

**BHUTAN POWER CORPORATION LIMITED**  
**THIMPHU: BHUTAN**



**TENDER DOCUMENT**  
**(TENDER NO. BPC/C&PD/CMS/TENDER-2023/07)**

**FOR**

**SUPPLY OF TOWERS AND ERECTION, TESTING AND  
COMMISSIONING OF 132kV DOUBLE CIRCUIT LILO AT  
YUNGICHU, LHUNTSE  
(PACKAGE – A)**

**MARCH 2023**

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## **NOTICE INVITING TENDER (NIT)**



**BHUTAN POWER CORPORATION LIMITED**  
**Registered Office, Thimphu**



**BPC/C&PD/CMS/TENDER-2023/07**

**1 March 2023**

**ABRIDGED NOTICE INVITING TENDER (NIT)**

Bhutan Power Corporation Limited (BPC) is pleased to invite Single Stage Single Envelope sealed bids from eligible contractors for the turnkey package for supply, construction, testing and commissioning of 132 kV double circuit transmission line (a) - **Package (A)** Yungichu LILO (approximately 5.96 km); and (b) - **Package (B)** Burgangchu LILO (approximately 7.69 km) as defined in this bidding document (hereinafter referred to as the Works) under BPC financing.

The Bidding Document shall be available on all working days from available for sale from March 1, 2023, to March 22, 2023. Sealed Bids shall be received up to 1500 hours on March 22, 2023, and shall be opened on the same day at 1600 hours.

Detailed NIT and Bidding Documents are available at BPC website: [www.bpc.bt](http://www.bpc.bt) for reference and purchase/download. Please contact +975 – 2 – 322046 (Office) for any queries.

A handwritten signature in blue ink, appearing to read 'Meyi Miki', written over a horizontal line.

**Senior Manager**



**BHUTAN POWER CORPORATION LIMITED  
THIMPHU: BHUTAN**



**BPC/C&PD/CMS/TENDER-2023/07**

**1 March 2023**

**NOTICE INVITING TENDER (NIT)**

Bhutan Power Corporation Limited (BPC) is pleased to invite Single Stage Single Envelope sealed bids from eligible contractors for the turnkey package for supply, construction, testing and commissioning of 132 kV double circuit transmission line (a) - **Package (A)** Yungichu LILO (approximately 5.96 km); and (b) - **Package (B)** Burgangchu LILO (approximately 7.69 km) as defined in this bidding document (hereinafter referred to as the Works) under BPC financing.

The tender is open to contractors who fulfill the qualification criteria set out in the tender documents. The followings are the details and some of the requirements:

- (a) The scope of work, in brief, includes check survey, soil investigation, preparation of tower schedule, manufacture & supply of Steel Towers in line with the drawings provided by the Employer, other line materials, transportation to site, insurance, storage, erecting, stringing, and testing & commissioning of the 132kV double circuit LILO as specified above. The scope of work shall also cover associated civil works, including clearing of Right of Way, benching, tower foundations, retaining & breast wall, etc.
- (b) A complete set of Bidding Documents containing both Package A & B may be purchased by Bidder(s) or their representatives on submission of a written application to the address given below upon payment of a non-refundable fee of Nu. 15,000/- (fifteen thousand), in cash or in the form of a demand draft in favour of the **“General Manager, Finance & Accounts Division, Bhutan Power Corporation Limited, Thimphu, Bhutan”**, payable at Bank of Bhutan, Thimphu on all working days between 0900 hours and 1700 hours. The tender will be available for sale from March 1, 2023, to March 22, 2023.

BPC shall not be responsible for loss of documents or delay in dispatch through the post. Further, the issuance of documents shall not construe the automatic qualification of Bidders.

- (c) The bidding document may also be downloaded from the BPC's website: [www.bpc.bt](http://www.bpc.bt). However, the interested bidders shall intimate BPC at the address given below of its intent to bid for the works and arrange to register by making payment of Nu. 9,000/- (nine thousand) on or before 1500 Hrs., March 22, 2023. It shall be noted that in case of any discrepancy between the web copy and the hard copy sold by BPC, the provisions of the latter shall govern.

- (d) All Bids must be accompanied by Bid Security as specified in the bid document, in the form of a Bank Draft or Bank Guarantee in the prescribed proforma given in the Bidding documents. All bids must be in Bhutanese Ngultrum only. All bidders will be required to sign and submit the Integrity Pact provided in the Bidding Document.
- (e) Sealed Bids complete in all respects along with the duly signed Integrity Pact may be submitted to the address of communication up to 1500 hours on March 23, 2023, and the Bids shall be opened on the same day at 1600 hours in the Conference Hall of BPC Head Office, Thimphu, Bhutan in the presence of the Bidders or their authorized representatives who choose to attend.
- (f) Before the bid submission, bidders must make themselves fully conversant with the complete bid specifications and the Project Sites. Towards this, a Zoom meeting of all interested bidders is scheduled on March 8, 2023, to present the proposed line route, and a pre-bid conference on March 14, 2023, will be held at Thimphu, Bhutan.

**Address for Communication:**

Senior Manager,  
Contracts Management Section,  
Construction Division,  
Construction & Procurement Department,  
PO Box No. 580,  
Bhutan Power Corporation Ltd.,  
Thimphu: Bhutan

Telephone: 00975-2-3 322046  
Email: [dorjikinley@bpc.bt](mailto:dorjikinley@bpc.bt)

- (g) BPC reserves the right to reject or accept the Bids or annul the bidding process without assigning any reason.

**Senior Manager**

## **SECTION 1**

### **INSTRUCTIONS TO BIDDERS**

**SECTION 1**  
**INSTRUCTIONS TO BIDDERS**

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## SECTION 1 - INSTRUCTIONS TO BIDDERS

### A. GENERAL

1. **Scope of Bid**
  - 1.1 Bhutan Power Corporation Limited (BPC), Bhutan (hereinafter referred to as the Employer/ Purchaser), invites sealed bids for the turnkey package for the supply & construction of a 132 kV double circuit LILO at:  
  
Package A: Yungichu (approximately 5.96 km); and  
  
Package B: Burgangchu LILO (approximately 7.55 km)  
  
as defined in these bidding documents (hereinafter referred to as the Works).  
  
Bids for each package shall be independently evaluated for award of any package. In the event a single bidder emerges successful for both the packages, BPC at its sole discretion reserves the right to award only one package to one bidder.
  - 1.2 The Successful bidder will be expected to complete the Works within contract period as described in the BDS from the date of Commencement of the Works, as defined in the Conditions of Contract.
2. **Eligible Bidders**
  - 2.1 Eligible bidders are the contractors, who fulfill the Qualification Requirements given in Clause 4 and meet the following requirements:  
  
A bidder or any of its affiliates shall not be affiliated with a firm or entity:
    - (i) which has provided consulting services to the Employer during the preparatory stages of the Works or of the project of which the Works form a part, or
    - (ii) which has been hired (or is proposed to be hired) by the Employer as Engineer for the Contract.
  - 2.2 Bidders shall provide such evidence of their eligibility satisfactory to the Employer as the Employer shall reasonably request.

3. **Origin of Materials, Equipment And Services**
- 3.1 The Origin of Materials, Equipment and Services to be supplied for this Project shall be from sources, which do not contravene the statutory requirements of Royal Government of Bhutan. "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 is substantially different in basic characteristics or in purpose or utility from its components.
4. **Qualification Of the Bidder**
- 4.1 To be qualified for award of Contract, bidders shall:
- a) submit copies of documents defining the constitution or legal status, place of registration, and principal place of business of the bidder. All Bhutanese bidders participating as Partner In Charge (Contractor Category as described in the BDS) and Joint Venture Partner (Contractor Category as described in the BDS) must be registered with Construction Development Board of Bhutan and possess valid license as a prerequisite for their bid to be considered;
  - b) submit duly signed Integrity Pact by the authorized signatory of the bid;
  - c) submit a written power of attorney authorizing the signatory of the bid to commit the bidder;
  - d) submit satisfactory evidence concerning the following:
    - i) The bidder is a qualified manufacturer/erector/ or an authorized representative of a qualified manufacturer/ erector who regularly manufactures/ erects the equipment/ materials of the type quoted and has the adequate technical knowledge and practical experience.
    - ii) The bidder does not anticipate change in ownership during the proposed period of work (if such a change is anticipated, the scope and effect thereof shall be defined).

- iii) The bidder has adequate financial capability to meet the financial obligations pursuant to the scope of the works. The bidder shall submit Audited Balance Sheet for the recent five (5) years.
- iv) The bidder has or has access to adequate plant and manufacturing capacity to execute the works within the time specified. The evidence shall consist of written details of the installed manufacturing capacities and present commitments (excluding the work under this specification) of the bidder or his principal. If the present commitments are such that the installed capacity results in inadequacy of the manufacturing capacity to meet the requirement of equipment/ materials corresponding to this tender then the details of alternative arrangements made shall also be furnished.
- v) The bidder has adequate field service organization to provide the necessary field erection and management services required to successfully erect, test and commission, the equipment/ materials as required under the specifications.
- vi) The bidder has established Quality Assurance System and Design Organization to achieve high level of equipment/ material reliability during manufacture and installation.
- vii) The bidder should provide details of any current litigation that he is involved with.

4.2 Bids submitted by a Joint Venture, if so, permitted in the BDS, of two or more firms as partners shall comply with the following requirements:

- a) the bid, and in case of a successful bid, the Form of Agreement, shall be signed so as to be legally binding on all partners;
- b) one of the partners shall be authorized to be in charge (referred as Lead Partner or Partner-In-Charge); and this authorization shall be evidenced by submitting a power of attorney, as

per the format in Section 5, signed by legally authorized signatories of all the partners;

- c) the Partner-In-Charge/Lead Partner shall meet all the Qualification Requirements by itself and each of the other partners shall meet at least 25% of the technical or financial qualification requirements;
- d) the Partner-In-Charge shall be authorized to incur liabilities and receive instructions for and on behalf of any or all partners of the joint venture and the entire execution of the Contract including payment shall be done exclusively with the partner-in-charge. The partner-in-charge cannot transfer his responsibility / authority to any other partners during the currency of the contract;
- e) all partners of the joint venture shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms, and a relevant statement to this effect shall be included in the authorization mentioned under (b) above as well as in the Bid Form and the Form of Agreement (in case of successful bid); and
- f) a copy of the undertaking / agreement entered into by the joint venture partners, as per the the format in Section 5, shall be submitted with the bid.

4.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 above.

4.4 Qualification will also be based on meeting all the following minimum criteria regarding the Bidder's general and particular experience, personnel and equipment capabilities and financial position as demonstrated by the Bidder's responses in the corresponding schedules to the Bid.

The Owner reserves the right to waive minor deviations if they do not materially affect the capability of a Bidder to perform the Contract.

#### 4.5 Experience of the Bidder

The Bidder and in case of JV, the Partner-in-charge, shall meet the following minimum qualification criteria:

(a) Technical Qualification Requirements

As indicated in the BDS.

(b) Financial Qualification Requirements

As indicated in the BDS.

#### 4.6 Qualification of Associate Contractors/Manufacturer's

A list of approved manufacturers, if applicable, whose products only are to be supplied is indicated in the technical specifications. The Employer may approve alternative suppliers in case of closure/merger of the specified makes. The Employer may also approve alternative suppliers, if the credentials of the Supplier are established to the satisfaction of the Employer based on documentary evidence and / or factory assessment of the Supplier. The Bidders at the time of Bid submission may propose alternative Suppliers with the proviso that if the proposed Supplier is not acceptable to the Employer, the Bidder will supply the material from the suppliers in the Employer's approved list without any cost implications.

