURPOSE .
9. PIDT INSULATOR TO BE USED WHEN ELEVATION IS MORE THAN 2200M FROM MSL.
10. ANTI-CLIMBING DEVICE SHALL BE PROVIDED 2500MM ABOVE TIBE GROUND LEVEL.

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- A: Document approved as submitted; proceed with fabrication/construction
- B: Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
- C: Our comments are notified on the enclosed marked-up print.
- D: Our comments are noted in the memo attached to this transmittal.
- E: Correct original of the document to reflect our comments and resubmit for approval.
- F: Correct original of the document to reflect our comments and resubmit for approval.
- G: Document is not reviewed, copy are for information only and not for approval. Information furnished on the documents noted.
- H: Documents reviewed only against our previous comments and other revisions highlighted and denoted by the vendor.
- I: Document returned without review.

Approval conveyed herein vide letter/E-mail neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with contractual terms as may be applicable; nor does it [illegible] under the contract.

Signed: Date: 11/5/2015

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TRANSMISSION CONSTRUCTION DEPARTMENT, BHUTAN POWER CORPORATION LTD, THIMPHU, BHUTAN

BHUTAN POWER CORPORATION LTD
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

(R1)	AS PER BPC COMMENT			
SYM.	REVISIONS	REVD.	CHKD.	DATE

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

JOB NO: 2011/01

TITLE : SINGLE LINE DIAGRAM OF TOWER TYPE "C"

	NAME	SIGN	DATE
DSGN & DRWN			27/8/15
CHKD			
APPD			

SCALE 1:100

PROJECTION

DRG. No: BPC/EDCD/SPIL/C/SLD/01

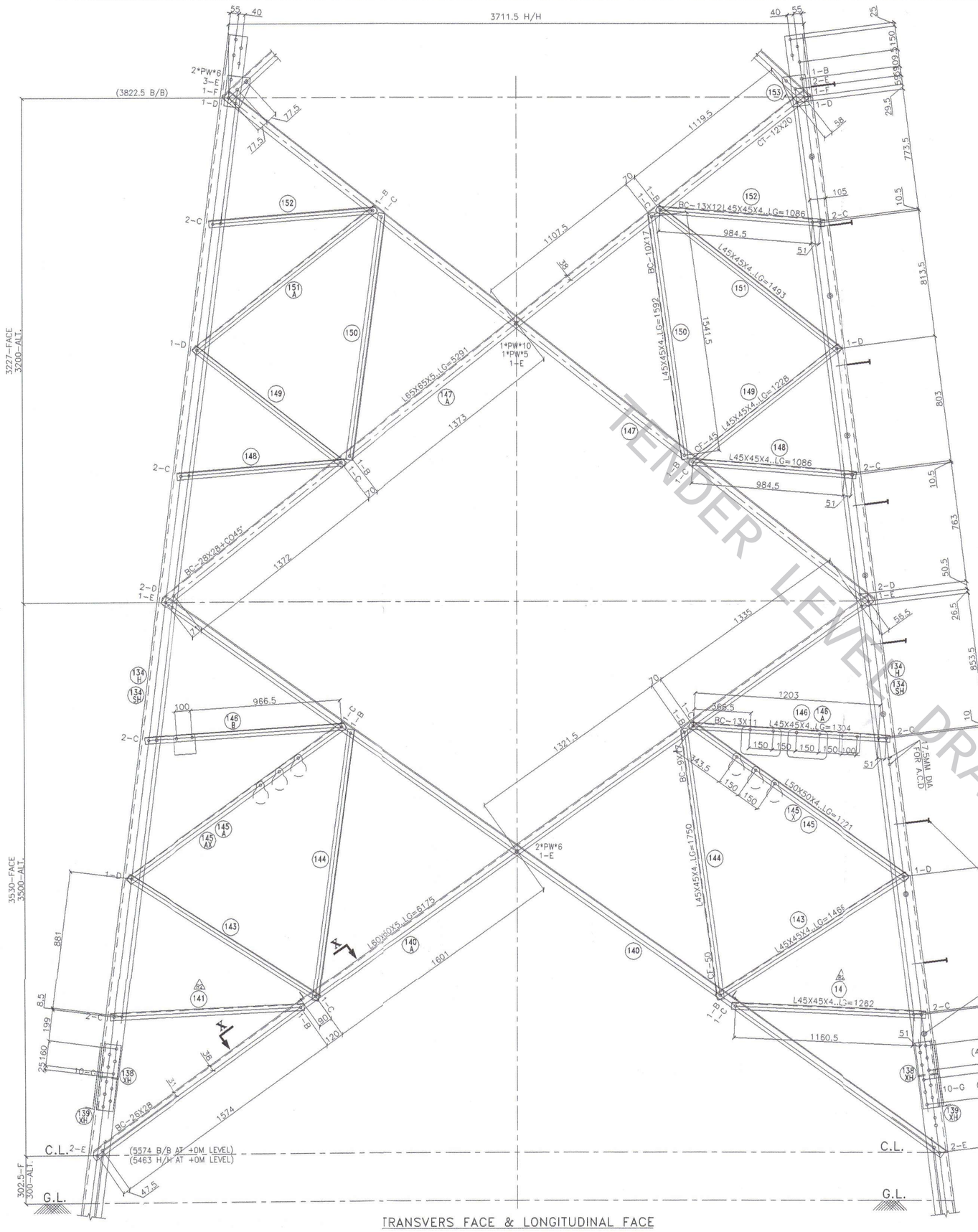
NO OF SHEETS : 1 OF 1

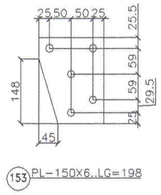
SIZE A1

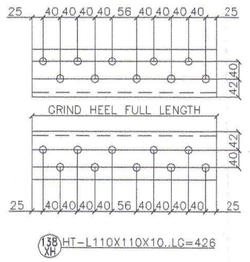
REV. 1

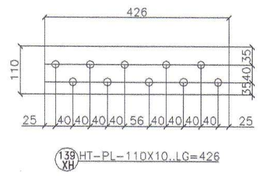
TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE

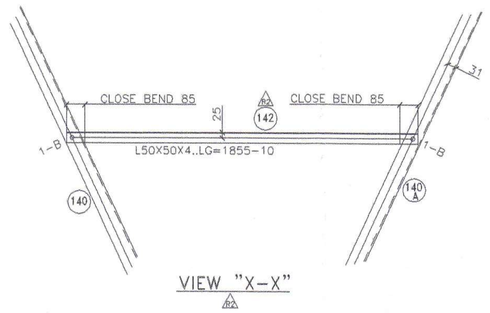




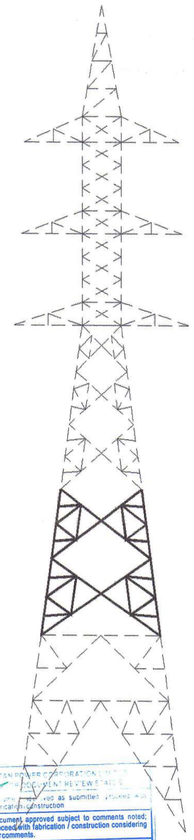




BODY VERTICAL SLOPE		
TAN β	=	0.1307171
2TAN β	=	0.2614341
FACE	=	1.0085073
DEV.	=	1.0169434
IN FACE SLOPE		
TAN β	=	0.1296144
SEC β	=	1.0083649



VIEW "X-X"



GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY-I (SHEET 4 OF 9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
18. FOR +3M. BODY EXTN (SHEET 6OF9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
19. FOR STUB & TEMPLATE (SHEET 9OF9) REFER DRG. NO. BPC/EDCD/SPIL/C/STR/01
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	BODY-I	PLAN
B	ø16 x 35mm long	44	–
C	ø16 x 40mm long	96	–
D	ø16 x 45mm long	26	–
E	ø16 x 50mm long	52	–
F	ø16 x 55mm long	8	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		306	–
ø16X175 STEP BOLTS		10	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		4	–
6 THK WASHER		16	–
8 THK WASHER		–	–
10 THK WASHER		4	–

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU-BHUTAN

BHUTAN POWER CORPORATION LTD. DOCUMENT REVIEW STATUS
ETA
- ☐ B Document approved subject to comments noted, proceed with fabrication / construction considering our comments.
- ☐ C Our comments are noted on the enclosed marked-up prints.
- ☐ D Our comments are noted in the memo attached to this transmittal.
- ☐ E Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F Correct original of the document to reflect our comments and resubmit for records.
- ☐ G Documents of this category are for information only and not for approval. Information furnished on the document is noted.
- ☐ H Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I Document returned without review.

Approval conveyed herein vide letter dated _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.
Signed _____ Date 6/7/16

PROTO CORRECTED

MARK Nos. :- 134, & 138 TO 153

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SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02/06/16
R3	REVISED AS PER CLIENT BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

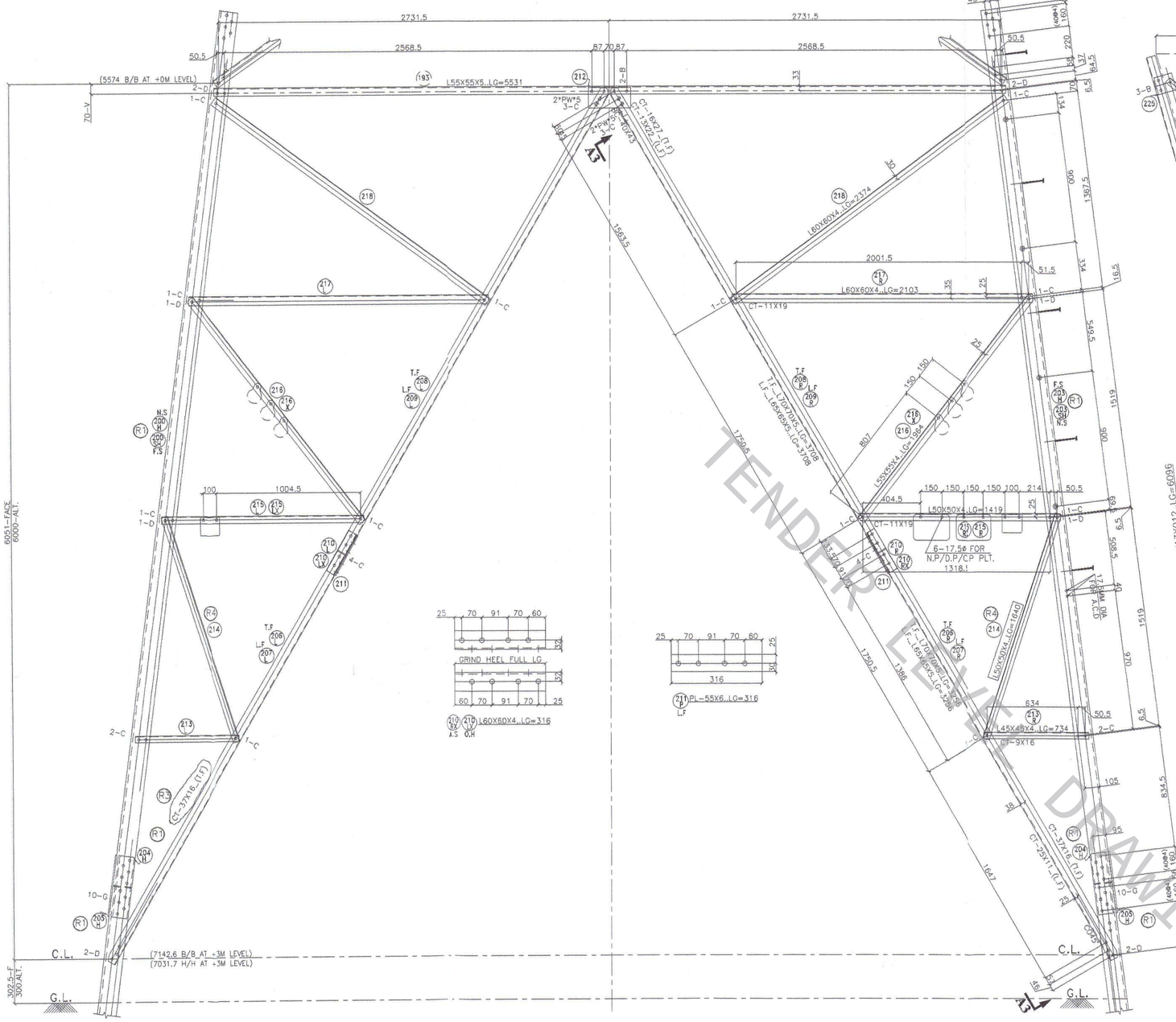
BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT
JOB NO: 2011/01

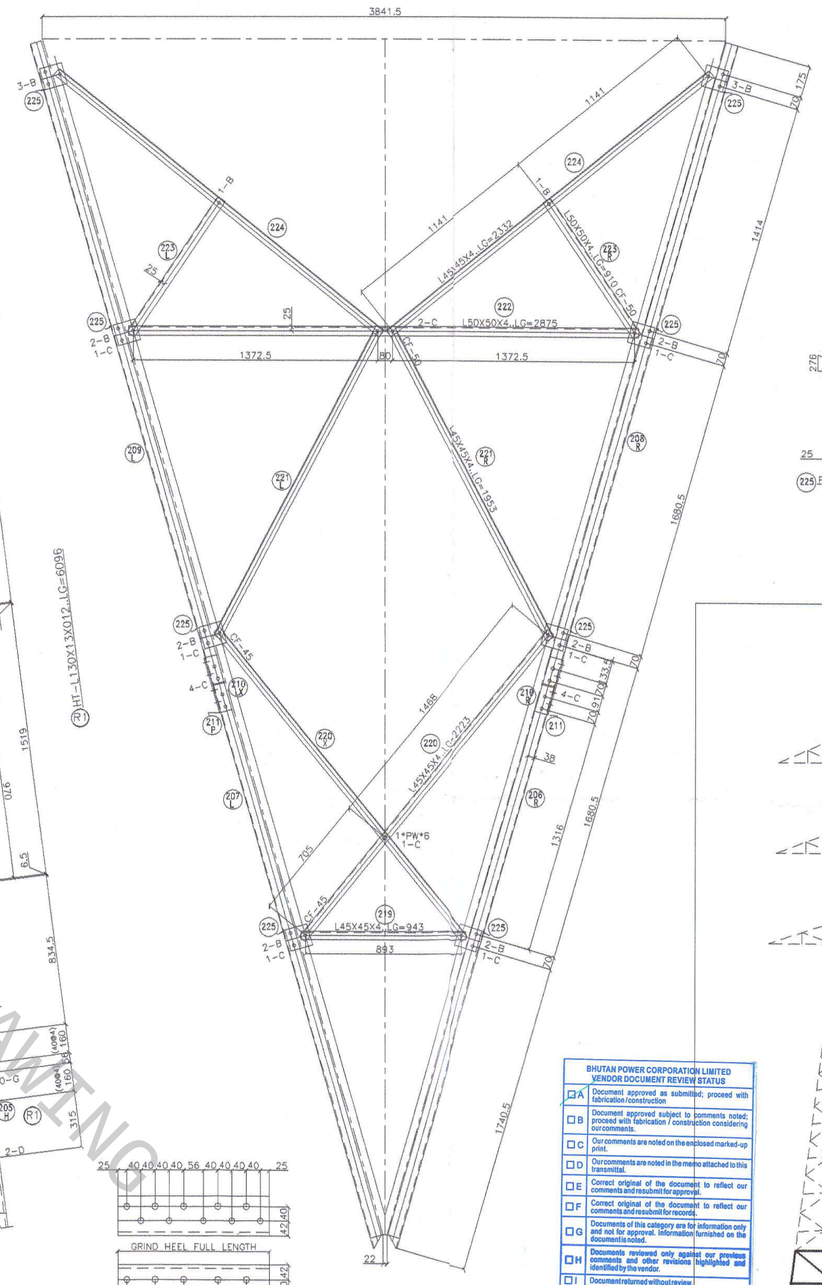
	NAME	SIGN	DATE
DSGN & DRWN.			07/9/15
CHKD			
APPD			

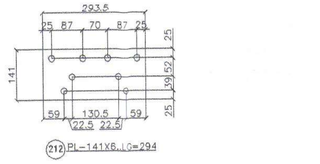
TITLE : "±0M BASE" FOR 132 KV DCTOWER TYPE "DCS" (X-ARM STRENGTHENED)
SCALE 1:15
PROJECTION
DRG. No: BPC/EDCD/SPIL/CS/STR/05
NO OF SHEETS : 5 OF 6
SIZE A1
REV. 4

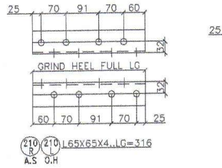
TO BE USED FOR WOBTHANG TRANSMISSION LINE

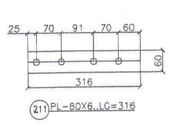


TRANSVERS FACE & LONGITUDINAL FACE









LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+6M EXT.	PLAN
B	ø16 x 35mm long	88	8
C	ø16 x 40mm long	188	8
D	ø16 x 45mm long	48	–
E	ø16 x 50mm long	–	–
F	ø16 x 55mm long	–	–
G	ø16 x 60mm long	80	–
H	ø16 x 65mm long	–	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		404	16
ø16/175 STEP BOLTS		13	–
30mm O.D PACK WASHERS ø17.5mm			
5 THK WASHER		16	4
6 THK WASHER		4	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2008 GI-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & S:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR BODY-II (SHEET 5 OF 9) REFER DRG. NO. BPC/EDCD/C/STR/01
18. FOR STUB & TEMPLATE (SHEET 9 OF 9) REFER DRG. NO. BPC/EDCD/C/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

BODY VERTICAL SLOPE	
TAN β	= 0.1307171
2TAN β	= 0.2614341
FACE	= 1.0085073
DEV.	= 1.0169434
IN FACE SLOPE	
TAN β	= 0.1296144
SEC β	= 1.0083649

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
☐ E	Correct original of the document to reflect our comments and resubmit for approval.
☐ F	Correct original of the document to reflect our comments and resubmit for records.
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☐ I	Documents returned without review.

Approval conveyed herein vide letter/ref. _____ neither relieves Vendor / Supplier of his contractual obligations and responsibilities for correctness of dimensions, materials, construction weights, quantities, design details, assembly, maximum, performance requirements and compliance with statutory, international laws as may be applicable, etc. nor reserves any rights under the contract.

Signed: _____ Date: 6/7/16

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT

MARK Nos. :- 193, 194 & 203 TO 225

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SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02/6/16
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17/01/16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO ASSEMBLY			08/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C TRANSMISSION LINE FROM KANGLUNG-PHUNTSHOTHANG & 132 KV D/C TRANSMISSION LINE FROM MOTANGA TO NGANGLAM

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			28/9/15
CHKD			
APPD			

TITLE : TOWER TYPE "DCS" "+6M BODY EXTENSION " (FOR X-ARM STRENGHTENED & NORMAL TOWER)

SCALE 1:15

PROJECTION

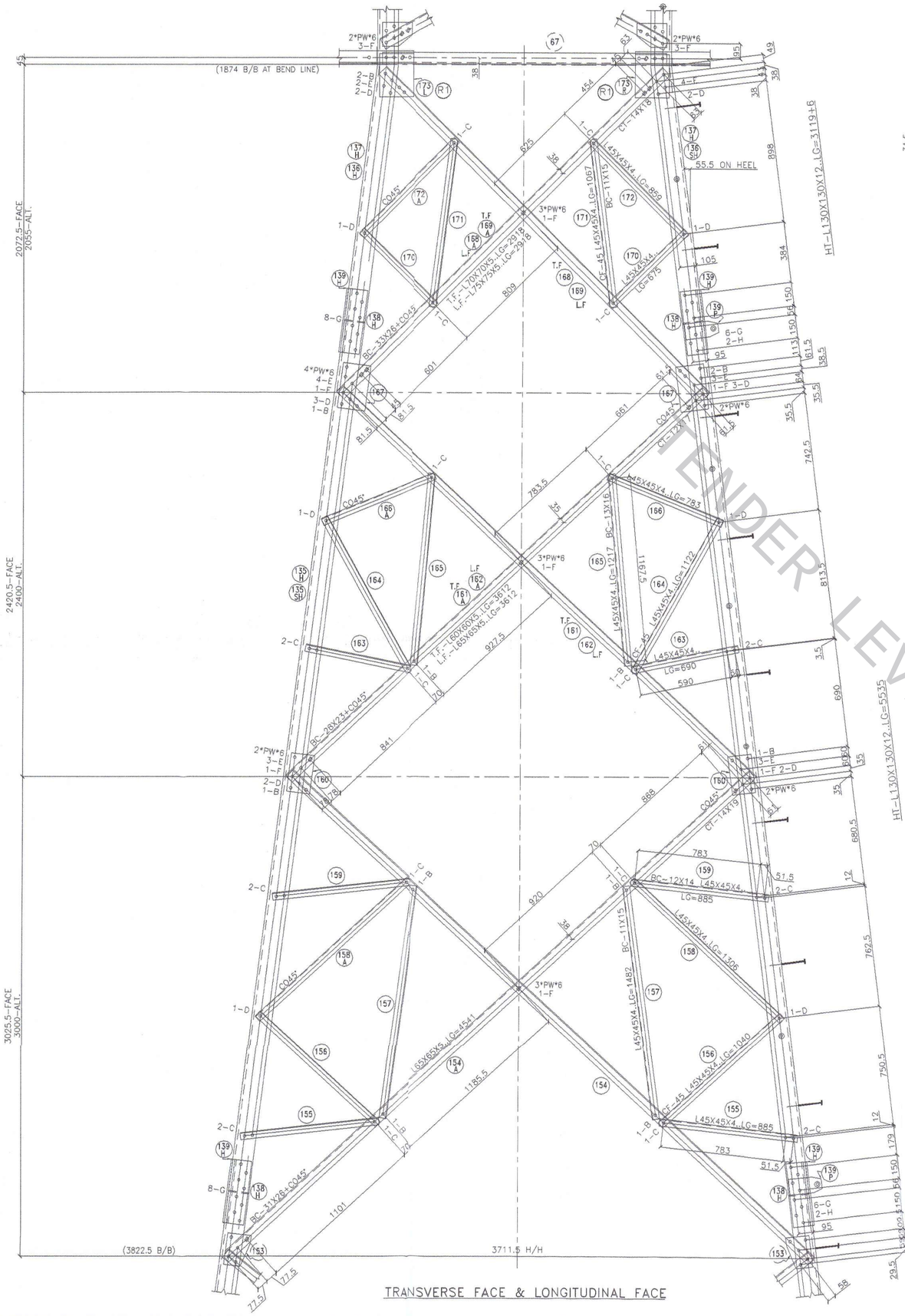
DRG. No: BPC/EDCD/SPIL/CS/STR/06

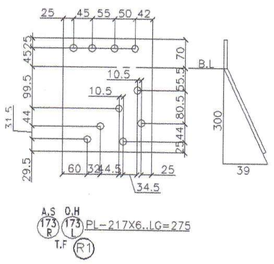
NO OF SHEETS : 6 OF 6

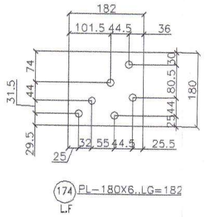
SIZE A1

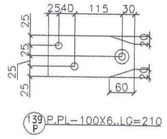
REV. 4

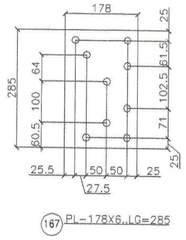
TO BE USED FOR WOBTHANG TRANSMISSION LINE

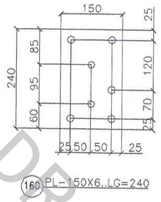












BODY VERTICAL SLOPE		
TAN β	=	0.1307171
2TAN β	=	0.2614341
FACE	=	1.0085073
DEV.	=	1.0169434
IN FACE SLOPE		
TAN β	=	0.1296144
SEC β	=	1.0083649

LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	BODY-I	PLAN
B	ø16 x 35mm long	52	–
C	ø16 x 40mm long	96	–
D	ø16 x 45mm long	80	–
E	ø16 x 50mm long	76	–
F	ø16 x 55mm long	52	–
G	ø16 x 60mm long	124	–
H	ø16 x 65mm long	4	–
J	ø16 x 70mm long	–	–
K	ø16 x 75mm long	–	–
L	ø16 x 80mm long	–	–
M	ø16 x 85mm long	–	–
SPRING WASHERS		484	–
ø16X175 STEP BOLTS		14	–
30mm O.D. PACK WASHERS ø17.5mm			
5 THK WASHER		–	–
6 THK WASHER		92	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
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14. ● ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 6) REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/03
18. FOR BODY-II (SHEET 5 OF 6) REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/05
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

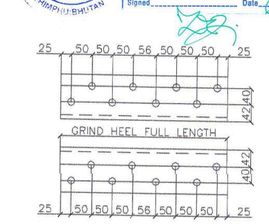
BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

☐ A	Document approved as submitted; proceed with fabrication/construction
☐ B	Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
☐ C	Our comments are noted on the enclosed marked-up print.
☐ D	Our comments are noted in the memo attached to this transmittal.
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☐ H	Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
☐ I	Document returned without review.