The bidder shall furnish the manufacturer's authorisation along with the offer in the formats provided in this bidding document.

#### 5 One Bid per Bidder

5.1 Each bidder shall submit only one bid either by itself, or as a partner in a joint venture or as a responsible officer in the management of the company. A bidder who submits or participates in more than one bid other than alternatives pursuant to Sub-Clause 17.1 will be disqualified.

#### 6. Cost of Bidding

6.1 The bidder shall bear all costs associated with the preparation and submission of its bid and the Employer will in no case be responsible or liable for those costs.

**7. Site Visit**

- 7.1 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 Works. The costs of visiting the Site shall be at the bidder's own expense and at his own risk.
- 7.2 The bidder and any of its personnel will be granted permission by the Employer to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the bidder, its personnel, will release and indemnify the Employer and its personnel 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.
- 7.3 The Employer may conduct a Site visit concurrently with the Pre-Bid Meeting referred to in Clause 18.

**B. BIDDING DOCUMENTS**

**8. Content of Bidding Documents**

- 8.1 The bidding documents are those stated below, and should be read in conjunction with any Addenda issued in accordance with Clause 10.

		Notice Inviting Tenders (NIT)
Section	1.	Instructions to Bidders
Section	2.	General Conditions of Contract
Section	3.	Conditions of Particular Application
Section	4.	Technical Specifications
Section	5.	Forms of Bid, Appendix to Bid, Integrity Pact, Forms for Joint Venture and Bid Security
Section	6.	Form of Agreement
Section	7.	Forms of Performance Bank Guarantee and Bank Guarantee for Advance Payment
Section	8.	Schedules of Supplementary Information
Section	9.	Preamble to Price Schedule and Schedule of Prices (including Bill of Quantities)

The above sections shall be arranged in Volumes as described in BDS.

The bidder is expected to examine carefully the contents of the Bidding documents. Failure to

comply with the requirements of bid submission will be at the bidder's own risk.

Pursuant to Clause 27, bids which are not substantially responsive to the requirements of the bidding documents shall be rejected.

9. **Clarification  
Of Bidding  
Documents**

9.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing at the Employer's address indicated in BDS. The Employer will respond to any request for clarification, which it receives as described in BDS. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry.

10. **Amendment  
of Bidding  
Documents**

10.1 At any time prior to the deadline for submission of bids, the Employer may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective bidder, or based on the proceedings of the pre-bid meeting modify the bidding documents by issuing addenda.

10.2 Any addendum thus issued shall be part of the bidding documents pursuant to Sub-Clause 8.1, and shall be communicated by the Employer in writing to all purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum to the Employer.

10.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend the deadline for submission of bids, in accordance with Clause 21.

**C. PREPARATION OF BIDS**

11. **Language of Bid**

11.1 The bid, and all correspondence and documents, related to the bid, exchanged between the bidder and the Employer shall be written in the English language. Supporting documents and printed literature furnished by the bidder may be in another language provided they are accompanied by an accurate translation of the relevant passages in the English language, in which case, for purposes of interpretation of the bid, the English translation shall prevail.



12. **Documents  
Comprising  
The Bid**

- 12.1 The bidder shall submit Bid Form, Bid security, Integrity Pact, Appendix to Bid, the information on eligibility and qualification, schedules of supplementary information, including those for alternatives, where proposed by the bidder and any other materials required to be completed and submitted by Bidders in accordance with these Instructions to Bidders. The documents listed under Section 5 (Bid Security and Integrity Pact) shall be in the format provided. Information on pending litigation and Priced Bill of Quantities, Price Bids for alternatives where proposed by the bidder and any other material required to be completed.

The Guaranteed Technical Particulars, where sought for, shall also be submitted in a soft copy (Memory Stick). However, the contents of the hard copy shall govern for the purpose of evaluation.

The filled-up price schedule shall also be submitted in soft copy (Memory Stick). However, the contents of the hard copy shall govern for the purpose of evaluation.

13. **Bid Prices**

- 13.1 Unless stated otherwise in the Bidding documents, the Contract shall be for the whole Works as described in Sub-Clause 1.1, based on the schedule of unit rates and prices submitted by the bidder.

- 13.2 The Bidder must quote unit Free at Site (FAS) prices of all items (along with Ex-works prices) for delivery of items to the actual site of erection including any storage, carriage (during transit and at site) by head load (if any) charges etc. as may be necessary. The unit FAS price shall comprise of the following components:

Ex-works price, packing and forwarding charges, railway freight, transport charges to actual work site, storage as and where necessary, any pandemic related costs, charges for transit insurance against all risks and storage after receipt of equipment at destination stores, all taxes, duties and levies. Insurance of materials/ equipment/ goods at site is a mandatory requirement of the Royal Government of Bhutan.

- 13.3 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 other rates and prices in the Bill of Quantities.

- |   |   |
|---|---|
|   | <p>13.4 All duties, taxes and other levies payable by the Contractor in Bhutan under the Contract, or any other clause, 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, and the evaluation and comparison of bids by the Employer shall be made accordingly. It is the responsibility of the Bidder to ascertain the value of applicable tax rates (Bhutan Sales Tax and / or Customs Duty and or any other applicable taxes / duties) for various items under Price Schedule and indicate the same in the price schedules. It shall be noted that payment towards such taxes / duties in Bhutan, will be limited to the value obtained by using the rate quoted in the Bid, unless there is any change in rates notified by relevant authorities after the date 28 days prior to the submission of Bids. In the event of such change by relevant authorities, the differential amount (increase or decrease) will be based on the differential rates between revised notified value and the maximum of (i) the rates assumed by the Bidder in its offer and (ii) the actual rate prevalent at the time 28 days prior to the due date of bid submission.</p> |
|   | <p>13.5 The rates and prices quoted by the bidder should be firm unless otherwise explicitly provided for as subject to adjustment during the performance of the Contract in accordance with Clause 70 of the Conditions Particular Application (Section 3).</p>  |
| <p>14. <b>Currency of Bid and Payment</b></p> | <p>14.1 The unit rates and the prices shall be quoted by the bidder entirely in Bhutanese Ngultrum and the payment will be made in Bhutanese Ngultrum.</p>  |
| <p>15. <b>Bid Validity</b></p>                | <p>15.1 Bids shall remain valid till the date as indicated in BDS.</p> <p>15.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request that the bidders to extend the period of validity for a specified additional period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiting its bid security. A bidder agreeing to the request will not</p>  |

be required or permitted to modify its bid, but will be required to extend the validity of its bid security for the period of the extension, and in compliance with Clause 16 in all respects.

**16. Bid Security**

16.1 The bidder shall furnish, as part of its bid, a bid security in the amount as indicated in BDS.

16.2 The Bid Security shall, at the bidder's option, be in the form of a banker's certified cheque, cash warrant, standby letter of credit or bank guarantee drawn in favour of "General Manager, Finance & Accounts Division, Bhutan Power Corporation Limited, Thimphu, Bhutan" payable at any Bank/Financial Institution in Thimphu, Bhutan. The format of the bank guarantee shall be in accordance with the sample form of Bid Security included in Section 5. Letters of credit and bank guarantees issued, as surety for the bid shall be valid till the date as indicated in BDS.

Bid Security, provided by the bidder shall be from a Bank/Financial Institution in Bhutan.

16.3 Any bid not accompanied by an acceptable bid security shall be rejected by the Employer as non-responsive.

16.4 The bid securities of unsuccessful bidders shall be returned after signing of the Contract and submission of the Performance Security by the successful bidder, in any case not later than the expiration of the period of bid security validity.

16.5 The bid security of the successful bidder will be returned upon furnishing required performance security and signing of the Contract by bidder.

16.6 The bid security may be forfeited

- (a) if the bidder withdraws its bid during the period of bid validity; or
- (b) if the bidder does not accept the correction of its bid price, pursuant to Sub-Clause 28.2; or
- (c) in the case of a successful bidder, if he fails within the specified time limit to
  - (i) sign the Agreement, or

- (ii) furnish the required performance security.

**17. Alternative Proposals by Bidders**

- 17.1 Bidders wishing to offer technical alternatives to the requirements of the bidding documents must first price the Employer's design as described in the bidding documents and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methods. Only the technical alternatives, if any, of the lowest evaluated bidder conforming to the basic technical requirements shall be considered by the Employer for adoption, at the sole discretion of the Employer.

**18. Pre- Bid Meeting**

- 18.1 The bidder or its official representative is invited to attend a pre-bid meeting, which shall take place on date / time and place as indicated in BDS. To provide Bidders with an opportunity to visit site and assess the project requirements prior to the pre-bid meeting, a ZOOM/GOOGLE meeting shall be arranged by the Employer from date / time and to the places as indicated in BDS or on any other dates / places as amended. Bidders wishing to make a site visit are required to furnish the identification and other details of the representatives to the Employer at least 3 days in advance, if the Bidder requires any letter from the Employer to the relevant authorities, for obtaining special permit. Any Bidder, who wishes to undertake any separate site visit may pursuant to Clause 7 undertake the same, by giving at least 3 days notice to the Employer along with the identification and other details of the bidder's representative, if Bidder requires any letter from the Employer to the relevant authorities for obtaining special permit. However, requests for site visits shall be entertained by the Employer, if the same are received by the Employer at least 7 days prior to the deadline of Bid submission.
- 18.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 18.3 The bidder is requested to submit any query in writing, to reach the Employer not later than as per BDS.

- 18.4 Proceedings of the meeting, including the text of the questions raised and the responses given, will be transmitted without delay to all purchasers of the bidding documents. Any modification of the bidding documents listed in Sub-Clause 8.1 which 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 Clause 10 and not through the minutes of the pre-bid meeting.
- 18.5 Bidders are advised to attend the pre-bid meeting. However, non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.
- 18.6 All costs associated with attending the pre-bid meeting and / or site visits shall be borne by the Bidder. It shall be noted that the Employer's issuance of letter for obtaining permits shall not be construed as Employer's commitment or obligation to arrange for the permits from the relevant Authorities, especially in the absence of any statutory requirements not being met by the Bidder.

**19. Format and Signing of Bid**

- 19.1 The bidder shall prepare ONE original and TWO copies of the Bid documents as described in Clause 12 of these Instructions to Bidders, and clearly marked "ORIGINAL" and "COPY". In the event of discrepancy between them, the original shall prevail.
- 19.2 The original and all copies of the bids shall be typed or written in indelible ink (in the case of copies, photostats are also acceptable) and shall be signed by a person or persons duly authorised to sign on behalf of the bidder, pursuant to Sub-Clause 4.1 (a) or 4.2 (b), as the case may be.
- 19.3 The bids shall contain no alterations, omission or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

**D. SUBMISSION OF BIDS**

**20. Sealing and Marking of Bids**

- 20.1 The bidder shall seal the original and each copy of the bid in an inner and an outer envelope, duly marking the envelopes as " BID - ORIGINAL " and " BID - COPY".

- 20.2 The inner and outer envelopes shall
- (a) be addressed to the Employer at the address indicated in BDS.
  - (b) bear the identification as indicated in BDS:
- 20.3 In addition to the identification required in Sub-Clause 20.2, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause 22.
- 20.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.
21. **Deadline for Submission of Bids**
- 21.1 Bids must be received by the Employer at the address specified as per ITB clause 20.2 (a) above no later than the date and time as indicated in BDS.
- 21.2 The Employer may, at his discretion, extend the deadline for submission of bids by issuing an addendum in accordance with Clause 10 in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.
22. **Late Bids**
- 22.1 Any bid received by the Employer after the deadline for submission of bids prescribed in Clause 21 will be rejected and returned unopened to the bidder.
23. **Modification and Withdrawal of Bids**
- 23.1 The bidder may modify or withdraw its bid after bid submission, provided that written notice of the modification or withdrawal is received by the Employer prior to the deadline for submission of bids.
- 23.2 The bidder's modification or withdrawal notice shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause 20, with the outer and inner envelopes additionally marked "MODIFICATION" or "WITHDRAWAL", as appropriate. A withdrawal notice may also be sent by fax but must be followed by a signed confirmation copy.