Approval conveyed herein vide letter dt. _____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly, fits, system / performance requirements and conformity of supplied with interrelated item as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed _____ Date 6/7/16

BHUTAN POWER CORPORATION TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU BHUTAN



PROTO CORRECTED

MARK No. :- 135 TO 139 & 154 TO 174

REVISIONS				
SYM.		REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR LONGER WEIGHT SPAN			02/06/16
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17/1/16
R2	REVISED AS PER CLIENT COMMENTS DURING TOWER TESTING			8/12/15
R1	REVISED AS PER CLIENT COMMENTS			01/11/15

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BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLING-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			07/8/15
CHKD			
APPD			

TITLE : BODY FOR 132KV D/C TOWER TYPE "DCS" (X-ARM STRENGTHENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/CS/STR/04

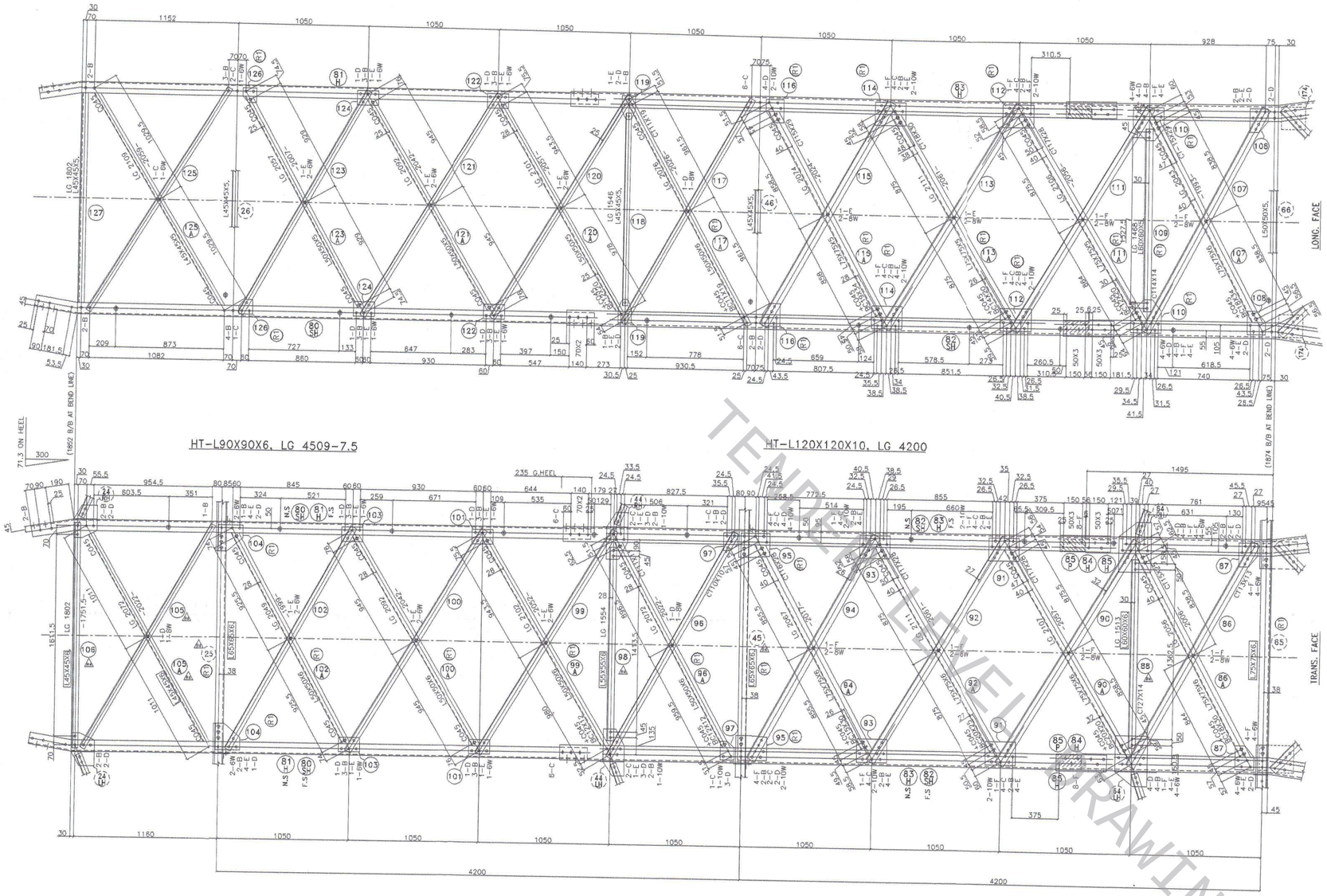
NO OF SHEETS : 4 OF 6

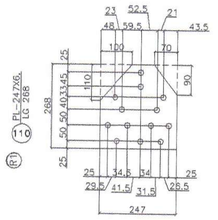
SIZE A1

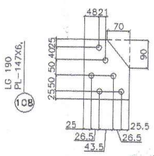
REV. 4

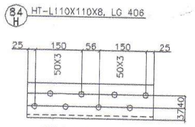
TRANSVERSE FACE & LONGITUDINAL FACE

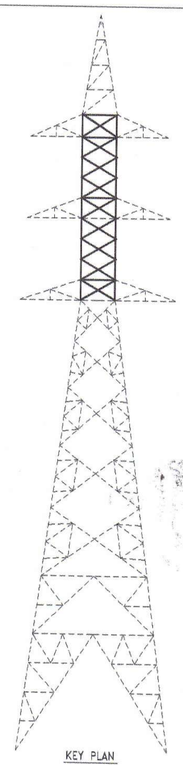
TO BE USED FOR WOBTHANG TRANSMISSION LINE

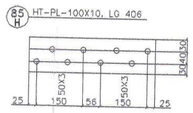


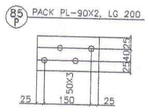












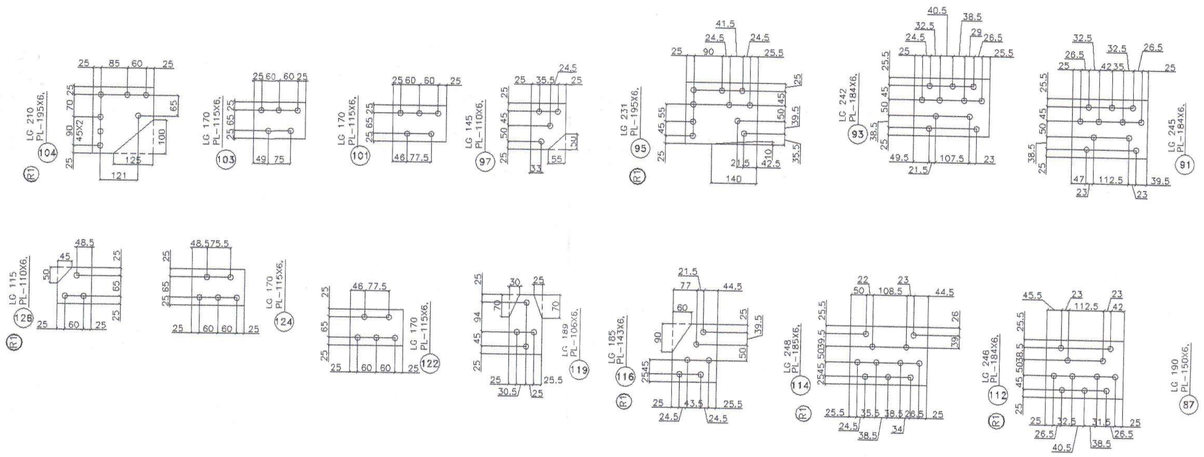
LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	178
C	ø16 x 40mm long	132
D	ø16 x 45mm long	140
E	ø16 x 50mm long	178
F	ø16 x 55mm long	124
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		752
STEP BOLTS		20
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		–
6 THK WASHER		114
8 THK WASHER		38
10 THK WASHER		58

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A — Document approved as submitted; proceed with fabrication/construction
- ☐ B — Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
- ☐ D — Our comments are noted in the memo attached to this transmittal.
- ☐ E — Correct original of the document to reflect our comments and resubmit for approval.
- ☐ F — Correct original of the document to reflect our comments and resubmit for records.
- ☐ G — Documents of this category are for information only and not for approval. Information furnished on the document is noted.
- ☐ H — Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I — Document returned without review.

Approval conveyed herein vide letter#..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed..... Date.....



GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS. IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR PEAK & TOP X–ARM REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/01
18. FOR MIDDLE & BOTTOM X ARM REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/02
19. FOR BODY REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/04
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C–1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR LONGER WEIGHT SPAN			02.06.16
R3	REVISED AS PER CLIENTS COMMENT BEFORE TOWER TESTING			17.1.16
R2	REVISED AS PER CLIENTS COMMENTS DURING PROTO ASSEMBLY			8.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			1.11.15

PROTO CORRECTED — MARK NOS 80 TO 126

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT
JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : CAGE FOR 132KV D/C TOWER TYPE "DCS" (X-ARM STRENGHTENED)

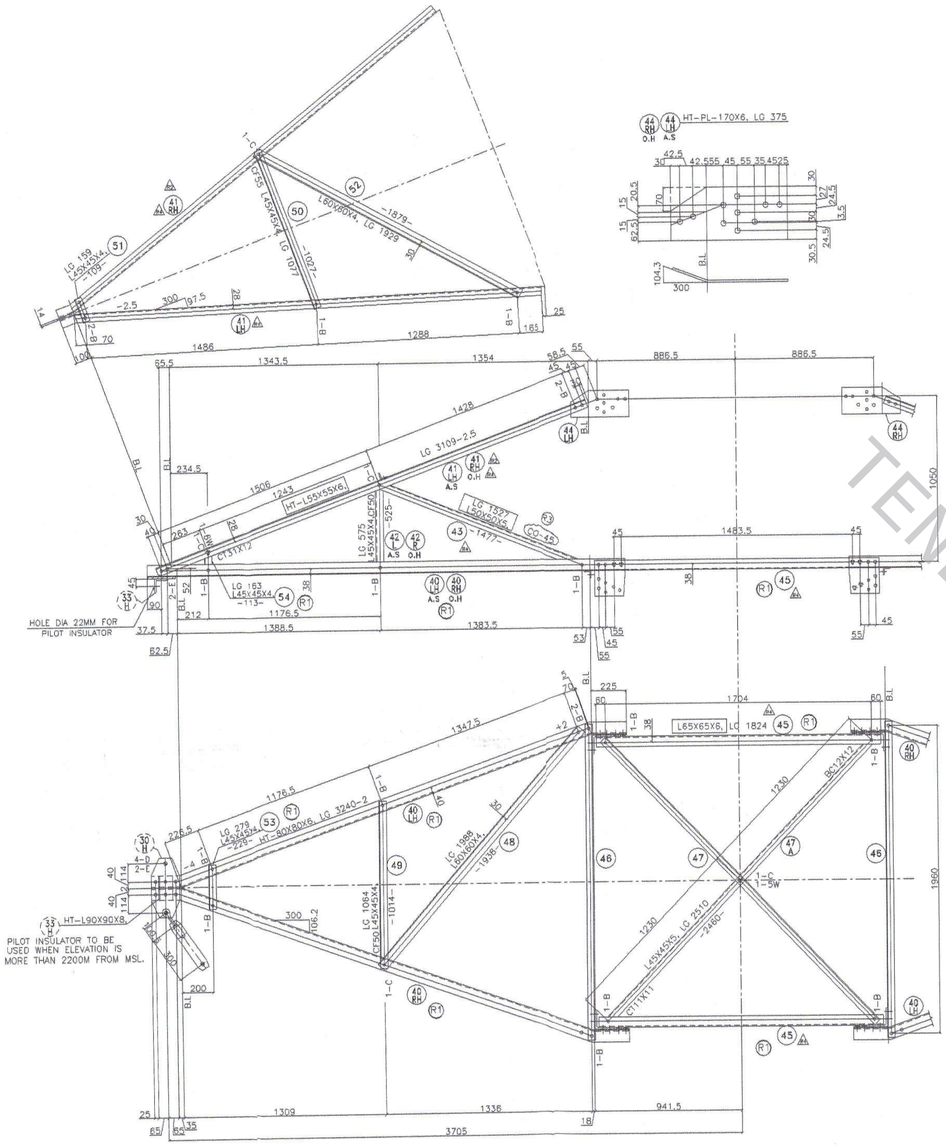
SCALE 1:15
PROJECTION

DRG. No: BPC/EDCD/SPIL/CS/STR/03
NO OF SHEETS : 3 OF 6
SIZE A1
REV. 4

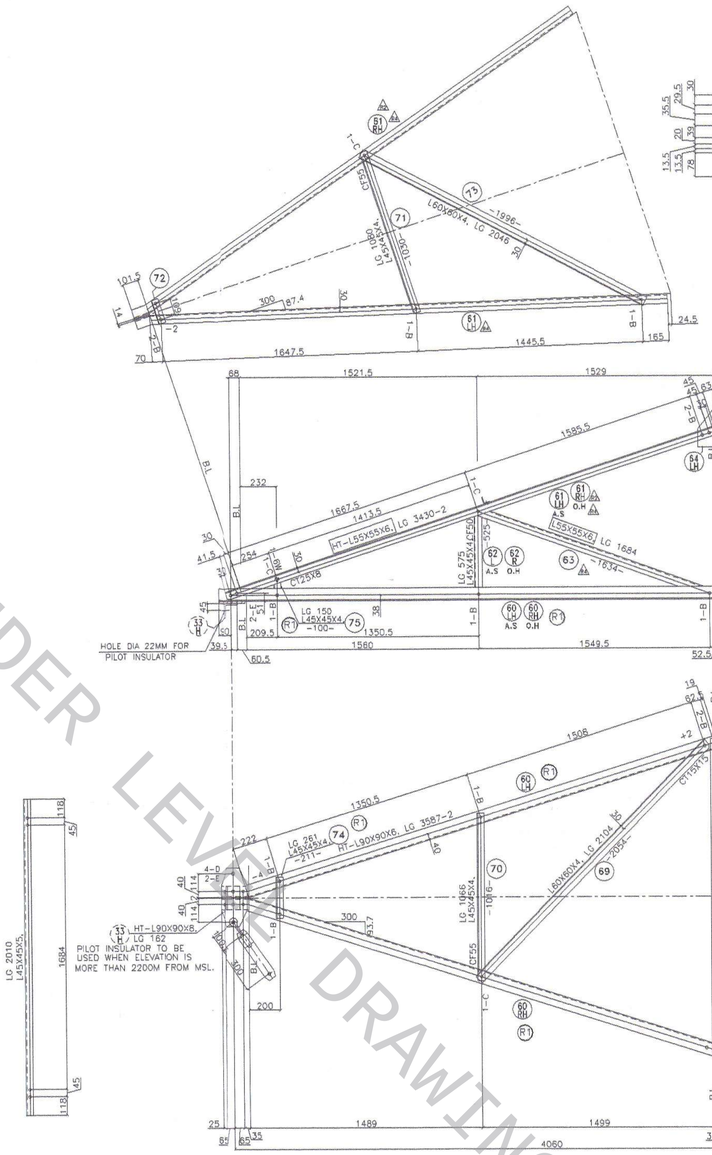
BHUTAN POWER CORPORATION * TRANSMISSION CONSTRUCTION DEPARTMENT * THIMPHU/BHUTAN

TENDER DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE

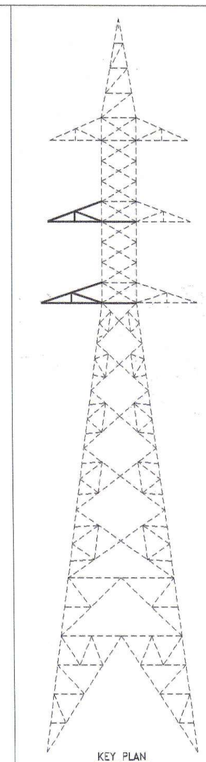


MIDDLE X-ARM



BOTTOM X-ARM





KEY PLAN

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	92
C	ø16 x 40mm long	34
D	ø16 x 45mm long	18
E	ø16 x 50mm long	24
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		166
STEP BOLTS		–
30mm O.D. PACK WASHERS		ø17.5mm
5 THK WASHER		01
6 THK WASHER		09
8 THK WASHER		–
10 THK WASHER		–

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A — Document approved as submitted; proceed with fabrication/construction
- ☐ B — Document approved subject to comments noted; proceed with fabrication / construction considering our comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
- ☐ D — Our comments are noted in the memo attached to this transmittal.
- ☐ E — Correct original of the document to reflect our comments and resubmit for approval.
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- ☐ H — Documents reviewed only against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I — Document returned without review.

Approval conveyed herein vide letter/ ..... neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, methods of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies with international laws as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed ..... Date 6/2/16

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE (SHEET 3 OF 6) REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/D6
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

MARK NOS 40 TO 54, 60 TO 75

PROTO CORRECTED

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02.06.16
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			01.11.15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE & 132 KV D/C MOTANGA TO NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT

JOB NO: 2011/01

	NAME	SIGN	DATE
DSN & DRWN			7/9/15
CHKD			
APPD			

TITLE : MIDDLE & BOTTOM X-ARM FOR 132KV D/C TOWER TYPE "DCS" (X-ARM STRENGHTENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/CS/STR/02

NO OF SHEETS : 2 OF 6

SIZE A1

REV. 4

BHUTAN POWER CORPORATION TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU/BHUTAN

TENDER LEVEL DRAWING

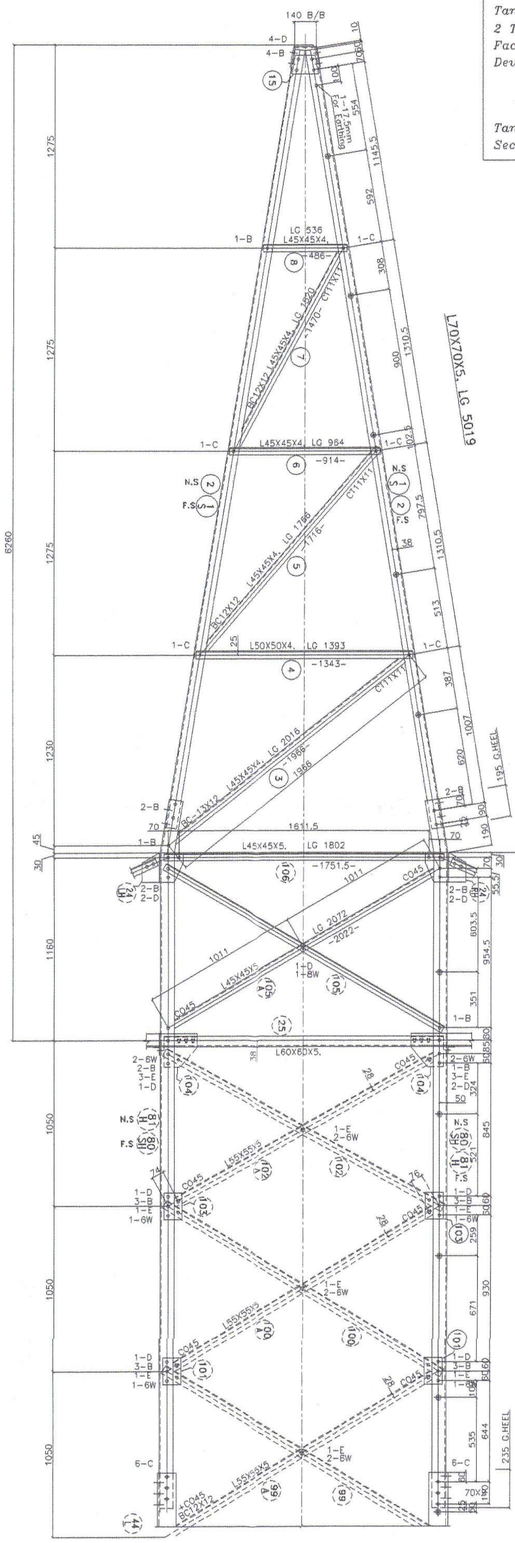
TO BE USED FOR WOBTHANG TRANSMISSION LINE

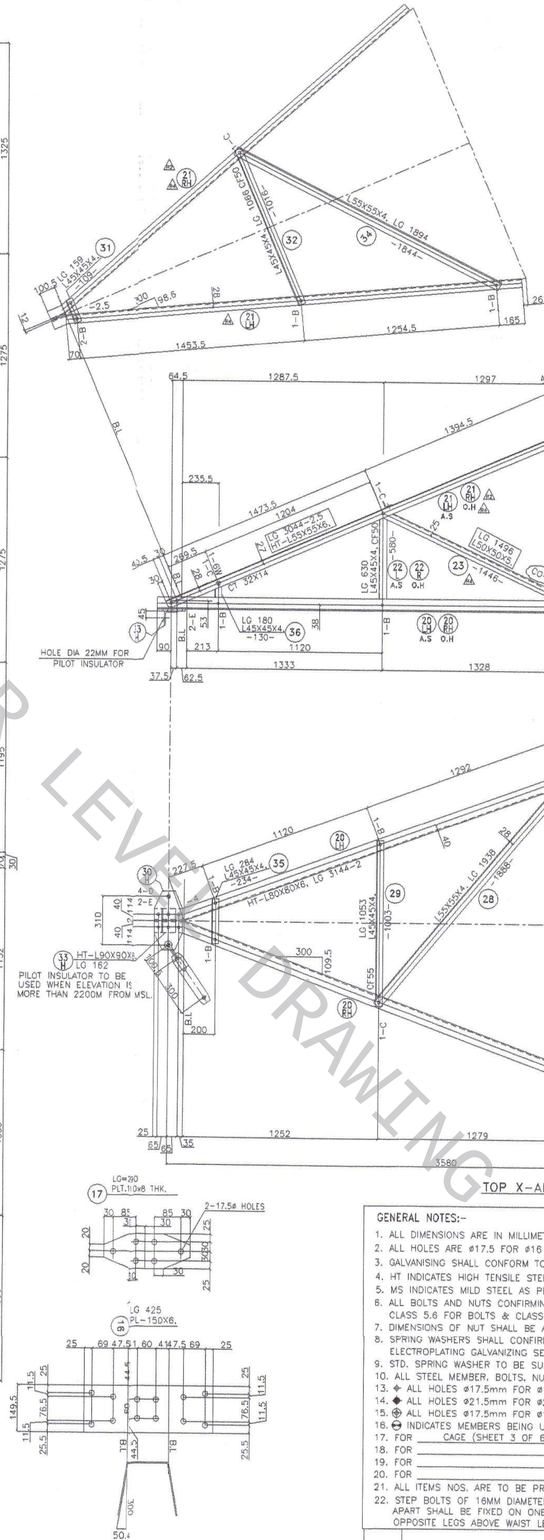
PEAK SLOPE

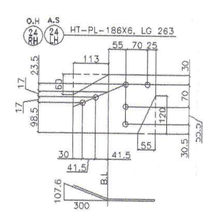
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2 Tan B	=	0.33610452
Face	=	1.01402247
Dev	=	1.02785365

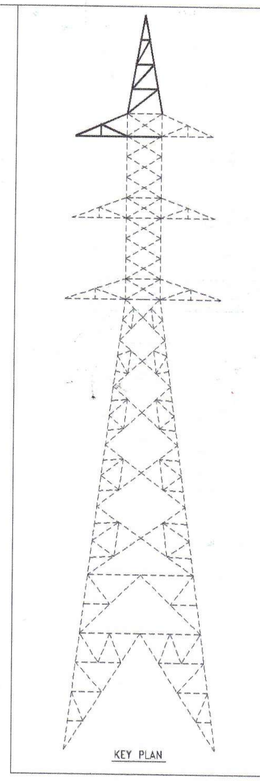
In Face Slopes

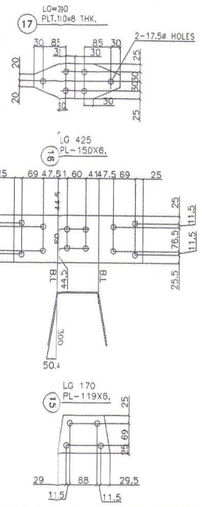
Tan B	=	0.16728336
Sec B	=	1.01363992











TOP X-ARM

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR ____ CAGE (SHEET 3 OF 6) REFER DRG. NO. BPC/EDCD/SPIL/CS/STR/03
18. FOR ____ REFER DRG. NO. ____
19. FOR ____ REFER DRG. NO. ____
20. FOR ____ REFER DRG. NO. ____
21. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "C-1,2 ETC."
22. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENING IS DONE FOR LONGER WEIGHT SPAN			02.06.16
R3	REVISED AS PER CLIENT COMMENTS BEFORE TOWER TESTING			17.01.16
R2	REVISED AS PER CLIENT COMMENTS DURING PROTO INSPECTION			08.12.15
R1	REVISED AS PER CLIENTS COMMENTS.			01.11.15

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY
B	ø16 x 35mm long	84
C	ø16 x 40mm long	34
D	ø16 x 45mm long	12
E	ø16 x 50mm long	12
F	ø16 x 55mm long	–
G	ø16 x 60mm long	–
H	ø16 x 65mm long	–
J	ø16 x 70mm long	–
K	ø16 x 75mm long	–
L	ø16 x 80mm long	–
M	ø16 x 85mm long	–
N	ø16 x 90mm long	–
SPRING WASHERS		142
STEP BOLTS		22
FLAT WASHERS		ø17.5mm
HW WASHER		01
TW WASHER		04

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A — Document approved as submitted, proceed with fabrication/construction.
- ☐ B — Document approved subject to comments noted; proceed with fabrication/construction considering our comments.
- ☐ C — Our comments are noted on the enclosed marked-up print.
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- ☐ I — Document returned without review.

Approval conveyed herein vide letter/E-mail dated ____ neither relieves Vendor / Supplier of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, system / performance requirements and conformity of supplies, with international laws, as may be applicable, nor does it limit the Purchaser's rights under the contract.

Signed ____ Date 6/7/16

BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT THIMPHU:BHUTAN

MARK NOS 1 TO 17, 20 TO 36

PROTO CORRECTED

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
132 KV D/C MOTANGA-NANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

MANUFACTURER: SHEETAL STRUCTURALS PVT. LTD.-BAGHPAT(UP)

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPD			

TITLE : PEAK & TOP X-ARM FOR 132KV D/C TOWER TYPE "DCS" (X-ARM STRENGTHENED)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPIL/CS/STR/01

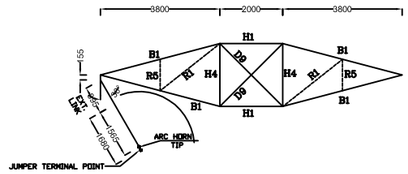
NO OF SHEETS : 1 OF 6

SIZE A1

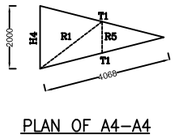
REV. 4

TENDER LEVEL DRAWING

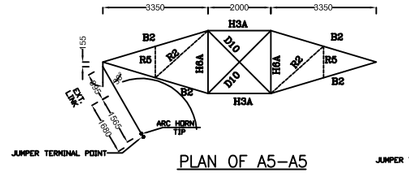
TO BE USED FOR WOBTHANG TRANSMISSION LINE



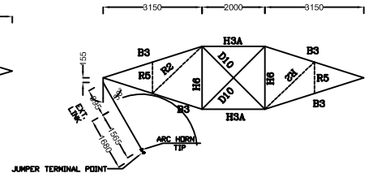
PLAN OF A3–A3



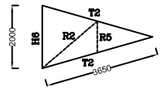
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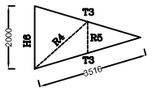
PLAN OF A5–A5



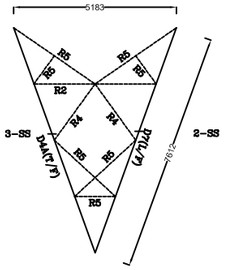
PLAN OF A7–A7



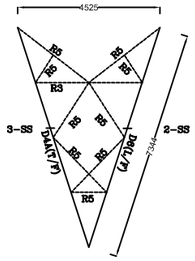
PLAN OF A6–A6



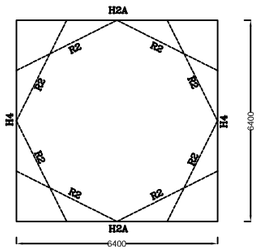
PLAN OF A8–A8



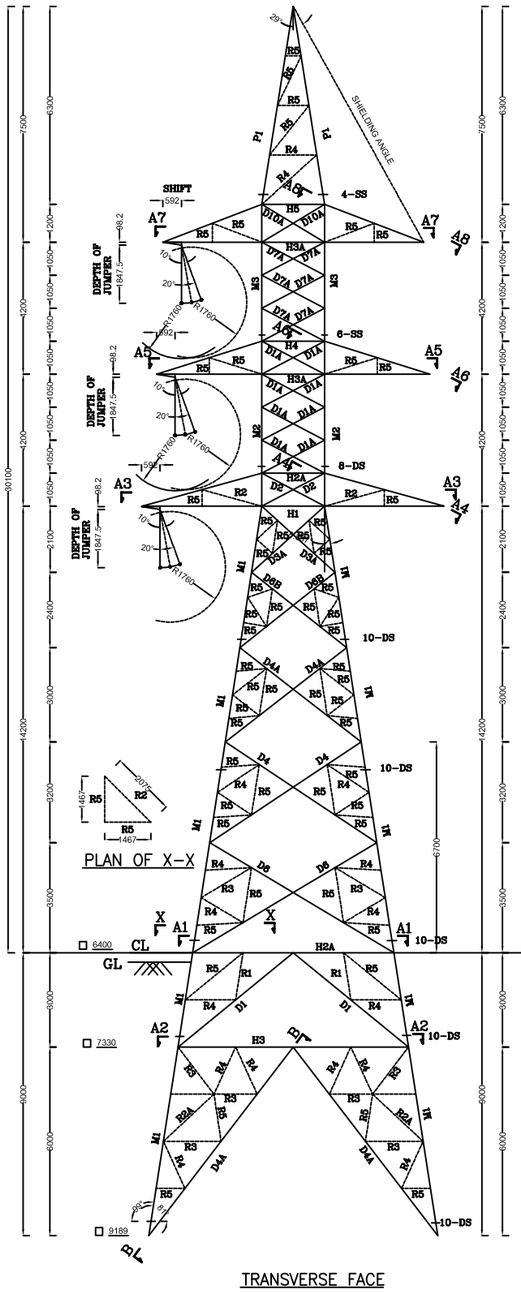
PLAN OF B–B



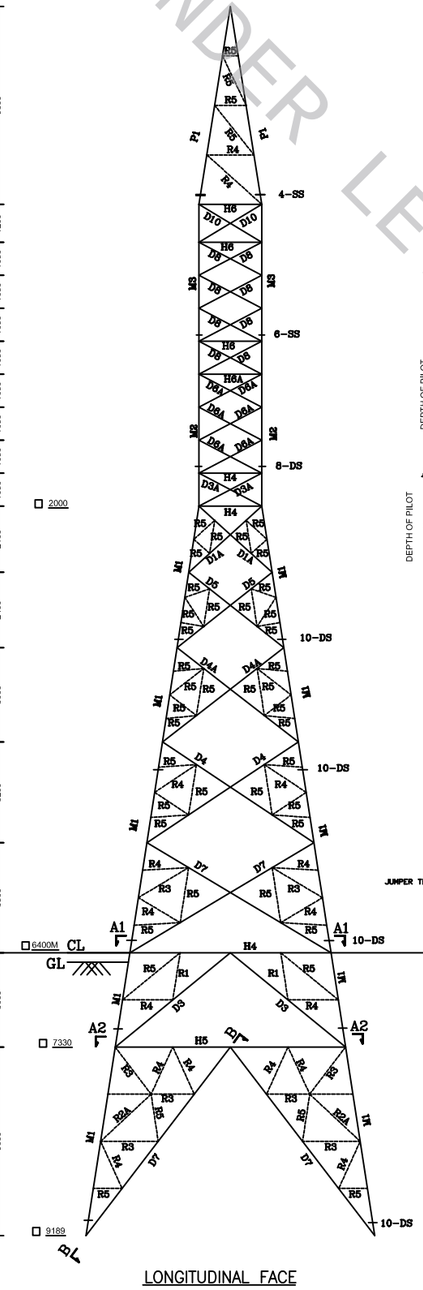
PLAN OF A–A



PLAN OF A1–A1

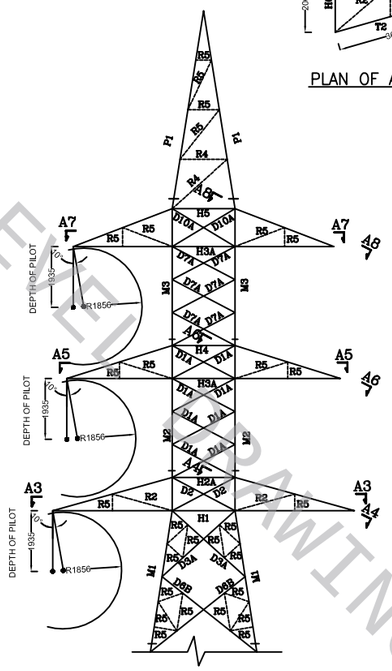


TRANSVERSE FACE

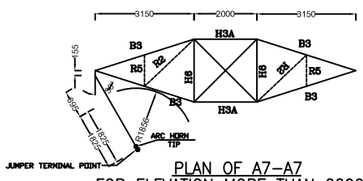


LONGITUDINAL FACE

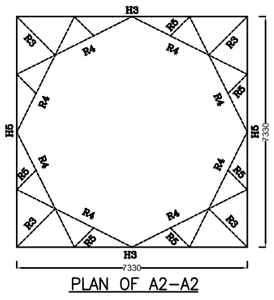
STANDARD TOWER +9M B.E.



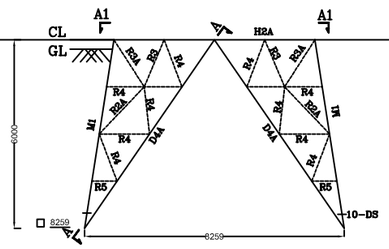
CLEARANCE
FOR ELEVATION MORE THAN 2200M



PLAN OF A7–A7
FOR ELEVATION MORE THAN 2200M

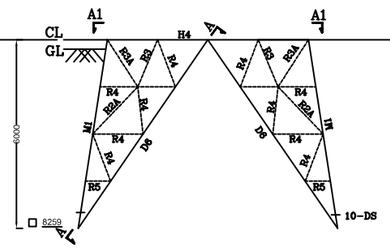


PLAN OF A2–A2

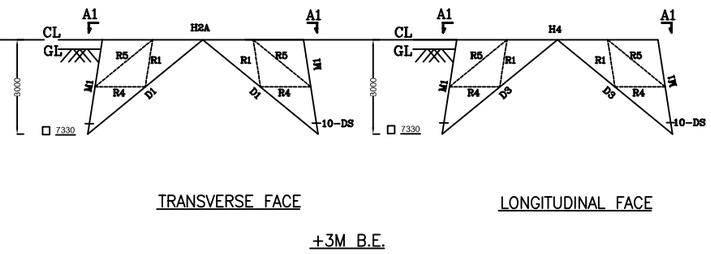


TRANSVERSE FACE

+6M B.E.



LONGITUDINAL FACE



TRANSVERSE FACE

LONGITUDINAL FACE

+3M B.E.

MEMBER CODE	SECTION	QTY. NOS.	MEMBER CODE	SECTION mmxmmxmm	QTY. NOS.
HORIZONTAL MEMBERS			MAIN LEG MEMBERS		
H1	L 80*80*6	3	M1	L 150*150*12 HT	10-DS
H2	L 75*75*5	2	M2	L 120*120*10 HT	8-DS
H2A	L 75*75*5	3	M3	L 90*90*8 HT	6
H3	L 70*70*5	2	PEAK MEMBER		
H3	L 70*70*5	3	P1	L 75*75*5	4
H4	L 65*65*5	2	DIAGONAL MEMBERS		
H5	L 60*60*5	2	D1	L 80*80*6	2
H6	L 50*50*5	1	D1A	L 80*80*6	4
H6	L 50*50*5	1	D2	L 75*75*8	4
H6A	L 50*50*5	2	D3	L 75*75*6	2
REDUNDANT MEMBERS			D3A	L 75*75*6	4
R1	L 65*65*4	1	D4	L 75*75*5	2
R2	L 60*60*4	1	D4A	L 75*75*5	3
R2A	L 60*60*4	2	D5	L 70*70*6	3
R3	L 55*55*4	1	D6	L 70*70*5	2
R3A	L 55*55*4	2	D6A	L 70*70*5	3
R4	L 50*50*4	1	D6B	L 65*65*6	3
R5	L 45*45*4	1	D7	L 65*65*5	2
ARM TOP MEMBERS			D7A	L 65*65*5	3
T1	L 60*60*4	3	D8	L 60*60*4	3
T2	L 55*55*4	3	D9	L 50*50*4	2
T3	L 50*50*4	2	D10	L 45*45*4	1
			D10A	L 45*45*5	2
			MAIN ARM MEMBERS		
			B1	L 90*90*6 HT	4
			B2	L 80*80*6 HT	4
			B3	L 75*75*6 HT	4

NOTE:-

1.ALL DIMENSION ARE IN MM.
2.ELECTRICAL CLEARANCE IS AS PER SPECIFICATION.
3.DOTTED MEMBERS INDICATE REDUNDAND MEMBERS .
4.UNDER COLUMN SHEAR,DS INDICATE DOUBLE SHEAR.
5.MATERIAL USED –MILD STEEL–IS 2062:2006 GR–250
HIGH TENSILE STEEL – IS 2062:2006 GR–350
BOLT AND NUTS – IS 12427:2001 GRADE –5.6/5
6.ALL STRAIN PLATE SHALL HAVE PROVISION FOR PILOT INSULATOR STRING.
7.STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.
8. TWO HOLES OF 17.5MM ABOUT 50MM APART SHALL BE DRILLED ON EACH TOWER LEG FOR EARTHING PURPOSE .
9.PILOT INSULATOR TO BE USED WHEN ELEVATION IS MORE THAN 2200M FROM MSL.
10.ANTI–CLIMBING DEVICE SHALL BE PROVIDED 2500MM ABOVE THE GROUND LEVEL.

TENDER LEVEL DRAWING

STUB –L 150*150*12 HT

TO BE USED FOR WOBTHANG TRANSMISSION LINE

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

JOB NO: 2011/01	NAME	SIGN	DATE
DSGN & DRWN			3/9/15
CHKD			
APPD			

TITLE : SINGLE LINE DIAGRAM OF TOWER TYPE "D"
SCALE 1:100
PROJECTION
DRG. No: BPC/EDCD/D/SLD/01
NO OF SHEETS : 1 OF 1
SIZE A1
REV. 0

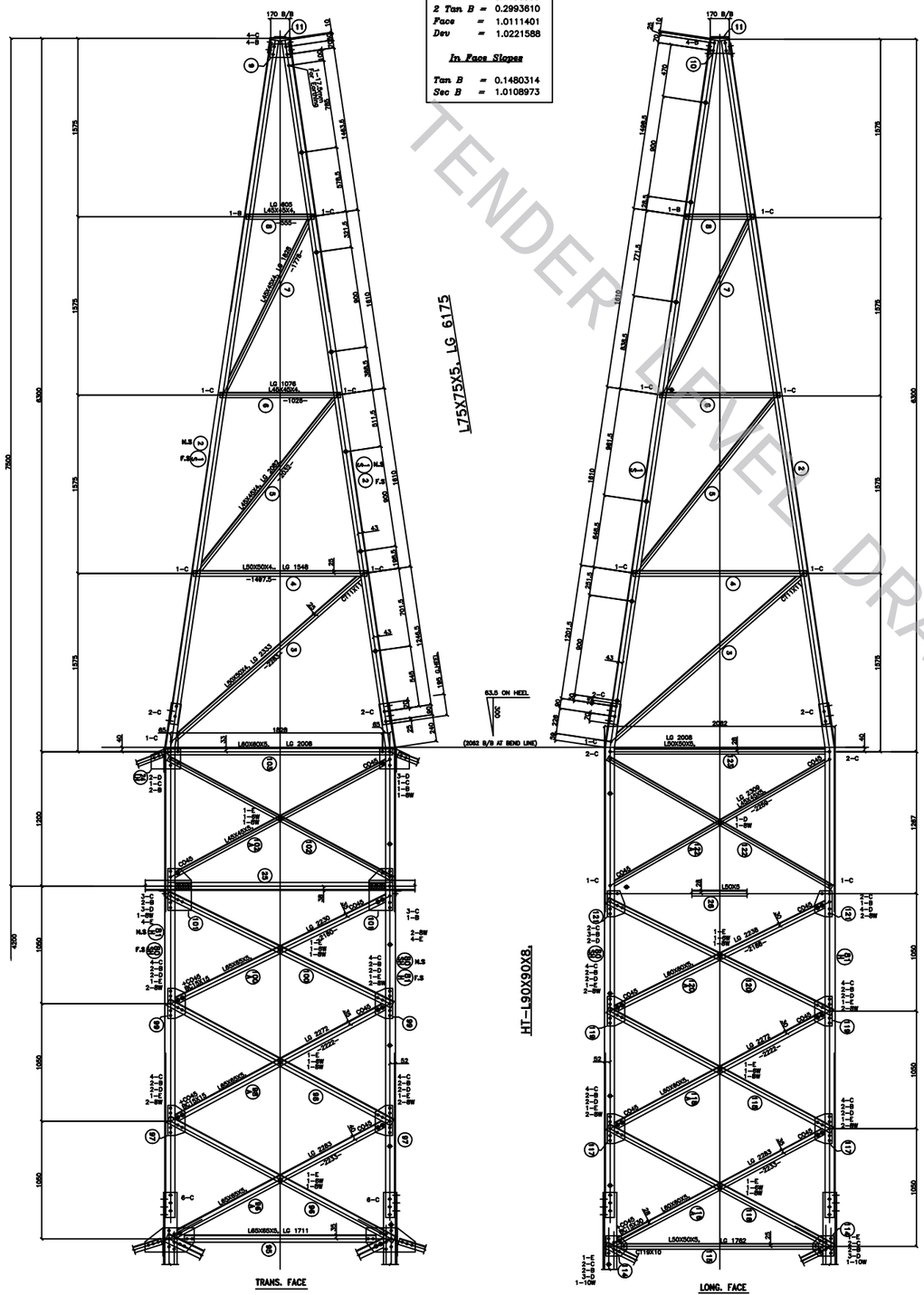
SYM.	REVISIONS	REVD.	CHKD.	DATE

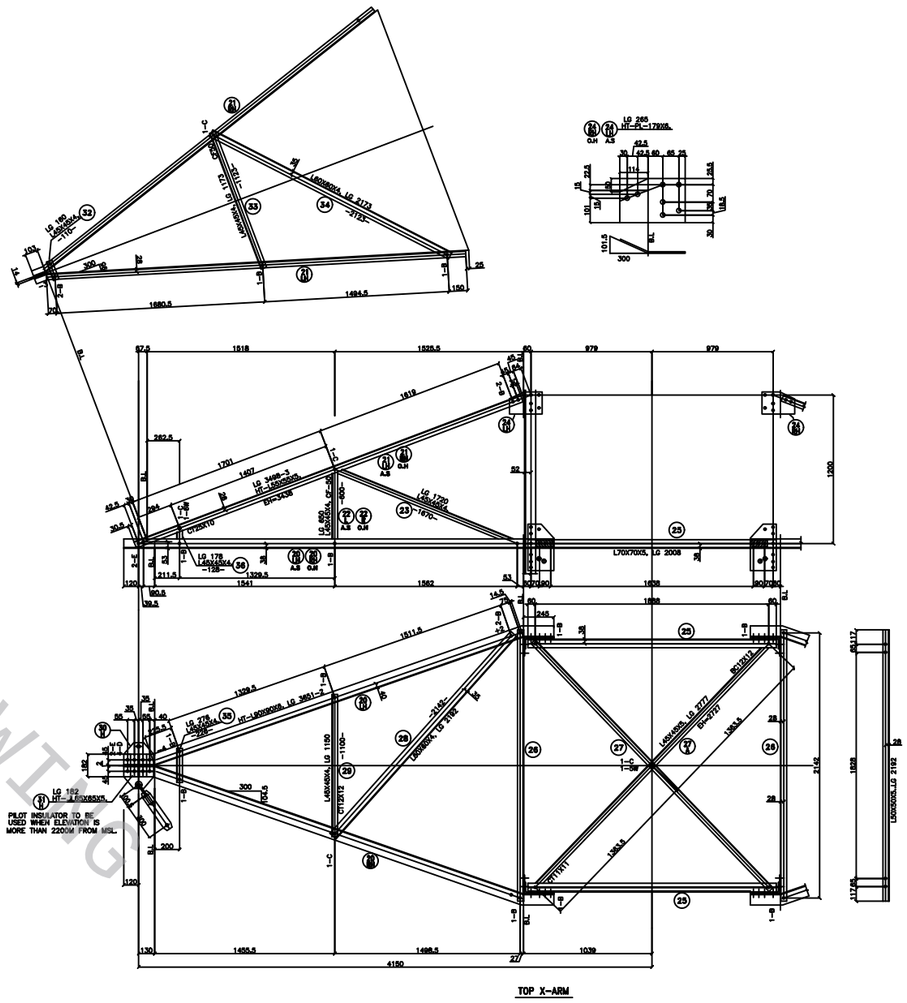
PEAK SLOPE

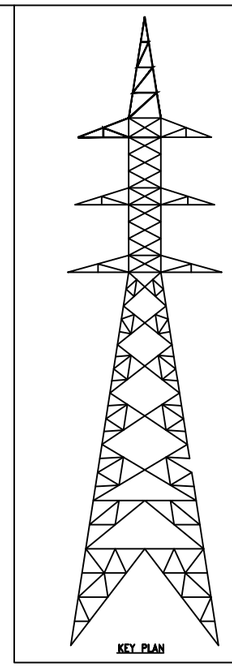
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2 Tan B	=	0.2993610
Face	=	1.0111401
Dev	=	1.0221588