- 23.3 No bid may be modified/withdrawn by the bidder after the deadline for submission of bids.
- 23.4 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in the forfeiture of the bid security pursuant to Clause 16.

## **E. BID OPENING AND EVALUATION**

- |     |                                      |      |  |
|-----|--------------------------------------|------|--|
| 24. | <b>Bid Opening – Opening of Bids</b> | 24.1 | The Employer will open the bids, including technical modifications made pursuant to Clause 23, in the presence of bidders' representatives who choose to attend, at the time, date and in the place specified in the BDS. The bidders' representatives who are present shall sign an attendance sheet evidencing their attendance.   |
|     |                                      | 24.2 | Envelopes marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause 23 shall not be opened.  |
|     |                                      | 24.3 | The bidders' names, technical bid modifications and withdrawals, the presence or absence of bid security and Integrity Pact, the bid prices, the total amount of each, any discount and such other details as the Employer may consider appropriate, will be announced and recorded by the Employer at the opening. The bidder's representatives will be required to sign the record.  |
|     |                                      | 24.4 | The Employer shall prepare, besides the record of bid opening, minutes of the bid opening, including the information disclosed to those present in accordance with Sub-Clause 24.3.  |
| 25. | <b>Process to be Confidential</b>    | 25.1 | Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced. Any effort by a bidder to influence the Employer's processing of bids or award decisions may result in the rejection of the bidder's bid. |
| 26. | <b>Clarification of Bids</b>         | 26.1 | To assist in the examination, evaluation and comparison of bids, the Employer may, at its  |

discretion, ask any bidder for clarification of its bid, including but not limited to (a) during evaluation of Technical aspects any information on the technical data/information provided, qualifying requirements and/or deviations taken by the Bidder or any other clarification deemed fit by the Employer and (b) during evaluation of Prices breakdowns of unit rates or any other clarifications deemed fit by the Employer. The request for clarification and the response shall be in writing or by fax, but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids in accordance with Clause 28. Also seeking of any clarifications shall not be construed as the Bidder having met all/any qualification requirements and the Employer's seeking such clarifications is without prejudice to the Employer's right to reject Bids which are not substantially responsive at the time of original Bid submission.

**27. Preliminary Examination of Bids and Determination of Responsiveness**

- 27.1 Prior to the detailed evaluation of bids (during evaluation of technical Bids as well as the Financial Bids as appropriate), the Employer will determine whether each bid (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required securities; (iv) is substantially responsive to the requirements of the bidding documents; and (v) provides any clarification and/or substantiation that the Employer may require pursuant to Clause 26.
- 27.2 A responsive bid is one which conforms to the terms, conditions and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one (i) which affects in any substantial way the scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the bidder's obligations under the Contract; or (iii) whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.
- 27.3 If a bid is not responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.



28. **Correction of Errors**

28.1 Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Arithmetic errors will be rectified on the following basis. If there is a discrepancy between the unit rate and the total cost per item that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the total cost per item will be corrected unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit rate, in which case the total cost per item as quoted will govern and the unit rate corrected. If there is a discrepancy between the total bid amount and the sum of total costs per item, the sum of the total costs per item shall prevail and the total bid amount will be corrected.

28.2 The amount stated in the Form of Price Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount of bid, its bid will be rejected, and the bid security may be forfeited in accordance with Sub-Clause 16.6 (b).

29. **Evaluation and Comparison of Bids**

29.1 The Employer will evaluate and compare only the bids determined to be responsive in accordance with Clause 27.

29.2 In evaluating the bids, the Employer will determine for each bid the Evaluated Bid Price separately for Package A and Package B by adjusting the Bid Price as follows :

- (a) making any correction for errors pursuant to Clause 28;
- (b) excluding Provisional Sums and the provision, if any, for Contingencies in the Summary Bill of Quantities, but including Daywork, where priced competitively;
- (c) making an appropriate adjustment for any other acceptable variations, deviations or alternative offers submitted in accordance with Clause 17; and
- (d) applying any discounts offered by the bidder for the award.

- 29.3 The Employer reserves the right to accept or reject any variation or deviations. Variations and other factors which are in excess of the requirements of the bidding documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in bid evaluation.
- 29.4 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 bid evaluation.
- 29.5 If the bid of the successful bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the Contract, 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. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 34 be increased at the expense of the successful bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful bidder under the Contract.

## **F. AWARD OF CONTRACT**

30. **Award**
- 30.1 Subject to Clause 31, the Employer will award the Contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the Lowest Evaluated Bid Price for Package A and Package B, respectively, provided that such bidder has been determined to be (i) eligible in accordance with the provisions of Sub-Clause 2.1; and (ii) qualified in accordance with the provisions of Clause 4.
31. **Employer's Right to Accept any Bid and to Reject any or all Bids**
- 31.1 Bids will be rejected if:
- a) Any conditional bids other than those offering conditional discounts pursuant to Clause 29.2 (d)
  - b) Bids that do not comply with completion time
- 31.2 Notwithstanding Clause 30, 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 award of Contract, without thereby incurring any liability to the affected bidder or bidders or any obligation to inform the affected bidder or bidders of the grounds for the Employer's action.

- |     |                               |  |
|-----|-------------------------------|--|
| 32. | <b>Notification of Award</b>  | 32.1 Prior to expiration of the period of bid validity prescribed by the Employer, the Employer will notify the successful bidder through letter (hereinafter called the “Letter of Acceptance”) that its bid has been accepted. This Letter of Acceptance may also seek for pre-award discussions.  |
|     |                               | 32.2 The notification of award through Letter of Acceptance will constitute the formation of the Contract.   |
|     |                               | 32.3 Upon the furnishing of a performance security by the successful bidder, the Employer will promptly notify the other bidders that their bids have been unsuccessful.   |
| 33. | <b>Signing of Agreement</b>   | 33.1 At the same time that the Employer notifies the successful bidder that its bid has been accepted. The Employer will intimate the date of signing of the agreement to the Bidder.  |
|     |                               | 33.2 The Agreement shall be signed within twenty eight (28) days of receipt of Letter of Acceptance from the Employer.   |
| 34. | <b>Performance Security</b>   | 34.1 Within twenty eight (28) days of receipt of the Letter of Acceptance from the Employer, the successful bidder shall furnish to the Employer a performance security in an amount of ten (10) percent of the Contract Price in accordance with the Conditions of Contract. The form of performance security provided in Section 8 of the bidding documents shall be used. |
|     |                               | Performance Security, provided by the successful bidder, shall be from a Bank/Financial Institution in Bhutan.   |
|     |                               | 34.2 Failure of the successful bidder to comply with the requirements of Clauses 33 or 34 shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.   |
| 35. | <b>Fraud &amp; Corruption</b> | 35.1 It is Royal Government of Bhutan’s (RGoB) policy to require that Employers, Bidders, Suppliers,   |

Contractors and their Subcontractors observe the highest standards of ethics during the procurement and execution of contracts. In pursuance to this policy the Employer/RGoB:

- (a) defines, for the purposes of this provision, the terms set forth below as:
  - (i) “corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
  - (ii) “fraudulent practice” is any intentional 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) “collusive practice” is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party’
  - (iv) “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the action of a party;
  - (v) “obstructive practice” is deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede any investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to investigation or from pursuing the investigation; or acts intended to materially impede the exercise of the inspection and audit rights of the Employer or any organization or person appointed by the Employer.

- (b) will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for the contract in question.
- (c) will sanction a firm or an individual, including declaring them ineligible, either indefinitely or for a stated period of time, to be awarded a contract if it at any time determines that they have, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for, or in executing contract;
- (d) will have the right to require that a provision be included in the bidding documents and in contracts, requiring bidders, suppliers, contractors and their subcontractors to permit the Employer, any organization or person appointed by the Employer and/or any relevant RGoB agency to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by the Employer;
- (e) requires that bidders, as a condition to admission to eligibility, execute and attach to their bids an Integrity Pact Statement in the form provided in the Instructions to bidders.
- (f) will report any case of corrupt, fraudulent, collusive, coercive or obstructive practice to relevant RGoB agencies, including but not limited to the Anti-Corruption Commission (ACC) of Bhutan, for necessary action in accordance with the statutes and provisions of the relevant agency.

**BIDDING DATA SHEET (BDS)**

<b>A. General</b>	
<b>ITB 1.1</b>	<p>The Works are <b>Supply of towers and erection, testing and commissioning of 132 kV Double Circuit LIL0 for</b></p> <p><b>Package A: Yungichu, Lhuntse (approximately 5.96 km).</b></p> <p>This project is being implemented and financed by <b>BPC</b>.</p>
<b>ITB 1.2</b>	The contract period is <b>18 months</b> .
<b>ITB 4.1</b>	<p>The Bhutanese Partner-in-Charge shall be <b>Large – W4</b>.</p> <p>The Bhutanese JV Partner shall be <b>Large – W4 or W3</b>.</p>
<b>ITB 4.2</b>	Joint Venture (JV) Bids are permitted: <b>Yes</b>
<b>ITB 4.5 (a)</b>	The Technical Qualification Requirements are as per <b>Appendix 1</b> .
<b>ITB 4.5 (b)</b>	The Financial Qualification Requirements are as per <b>Appendix 1</b> .
<b>B. Bidding Documents</b>	
<b>ITB 8.1</b>	<p>The sections are arranged as per the following volumes.</p> <p><b>Section 1, 2, 3, 4, 5, 6, 7, 8 and 9 in one document. No Volumes are applicable.</b></p>
<b>ITB 9.1</b>	<p>The Employer's address for clarification is:</p> <p><b>Senior Manager Contracts Management Section Construction Division Construction &amp; Procurement Department Bhutan Power Corporation Limited Thimphu, Bhutan</b></p> <p><b>Telephone:+975-2-322046; Email: dorjikinley@bpc.bt</b></p> <p>The Employer will respond to any request for clarification, which it receives on or before <b>March 17, 2023</b>.</p>
<b>C. Preparation of Bids</b>	
<b>ITB 15.1</b>	The Bids shall remain valid till <b>September 18, 2023</b> .