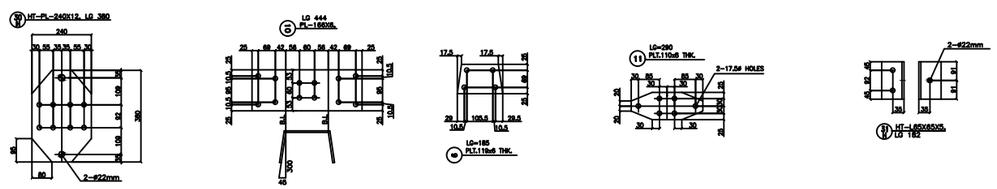
In Face Slopes

Tan B	=	0.1480314
Sec B	=	1.0108973









LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	66
C	#16 x 40mm long	58
D	#16 x 45mm long	8
E	#16 x 50mm long	12
F	#16 x 55mm long	--
G	#16 x 60mm long	--
H	#16 x 65mm long	--
J	#16 x 70mm long	--
K	#16 x 75mm long	--
L	#16 x 80mm long	--
M	#16 x 85mm long	--
SPRING WASHERS		144
#16X175 STEP BOLTS		24
30mm O.D. PACK WASHERS #17.5mm		
5 THK WASHER		01
6 THK WASHER		04
8 THK WASHER		--
10 THK WASHER		--

GENERAL NOTES:--

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBERS, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ALL HOLES #17.5mm FOR #16mm BOLTS.
14. ALL HOLES #21.5mm FOR #20mm BOLTS.
15. ALL HOLES #17.5mm FOR #16mm STEP BOLTS.
16. INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE SHEET 3 OF 9 REFER DRG. NO. BPC/EDCD/SPIL/D/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

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MARK NOS : 1 TO 11, 20 TO 36

SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01	NAME	SIGN	DATE
DSGN & DRWN			07/8/15
CHKD			
APPD			

TITLE : 132KV DC TOWER TYPE "D" "PEAK & TOP X-ARM"

SCALE 1:15

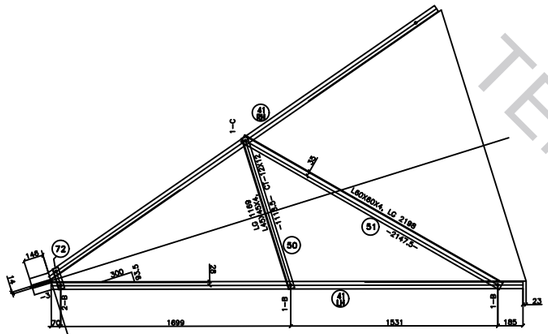
PROJECTION

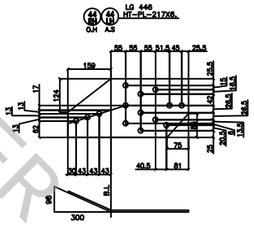
DRG. No: BPC/EDCD/SPIL/D/STR/01

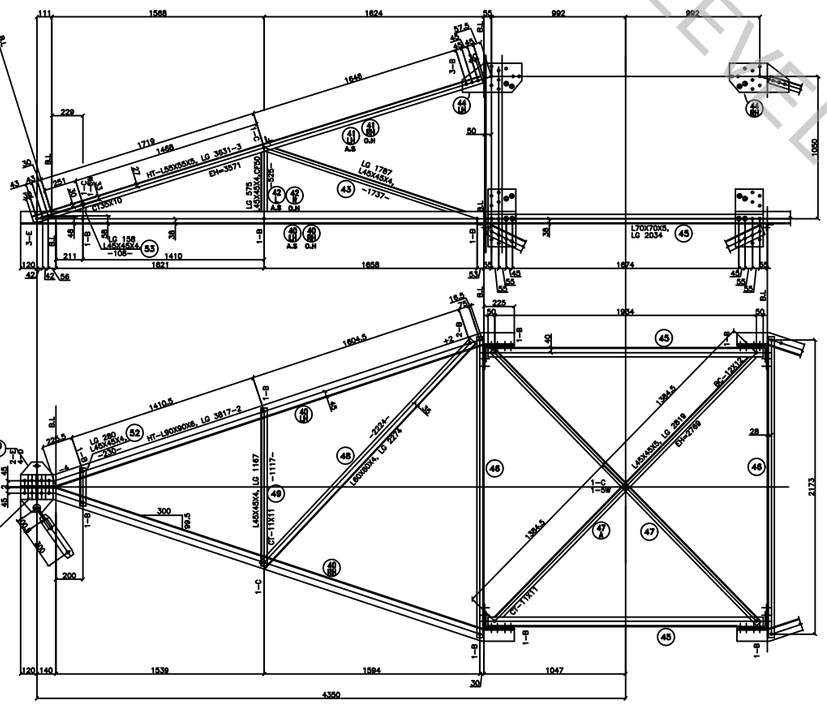
NO OF SHEETS : 1 OF 9

SIZE A1 REV. 1

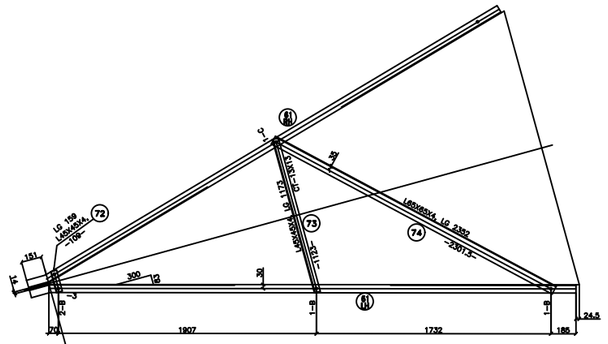
TO BE USED FOR WOBTHANG TRANSMISSION LINE

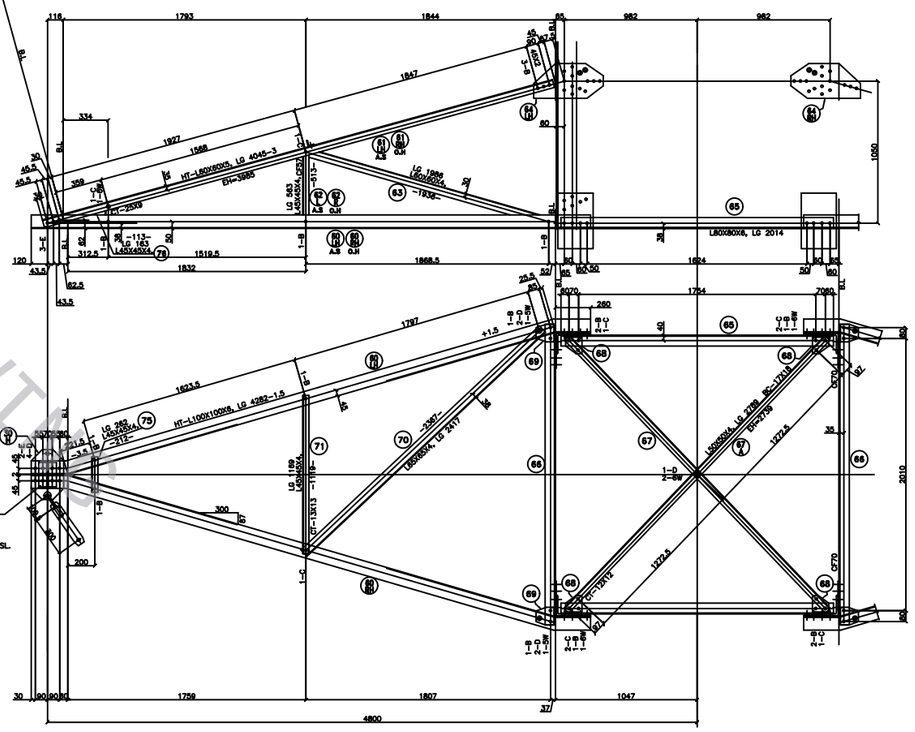




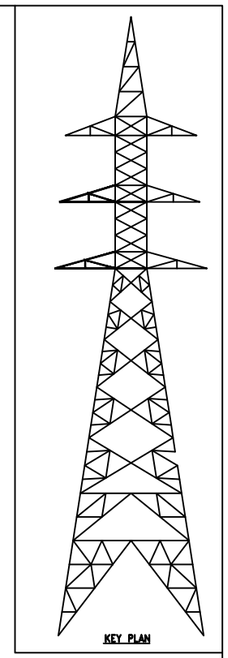


MIDDLE X-ARM

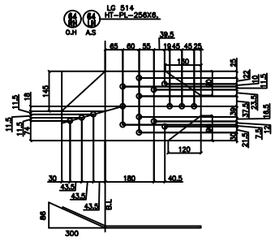


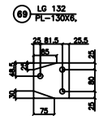


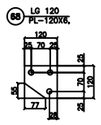
BOTTOM X-ARM



KEY PLAN







LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	96
C	#16 x 40mm long	31
D	#16 x 45mm long	25
E	#16 x 50mm long	32
F	#16 x 55mm long	--
G	#16 x 60mm long	--
H	#16 x 65mm long	--
J	#16 x 70mm long	--
K	#16 x 75mm long	--
L	#16 x 80mm long	--
M	#16 x 85mm long	--
SPRING WASHERS		184
#16X175 STEP BOLTS		--
30mm O.D. PACK WASHERS @17.5mm		
5 THK WASHER		05
6 THK WASHER		10
8 THK WASHER		--
10 THK WASHER		--

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ⌀17.5 FOR ⌀16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ⌀17.5mm FOR ⌀16mm BOLTS.
14. ◆ ALL HOLES ⌀21.5mm FOR ⌀20mm BOLTS.
15. ⊕ ALL HOLES ⌀17.5mm FOR ⌀16mm STEP BOLTS.
16. ⊕ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CAGE SHEET 3 OF 9 REFER DRG. NO. BPC/EDCD/SPIL/D/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

TO BE USED FOR WOBTHANG TRANSMISSION LINE

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MARK NOS : 40 TO 53, 60 TO 76, 30 & 31

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01	NAME	SIGN	DATE
DSGN & DRWN			07/8/15
CHKD			
APPD			

TITLE : 132KV DC TOWER TYPE "D" "MIDDLE & BOTTOM X-ARM"

SCALE 1:10

PROJECTION

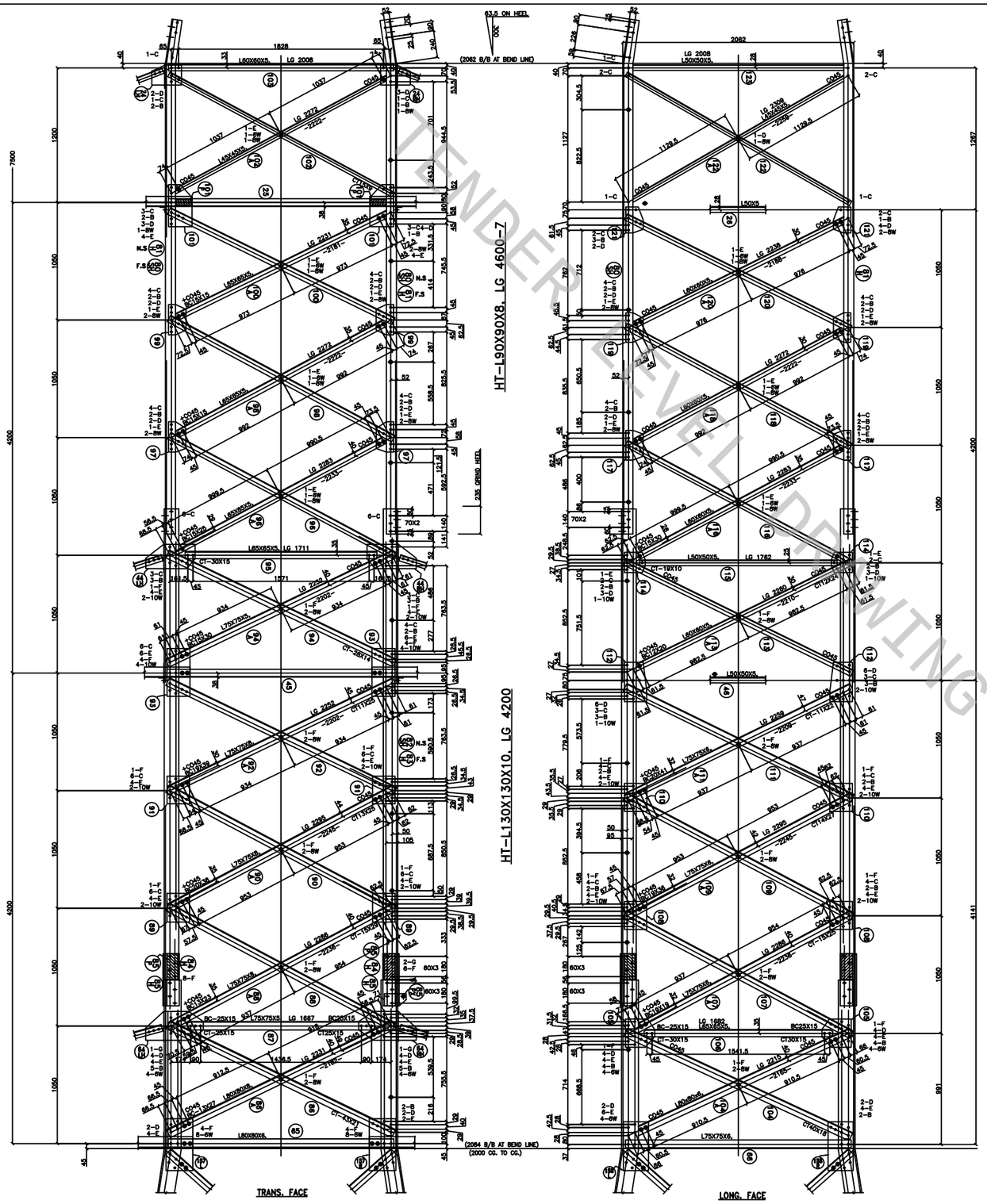
SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

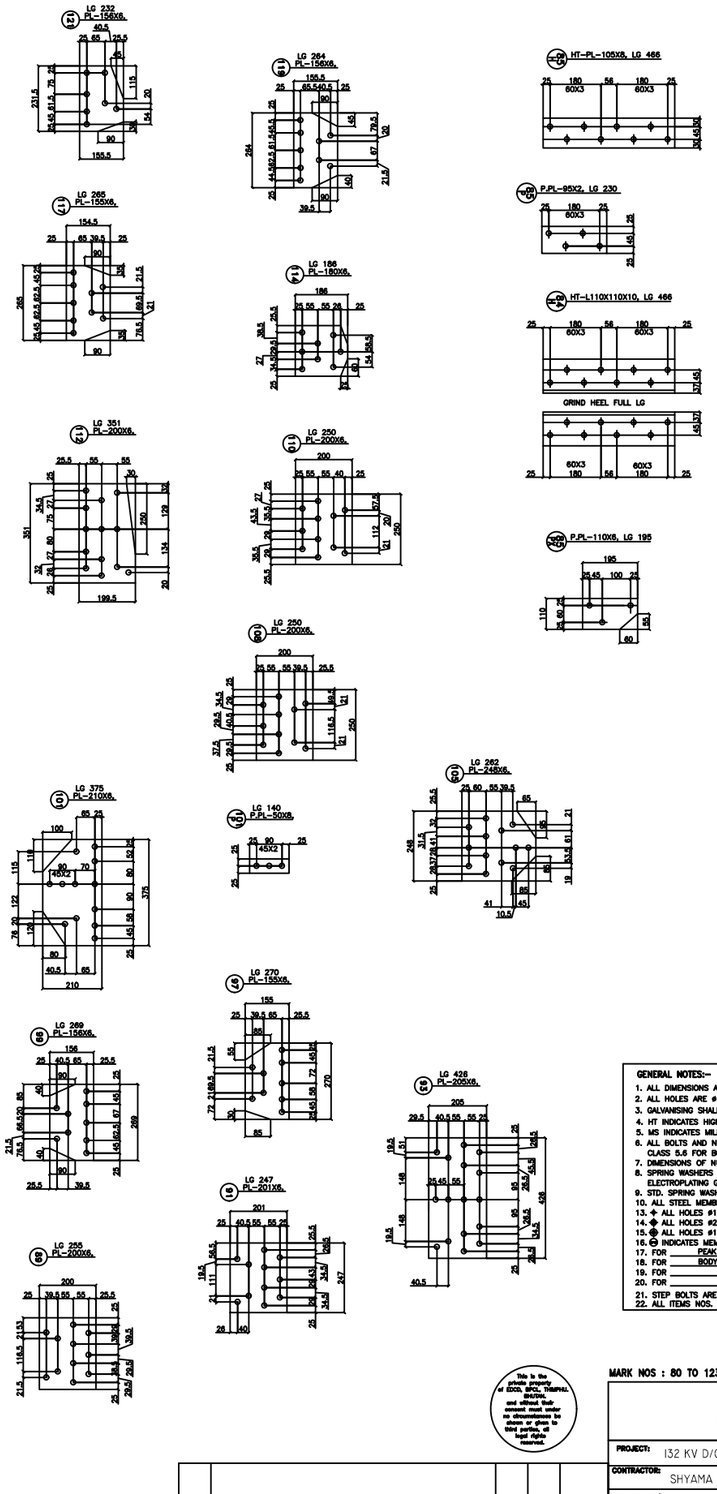
DRG. No: BPC/EDCD/SPIL/D/STR/01

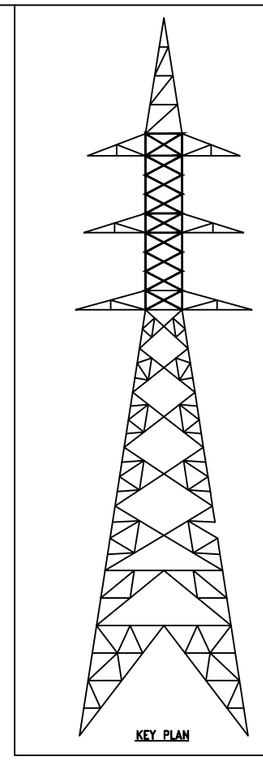
NO OF SHEETS : 2 OF 9

SIZE A1

REV. 1







LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	146
C	#16 x 40mm long	278
D	#16 x 45mm long	156
E	#16 x 50mm long	220
F	#16 x 55mm long	140
G	#16 x 60mm long	06
H	#16 x 65mm long	–
J	#16 x 70mm long	–
K	#16 x 75mm long	–
L	#16 x 80mm long	–
M	#16 x 85mm long	–
SPRING WASHERS		946
#16X175 STEP BOLTS		40
30mm O.D. PACK WASHERS #17.5mm		
5 THK WASHER		–
6 THK WASHER		88
8 THK WASHER		100
10 THK WASHER		66

GENERAL NOTES:–

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4750.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR–350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR–250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ✦ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR _____ PEAK & TOP X–ARM I OF 9 REFER DRG. NO. BPC/EDCD/SPIL/D/STR/01
18. FOR BODY SHEET 4 OF 9 REFER DRG. NO. BPC/EDCD/SPIL/D/STR/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D–1,2 ETC."

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MARK NOS : 80 TO 123

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

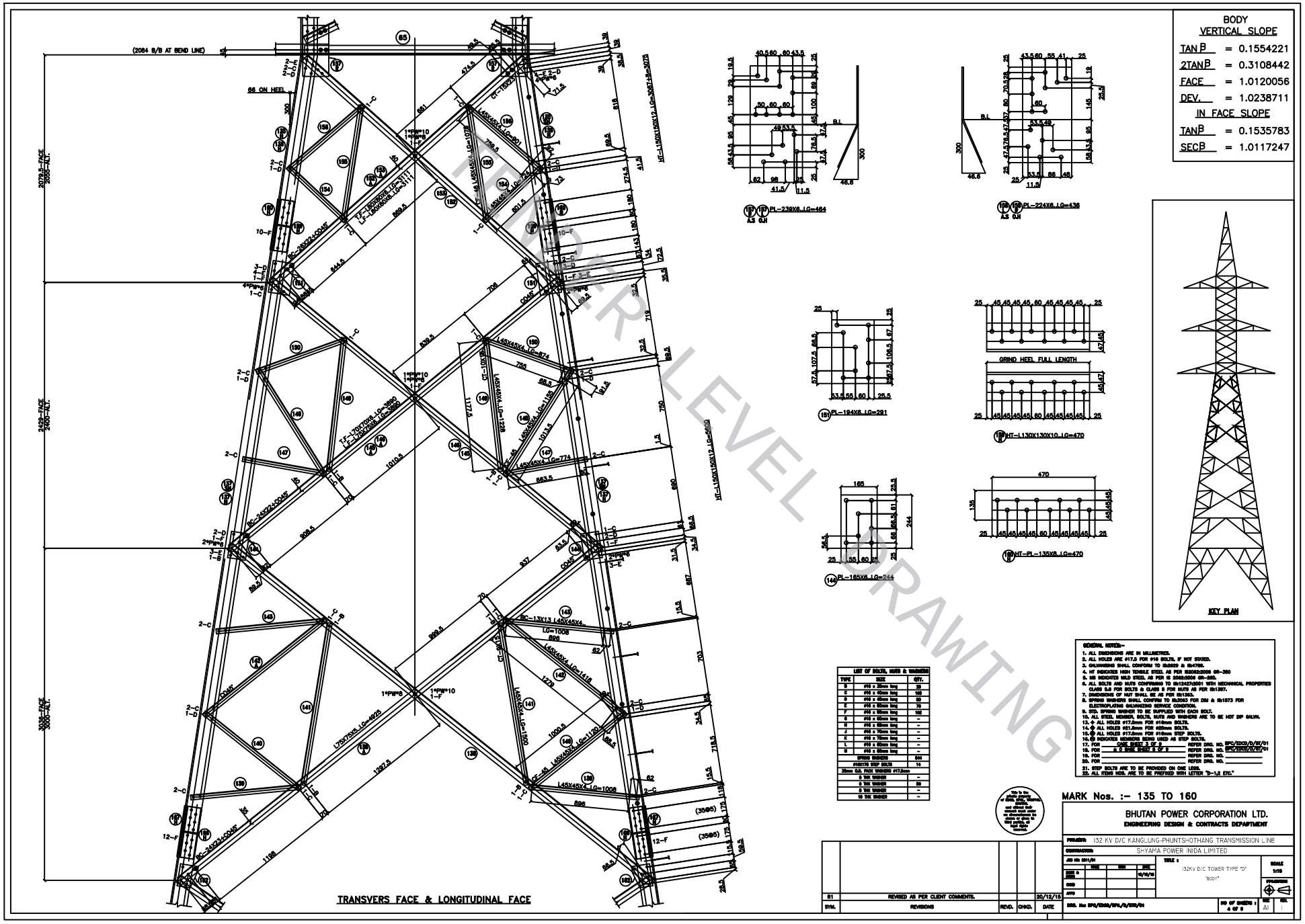
PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
JOB NO: 2011/01
TITLE : 132KV DC TOWER TYPE "D" "CAGE"
SCALE 1:15
PROJECTION