<b>ITB 16.1 &amp; 16.2</b>	<p>The bidder shall furnish, as part of its bid, a bid security in the amount of <b>Nu. 1,500,000 (One million five hundred thousand)</b> only for package A.</p> <p>Letters of credit and bank guarantees issued, as surety for the bid shall be valid till <b>October 18, 2023</b>.</p>
<b>ITB 18.1</b>	<p>Pre-bid Meeting shall be held on <b>March 14, 2023 at the Conference Hall of BPC, Thimphu</b> or on any other dates /address as amended.</p> <p>The Employer shall arrange a Zoom meeting/site visit from <b>March 8, 2023</b>, or on any other dates as amended. The joint site visit to the transmission line route shall be made in any other places as amended.</p> <p>Bidders wishing to visit site sites must reach Thimphu before <b>March 14, 2022</b>.</p>
<b>ITB 18.3</b>	<p>The bidder is requested to submit any query in writing, to reach the Employer not later than the <b>March 17, 2023</b></p>
<b>D. Submission of Bids</b>	
<b>ITB 20.2 (a)</b>	<p>The inner and outer envelopes, for the purpose of Bid submission, shall bear the Employer's address:</p> <p><b>Senior Manager Contracts Management Section Construction Division Construction &amp; Procurement Department Bhutan Power Corporation Limited Thimphu, Bhutan</b></p>
<b>ITB 20.2 (b)</b>	<p>The inner and outer envelopes shall bear the following identification :</p> <p><b>Tender Name: Supply of towers and erection, testing and commissioning of a. 132 kV Double Circuit LIL0 for</b></p> <p><b>Package A: Yungichu, Lhuntse (approximately 5.96 km).</b></p> <p><b>Tender Number: BPC/C&amp;PD/CMS/TENDER-2023/07</b></p> <p><b>DO NOT OPEN BEFORE: 1600 Hrs. on March 22, 2023</b></p>
<b>ITB 21.1</b>	<p>Bids must be received by the Employer no later than <b>1500 Hrs. on March 22, 2023</b>.</p>
<b>E. Bid Opening and Evaluation</b>	

## Bidding Data Sheet

<b>ITB 24.1</b>	The Bid opening shall take place at <b>1600 Hrs. on 1600 Hrs. on March 22, 2023</b> , in the <b>Conference Hall of BPC at Thimphu</b> .
<b>ITB 29.2</b>	The financial bid will be evaluated separately for packages A and B and awarded accordingly.



## Qualification Requirements

(a) Technical

As a minimum qualifying requirement, the bidder should have successfully carried out, as a prime contractor, the execution of at least one project of the similar nature and complexity in hilly areas comparable to the proposed project during the last Fifteen years. This experience should include the following:

i) Erection of the Transmission Line

Surveyed, optimized tower locations, constructed foundations and based thereon, erected, strung and commissioned not less than **10 km of 132 kV** or higher transmission lines in hilly areas and the lines erected by the Bidder should have been in satisfactory operation for a minimum period of one (1) year as on the date of bid opening.

ii) Supply of towers

The Bidder should have its own manufacturing facilities for the Transmission Line towers and tower parts having the following minimum manufacturing capacities and manufacturing experience:-

- (i) Manufacturing capacity per financial year: **846 MT**
- (ii) Manufacturing experience: Average quantity of latticed steel structures (transmission line tower parts, microwave tower parts, substation structures etc.) manufactured per financial year, during the last three financial years should not be less than **1269 MT**.

(b) Financial

- i) The Bidder and in case of JV, the Partner-in-Charge should have an Minimum Average Annual Turnover (defined as billing for works in progress and completed) over last five years of **Nu. 161.00 (one hundred sixty-one) million**. For the purpose of assessing the average annual turnover, average of three highest-turnover years out of the recent five years will be considered.
- ii) The Bidder should meet the construction cash flow for a period of three months, estimated as **Nu. 27,000,000.00 (twenty-seven) million**. The same shall be demonstrated by:
  - a) Banker's certificate (in the format provided in this bid document) providing the details of the fund-based credit facilities available from Banker(s) indicating the total credit available, utilization as of date (60 days (or later) prior to the date of bid opening) and the balance available along with the Banker's assurance for support to meet the construction cash flow for the

project duration. The Employer reserves the right to seek reconfirmation of the credit facilities from the Banker(s), during the evaluation and / or prior to award in case of successful bidder; and

- b) Liquid assets determined from the audited balance sheet of the recent financial year.

The recent five years audited balance sheet submitted shall demonstrate the soundness of the Bidder's position, showing long term profitability. Net Worth for recent 3 financial years should be positive.

The Bidder shall fill the above information in the relevant Bid Schedules and submit banker's certificate in the format provided in the bidding document.

## **SECTION 2**

### **CONDITIONS OF CONTRACT**

#### **PART I - GENERAL CONDITIONS OF CONTRACT**



FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS

**CONDITIONS OF CONTRACT**

**FOR WORKS OF CIVIL**

**ENGINEERING CONSTRUCTION**

**PART I GENERAL CONDITIONS**

**WITH FORMS OF TENDER AND AGREEMENT**

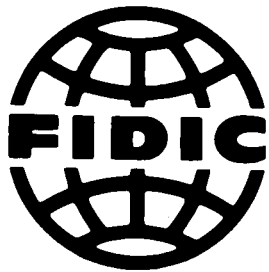
**PART II CONDITIONS OF PARTICULAR APPLICATION**

**WITH GUIDELINES FOR PREPARATION OF PART II CLAUSES**

**FOURTH EDITION 1987**

**Reprinted 1988 with editorial amendments**

**Reprinted 1992 with further amendments**



FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS

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**FOR WORKS OF CIVIL**

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Reprinted 1988 with editorial amendments

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## FOREWORD

The terms of the Fourth Edition of the Conditions of Contract for Works of Civil Engineering Construction have been prepared by the Fédération Internationale des Ingénieurs Conseils (FIDIC) and are recommended for general use for the purpose of construction of such works where tenders are invited on an international basis. The Conditions, subject to minor modifications, are also suitable for use on domestic contracts.

The version in English of the Conditions is considered by FIDIC as the official and authentic text for the purpose of translation.

In the preparation of the Conditions it was recognised that while there are numerous Clauses which will be generally applicable there are some Clauses which must necessarily vary to take account of the circumstances and locality of the Works. The Clauses of general application have been grouped together in this document and are referred to as Part I – General Conditions. They have been printed in a form which will facilitate their inclusion as printed in the contract documents normally prepared.

The General Conditions are linked with the Conditions of Particular Application, referred to as Part II, by the corresponding numbering of the Clauses, so that Parts I and II together comprise the Conditions governing the rights and obligations of the parties.

Part II must be specially drafted to suit each individual Contract.

When dredging and certain types of reclamation work are involved special consideration must be given to Part II.

To assist in the preparation of Part II explanatory material and example clauses are published with the Conditions in a separately bound document entitled “Conditions of Contract for Works of Civil Engineering Construction, Part II – Conditions of Particular Application, with Guidelines for preparation of Part II Clauses, Fourth Edition”.

FIDIC has published a “Guide to the Use of FIDIC Conditions of Contract for Works of Civil Engineering Construction” which includes comments on the provisions of the Fourth Edition of the Conditions. Users of the Fourth Edition may find it helpful to refer to this Guide.

It may also be helpful for users to refer to other FIDIC publications, such as:

Tendering Procedure (First Edition 1982)  
Construction, Insurance and Law (1986)

FIDIC gratefully acknowledges the suggestions and comments it has received during the preparation of this edition from European International Contractors (EIC) as mandatory of Confederation of International Contractors Associations (CICA) with participation of Associated General Contractors of America (AGC).

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# PART I - GENERAL CONDITIONS

## Definitions and Interpretation

### Definitions

- 1.1** In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:
- (a) (i) “Employer” means the person named as such in Part II of these Conditions and the legal successors in title to such person, but not (except with the consent of the Contractor) any assignee of such person.
  - (ii) “Contractor” means the person whose tender has been accepted by the Employer and the legal successors in title to such person, but not (except with the consent of the Employer) any assignee of such person.
  - (iii) “Subcontractor” means any person named in the Contract as a Subcontractor for a part of the Works or any person to whom a part of the Works has been subcontracted with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.
  - (iv) “Engineer” means the person appointed by the Employer to act as Engineer for the purposes of the Contract and named as such in Part II of these Conditions.
  - (v) “Engineer’s Representative” means a person appointed from time to time by the Engineer under Sub-Clause 2.2.
  - (b) (i) “Contract” means these Conditions (Parts I and II), the Specification, the Drawings, the Bill of Quantities, the Tender, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).
  - (ii) “Specification” means the specification of the Works included in the Contract and any modification thereof or addition thereto made under Clause 51 or submitted by the Contractor and approved by the Engineer.
  - (iii) “Drawings” means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.
  - (iv) “Bill of Quantities” means the priced and completed bill of quantities forming part of the Tender.
  - (v) “Tender” means the Contractor’s priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance.
  - (vi) “Letter of Acceptance” means the formal acceptance by the Employer of the Tender.
  - (vii) “Contract Agreement” means the contract agreement (if any) referred to in Sub-Clause 9.1.
  - (viii) “Appendix to Tender” means the appendix comprised in the form of Tender annexed to these Conditions.
  - (c) (i) “Commencement Date” means the date upon which the Contractor receives the notice to commence issued by the Engineer pursuant to Clause 41.
  - (ii) “Time for Completion” means the time for completing the execution of and passing the Tests on Completion of the Works or any Section or part thereof as stated in the Contract (or as extended under Clause 44) calculated from the Commencement Date.

- (d) (i) “Tests on Completion” means the tests specified in the Contract or otherwise agreed by the Engineer and the Contractor which are to be made by the Contractor before the Works or any Section or part thereof are taken over by the Employer.
- (ii) “Taking-Over Certificate” means a certificate issued pursuant to Clause 48.
- (e) (i) “Contract Price” means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract.
- (ii) “Retention Money” means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 60.2(a).
- (iii) “Interim Payment Certificate” means any certificate of payment issued by the Engineer other than the Final Payment Certificate.
- (iv) “Final Payment Certificate” means the certificate of payment issued by the Engineer pursuant to Sub-Clause 60.8.
- (f) (i) “Works” means the Permanent Works and the Temporary Works or either of them as appropriate.
- (ii) “Permanent Works” means the permanent works to be executed (including Plant) in accordance with the Contract.
- (iii) “Temporary Works” means all temporary works of every kind (other than Contractor’s Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.
- (iv) “Plant” means machinery, apparatus and the like intended to form or forming part of the Permanent Works.
- (v) “Contractor’s Equipment” means all appliances and things of whatsoever nature (other than Temporary Works) required for the execution and completion of the Works and the remedying of any defects therein, but does not include Plant, materials or other things intended to form or forming part of the Permanent Works.
- (vi) “Section” means a part of the Works specifically identified in the Contract as a Section.
- (vii) “Site” means the places provided by the Employer where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the Site.
- (g) (i) “cost” means all expenditure properly incurred or to be incurred, whether on or off the Site, including overhead and other charges properly allocable thereto but does not include any allowance for profit.
- (ii) “day” means calendar day.
- (iii) “foreign currency” means a currency of a country other than that in which the Works are to be located.
- (iv) “writing” means any hand-written, type-written, or printed communication, including telex, cable and facsimile transmission.

**Headings and  
Marginal Notes**

**1.2** The headings and marginal notes in these Conditions shall not be deemed part thereof or be taken into consideration in the interpretation or construction thereof or of the Contract.

**Interpretation**

**1.3** Words importing persons or parties shall include firms and corporations and any organisation having legal capacity.

**Singular and  
Plural**

**1.4** Words importing the singular only also include the plural and vice versa where the context requires.

**Notices,  
Consents,  
Approvals,  
Certificates and  
Determinations**

- 1.5** Wherever in the Contract provision is made for the giving or issue of any notice, consent, approval, certificate or determination by any person, unless otherwise specified such notice, consent, approval, certificate or determination shall be in writing and the words “notify”, “certify” or “determine” shall be construed accordingly. Any such consent, approval, certificate or determination shall not unreasonably be withheld or delayed.

## **Engineer and Engineer’s Representative**

**Engineer’s  
Duties and  
Authority**

- 2.1** (a) The Engineer shall carry out the duties specified in the Contract.
- (b) The Engineer may exercise the authority specified in or necessarily to be implied from the Contract, provided, however, that if the Engineer is required, under the terms of his appointment by the Employer, to obtain the specific approval of the Employer before exercising any such authority, particulars of such requirements shall be set out in Part II of these Conditions. Provided further that any requisite approval shall be deemed to have been given by the Employer for any such authority exercised by the Engineer.
- (c) Except as expressly stated in the Contract, the Engineer shall have no authority to relieve the Contractor of any of his obligations under the Contract.