	NAME	SIGN	DATE
DSGN & DRWN			07/8/15
CHKD			
APPD			

SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

DRG. No: BPC/EDCD/SPIL/D/STR/01 — NO OF SHEETS : 3 OF 9 — SIZE A1 — REV. 1

TO BE USED FOR WOBTHANG TRANSMISSION LINE



BODY VERTICAL SLOPE	
TAN β	= 0.1554221
2TAN β	= 0.3108442
FACE	= 1.0120056
DEV.	= 1.0238711
IN FACE SLOPE	
TAN β	= 0.1535783
SEC β	= 1.0117247

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	M16 x 35mm long	20
C	M16 x 40mm long	168
D	M16 x 45mm long	80
E	M16 x 60mm long	36
F	M16 x 65mm long	192
G	M16 x 80mm long	-
H	M16 x 85mm long	-
J	M16 x 75mm long	-
K	M16 x 75mm long	-
L	M16 x 65mm long	-
M	M16 x 65mm long	-
SPRING WASHER		864
PENETRA STEP BOLTS		14
35mm DIA. PACK WASHER Ø17.5mm		
5 THK WASHER		-
6 THK WASHER		88
8 THK WASHER		-
10 THK WASHER		-

GENERAL NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE Ø17.0 FOR M16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS/ISO 3347:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◇ ALL HOLES Ø17.0mm FOR M16mm BOLTS.
14. ◆ ALL HOLES Ø21.0mm FOR M20mm BOLTS.
15. ⊕ ALL HOLES Ø17.0mm FOR M16mm STEP BOLTS.
16. ⊕ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR _____ REFER DRG. NO. BPC/EDCD/D/ST/01
18. FOR 6.1 DEG. BEND 1 OF 2 REFER DRG. NO. BPC/EDCD/D/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

MARK Nos. :- 135 TO 160

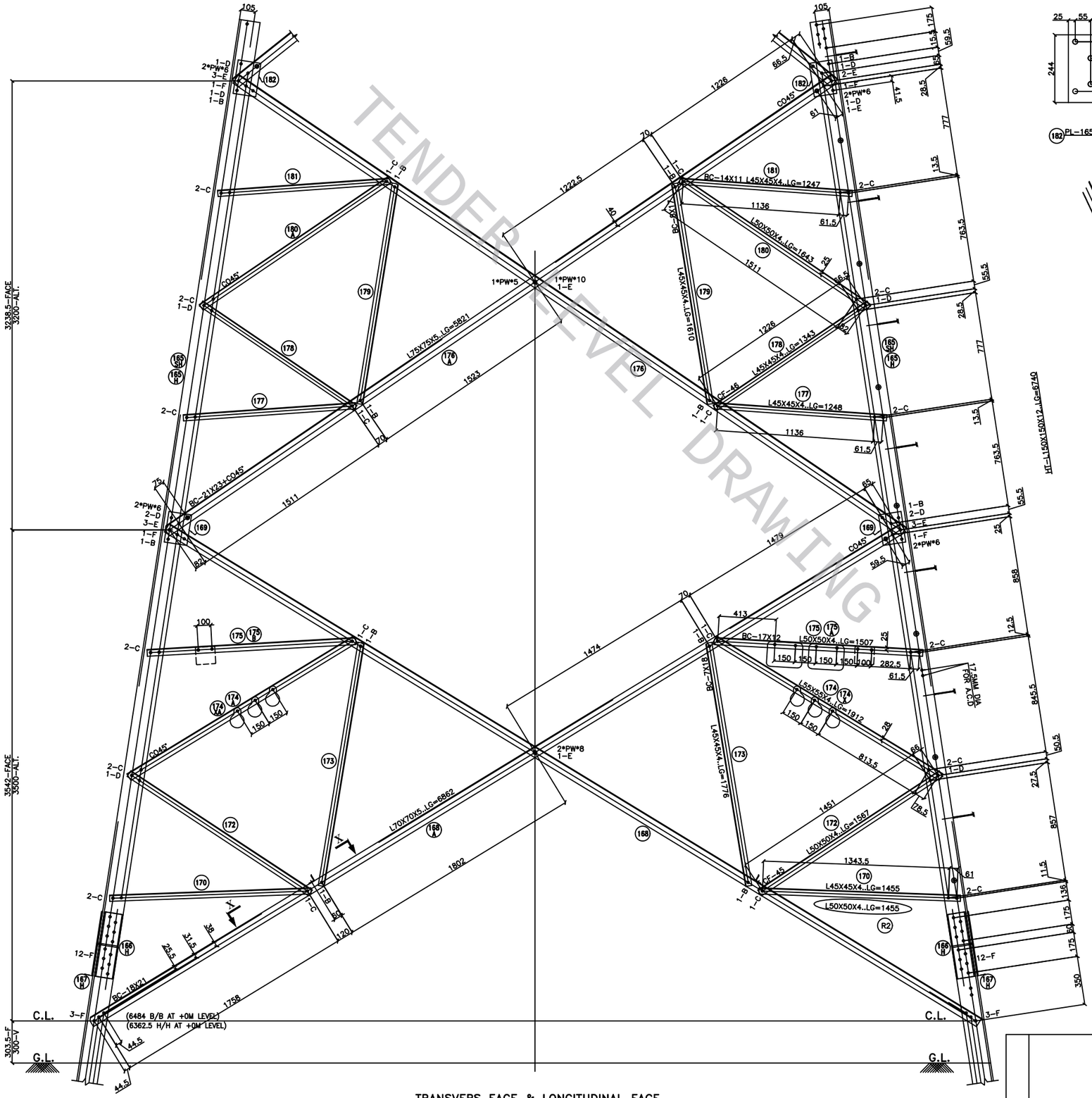
BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
TITLE: 132KV D/C TOWER TYPE "D" "BODY"
SCALE 1:15
DRG. No. BPC/EDCD/D/ST/01/01
NO OF SHEETS: 1 OF 1
REV. A1

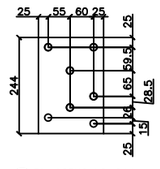
SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

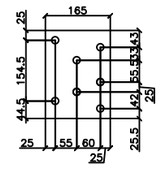
PROPERLEVEL DRAWING

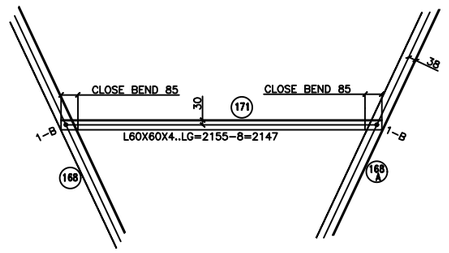
TO BE USED FOR WOBTHANG TRANSMISSION LINE



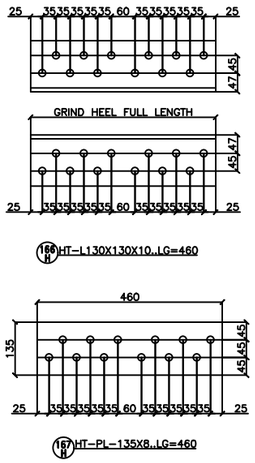
TRANSVERS FACE & LONGITUDINAL FACE

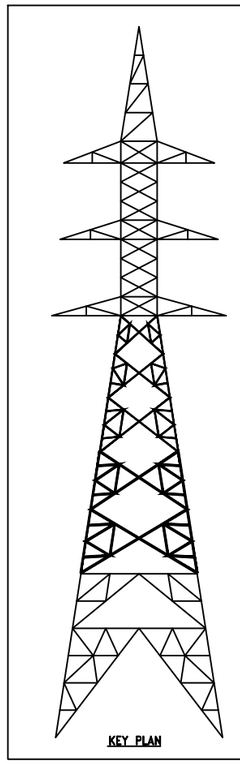






VIEW "X-X"





KEY PLAN

BODY
VERTICAL SLOPE

TAN β	=	0.1554221
2TAN β	=	0.3108442
FACE	=	1.0120056
DEV.	=	1.0238711

IN FACE SLOPE

TAN β	=	0.1535783
SEC β	=	1.0117247

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY.
B	ø16 x 30mm long	56
C	ø16 x 40mm long	128
D	ø16 x 45mm long	48
E	ø16 x 50mm long	56
F	ø16 x 55mm long	136
G	ø16 x 60mm long	--
H	ø16 x 65mm long	--
J	ø16 x 70mm long	--
K	ø16 x 75mm long	--
L	ø16 x 80mm long	--
M	ø16 x 85mm long	--
SPRING WASHERS		424
ø16X175 STEP BOLTS		10
30mm O.D. PACK WASHERS ø17.5mm		
5 THK WASHER		4
6 THK WASHER		32
8 THK WASHER		8
10 THK WASHER		4

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR _____ BASIC BODY SHEET 4 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
18. FOR STUB & TEPMLATE SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

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MARK Nos. :- 165 TO 182

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INIDA LIMITED
JOB NO: 2011/01
TITLE : 132KV D/C TOWER TYPE "D" "± 0 BASE"
SCALE 1:15
PROJECTION

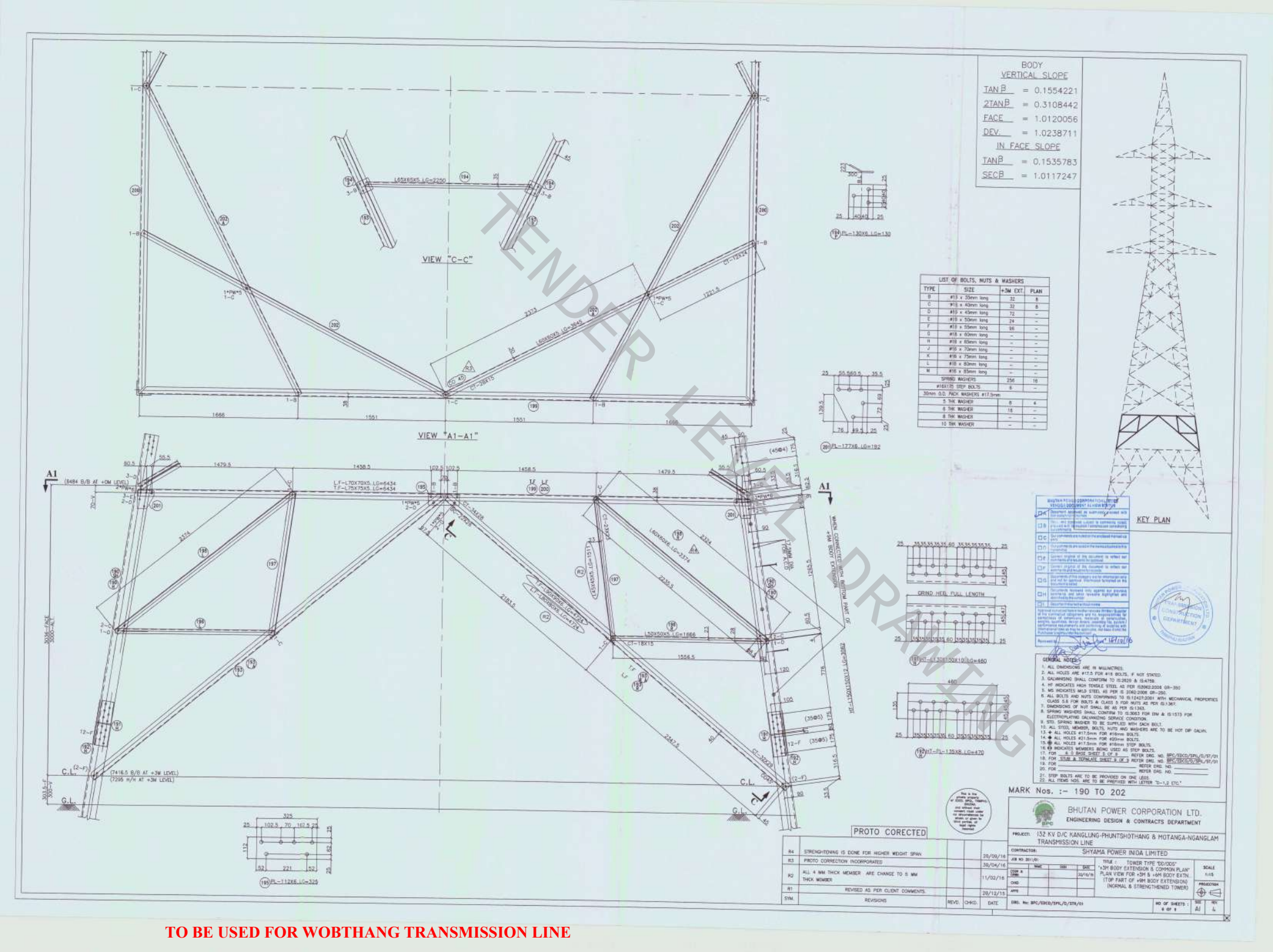
	NAME	SIGN	DATE
DESIGN & DRAWN			10/10/15
CHKD			
APPD			

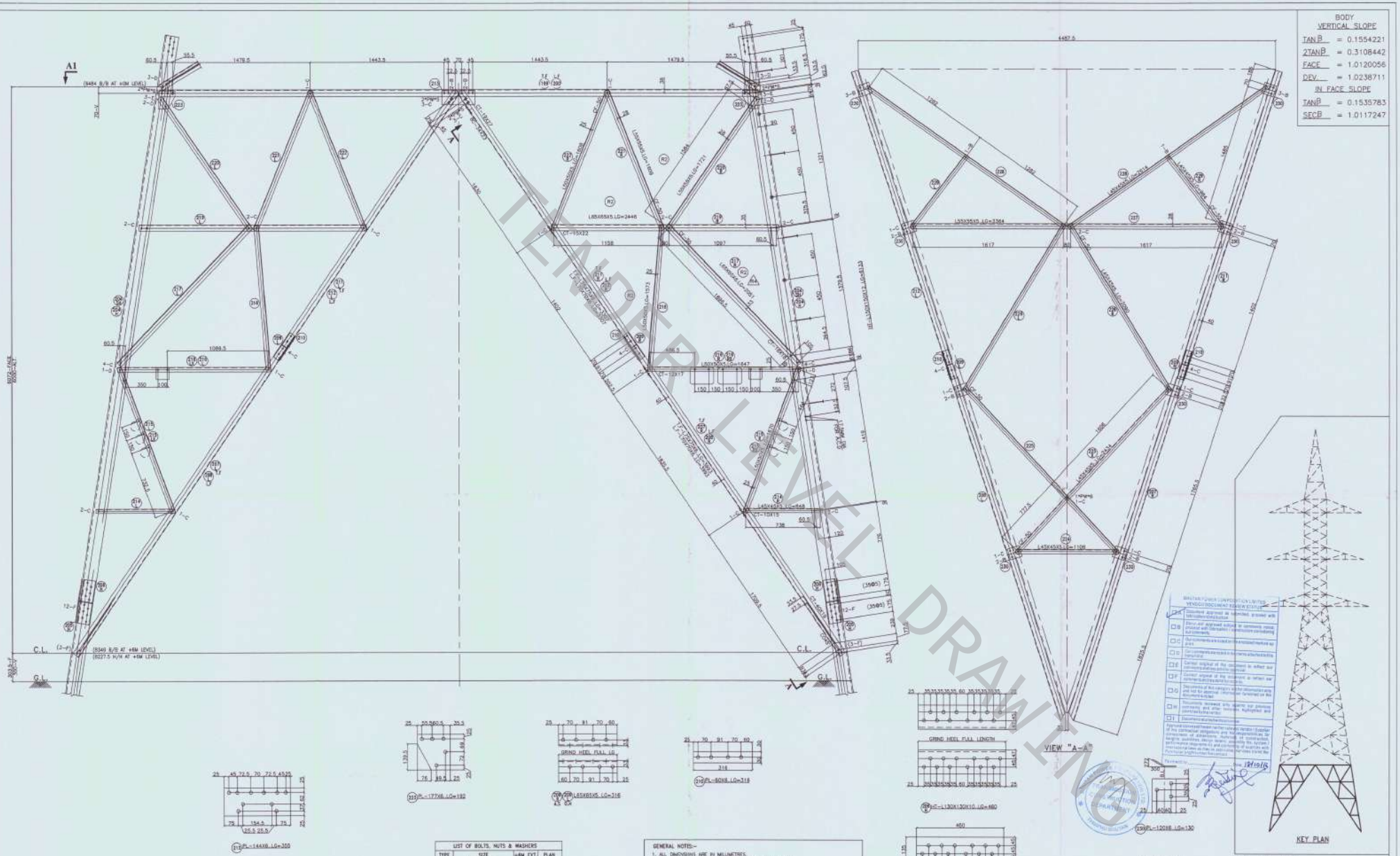
DRG. No: BPC/EDCD/SPR./D/STR/01
NO OF SHEETS : 5 OF 9
SIZE A1
REV. I

SYM.	REVISIONS	REVD.	CHKD.	DATE
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE


VIEW "C-C"
VIEW "A1-A1"
BODY
VERTICAL SLOPE
TAN β = 0.1554221
2TANβ = 0.3108442
FACE = 1.0120056
DEV. = 1.0238711
IN FACE SLOPE
TANβ = 0.1535783
SECβ = 1.0117247
LIST OF BOLTS, NUTS & WASHERS
TYPE | SIZE | +3M EXT. | PLAN
KEY PLAN
GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIN & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR & 9 BASE SHEET 8 OF 9 REFER DRG. NO. BPC/EDCD/SPL/D/ST/01
18. FOR STUB & TOPMAST SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/SPL/ST/01
19. FOR REFER DRG. NO.
20. FOR REFER DRG. NO.
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."
MARK Nos. :- 190 TO 202
PROTO CORECTED
R4 STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN 20/09/16
R3 PROTO CORRECTION INCORPORATED 30/04/16
R2 ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER 11/02/16
R1 REVISED AS PER CLIENT COMMENTS. 28/12/15
BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT
PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
TITLE : TOWER TYPE 'DD/DDS' +3M BODY EXTENSION & COMMON PLAN' PLAN VIEW FOR +3M & +6M BODY EXTN. (TOP PART OF +9M BODY EXTENSION) (NORMAL & STRENGTHENED TOWER)
SCALE 1:15
DRG. No: BPC/EDCD/SPL/D/STR/01
NO. OF SHEETS : 9 OF 9
SIZE A1
REV. 4
TENDER LEVEL DRAWING
TO BE USED FOR WOBTHANG TRANSMISSION LINE



BODY
VERTICAL SLOPE

TAN β	= 0.1554221
2TAN β	= 0.3108442
FACE	= 1.0120056
DEV.	= 1.0238711
IN FACE SLOPE	
TAN β	= 0.1535783
SEC β	= 1.0117247

TENDER LEVEL DRAWING

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+6M EXT.	PLAN
B	#16 x 35mm long	96	8
C	#16 x 40mm long	336	8
D	#16 x 45mm long	64	–
E	#16 x 50mm long	24	–
F	#16 x 55mm long	36	–
G	#16 x 60mm long	–	–
H	#16 x 65mm long	–	–
J	#16 x 70mm long	–	–
K	#16 x 75mm long	–	–
L	#16 x 80mm long	–	–
M	#16 x 85mm long	–	–
SPRING WASHERS		518	18
#16175 STEP BOLTS		12	–
30mm O.D. PACK WASHERS #17.5mm			
5 THK WASHER		16	4
8 THK WASHER		20	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVA.
13. ◆ ALL HOLES #17.5mm FOR #16mm BOLTS.
14. ◆ ALL HOLES #21.5mm FOR #20mm BOLTS.
15. ⊕ ALL HOLES #17.5mm FOR #16mm STEP BOLTS.
16. (S) INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR # 1 BASE SHEET 5 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
18. FOR STEP & TEMPLATE SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			23/09/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER & CERTAIN MEMBER MARKED R2			11/03/16
R1	REVISED AS PER CLIENT COMMENTS			23/12/15

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MARK Nos. :- 204 TO 230

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

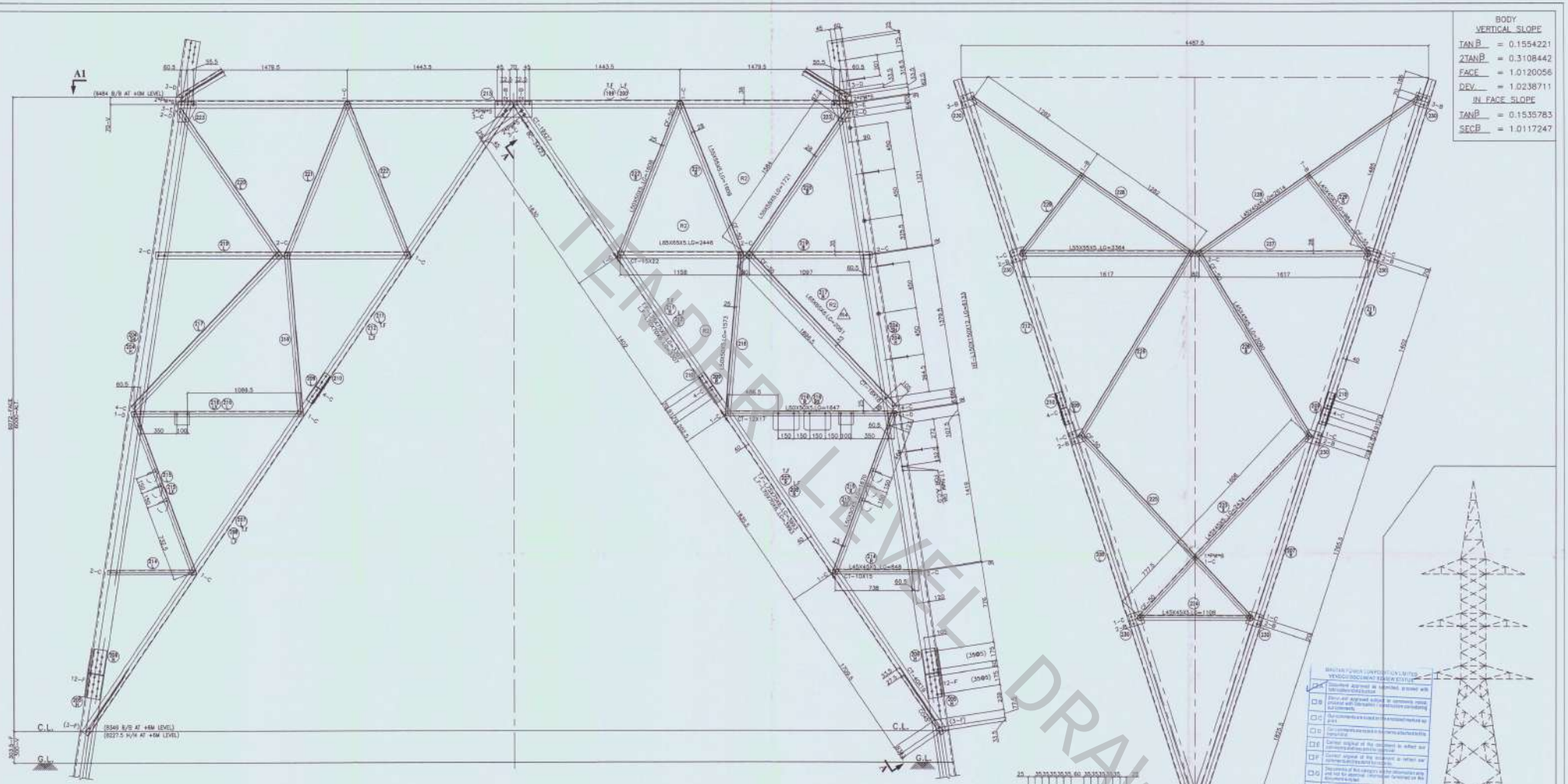
JOB NO: 251/01	NAME	SIGN	DATE
DSGN & DRWN			22/6/15
CHKD			
APPD			