**Engineer’s  
Representative**

- 2.2** The Engineer’s Representative shall be appointed by and be responsible to the Engineer and shall carry out such duties and exercise such authority as may be delegated to him by the Engineer under Sub-Clause 2.3.

**Engineer’s  
Authority to  
Delegate**

- 2.3** The Engineer may from time to time delegate to the Engineer’s Representative any of the duties and authorities vested in the Engineer and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until a copy thereof has been delivered to the Employer and the Contractor.

Any communication given by the Engineer’s Representative to the Contractor in accordance with such delegation shall have the same effect as though it had been given by the Engineer. Provided that:

- (a) any failure of the Engineer’s Representative to disapprove any work, materials or Plant shall not prejudice the authority of the Engineer to disapprove such work, materials or Plant and to give instructions for the rectification thereof; and
- (b) if the Contractor questions any communication of the Engineer’s Representative he may refer the matter to the Engineer who shall confirm, reverse or vary the contents of such communication.

**Appointment  
of Assistants**

- 2.4** The Engineer or the Engineer’s Representative may appoint any number of persons to assist the Engineer’s Representative in the carrying out of his duties under Sub-Clause 2.2. He shall notify to the Contractor the names, duties and scope of authority of such persons. Such assistants shall have no authority to issue any instructions to the Contractor save in so far as such instructions may be necessary to enable them to carry out their duties and to secure their acceptance of materials, Plant or workmanship as being in accordance with the Contract, and any instructions given by any of them for those purposes shall be deemed to have been given by the Engineer’s Representative.

**Instructions  
in Writing**

- 2.5** Instructions given by the Engineer shall be in writing, provided that if for any reason the Engineer considers it necessary to give any such instruction orally, the Contractor shall comply with such instruction. Confirmation in writing of such oral instruction given by the Engineer, whether before or after the carrying out of the instruction, shall be deemed to be an instruction within the meaning of this Sub-Clause. Provided further that if the Contractor, within 7 days, confirms in writing to the Engineer any oral instruction of the Engineer and such confirmation is not contradicted in writing within 7 days by the Engineer, it shall be deemed to be an instruction of the Engineer.

The provisions of this Sub-Clause shall equally apply to instructions given by the Engineer's Representative and any assistants of the Engineer or the Engineer's Representative appointed pursuant to Sub-Clause 2.4.

## **Engineer to Act Impartially**

- 2.6** Wherever, under the Contract, the Engineer is required to exercise his discretion by:
- (a) giving his decision, opinion or consent,
  - (b) expressing his satisfaction or approval,
  - (c) determining value, or
  - (d) otherwise taking action which may affect the rights and obligations of the Employer or the Contractor

he shall exercise such discretion impartially within the terms of the Contract and having regard to all the circumstances. Any such decision, opinion, consent, expression of satisfaction, or approval, determination of value or action may be opened up, reviewed or revised as provided in Clause 67.

## **Assignment and Subcontracting**

### **Assignment of Contract**

- 3.1** The Contractor shall not, without the prior consent of the Employer (which consent, notwithstanding the provisions of Sub-Clause 1.5, shall be at the sole discretion of the Employer), assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by:

- (a) a charge in favour of the Contractor's bankers of any monies due or to become due under the Contract, or
- (b) assignment to the Contractor's insurers (in cases where the insurers have discharged the Contractor's loss or liability) of the Contractor's right to obtain relief against any other party liable.

### **Subcontracting**

- 4.1** The Contractor shall not subcontract the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not subcontract any part of the Works without the prior consent of the Engineer. Any such consent shall not relieve the Contractor from any liability or obligation under the Contract and he shall be responsible for the acts, defaults and neglects of any Subcontractor, his agents, servants or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, servants or workmen.

Provided that the Contractor shall not be required to obtain such consent for:

- (a) the provision of labour,
- (b) the purchase of materials which are in accordance with the standards specified in the Contract, or
- (c) the subcontracting of any part of the Works for which the Subcontractor is named in the Contract.

### **Assignment of Subcontractors' Obligations**

- 4.2** In the event of a Subcontractor having undertaken towards the Contractor in respect of the work executed, or the goods, materials, Plant or services supplied by such Subcontractor, any continuing obligation extending for a period exceeding that of the Defects Liability Period under the Contract, the Contractor shall at any time, after the expiration of such Period, assign to the Employer, at the Employer's request and cost, the benefit of such obligation for the unexpired duration thereof.

## **Contract Documents**

### **Language/s and Law**

- 5.1** There is stated in Part II of these Conditions:
- (a) the language or languages in which the Contract documents shall be drawn up, and
  - (b) the country or state the law of which shall apply to the Contract and according to which the Contract shall be construed.

If the said documents are written in more than one language, the language according to which the Contract shall be construed and interpreted is also stated in Part II of these Conditions, being therein designated the “Ruling Language”.

<b>Priority of Contract Documents</b>	<p><b>5.2</b> The several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer who shall thereupon issue to the Contractor instructions thereon and in such event, unless otherwise provided in the Contract, the priority of the documents forming the Contract shall be as follows:</p> <ul style="list-style-type: none"> <li>(1) The Contract Agreement (if completed);</li> <li>(2) The Letter of Acceptance;</li> <li>(3) The Tender;</li> <li>(4) Part II of these Conditions;</li> <li>(5) Part I of these Conditions; and</li> <li>(6) Any other document forming part of the Contract.</li> </ul>
<b>Custody and Supply of Drawings and Documents</b>	<p><b>6.1</b> The Drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of charge. The Contractor shall make at his own cost any further copies required by him. Unless it is strictly necessary for the purposes of the Contract, the Drawings, Specification and other documents provided by the Employer or the Engineer shall not, without the consent of the Engineer, be used or communicated to a third party by the Contractor. Upon issue of the Defects Liability Certificate, the Contractor shall return to the Engineer all Drawings, Specification and other documents provided under the Contract.</p> <p>The Contractor shall supply to the Engineer four copies of all Drawings, Specification and other documents submitted by the Contractor and approved by the Engineer in accordance with Clause 7, together with a reproducible copy of any material which cannot be reproduced to an equal standard by photocopying. In addition the Contractor shall supply such further copies of such Drawings, Specification and other documents as the Engineer may request in writing for the use of the Employer, who shall pay the cost thereof.</p>
<b>One Copy of Drawings to be Kept on Site</b>	<p><b>6.2</b> One copy of the Drawings, provided to or supplied by the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall at all reasonable times be available for inspection and use by the Engineer and by any other person authorised by the Engineer in writing.</p>
<b>Disruption of Progress</b>	<p><b>6.3</b> The Contractor shall give notice to the Engineer, with a copy to the Employer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Engineer within a reasonable time. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.</p>
<b>Delays and Cost of Delay of Drawings</b>	<p><b>6.4</b> If, by reason of any failure or inability of the Engineer to issue, within a time reasonable in all the circumstances, any drawing or instruction for which notice has been given by the Contractor in accordance with Sub-Clause 6.3, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:</p> <ul style="list-style-type: none"> <li>(a) any extension of time to which the Contractor is entitled under Clause 44, and</li> <li>(b) the amount of such costs, which shall be added to the Contract Price,</li> </ul> <p>and shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Failure by Contractor to Submit Drawings</b>	<p><b>6.5</b> If the failure or inability of the Engineer to issue any drawings or instructions is caused in whole or in part by the failure of the Contractor to submit Drawings, Specification or other documents which he is required to submit under the Contract, the Engineer shall take such failure by the Contractor into account when making his determination pursuant to Sub-Clause 6.4.</p>



<b>Supplementary Drawings and Instructions</b>	<b>7.1</b>	The Engineer shall have authority to issue to the Contractor, from time to time, such supplementary Drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and completion of the Works and the remedying of any defects therein. The Contractor shall carry out and be bound by the same.
<b>Permanent Works Designed by Contractor</b>	<b>7.2</b>	Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall submit to the Engineer, for approval: <p>(a) such drawings, specifications, calculations and other information as shall be necessary to satisfy the Engineer as to the suitability and adequacy of that design, and</p> <p>(b) operation and maintenance manuals together with drawings of the Permanent Works as completed, in sufficient detail to enable the Employer to operate, maintain, dismantle, reassemble and adjust the Permanent Works incorporating that design. The Works shall not be considered to be completed for the purposes of taking over in accordance with Clause 48 until such operation and maintenance manuals, together with drawings on completion, have been submitted to and approved by the Engineer.</p>
<b>Responsibility Unaffected by Approval</b>	<b>7.3</b>	Approval by the Engineer, in accordance with Sub-Clause 7.2, shall not relieve the Contractor of any of his responsibilities under the Contract.

## General Obligations

<b>Contractor's General Responsibilities</b>	<b>8.1</b>	The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), execute and complete the Works and remedy any defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, materials, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract. <p>The Contractor shall give prompt notice to the Engineer, with a copy to the Employer, of any error, omission, fault or other defect in the design of or Specification for the Works which he discovers when reviewing the Contract or executing the Works.</p>
<b>Site Operations and Methods of Construction</b>	<b>8.2</b>	The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, or for the design or specification of any Temporary Works not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Engineer.
<b>Contract Agreement</b>	<b>9.1</b>	The Contractor shall, if called upon so to do, enter into and execute the Contract Agreement, to be prepared and completed at the cost of the Employer, in the form annexed to these Conditions with such modification as may be necessary.
<b>Performance Security</b>	<b>10.1</b>	If the Contract requires the Contractor to obtain security for his proper performance of the Contract, he shall obtain and provide to the Employer such security within 28 days after the receipt of the Letter of Acceptance, in the sum stated in the Appendix to Tender. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing. Such security shall be in the form annexed to these Conditions or in such other form as may be agreed between the Employer and the Contractor. The institution providing such security shall be subject to the approval of the Employer. The cost of complying with the requirements of this Clause shall be borne by the Contractor, unless the Contract otherwise provides.