TITLE : TOWER TYPE "DD/DDS" "+6M BODY EXTENSION " (NORMAL&STRENGTHENED TOWER)

SCALE 1:15 | PROJECTION

DRG. No: BPC/EDCD/SPL/D/STR/04 | NO OF SHEETS : 7 OF 9 | SIZE A1 | REV. 3

TO BE USED FOR WOBTHANG TRANSMISSION LINE



TENDER LEVEL DRAWING

BODY VERTICAL SLOPE

TAN β	= 0.1554221
2TAN β	= 0.3108442
FACE	= 1.0120056
DEV.	= 1.0238711

IN FACE SLOPE

TAN β	= 0.1535783
SEC β	= 1.0117247

KEY PLAN

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+6M EXT.	PLAN
B	#16 x 35mm long	96	8
C	#16 x 40mm long	336	8
D	#16 x 45mm long	64	–
E	#16 x 50mm long	24	–
F	#16 x 55mm long	96	–
G	#16 x 60mm long	–	–
H	#16 x 65mm long	–	–
J	#16 x 70mm long	–	–
K	#16 x 75mm long	–	–
L	#16 x 80mm long	–	–
M	#16 x 85mm long	–	–
SPRING WASHERS		518	18
#16175 STEP BOLTS		12	–
30mm O.D. PACK WASHERS #17.5mm			
5 THK WASHER		16	4
8 THK WASHER		20	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS:2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS :2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVA.
13. ◆ ALL HOLES #17.5mm FOR #16mm BOLTS.
14. ◆ ALL HOLES #21.5mm FOR #20mm BOLTS.
15. ⊕ ALL HOLES #17.5mm FOR #16mm STEP BOLTS.
16. 69 INDICATE) MEMBERS BEING USED AS STEP BOLTS.
17. FOR ± 1 BASE SHEET 5 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
18. FOR STR & TEMPLATE SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

REV.	DESCRIPTION	CHKD.	DATE
R3	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN		20/09/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER & CERTAIN MEMBER MARKED R2		11/02/16
R1	REVISED AS PER CLIENT COMMENTS		20/12/15
SYM.	REVISIONS	REVD. CHKD.	DATE

MARK Nos. :- 204 TO 230

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

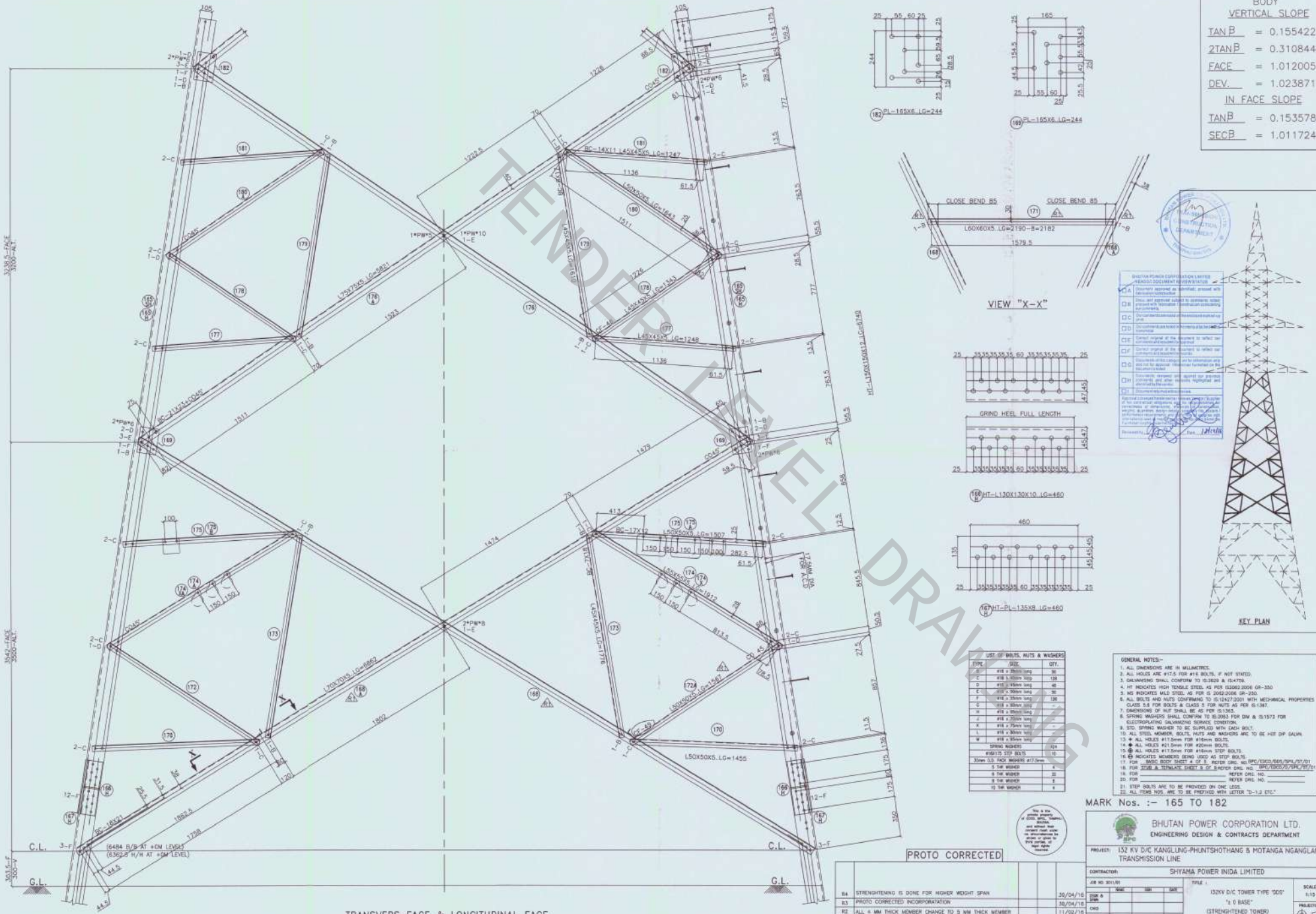
PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

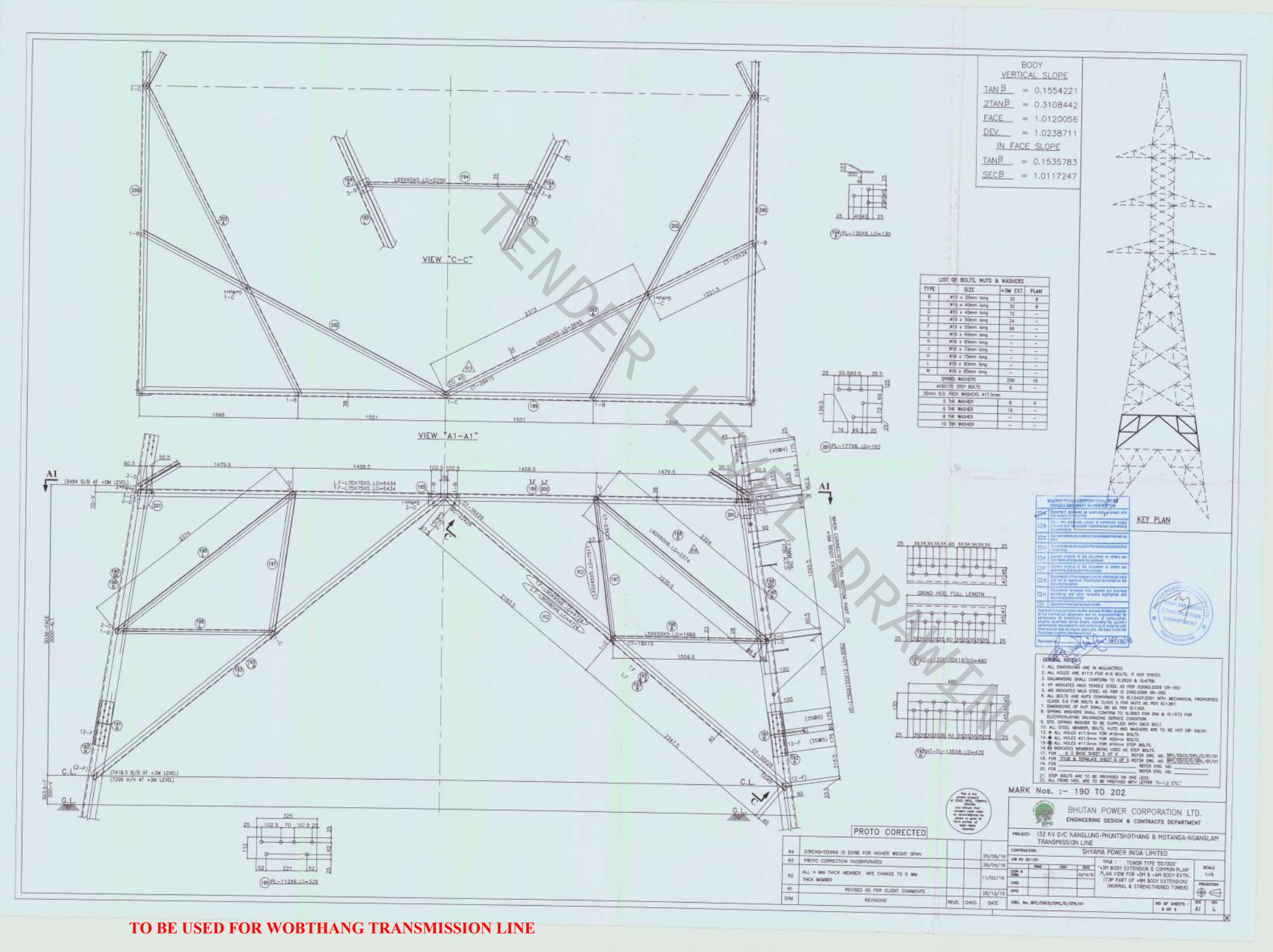
JOB NO: 251/01	TITLE :	SCALE
DSGN & DRWN	TOWER TYPE "DD/DDS" +6M BODY EXTENSION " (NORMAL&STRENGTHENED TOWER)	1:15
CHKD		PROJECTION
APPD		
DATE 22/06/15		

DRG. No: BPC/EDCD/SPL/D/STR/04 — NO OF SHEETS : 7 OF 9 — SIZE A1 — REV. 3

TO BE USED FOR WOBTHANG TRANSMISSION LINE



TO BE USED FOR WOBTHANG TRANSMISSION LINE



BODY
VERTICAL SLOPE

TAN β	=	0.1554221
2TANβ	=	0.3108442
FACE	=	1.0120056
DEV.	=	1.0238711

IN FACE SLOPE

TANβ	=	0.1535783
SECβ	=	1.0117247

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+3M EXT.	PLAN
B	#13 x 30mm long	32	8
C	#16 x 40mm long	32	8
D	#16 x 45mm long	72	–
E	#16 x 50mm long	24	–
F	#16 x 55mm long	96	–
G	#16 x 60mm long	–	–
H	#16 x 65mm long	–	–
J	#16 x 70mm long	–	–
K	#16 x 75mm long	–	–
L	#16 x 80mm long	–	–
M	#16 x 85mm long	–	–
SPRING WASHERS		256	16
#16X135 STEP BOLTS		8	–
30mm O.D. PACK WASHERS #17.5mm			
5 THK WASHER		8	4
6 THK WASHER		16	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANIZING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR SW & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. + ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR _____ & 5 BASE SHEET 5 OF 5 _____ REFER DRG. NO. BPC/EDCD/SPL/D/ST/01
18. FOR STUB & TOPMAST SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/SPL/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTOHANG IS DONE FOR HIGHER WEIGHT SPAN.			20/09/16
R3	PROTO CORRECTION INCORPORATED			30/04/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER			11/02/16
R1	REVISED AS PER CLIENT COMMENTS.			28/12/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO 201/01

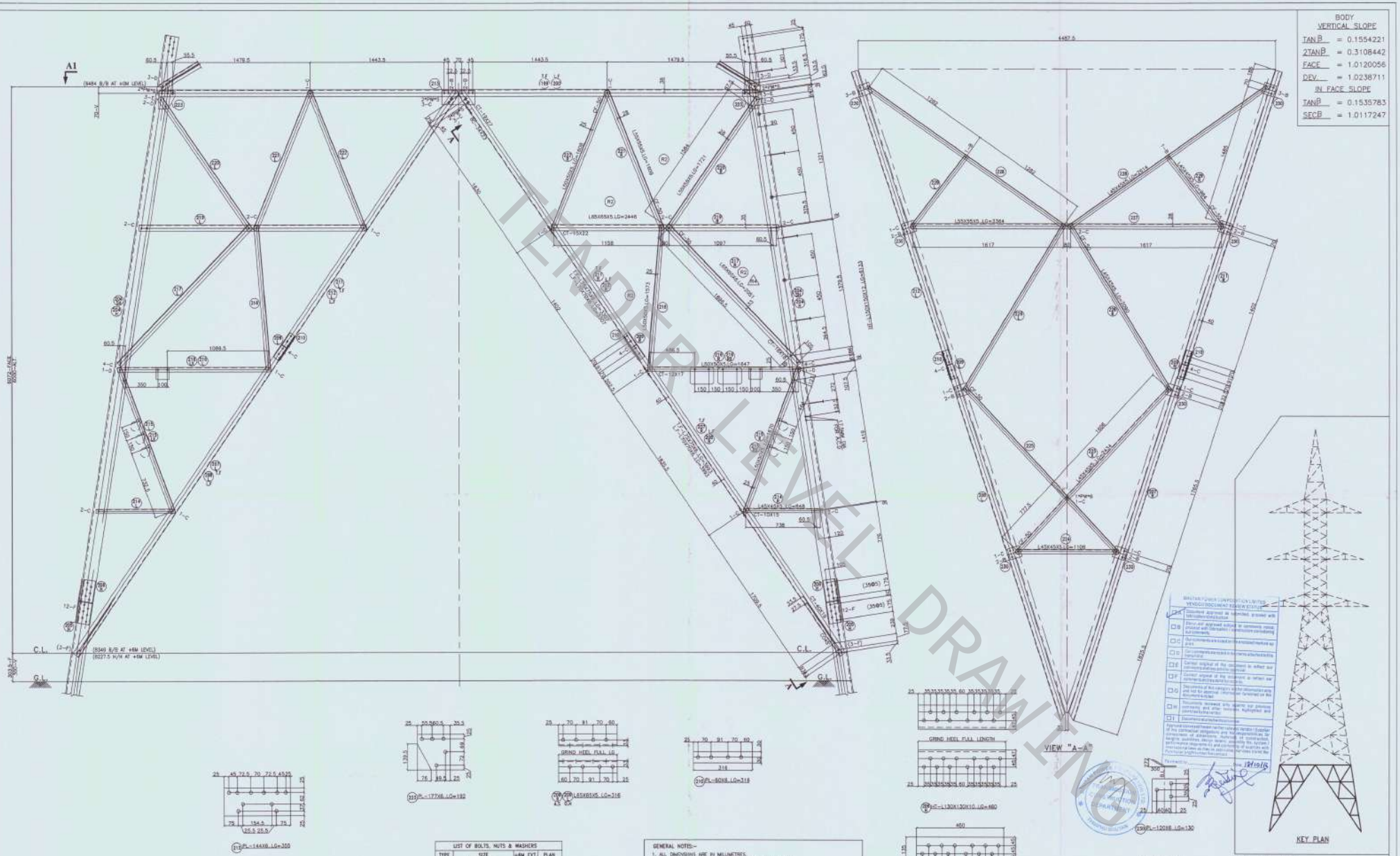
	NAME	SIGN	DATE
DSGN & DRWN			30/11/15
CHKD.			
APPD.			

DRG. No: BPC/EDCD/SPL/D/STR/01

TITLE : TOWER TYPE 'DD/DDS' +3M BODY EXTENSION & COMMON PLAN' PLAN VIEW FOR +3M & +6M BODY EXTN. (TOP PART OF +9M BODY EXTENSION) (NORMAL & STRENGTHENED TOWER)

SCALE 1:15 | PROJECTION | NO OF SHEETS : 6 OF 9 | SIZE A1 | REV 4

TO BE USED FOR WOBTHANG TRANSMISSION LINE



BODY VERTICAL SLOPE

TAN β	= 0.1554221
2TAN β	= 0.3108442
FACE	= 1.0120056
DEV.	= 1.0238711

IN FACE SLOPE

TAN β	= 0.1535783
SEC β	= 1.0117247

TENDER LEVEL DRAWING

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	+6M EXT.	PLAN
B	M16 x 35mm long	96	6
C	M16 x 40mm long	336	8
D	M16 x 45mm long	64	–
E	M16 x 50mm long	24	–
F	M16 x 55mm long	96	–
G	M16 x 60mm long	–	–
H	M16 x 65mm long	–	–
J	M16 x 70mm long	–	–
K	M16 x 75mm long	–	–
L	M16 x 80mm long	–	–
M	M16 x 85mm long	–	–
SPRING WASHERS		518	18
#16175 STEP BOLTS		12	–
30mm O.D. PACK WASHERS #17.5mm			
5 THK WASHER		16	4
8 THK WASHER		20	–
8 THK WASHER		–	–
10 THK WASHER		–	–

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR ø16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS:2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS :2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD: SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVA.
13. ◆ ALL HOLES ø17.5mm FOR ø16mm BOLTS.
14. ◆ ALL HOLES ø21.5mm FOR ø20mm BOLTS.
15. ⊕ ALL HOLES ø17.5mm FOR ø16mm STEP BOLTS.
16. (S) INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR ± 1 BASE SHEET 5 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
18. FOR STR & TEMPLATE SHEET 9 OF 9 REFER DRG. NO. BPC/EDCD/D/ST/01
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R3	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			23/09/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER & CERTAIN MEMBER MARKED R2			11/02/16
R1	REVISED AS PER CLIENT COMMENTS			23/12/15

MARK Nos. :- 204 TO 230

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

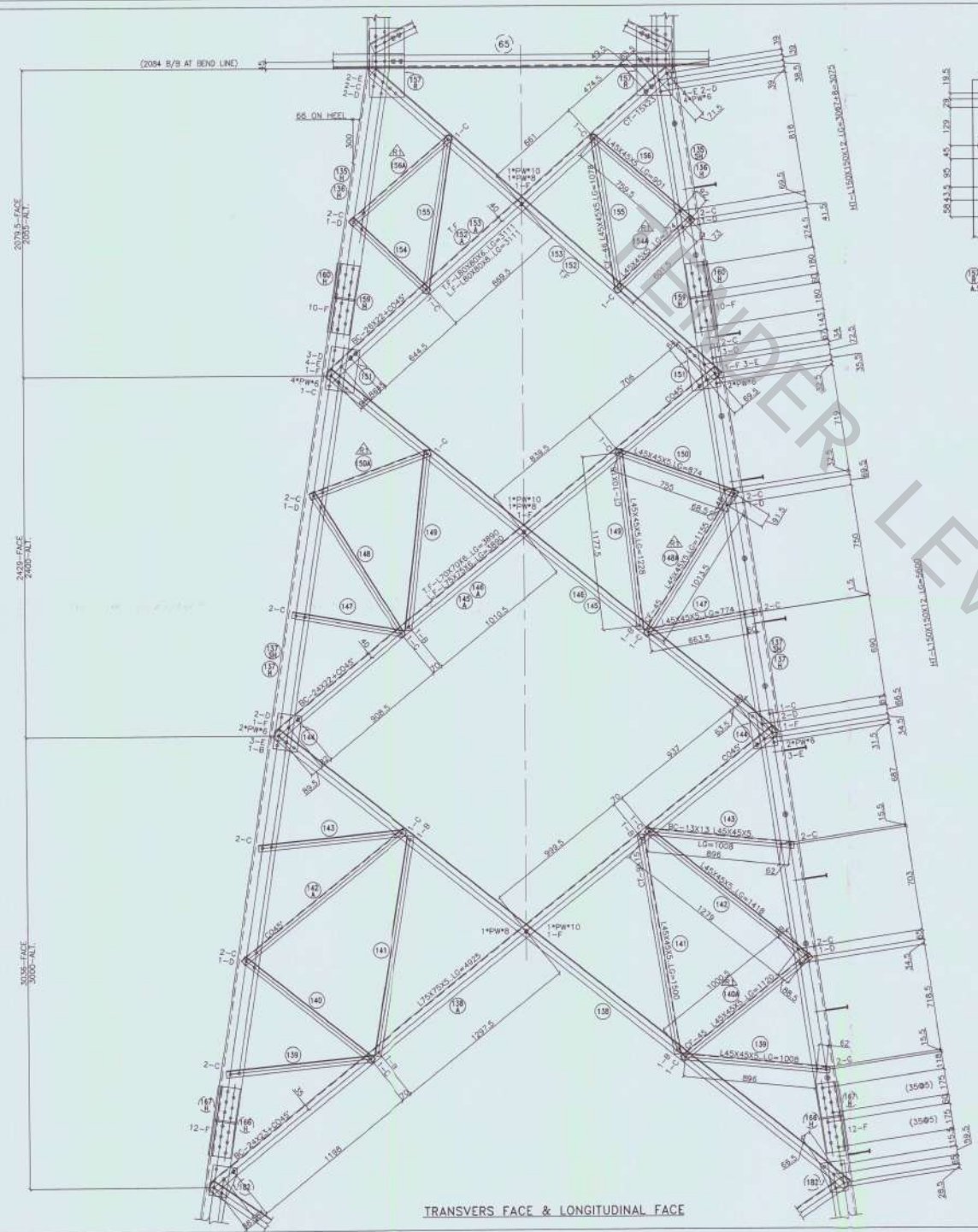
JOB NO: 231/01	NAME	SIGN	DATE
DSGN & DRWN			22/6/15
CHKD			
APPD			

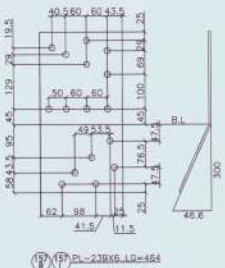
TITLE : TOWER TYPE "DD/DDS" +6M BODY EXTENSION " (NORMAL&STRENGTHENED TOWER)

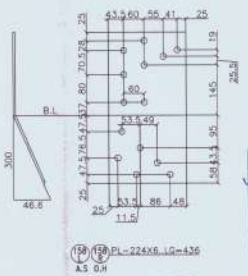
SCALE 1:15 | PROJECTION

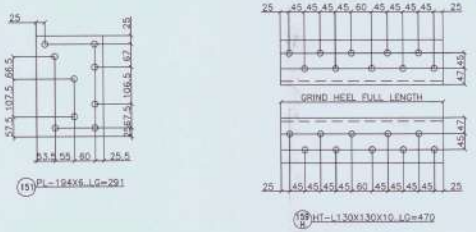
DRG. No: BPC/EDCD/SPL/D/STR/04 | NO OF SHEETS : 7 OF 9 | SIZE A1 | REV. 3

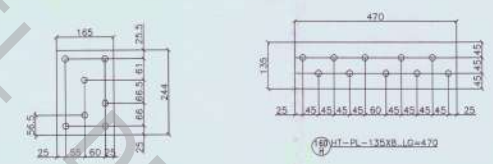
TO BE USED FOR WOBTHANG TRANSMISSION LINE

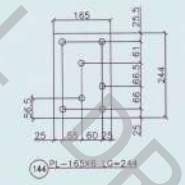










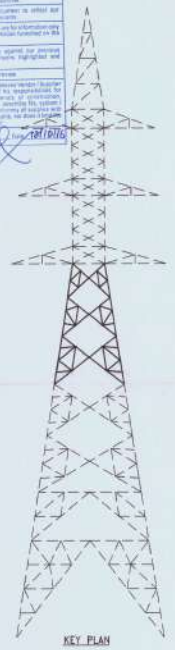


BODY
VERTICAL SLOPE

TAN β	=	0.1554221
2TAN β	=	0.3108442
FACE	=	1.0120056
DEV.	=	1.0238711

IN FACE SLOPE

TAN β	=	0.1535783
SEC β	=	1.0117247



LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	28
C	#16 x 40mm long	188
D	#16 x 45mm long	80
E	#16 x 50mm long	76
F	#16 x 55mm long	182
G	#16 x 60mm long	-
H	#16 x 65mm long	-
J	#16 x 70mm long	-
K	#16 x 75mm long	-
L	#16 x 80mm long	-
M	#16 x 90mm long	-
SPRING WASHERS		544
#16X175 STEP BOLTS		14
30mm O.D. PACK WASHERS #17.5mm		
1 THK WASHER		-
3 THK WASHER		28
5 THK WASHER		-
10 THK WASHER		-

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIN & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
13. ◆ ALL HOLES #17.5mm FOR #16mm BOLTS.
14. ◆ ALL HOLES #21.5mm FOR #20mm BOLTS.
15. ◆ ALL HOLES #17.5mm FOR #16mm STEP BOLTS.
16. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR CASE SHEET 3 OF 5 REFER DRG. NO. BPC/EDCD/DDS/ST/01
18. FOR & D BASE SHEET 3 OF 5 REFER DRG. NO. BPC/EDCD/DDS/ST/01
19. FOR REFER DRG. NO.
20. FOR REFER DRG. NO.
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

MARK Nos. :- 135 TO 160

PROTO CORRECTED

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			20/9/16
R3	PROTO CORRECTION INCORPORATED			30/04/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER			11/02/16
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO. 2011/01

TITLE : 132KV D/C TOWER TYPE "DD" "BODY" (STRENGTHENED TOWER)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/BPL/DDS/STR/01

NO OF SHEETS : 4 OF 5

SIZE A1

REV. 4

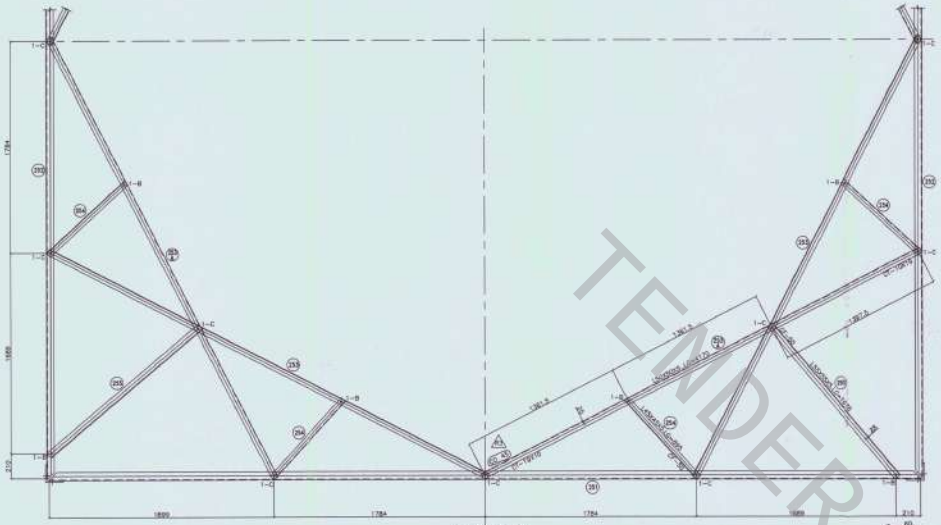
This is the private property of EDCD, BPCL, Phuentsholing, Bhutan. Loan and other use without our written permission not allowed nor information be shown or given to third parties, all legal rights reserved.

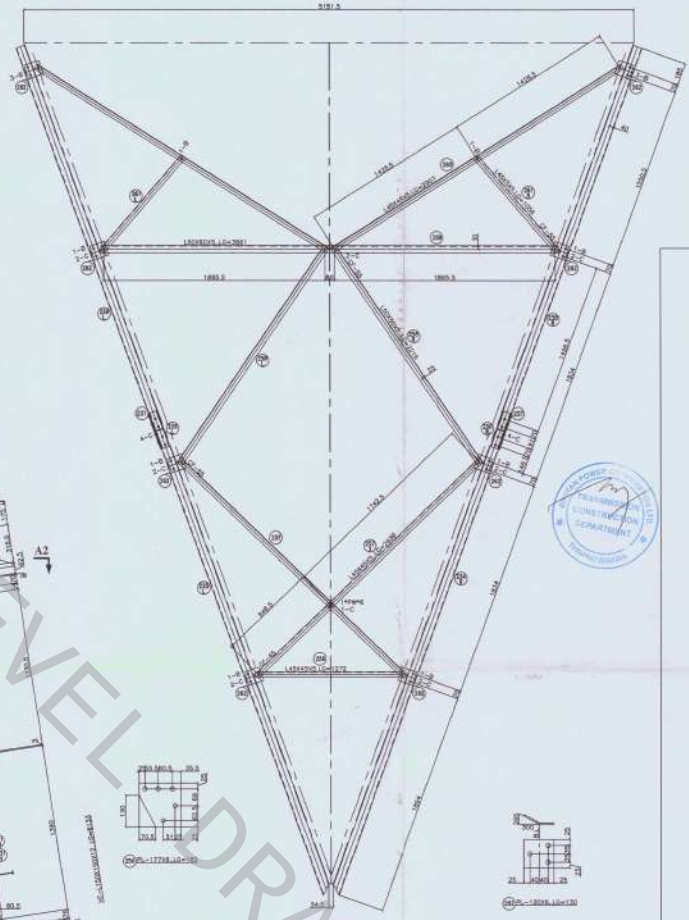
TRANSMISSION CONSTRUCTION DEPARTMENT

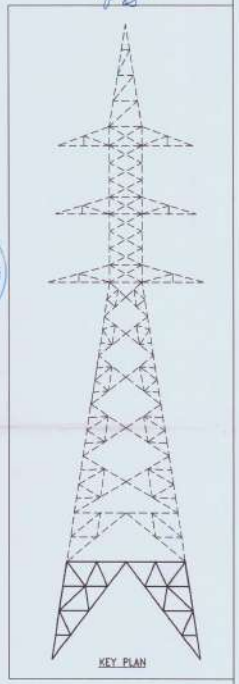
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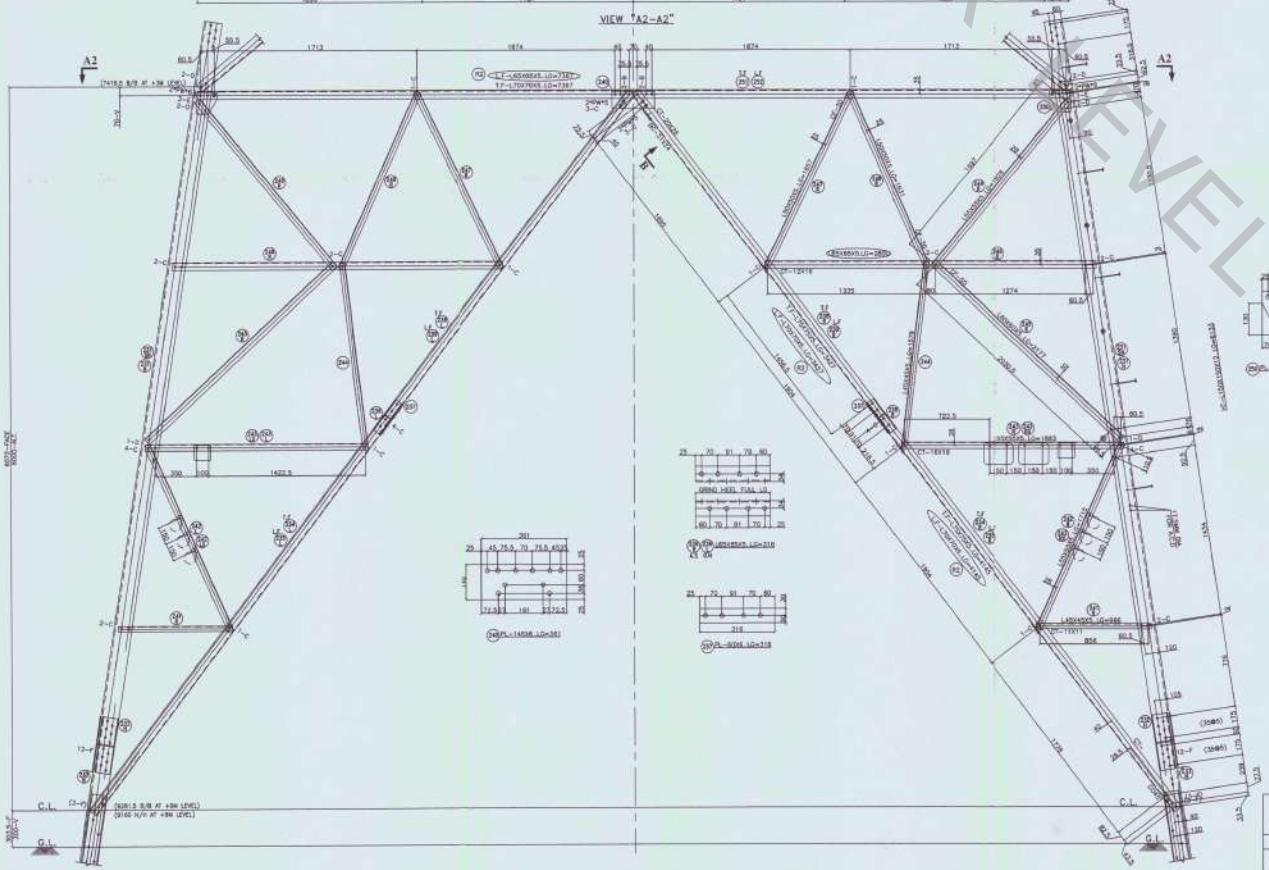
TO BE USED FOR WOBTHANG TRANSMISSION LINE

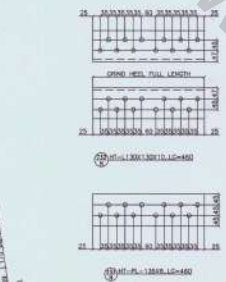
BODY
VERTICAL SLOPE
TAN β = 0.1554221
2TAN β = 0.3108442
FACE = 1.0120056
DEV. = 1.0238711
IN FACE SLOPE
TAN β = 0.1535783
SEC β = 1.0117247











LIST OF BOLTS, NUTS & WASHERS			
TYPE	SIZE	+5M EXT.	PLAN
1	M16 x 35mm long	96	12
2	M16 x 40mm long	236	16
3	M16 x 45mm long	48	-
4	M16 x 50mm long	24	-
5	M16 x 55mm long	104	-
6	M16 x 60mm long	-	-
7	M16 x 65mm long	-	-
8	M16 x 70mm long	-	-
9	M16 x 75mm long	-	-
10	M16 x 80mm long	-	-
11	M16 x 85mm long	-	-
SPRING WASHER		500	28
M16/18 STEP BOLTS		12	-
20mm O.D. FACE WASHER(@ #17.5mm)			
1 THK WASHER		18	-
6 THK WASHER		20	-
8 THK WASHER		-	-
10 THK WASHER		-	-

GENERAL NOTES:-
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFORMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SURFACE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
11. ALL HOLES #17.5mm FOR #16mm BOLTS.
12. ALL HOLES #21.5mm FOR #20mm BOLTS.
13. ALL HOLES #17.5mm FOR #18mm STEP BOLTS.
14. INDICATES MEMBERS SIGNG (SEC) AS STEP BOLTS.
15. FOR +3M BODY CUTH SHEET 8 OF 9. REFER DRG. NO. BPC/CDCD/D/S1/01
16. FOR STUB & TECHLATE SHEET 8 OF 9. REFER DRG. NO. BPC/CDCD/D/T/01
17. FOR REFER DRG. NO.
18. FOR REFER DRG. NO.
19. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
20. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "B-1,2 ETC."

MARK Nos. :- 231 TO 262

PROTO CORRECTED

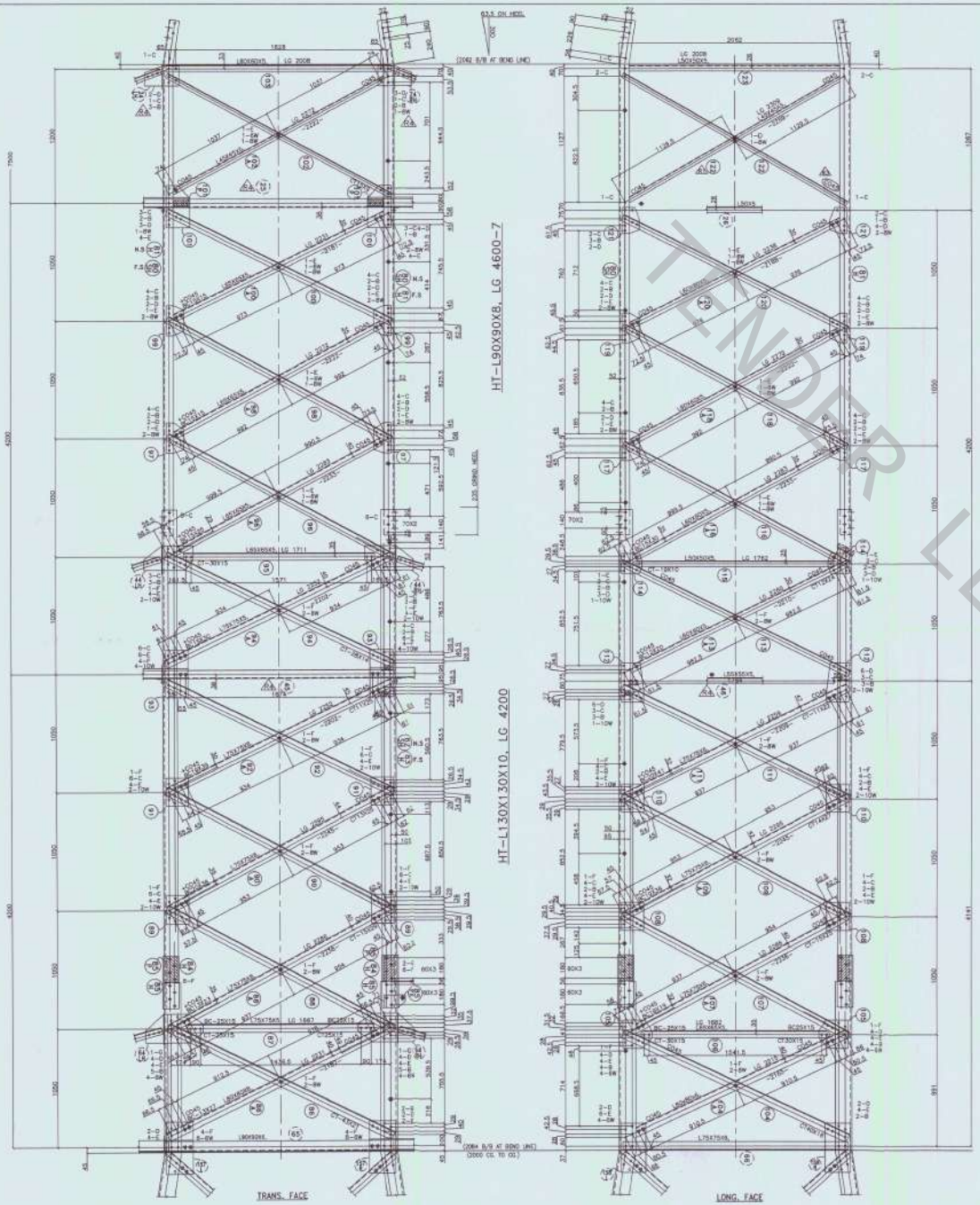
SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			20/09/16
R3	PROTO CORRECTION INCORPORATED			30/04/16
R2	ALL 4 MM THICK MEMBER ARE CHANGE TO 5 MM THICK MEMBER & CERTAIN MEMBER MARKED R2			11/02/16
R1	REVISED AS PER CLIENT COMMENTS			20/12/15

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

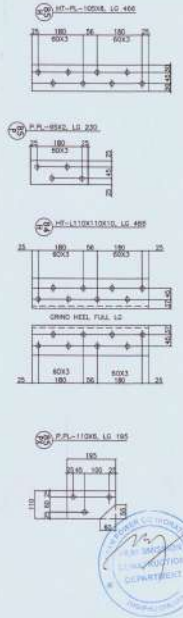
PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE
CONTRACTOR: SHYAMA POWER INDIA LIMITED
JOB NO. 2011/01
TITLE : TOWER TYPE "DD"
"BOTTOM PART OF +9M BODY EXTENSION" (ATTACHED TO +5M BODY EXTENSION) (NORMAL & STRENGTHENED TOWER)
SCALE 1:15
PROJECTION
DRG. No: BPC/CDCD/SPL/D/STR/01
NO OF SHEETS : 8 OF 9
SIZE A1
REV. 4

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE







KEY PLAN

LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	M16 x 35mm long	150
C	M16 x 40mm long	278
D	M16 x 45mm long	156
E	M16 x 50mm long	220
F	M16 x 55mm long	140
G	M16 x 60mm long	09
H	M16 x 65mm long	--
J	M16 x 70mm long	--
K	M16 x 75mm long	--
L	M16 x 80mm long	--
M	M16 x 85mm long	--
	SPRING WASHERS	846
	M16X175 STEP BOLTS	60
30mm O.D. PACK WASHERS ø17.5mm		
	5 THK WASHER	--
	6 THK WASHER	66
	8 THK WASHER	100
	10 THK WASHER	66

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE ø17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS: 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALV.
11. ● ALL HOLES ø17.5mm FOR #16mm BOLTS.
12. ◆ ALL HOLES ø21.5mm FOR #20mm BOLTS.
13. ⊕ ALL HOLES ø17.5mm FOR #16mm STEP BOLTS.
14. ⊖ INDICATES MEMBERS BEING USED AS STEP BOLTS.
15. FOR _____ PEAK & TOP X-ARM (OF 5) REFER DRG. NO. BPC/EDCD/SPL/DDS/STR/01
16. FOR _____ BODY SHEET 4 OF 5 REFER DRG. NO. BPC/EDCD/SPL/DDS/STR/01
17. FOR _____ REFER DRG. NO. _____
18. FOR _____ REFER DRG. NO. _____
19. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
20. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

PROTO CORRECTED

MARK NOS : 80 TO 123

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01

	WHAT	SIGN	DATE
DSN & DWG			
CHKD			
APPD			

TITLE : 132KV DC TOWER TYPE "DDS" "CAGE" (STRENGTHENED TOWER)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPL/DDS/STR/01

NO OF SHEETS : 5 OF 5

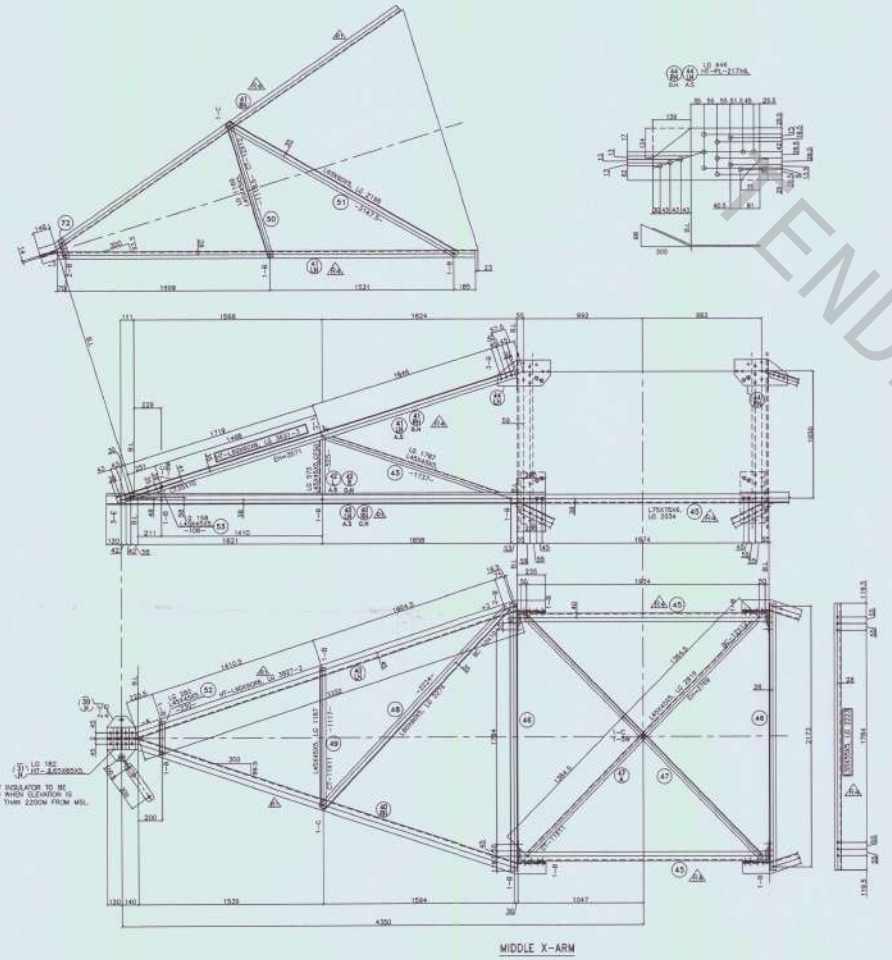
SIZE A1

REV. 4

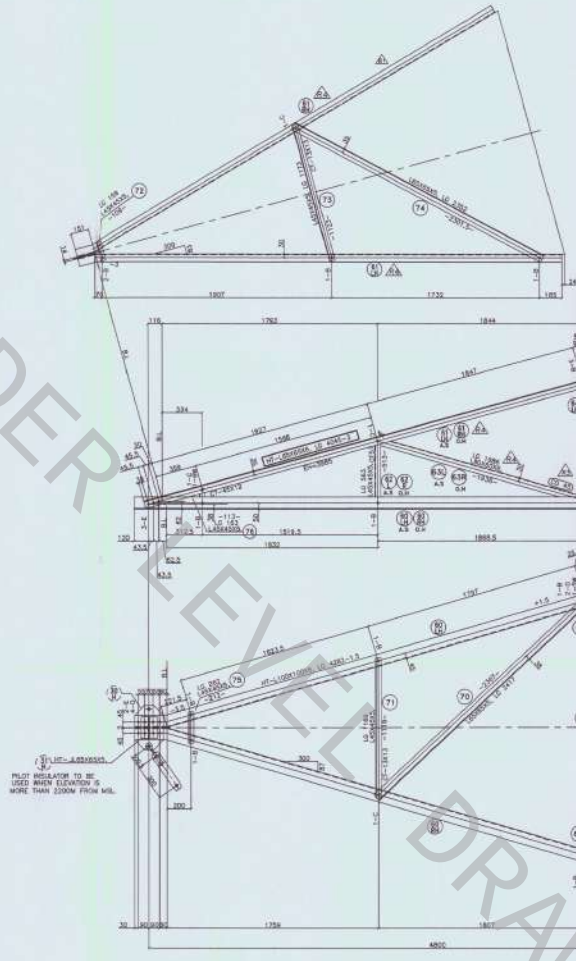
SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGTHENED IS DONE FOR HIGHER WEIGHT SPAN			20/09/16
R3	PROTO CORECTION INCORPORATED			30/04/16
R2	ALL 4 MM THICK MEMBER CHANGE TO 5 MM THICK MEMBER			11/02/16
R1	REVISED AS PER CLIENT COMMENTS.			29/12/15