<b>Period of Validity of Performance Security</b>	<b>10.2</b>	The performance security shall be valid until the Contractor has executed and completed the Works and remedied any defects therein in accordance with the Contract. No claim shall be made against such security after the issue of the Defects Liability Certificate in accordance with Sub-Clause 62.1 and such security shall be returned to the Contractor within 14 days of the issue of the said Defects Liability Certificate.
<b>Claims under Performance Security</b>	<b>10.3</b>	Prior to making a claim under the performance security the Employer shall, in every case, notify the Contractor stating the nature of the default in respect of which the claim is to be made.
<b>Inspection of Site</b>	<b>11.1</b>	<p>The Employer shall have made available to the Contractor, before the submission by the Contractor of the Tender, such data on hydrological and sub-surface conditions as have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works but the Contractor shall be responsible for his own interpretation thereof.</p> <p>The Contractor shall be deemed to have inspected and examined the Site and its surroundings and information available in connection therewith and to have satisfied himself (so far as is practicable, having regard to considerations of cost and time) before submitting his Tender, as to:</p> <ul style="list-style-type: none"> <li>(a) the form and nature thereof, including the sub-surface conditions,</li> <li>(b) the hydrological and climatic conditions,</li> <li>(c) the extent and nature of work and materials necessary for the execution and completion of the Works and the remedying of any defects therein, and</li> <li>(d) the means of access to the Site and the accommodation he may require,</li> </ul> <p>and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Tender.</p> <p>The Contractor shall be deemed to have based his Tender on the data made available by the Employer and on his own inspection and examination, all as aforementioned.</p>
<b>Sufficiency of Tender</b>	<b>12.1</b>	The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except insofar as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, Plant or services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the Works and the remedying of any defects therein.
<b>Not Foreseeable Physical Obstructions or Conditions</b>	<b>12.2</b>	<p>If, however, during the execution of the Works the Contractor encounters physical obstructions or physical conditions, other than climatic conditions on the Site, which obstructions or conditions were, in his opinion, not foreseeable by an experienced contractor, the Contractor shall forthwith give notice thereof to the Engineer, with a copy to the Employer. On receipt of such notice, the Engineer shall, if in his opinion such obstructions or conditions could not have been reasonably foreseen by an experienced contractor, after due consultation with the Employer and the Contractor, determine:</p> <ul style="list-style-type: none"> <li>(a) any extension of time to which the Contractor is entitled under Clause 44, and</li> <li>(b) the amount of any costs which may have been incurred by the Contractor by reason of such obstructions or conditions having been encountered, which shall be added to the Contract Price,</li> </ul> <p>and shall notify the Contractor accordingly, with a copy to the Employer. Such determination shall take account of any instruction which the Engineer may issue to the Contractor in connection therewith, and any proper and reasonable measures acceptable to the Engineer which the Contractor may take in the absence of specific instructions from the Engineer.</p>

<b>Work to be in Accordance with Contract</b>	<b>13.1</b>	Unless it is legally or physically impossible, the Contractor shall execute and complete the Works and remedy any defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions only from the Engineer (or his delegate).
<b>Programme to be Submitted</b>	<b>14.1</b>	The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, submit to the Engineer for his consent a programme, in such form and detail as the Engineer shall reasonably prescribe, for the execution of the Works. The Contractor shall, whenever required by the Engineer, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works.
<b>Revised Programme</b>	<b>14.2</b>	If at any time it should appear to the Engineer that the actual progress of the Works does not conform to the programme to which consent has been given under Sub-Clause 14.1, the Contractor shall produce, at the request of the Engineer, a revised programme showing the modifications to such programme necessary to ensure completion of the Works within the Time for Completion.
<b>Cash Flow Estimate to be Submitted</b>	<b>14.3</b>	The Contractor shall, within the time stated in Part II of these Conditions after the date of the Letter of Acceptance, provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Contractor will be entitled under the Contract and the Contractor shall subsequently supply revised cash flow estimates at quarterly intervals, if required to do so by the Engineer.
<b>Contractor not Relieved of Duties or Responsibilities</b>	<b>14.4</b>	The submission to and consent by the Engineer of such programmes or the provision of such general descriptions or cash flow estimates shall not relieve the Contractor of any of his duties or responsibilities under the Contract.
<b>Contractor's Superintendence</b>	<b>15.1</b>	<p>The Contractor shall provide all necessary superintendence during the execution of the Works and as long thereafter as the Engineer may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorised representative approved of by the Engineer, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorised representative shall receive, on behalf of the Contractor, instructions from the Engineer.</p> <p>If approval of the representative is withdrawn by the Engineer, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.</p>
<b>Contractor's Employees</b>	<b>16.1</b>	<p>The Contractor shall provide on the Site in connection with the execution and completion of the Works and the remedying of any defects therein:</p> <p>(a) only such technical assistants as are skilled and experienced in their respective callings and such foremen and leading hands as are competent to give proper superintendence of the Works, and</p> <p>(b) such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely fulfilling of the Contractor's obligations under the Contract.</p>
<b>Engineer at Liberty to Object</b>	<b>16.2</b>	The Engineer shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person provided by the Contractor who, in the opinion of the Engineer, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose presence on Site is otherwise considered by the Engineer to be undesirable, and such person shall not be again allowed upon the Works without the consent of the Engineer. Any person so removed from the Works shall be replaced as soon as possible.

<b>Setting-out</b>	<p><b>17.1</b> The Contractor shall be responsible for:</p> <ul style="list-style-type: none"> <li>(a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,</li> <li>(b) the correctness, subject as above mentioned, of the position, levels, dimensions and alignment of all parts of the Works, and</li> <li>(c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.</li> </ul> <p>If, at any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer, shall, at his own cost, rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.</p> <p>The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things used in setting-out the Works.</p>
<b>Boreholes and Exploratory Excavation</b>	<p><b>18.1</b> If, at any time during the execution of the Works, the Engineer requires the Contractor to make boreholes or to carry out exploratory excavation, such requirement shall be the subject of an instruction in accordance with Clause 51, unless an item or a Provisional Sum in respect of such work is included in the Bill of Quantities.</p>
<b>Safety, Security and Protection of the Environment</b>	<p><b>19.1</b> The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:</p> <ul style="list-style-type: none"> <li>(a) have full regard for the safety of all persons entitled to be upon the Site and keep the Site (so far as the same is under his control) and the Works (so far as the same are not completed or occupied by the Employer) in an orderly state appropriate to the avoidance of danger to such persons,</li> <li>(b) provide and maintain at his own cost all lights, guards, fencing, warning signs and watching, when and where necessary or required by the Engineer or by any duly constituted authority, for the protection of the Works or for the safety and convenience of the public or others, and</li> <li>(c) take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation.</li> </ul>
<b>Employer's Responsibilities</b>	<p><b>19.2</b> If under Clause 31 the Employer shall carry out work on the Site with his own workmen he shall, in respect of such work:</p> <ul style="list-style-type: none"> <li>(a) have full regard to the safety of all persons entitled to be upon the Site, and</li> <li>(b) keep the Site in an orderly state appropriate to the avoidance of danger to such persons.</li> </ul> <p>If under Clause 31 the Employer shall employ other contractors on the Site he shall require them to have the same regard for safety and avoidance of danger.</p>
<b>Care of Works</b>	<p><b>20.1</b> The Contractor shall take full responsibility for the care of the Works and materials and Plant for incorporation therein from the Commencement Date until the date of issue of the Taking-Over Certificate for the whole of the Works, when the responsibility for the said care shall pass to the Employer. Provided that:</p> <ul style="list-style-type: none"> <li>(a) if the Engineer issues a Taking-Over Certificate for any Section or part of the Permanent Works the Contractor shall cease to be liable for the care of that Section or part from the date of issue of the Taking-Over Certificate, when the responsibility for the care of that Section or part shall pass to the Employer, and</li> </ul>

(b) the Contractor shall take full responsibility for the care of any outstanding Works and materials and Plant for incorporation therein which he undertakes to finish during the Defects Liability Period until such outstanding Works have been completed pursuant to Clause 49.

<b>Responsibility to Rectify Loss or Damage</b>	<b>20.2</b>	If any loss or damage happens to the Works, or any part thereof, or materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Sub-Clause 20.4, the Contractor shall, at his own cost, rectify such loss or damage so that the Permanent Works conform in every respect with the provisions of the Contract to the satisfaction of the Engineer. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49 and 50.
<b>Loss or Damage Due to Employer's Risks</b>	<b>20.3</b>	In the event of any such loss or damage happening from any of the risks defined in Sub-Clause 20.4, or in combination with other risks, the Contractor shall, if and to the extent required by the Engineer, rectify the loss or damage and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer. In the case of a combination of risks causing loss or damage any such determination shall take into account the proportional responsibility of the Contractor and the Employer.
<b>Employer's Risks</b>	<b>20.4</b>	<p>The Employer's risks are:</p> <ul style="list-style-type: none"> <li>(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,</li> <li>(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,</li> <li>(c) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,</li> <li>(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,</li> <li>(e) riot, commotion or disorder, unless solely restricted to employees of the Contractor or of his Subcontractors and arising from the conduct of the Works,</li> <li>(f) loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract,</li> <li>(g) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible, and</li> <li>(h) any operation of the forces of nature against which an experienced contractor could not reasonably have been expected to take precautions.</li> </ul>
<b>Insurance of Works and Contractor's Equipment</b>	<b>21.1</b>	<p>The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 20, insure:</p> <ul style="list-style-type: none"> <li>(a) the Works, together with materials and Plant for incorporation therein, to the full replacement cost (the term "cost" in this context shall include profit),</li> <li>(b) an additional sum of 15 per cent of such replacement cost, or as may be specified in Part II of these Conditions, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature, and</li> <li>(c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.</li> </ul>

<b>Scope of Cover</b>	<b>21.2</b>	<p>The insurance in paragraphs (a) and (b) of Sub-Clause 21.1 shall be in the joint names of the Contractor and the Employer and shall cover:</p> <p>(a) the Employer and the Contractor against all loss or damage from whatsoever cause arising, other than as provided in Sub-Clause 21.4, from the start of work at the Site until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and</p> <p>(b) the Contractor for his liability:</p> <p>(i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Period, and</p> <p>(ii) for loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clauses 49 and 50.</p>
<b>Responsibility for Amounts not Recovered</b>	<b>21.3</b>	<p>Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities under Clause 20.</p>
<b>Exclusions</b>	<b>21.4</b>	<p>There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by:</p> <p>(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,</p> <p>(b) rebellion, revolution, insurrection, or military or usurped power, or civil war,</p> <p>(c) ionising radiations, or contamination by radio-activity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radio-active toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof, or</p> <p>(d) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds.</p>
<b>Damage to Persons and Property</b>	<b>22.1</b>	<p>The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Employer against all losses and claims in respect of:</p> <p>(a) death of or injury to any person, or</p> <p>(b) loss of or damage to any property (other than the Works),</p> <p>which may arise out of or in consequence of the execution and completion of the Works and the remedying of any defects therein, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, subject to the exceptions defined in Sub-Clause 22.2.</p>
<b>Exceptions</b>	<b>22.2</b>	<p>The “exceptions” referred to in Sub-Clause 22.1 are:</p> <p>(a) the permanent use or occupation of land by the Works, or any part thereof,</p> <p>(b) the right of the Employer to execute the Works, or any part thereof, on, over, under, in or through any land,</p> <p>(c) damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract, and</p> <p>(d) death of or injury to persons or loss of or damage to property resulting from any act or neglect of the Employer, his agents, servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto, where the injury or damage was contributed to by the Contractor, his servants or agents, such part of the said injury or damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.</p>

<b>Indemnity by Employer</b>	<b>22.3</b>	The Employer shall indemnify the Contractor against all claims, proceedings, damages, costs, charges and expenses in respect of the matters referred to in the exceptions defined in Sub-Clause 22.2.
<b>Third Party Insurance (including Employer's Property)</b>	<b>23.1</b>	The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause 22, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in Clause 24) or loss of or damage to any property (other than the Works) arising out of the performance of the Contract, other than the exceptions defined in paragraphs (a), (b) and (c) of Sub-Clause 22.2.
<b>Minimum Amount of Insurance</b>	<b>23.2</b>	Such insurance shall be for at least the amount stated in the Appendix to Tender.
<b>Cross Liabilities</b>	<b>23.3</b>	The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insureds.
<b>Accident or Injury to Workmen</b>	<b>24.1</b>	The Employer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any Subcontractor, other than death or injury resulting from any act or default of the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.
<b>Insurance Against Accident to Workmen</b>	<b>24.2</b>	The Contractor shall insure against such liability and shall continue such insurance during the whole of the time that any persons are employed by him on the Works. Provided that, in respect of any persons employed by any Subcontractor, the Contractor's obligations to insure as aforesaid under this Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Employer, when required, such policy of insurance and the receipt for the payment of the current premium.
<b>Evidence and Terms of Insurances</b>	<b>25.1</b>	The Contractor shall provide evidence to the Employer prior to the start of work at the Site that the insurances required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Engineer of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the Employer.
<b>Adequacy of Insurances</b>	<b>25.2</b>	The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of the Contract and shall, when required, produce to the Employer the insurance policies in force and the receipts for payment of the current premiums.
<b>Remedy on Contractor's Failure to Insure</b>	<b>25.3</b>	If the Contractor fails to effect and keep in force any of the insurances required under the Contract, or fails to provide the policies to the Employer within the period required by Sub-Clause 25.1, then and in any such case the Employer may effect and keep in force any such insurances and pay any premium as may be necessary for that purpose and from time to time deduct the amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.
<b>Compliance with Policy Conditions</b>	<b>25.4</b>	In the event that the Contractor or the Employer fails to comply with conditions imposed by the insurance policies effected pursuant to the Contract, each shall indemnify the other against all losses and claims arising from such failure.