TENDER LEVEL DRAWING

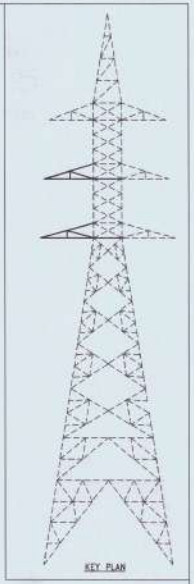
TO BE USED FOR WOBTHANG TRANSMISSION LINE



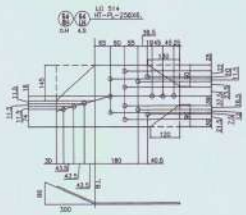
MIDDLE X-ARM



BOTTOM X-ARM



KEY PLAN







LIST OF BOLTS, NUTS & WASHERS		
TYPE	SIZE	QTY.
B	#16 x 35mm long	99
C	#16 x 40mm long	31
D	#16 x 45mm long	23
E	#16 x 50mm long	33
F	#16 x 55mm long	"
G	#16 x 60mm long	"
H	#16 x 65mm long	"
I	#16 x 70mm long	"
K	#16 x 75mm long	"
L	#16 x 80mm long	"
M	#16 x 85mm long	"
SPRING WASHERS		184
#16X175 STEP BOLTS		"
36mm O.D. PACK WASHERS #17.5mm		
S THK WASHER		05
6 THK WASHER		10
8 THK WASHER		"
10 THK WASHER		"

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE #17.5 FOR #16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFORMING TO IS:1367:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFORM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANISING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBER, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVN.
12. ◆ ALL HOLES #17.5mm FOR #16mm BOLTS.
14. ◆ ALL HOLES #21.5mm FOR #20mm BOLTS.
15. ⊕ ALL HOLES #17.5mm FOR #16mm STEP BOLTS.
16. ⊠ INDICATES MEMBERS BEING USED AS STEP BOLTS.
17. FOR _____ REFER DRG. NO. : BPC/EDCD/SPL/DDS/STR/01
18. FOR _____ REFER DRG. NO. _____
19. FOR _____ REFER DRG. NO. _____
20. FOR _____ REFER DRG. NO. _____
21. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
22. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "D-1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			21/09/16
R3	PROTO CORRECTION INCORPORATED			20/04/16
R2	ALL 4 MM THICK MEMBER CHANGE TO 5 MM THICK MEMBER			11/02/16
R1	REVISED AS PER CLIENT COMMENTS.			20/12/15

PROTO CORRETCED

MARK NOS : 40 TO 53, 60 TO 76, 30 & 31

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA-NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 301/01

TITLE : 132KV DC TOWER TYPE "DDS" "MIDDLE & BOTTOM X-ARM" (STRENGTHENED TOWER)

SCALE 1:15

PROJECTION

DRG. No: BPC/EDCD/SPL/DDS/STR/01

NO OF SHEETS : 2 OF 5

SIZE A1

REV. 4

BHUTAN POWER CORPORATION LIMITED
VENDOR DOCUMENT REVIEW STATUS

- ☐ A — Document approved as submitted, proceed with fabrication/construction
- ☐ B — Drawing approved subject to comments noted, proceed with fabrication / construction considering comments
- ☐ C — Comments are noted in the revised/marked up print
- ☐ D — Comments are noted in the revised/updated notes document
- ☐ E — Correct original of the document to reflect our comments/requirements
- ☐ F — Correct original of the document to reflect last comments/requirements issued.
- ☐ G — Documents under category are for information only and not for approval. Information contained on the document
- ☐ H — Documents received only against our previous comments and other revisions highlighted and marked by the vendor
- ☐ I — Document received for record

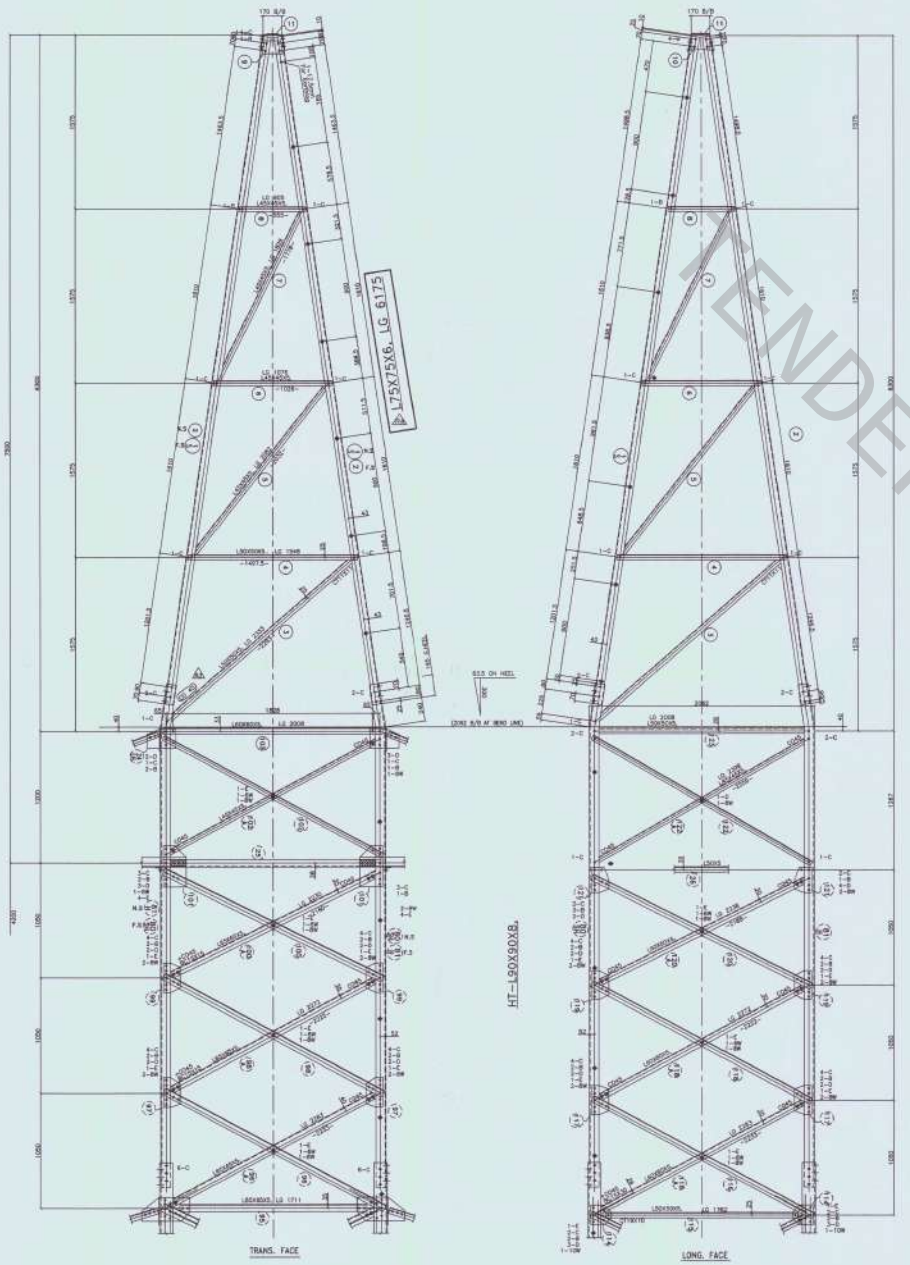
Approval received from the Purchaser/Owner/Supervisor/Consultant does not relieve the Supplier of his contractual obligations and the responsibilities for adequate design, materials of construction, weight & quantity of the goods, satisfying the system / service requirements, performance of equipment and processing data etc. Approval also does not relieve the Supplier of his responsibility for errors and omissions in the documents.

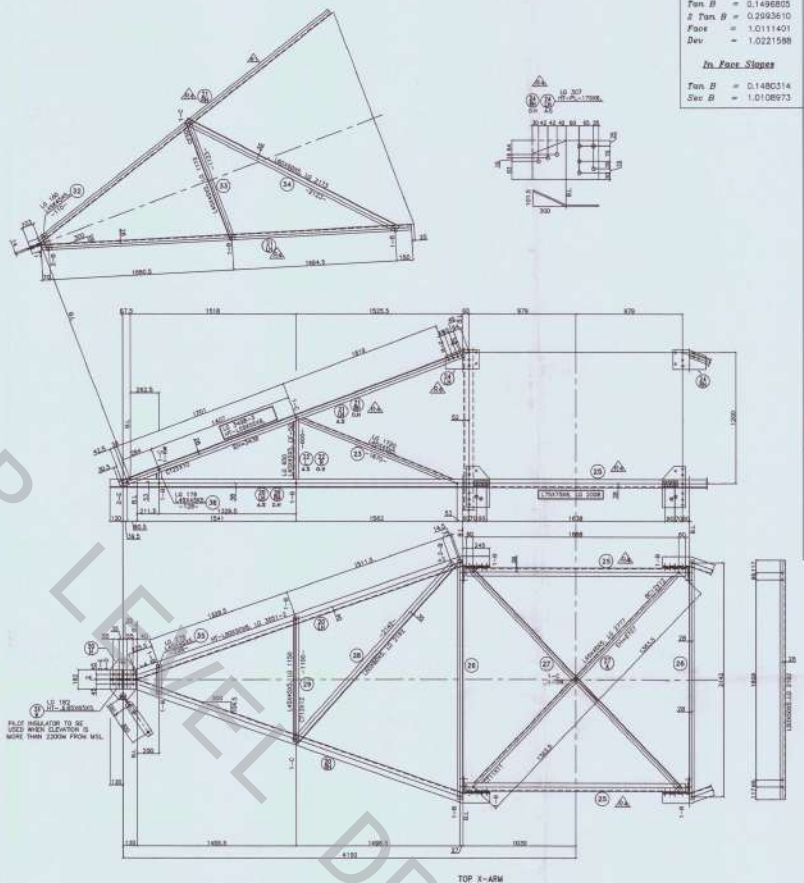
Sign: 19/1/16

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TO BE USED FOR WOBTHANG TRANSMISSION LINE

TENDER LEVEL DRAWING







PEAK SLOPE

Tan B	=	0.1496805
± Tan B	=	0.2993610
Face	=	1.0111401
Dev	=	1.0221588

In Face Slopes

Tan B	=	0.1480314
Sec B	=	1.0108973

TENDER LEVEL DRAWING

LIST OF BOLTS, NUTS & WASHERS

TYPE	SIZE	QTY.
B	M16 x 35mm long	66
C	M16 x 40mm long	88
D	M16 x 45mm long	8
E	M16 x 50mm long	12
F	M16 x 55mm long	-
G	M16 x 60mm long	-
H	M16 x 65mm long	-
J	M16 x 70mm long	-
K	M16 x 75mm long	-
L	M16 x 80mm long	-
M	M16 x 85mm long	-
SPRING WASHERS		144
M16X175 STEP BOLTS		24
30mm O.D. PACK WASHERS 4175mm		
1.5M WASHER		01
3.5M WASHER		04
6.5M WASHER		-
12.5M WASHER		-

GENERAL NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. ALL HOLES ARE Ø17.5 FOR M16 BOLTS, IF NOT STATED.
3. GALVANISING SHALL CONFORM TO IS:2629 & IS:4759.
4. HT INDICATES HIGH TENSILE STEEL AS PER IS:2062:2006 GR-350
5. MS INDICATES MILD STEEL AS PER IS 2062:2006 GR-250.
6. ALL BOLTS AND NUTS CONFIRMING TO IS:12427:2001 WITH MECHANICAL PROPERTIES CLASS 5.6 FOR BOLTS & CLASS 5 FOR NUTS AS PER IS:1367.
7. DIMENSIONS OF NUT SHALL BE AS PER IS:1363.
8. SPRING WASHERS SHALL CONFIRM TO IS:3063 FOR DIM & IS:1573 FOR ELECTROPLATING GALVANIZING SERVICE CONDITION.
9. STD. SPRING WASHER TO BE SUPPLIED WITH EACH BOLT.
10. ALL STEEL MEMBERS, BOLTS, NUTS AND WASHERS ARE TO BE HOT DIP GALVA.
11. ◆ ALL HOLES Ø17.5mm FOR M16mm BOLTS.
12. ◆ ALL HOLES Ø21.5mm FOR Ø20mm BOLTS.
13. ◆ ALL HOLES Ø17.5mm FOR M16mm STEP BOLTS.
14. ◆ INDICATES MEMBERS BEING USED AS STEP BOLTS.
15. FOR _____ REFER SRG. NO. _____
16. FOR _____ REFER SRG. NO. _____
17. FOR _____ REFER SRG. NO. _____
18. STEP BOLTS ARE TO BE PROVIDED ON ONE LEGS.
19. ALL ITEMS NOS. ARE TO BE PREFIXED WITH LETTER "S-1,2 ETC."

SYM.	REVISIONS	REVD.	CHKD.	DATE
R4	STRENGHTENING IS DONE FOR HIGHER WEIGHT SPAN			23/08/16
R3	PROTO CORECTION INCORPORATED			30/04/16
R2	ALL 4 MM THICK MEMBER CHANGE TO 5 MM THICK MEMBER			11/02/16
R1	REVISED AS PER CLIENT COMMENTS.			25/12/15

PROTO CORRECTED

MARK NOS : 1 TO 11, 20 TO 36

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG & MOTANGA- NGANGLAM TRANSMISSION LINE

CONTRACTOR: SHYAMA POWER INDIA LIMITED

JOB NO: 2011/01

	NAME	SIGN	DATE
DSGN & DRWN			
CHKD			
APPR.			

TITLE : 132KV D/C TOWER TYPE "DDS" "PEAK & TOP X-ARM" (STRENGHTENED TOWER)

SCALE 1:15

PROJECTION

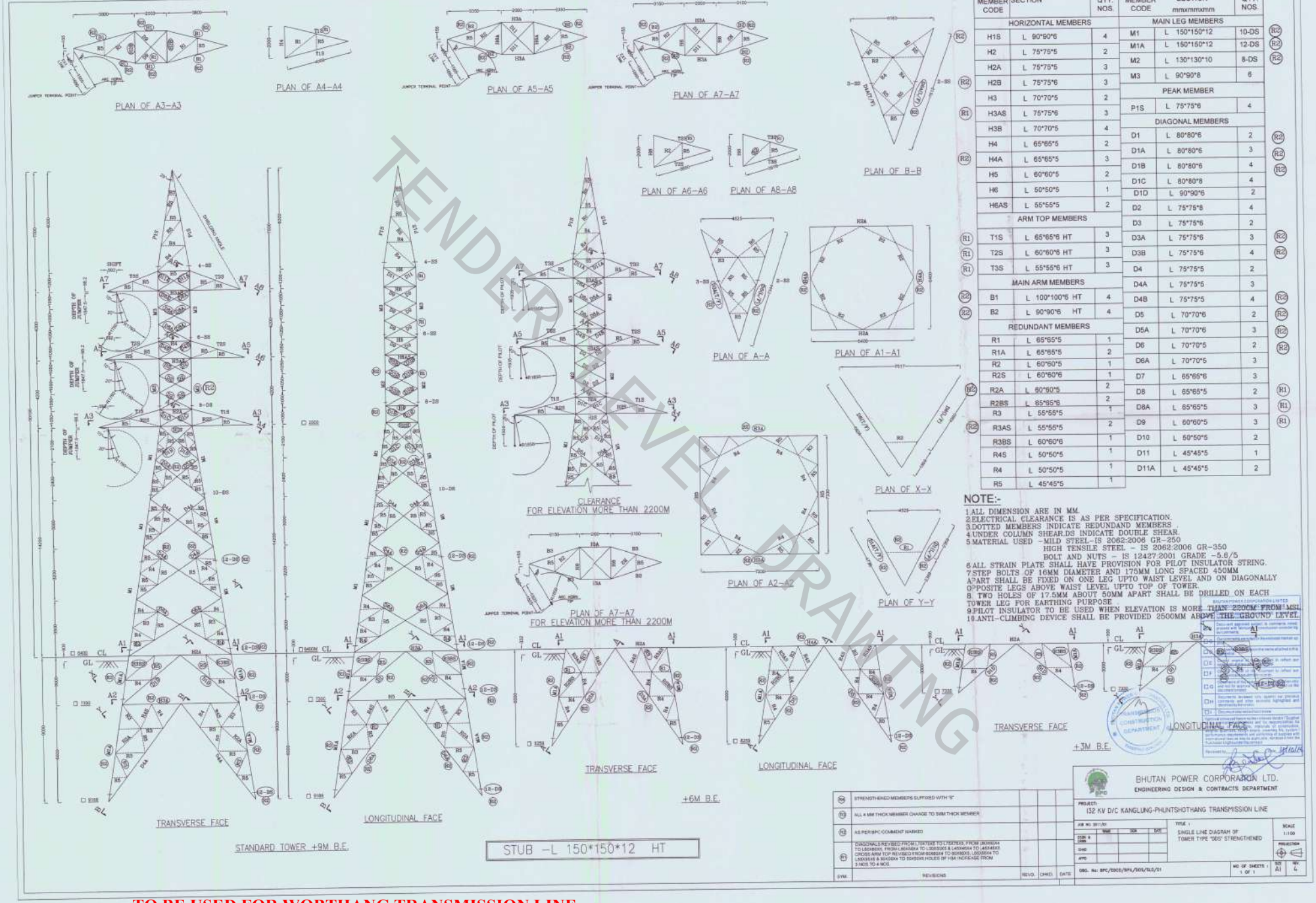
DRG. No: BPC/DSCD/SPIL/DDS/STR/01

NO OF SHEETS : 1 OF 5

SIZE A1

REV 4

TO BE USED FOR WOBTHANG TRANSMISSION LINE



MEMBER CODE	SECTION	QTY. NOS.
HORIZONTAL MEMBERS		
H1S	L 90*90*6	4
H2	L 75*75*5	2
H2A	L 75*75*5	3
H2B	L 75*75*6	3
H3	L 70*70*5	2
H3AS	L 75*75*6	3
H3B	L 70*70*5	4
H4	L 65*65*5	2
H4A	L 65*65*5	3
H5	L 60*60*5	2
H6	L 50*50*5	1
H6AS	L 55*55*5	2
ARM TOP MEMBERS		
T1S	L 65*65*6 HT	3
T2S	L 60*60*6 HT	3
T3S	L 55*55*6 HT	3
MAIN ARM MEMBERS		
B1	L 100*100*6 HT	4
B2	L 90*90*6 HT	4
REDUNDANT MEMBERS		
R1	L 65*65*5	1
R1A	L 65*65*5	2
R2	L 60*60*5	1
R2S	L 60*60*6	1
R2A	L 60*60*5	2
R2BS	L 65*65*6	2
R3	L 55*55*5	1
R3AS	L 55*55*5	2
R3BS	L 60*60*6	1
R4S	L 50*50*5	1
R4	L 50*50*5	1
R5	L 45*45*5	1

MEMBER CODE	SECTION mmxmmxmm	QTY. NOS.
MAIN LEG MEMBERS		
M1	L 150*150*12	10-DS
M1A	L 150*150*12	12-DS
M2	L 130*130*10	8-DS
M3	L 90*90*8	6
PEAK MEMBER		
P1S	L 75*75*6	4
DIAGONAL MEMBERS		
D1	L 80*80*6	2
D1A	L 80*80*6	3
D1B	L 80*80*6	4
D1C	L 80*80*8	4
D1D	L 90*90*6	2
D2	L 75*75*6	4
D3	L 75*75*6	2
D3A	L 75*75*6	3
D3B	L 75*75*6	4
D4	L 75*75*5	2
D4A	L 75*75*5	3
D4B	L 75*75*5	4
D5	L 70*70*6	2
D5A	L 70*70*6	3
D6	L 70*70*5	2
D6A	L 70*70*5	3
D7	L 65*65*6	3
D8	L 65*65*5	2
D8A	L 65*65*5	3
D9	L 60*60*5	3
D10	L 50*50*5	2
D11	L 45*45*5	1
D11A	L 45*45*5	2

NOTE:-

1. ALL DIMENSION ARE IN MM.
2. ELECTRICAL CLEARANCE IS AS PER SPECIFICATION.
3. DOTTED MEMBERS INDICATE REDUNDAND MEMBERS.
4. UNDER COLUMN SHEAR DS INDICATE DOUBLE SHEAR.
5. MATERIAL USED -MILD STEEL-IS 2062:2006 GR-250
   HIGH TENSILE STEEL - IS 2062:2006 GR-350
   BOLT AND NUTS - IS 12427:2001 GRADE -5.6/5
6. ALL STRAIN PLATE SHALL HAVE PROVISION FOR PILOT INSULATOR STRING.
7. STEP BOLTS OF 16MM DIAMETER AND 175MM LONG SPACED 450MM APART SHALL BE FIXED ON ONE LEG UPTO WAIST LEVEL AND ON DIAGONALLY OPPOSITE LEGS ABOVE WAIST LEVEL UPTO TOP OF TOWER.
8. TWO HOLES OF 17.5MM ABOUT 50MM APART SHALL BE DRILLED ON EACH TOWER LEG FOR EARTHING PURPOSE
9. PILOT INSULATOR TO BE USED WHEN ELEVATION IS MORE THAN 2200M FROM MSL
10. ANTI-CLIMBING DEVICE SHALL BE PROVIDED 2500MM ABOVE THE GROUND LEVEL.

SYM.	REVISIONS	REVD.	CHKD.	DATE
S4	STRENGTHENED MEMBERS SUFFIXED WITH "S"			
R3	ALL 4 MM THICK MEMBER CHANGE TO 5MM THICK MEMBER			
R2	AS PER BPC COMMENT MARKED			
R1	DIAGONALS REVISED FROM L75X75X6 TO L75X75X5, FROM L80X80X4 TO L80X80X5, FROM L65X65X4 TO L65X65X5, FROM L60X60X4 TO L60X60X5, L65X65X4 TO L65X65X5 & L70X70X4 TO L70X70X5, CROSS ARM TOP REVISED FROM 60X60X4 TO 60X60X5, L60X60X4 TO L55X55X5 & 50X50X4 TO 50X50X5, HOLES OF H3A INCREASE FROM 3 NOS TO 4 NOS.			

BHUTAN POWER CORPORATION LTD.
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

PROJECT: 132 KV D/C KANGLUNG-PHUNTSHOTHANG TRANSMISSION LINE

	NAME	SIGN	DATE
DSN & DWN			
CHKD			
APPD			

TITLE: SINGLE LINE DIAGRAM OF TOWER TYPE "D0S" STRENGTHENED

SCALE: 1:100

PROJECTION

DRG. No: BPC/EDCD/SPL/D0S/SLD/01

NO OF SHEETS: 1 OF 1

SIZE: A1 REV: 4

TENDER LEVEL DRAWING

TO BE USED FOR WOBTHANG TRANSMISSION LINE