**Compliance with  
Statutes,  
Regulations**

**26.1** The Contractor shall conform in all respects, including by the giving of all notices and the paying of all fees, with the provisions of:

(a) any National or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the Works and the remedying of any defects therein, and

(b) the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works,

and the Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such provisions. Provided always that the Employer shall be responsible for obtaining any planning, zoning or other similar permission required for the Works to proceed and shall indemnify the Contractor in accordance with Sub-Clause 22.3.

**Fossils**

**27.1** All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall, as between the Employer and the Contractor, be deemed to be the absolute property of the Employer. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging any such article or thing and shall, immediately upon discovery thereof and before removal, acquaint the Engineer of such discovery and carry out the Engineer's instructions for dealing with the same. If, by reason of such instructions, the Contractor suffers delay and/or incurs costs then the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

**Patent Rights**

**28.1** The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or other protected rights in respect of any Contractor's Equipment, materials or Plant used for or in connection with or for incorporation in the Works and from and against all damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto, except where such infringement results from compliance with the design or Specification provided by the Engineer.

**Royalties**

**28.2** Except where otherwise stated, the Contractor shall pay all tonnage and other royalties, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials required for the Works.

**Interference  
with Traffic  
and Adjoining  
Properties**

**29.1** All operations necessary for the execution and completion of the Works and the remedying of any defects therein shall, so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with:

(a) the convenience of the public, or

(b) the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the Employer or of any other person.

The Contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters insofar as the Contractor is responsible therefor.



<b>Avoidance of Damage to Roads</b>	<b>30.1</b>	The Contractor shall use every reasonable means to prevent any of the roads or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his Subcontractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as will inevitably arise from the moving of materials, Plant, Contractor's Equipment or Temporary Works from and to the Site shall be limited, as far as reasonably possible, and so that no unnecessary damage or injury may be occasioned to such roads and bridges.
<b>Transport of Contractor's Equipment or Temporary Works</b>	<b>30.2</b>	Save insofar as the Contract otherwise provides, the Contractor shall be responsible for and shall pay the cost of strengthening any bridges or altering or improving any road communicating with or on the routes to the Site to facilitate the movement of Contractor's Equipment or Temporary Works and the Contractor shall indemnify and keep indemnified the Employer against all claims for damage to any such road or bridge caused by such movement, including such claims as may be made directly against the Employer, and shall negotiate and pay all claims arising solely out of such damage.
<b>Transport of Materials or Plant</b>	<b>30.3</b>	If, notwithstanding Sub-Clause 30.1, any damage occurs to any bridge or road communicating with or on the routes to the Site arising from the transport of materials or Plant, the Contractor shall notify the Engineer with a copy to the Employer, as soon as he becomes aware of such damage or as soon as he receives any claim from the authority entitled to make such claim. Where under any law or regulation the haulier of such materials or Plant is required to indemnify the road authority against damage the Employer shall not be liable for any costs, charges or expenses in respect thereof or in relation thereto. In other cases the Employer shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto. Provided that if and so far as any such claim or part thereof is, in the opinion of the Engineer, due to any failure on the part of the Contractor to observe and perform his obligations under Sub-Clause 30.1, then the amount, determined by the Engineer, after due consultation with the Employer and the Contractor, to be due to such failure shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided also that the Employer shall notify the Contractor whenever a settlement is to be negotiated and, where any amount may be due from the Contractor, the Employer shall consult with the Contractor before such settlement is agreed.
<b>Waterborne Traffic</b>	<b>30.4</b>	Where the nature of the Works is such as to require the use by the Contractor of waterborne transport the foregoing provisions of this Clause shall be construed as though "road" included a lock, dock, sea wall or other structure related to a waterway and "vehicle" included craft, and shall have effect accordingly.
<b>Opportunities for Other Contractors</b>	<b>31.1</b>	<p>The Contractor shall, in accordance with the requirements of the Engineer, afford all reasonable opportunities for carrying out their work to:</p> <ul style="list-style-type: none"> <li>(a) any other contractors employed by the Employer and their workmen,</li> <li>(b) the workmen of the Employer, and</li> <li>(c) the workmen of any duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the Works.</li> </ul>
<b>Facilities for Other Contractors</b>	<b>31.2</b>	<p>If, however, pursuant to Sub-Clause 31.1 the Contractor shall, on the written request of the Engineer:</p> <ul style="list-style-type: none"> <li>(a) make available to any such other contractor, or to the Employer or any such authority, any roads or ways for the maintenance of which the Contractor is responsible,</li> </ul>

(b) permit the use, by any such, of Temporary Works or Contractor's Equipment on the Site, or

(c) provide any other service of whatsoever nature for any such,

the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.

<b>Contractor to Keep Site Clear</b>	<b>32.1</b>	During the execution of the Works the Contractor shall keep the Site reasonably free from all unnecessary obstruction and shall store or dispose of any Contractor's Equipment and surplus materials and clear away and remove from the Site any wreckage, rubbish or Temporary Works no longer required.
<b>Clearance of Site on Completion</b>	<b>33.1</b>	Upon the issue of any Taking-Over Certificate the Contractor shall clear away and remove from that part of the Site to which such Taking-Over Certificate relates all Contractor's Equipment, surplus material, rubbish and Temporary Works of every kind, and leave such part of the Site and Works clean and in a workmanlike condition to the satisfaction of the Engineer. Provided that the Contractor shall be entitled to retain on Site, until the end of the Defects Liability Period, such materials, Contractor's Equipment and Temporary Works as are required by him for the purpose of fulfilling his obligations during the Defects Liability Period.

## Labour

<b>Engagement of Staff and Labour</b>	<b>34.1</b>	The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.
<b>Returns of Labour and Contractor's Equipment</b>	<b>35.1</b>	The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the Site and such information respecting Contractor's Equipment as the Engineer may require.

## Materials, Plant and Workmanship

<b>Quality of Materials, Plant and Workmanship</b>	<b>36.1</b>	<p>All materials, Plant and workmanship shall be :</p> <p>(a) of the respective kinds described in the Contract and in accordance with the Engineer's instructions, and</p> <p>(b) subjected from time to time to such tests as the Engineer may require at the place of manufacture, fabrication or preparation, or on the Site or at such other place or places as may be specified in the Contract, or at all or any of such places.</p> <p>The Contractor shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or Plant and shall supply samples of materials, before incorporation in the Works, for testing as may be selected and required by the Engineer.</p>
<b>Cost of Samples</b>	<b>36.2</b>	All samples shall be supplied by the Contractor at his own cost if the supply thereof is clearly intended by or provided for in the Contract.
<b>Cost of Tests</b>	<b>36.3</b>	<p>The cost of making any test shall be borne by the Contractor if such test is :</p> <p>(a) clearly intended by or provided for in the Contract, or</p> <p>(b) particularised in the Contract (in cases only of a test under load or of a test to ascertain whether the design of any finished or partially finished work is appropriate for the purposes which it was intended to fulfil) in sufficient detail to enable the Contractor to price or allow for the same in his Tender.</p>

<b>Cost of Tests not Provided for</b>	<b>36.4</b>	<p>If any test required by the Engineer which is:</p> <p>(a) not so intended by or provided for,</p> <p>(b) (in the cases above mentioned) not so particularised, or</p> <p>(c) (though so intended or provided for) required by the Engineer to be carried out at any place other than the Site or the place of manufacture, fabrication or preparation of the materials or Plant tested,</p> <p>shows the materials, Plant or workmanship not to be in accordance with the provisions of the Contract to the satisfaction of the Engineer, then the cost of such test shall be borne by the Contractor, but in any other case Sub-Clause 36.5 shall apply.</p>
<b>Engineer's Determination where Tests not Provided for</b>	<b>36.5</b>	<p>Where, pursuant to Sub-Clause 36.4, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:</p> <p>(a) any extension of time to which the Contractor is entitled under Clause 44, and</p> <p>(b) the amount of such costs, which shall be added to the Contract Price,</p> <p>and shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Inspection of Operations</b>	<b>37.1</b>	<p>The Engineer, and any person authorised by him, shall at all reasonable times have access to the Site and to all workshops and places where materials or Plant are being manufactured, fabricated or prepared for the Works and the Contractor shall afford every facility for and every assistance in obtaining the right to such access.</p>
<b>Inspection and Testing</b>	<b>37.2</b>	<p>The Engineer shall be entitled, during manufacture, fabrication or preparation to inspect and test the materials and Plant to be supplied under the Contract. If materials or Plant are being manufactured, fabricated or prepared in workshops or places other than those of the Contractor, the Contractor shall obtain permission for the Engineer to carry out such inspection and testing in those workshops or places. Such inspection or testing shall not release the Contractor from any obligation under the Contract.</p>
<b>Dates for Inspection and Testing</b>	<b>37.3</b>	<p>The Contractor shall agree with the Engineer on the time and place for the inspection or testing of any materials or Plant as provided in the Contract. The Engineer shall give the Contractor not less than 24 hours notice of his intention to carry out the inspection or to attend the tests. If the Engineer, or his duly authorised representative, does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Engineer, proceed with the tests, which shall be deemed to have been made in the presence of the Engineer. The Contractor shall forthwith forward to the Engineer duly certified copies of the test readings. If the Engineer has not attended the tests, he shall accept the said readings as accurate.</p>
<b>Rejection</b>	<b>37.4</b>	<p>If, at the time and place agreed in accordance with Sub-Clause 37.3, the materials or Plant are not ready for inspection or testing or if, as a result of the inspection or testing referred to in this Clause, the Engineer determines that the materials or Plant are defective or otherwise not in accordance with the Contract, he may reject the materials or Plant and shall notify the Contractor thereof immediately. The notice shall state the Engineer's objections with reasons. The Contractor shall then promptly make good the defect or ensure that rejected materials or Plant comply with the Contract. If the Engineer so requests, the tests of rejected materials or Plant shall be made or repeated under the same terms and conditions. All costs incurred by the Employer by the repetition of the tests shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer and may be deducted from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.</p>

<b>Independent Inspection</b>	<b>37.5</b>	The Engineer may delegate inspection and testing of materials or Plant to an independent inspector. Any such delegation shall be effected in accordance with Sub-Clause 2.4 and for this purpose such independent inspector shall be considered as an assistant of the Engineer. Notice of such appointment (not being less than 14 days) shall be given by the Engineer to the Contractor.
<b>Examination of Work before Covering up</b>	<b>38.1</b>	No part of the Works shall be covered up or put out of view without the approval of the Engineer and the Contractor shall afford full opportunity for the Engineer to examine and measure any such part of the Works which is about to be covered up or put out of view and to examine foundations before any part of the Works is placed thereon. The Contractor shall give notice to the Engineer whenever any such part of the Works or foundations is or are ready or about to be ready for examination and the Engineer shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such part of the Works or of examining such foundations.
<b>Uncovering and Making Openings</b>	<b>38.2</b>	The Contractor shall uncover any part of the Works or make openings in or through the same as the Engineer may from time to time instruct and shall reinstate and make good such part. If any such part has been covered up or put out of view after compliance with the requirement of Sub-Clause 38.1 and is found to be executed in accordance with the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of the Contractor's costs in respect of such of uncovering, making openings in or through, reinstating and making good the same, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer. In any other case all costs shall be borne by the Contractor.
<b>Removal of Improper Work, Materials or Plant</b>	<b>39.1</b>	<p>The Engineer shall have authority to issue instructions from time to time, for:</p> <p>(a) the removal from the Site, within such time or times as may be specified in the instruction, of any materials or Plant which, in the opinion of the Engineer, are not in accordance with the Contract,</p> <p>(b) the substitution of proper and suitable materials or Plant, and</p> <p>(c) the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which, in respect of</p> <p style="padding-left: 40px;">(i) materials, Plant or workmanship, or</p> <p style="padding-left: 40px;">(ii) design by the Contractor or for which he is responsible,</p> <p>is not, in the opinion of the Engineer, in accordance with the Contract.</p>
<b>Default of Contractor in Compliance</b>	<b>39.2</b>	In case of default on the part of the Contractor in carrying out such instruction within the time specified therein or, if none, within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

## Suspension

<b>Suspension of Work</b>	<b>40. 1</b>	<p>The Contractor shall, on the instructions of the Engineer, suspend the progress of the Works or any part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such suspension, properly protect and secure the Works or such part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is:</p> <p>(a) otherwise provided for in the Contract,</p> <p>(b) necessary by reason of some default of or breach of contract by the Contractor or for which he is responsible,</p>
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(c) necessary by reason of climatic conditions on the Site, or

(d) necessary for the proper execution of the Works or for the safety of the Works or any part thereof (save to the extent that such necessity arises from any act or default by the Engineer or the Employer or from any of the risks defined in Sub-Clause 20.4),

Sub-Clause 40.2 shall apply.

**Engineer's  
Determination  
following  
Suspension**

**40.2** Where, pursuant to Sub-Clause 40.1, this Sub-Clause applies the Engineer shall, after due consultation with the Employer and the Contractor, determine:

(a) any extension of time to which the Contractor is entitled under Clause 44, and

(b) the amount, which shall be added to the Contract Price, in respect of the cost incurred by the Contractor by reason of such suspension,

and shall notify the Contractor accordingly, with a copy to the Employer.

**Suspension  
lasting more  
than 84 Days**

**40.3** If the progress of the Works or any part thereof is suspended on the instructions of the Engineer and if permission to resume work is not given by the Engineer within a period of 84 days from the date of suspension then, unless such suspension is within paragraph (a), (b), (c) or (d) of Sub-Clause 40.1, the Contractor may give notice to the Engineer requiring permission, within 28 days from the receipt thereof, to proceed with the Works or that part thereof in regard to which progress is suspended. If, within the said time, such permission is not granted, the Contractor may, but is not bound to, elect to treat the suspension, where it affects part only of the Works, as an omission of such part under Clause 51 by giving a further notice to the Engineer to that effect, or, where it affects the whole of the Works, treat the suspension as an event of default by the Employer and terminate his employment under the Contract in accordance with the provisions of Sub-Clause 69.1, whereupon the provisions of Sub-Clauses 69.2 and 69.3 shall apply.

## **Commencement and Delays**

**Commencement  
of Works**

**41.1** The Contractor shall commence the Works as soon as is reasonably possible after the receipt by him of a notice to this effect from the Engineer, which notice shall be issued within the time stated in the Appendix to Tender after the date of the Letter of Acceptance. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

**Possession of  
Site and Access  
Thereto**

**42.1** Save insofar as the Contract may prescribe:

(a) the extent of portions of the Site of which the Contractor is to be given possession from time to time,

(b) the order in which such portions shall be made available to the Contractor,

and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's notice to commence the Works, give to the Contractor possession of

(c) so much of the Site, and

(d) such access as, in accordance with the Contract, is to be provided by the Employer as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause 14, if any, and otherwise in accordance with such reasonable proposals as the Contractor shall, by notice to the Engineer with a copy to the Employer, make. The Employer will, from time to time as the Works proceed, give to the Contractor possession of such further portions of the Site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with such programme or proposals, as the case may be.

<b>Failure to Give Possession</b>	<b>42.2</b>	<p>If the Contractor suffers delay and/or incurs costs from failure on the part of the Employer to give possession in accordance with the terms of Sub-Clause 42. 1, the Engineer shall, after due consultation with the Employer and the Contractor, determine:</p> <p>(a) any extension of time to which the Contractor is entitled under Clause 44, and</p> <p>(b) the amount of such costs, which shall be added to the Contract Price, and shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Rights of Way and Facilities</b>	<b>42.3</b>	<p>The Contractor shall bear all costs and charges for special or temporary rights of way required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works.</p>
<b>Time for Completion</b>	<b>43.1</b>	<p>The whole of the Works and, if applicable, any Section required to be completed within a particular time as stated in the Appendix to Tender, shall be completed, in accordance with the provisions of Clause 48, within the time stated in the Appendix to Tender for the whole of the Works or the Section (as the case may be), calculated from the Commencement Date, or such extended time as may be allowed under Clause 44.</p>
<b>Extension of Time for Completion</b>	<b>44.1</b>	<p>In the event of:</p> <p>(a) the amount or nature of extra or additional work,</p> <p>(b) any cause of delay referred to in these Conditions,</p> <p>(c) exceptionally adverse climatic conditions,</p> <p>(d) any delay, impediment or prevention by the Employer, or</p> <p>(e) other special circumstances which may occur, other than through a default of or breach of contract by the Contractor or for which he is responsible,</p> <p>being such as fairly to entitle the Contractor to an extension of the Time for Completion of the Works, or any Section or part thereof, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of such extension and shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Contractor to Provide Notification and Detailed Particulars</b>	<b>44.2</b>	<p>Provided that the Engineer is not bound to make any determination unless the Contractor has</p> <p>(a) within 28 days after such event has first arisen notified the Engineer with a copy to the Employer, and</p> <p>(b) within 28 days, or such other reasonable time as may be agreed by the Engineer, after such notification submitted to the Engineer detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.</p>
<b>Interim Determination of Extension</b>	<b>44.3</b>	<p>Provided also that where an event has a continuing effect such that it is not practicable for the Contractor to submit detailed particulars within the period of 28 days referred to in Sub-Clause 44.2(b), he shall nevertheless be entitled to an extension of time provided that he has submitted to the Engineer interim particulars at intervals of not more than 28 days and final particulars within 28 days of the end of the effects resulting from the event. On receipt of such interim particulars, the Engineer shall, without undue delay, make an interim determination of extension of time and, on receipt of the final particulars, the Engineer shall review all the circumstances and shall determine an overall extension of time in regard to the event. In both such cases the Engineer shall make his determination after due consultation with the Employer and the Contractor and shall notify the Contractor of the determination, with a copy to the Employer. No final review shall result in a decrease of any extension of time already determined by the Engineer.</p>

<b>Restriction on Working Hours</b>	<b>45.1</b>	Subject to any provision to the contrary contained in the Contract, none of the Works shall, save as hereinafter provided, be carried on during the night or on locally recognised days of rest without the consent of the Engineer, except when work is unavoidable or absolutely necessary for the saving of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer. Provided that the provisions of this Clause shall not be applicable in the case of any work which it is customary to carry out by multiple shifts.
<b>Rate of Progress</b>	<b>46.1</b>	If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works or any Section is at any time, in the opinion of the Engineer, too slow to comply with the Time for Completion, the Engineer shall so notify the Contractor who shall thereupon take such steps as are necessary, subject to the consent of the Engineer, to expedite progress so as to comply with the Time for Completion. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the Contractor considers that it is necessary to do any work at night or on locally recognised days of rest, he shall be entitled to seek the consent of the Engineer so to do. Provided that if any steps, taken by the Contractor in meeting his obligations under this Clause, involve the Employer in additional supervision costs, such costs shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.
<b>Liquidated Damages for Delay</b>	<b>47.1</b>	If the Contractor fails to comply with the Time for Completion in accordance with Clause 48, for the whole of the Works or, if applicable, any Section within the relevant time prescribed by Clause 43, then the Contractor shall pay to the Employer the relevant sum stated in the Appendix to Tender as liquidated damages for such default and not as a penalty (which sum shall be the only monies due from the Contractor for such default) for every day or part of a day which shall elapse between the relevant Time for Completion and the date stated in a Taking-Over Certificate of the whole of the Works or the relevant Section, subject to the applicable limit stated in the Appendix to Tender. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies due or to become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.
<b>Reduction of Liquidated Damages</b>	<b>47.2</b>	If, before the Time for Completion of the whole of the Works or, if applicable, any Section, a Taking-Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-Clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

**Taking-Over Certificate**      **48.1**      When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer, with a copy to the Employer, accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking-Over Certificate in respect of the Works. The Engineer shall, within 21 days of the date of delivery of such notice, either issue to the Contractor, with a copy to the Employer, a Taking-Over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work which, in the Engineer's opinion, is required to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Taking-Over Certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

**Taking Over of Sections or Parts**      **48.2**      Similarly, in accordance with the procedure set out in Sub-Clause 48.1, the Contractor may request and the Engineer shall issue a Taking-Over Certificate in respect of:

(a) any Section in respect of which a separate Time for Completion is provided in the Appendix to Tender,

(b) any substantial part of the Permanent Works which has been both completed to the satisfaction of the Engineer and, otherwise than as provided for in the Contract, occupied or used by the Employer, or

(c) any part of the Permanent Works which the Employer has elected to occupy or use prior to completion (where such prior occupation or use is not provided for in the Contract or has not been agreed by the Contractor as a temporary measure).

**Substantial Completion of Parts**      **48.3**      If any part of the Permanent Works has been substantially completed and has satisfactorily passed any Tests on Completion prescribed by the Contract, the Engineer may issue a Taking-Over Certificate in respect of that part of the Permanent Works before completion of the whole of the Works and, upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of the Permanent Works during the Defects Liability Period.

**Surfaces Requiring Reinstatement**      **48.4**      Provided that a Taking-Over Certificate given in respect of any Section or part of the Permanent Works before completion of the whole of the Works shall not be deemed to certify completion of any ground or surfaces requiring reinstatement, unless such Taking-Over Certificate shall expressly so state.

## Defects Liability

**Defects Liability Period**      **49.1**      In these Conditions the expression "Defects Liability Period" shall mean the defects liability period named in the Appendix to Tender, calculated from:

(a) the date of completion of the Works certified by the Engineer in accordance with Clause 48, or

(b) in the event of more than one certificate having been issued by the Engineer under Clause 48, the respective dates so certified,

and in relation to the Defects Liability Period the expression "the Works" shall be construed accordingly.



<b>Completion of Outstanding Work and Remedying Defects</b>	<b>49.2</b>	<p>To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period, be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall:</p> <p>(a) complete the work, if any, outstanding on the date stated in the Taking-Over Certificate as soon as practicable after such date, and</p> <p>(b) execute all such work of amendment, reconstruction, and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration, instruct the Contractor to execute.</p>
<b>Cost of Remedying Defects</b>	<b>49.3</b>	<p>All work referred to in Sub-Clause 49.2 (b) shall be executed by the Contractor at his own cost if the necessity thereof is, in the opinion of the Engineer, due to:</p> <p>(a) the use of materials, Plant or workmanship not in accordance with the Contract,</p> <p>(b) where the Contractor is responsible for the design of part of the Permanent Works, any fault in such design, or</p> <p>(c) the neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the Contract.</p> <p>If, in the opinion of the Engineer, such necessity is due to any other cause, he shall determine an addition to the Contract Price in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Contractor's Failure to Carry Out Instructions</b>	<b>49.4</b>	<p>In case of default on the part of the Contractor in carrying out such instruction within a reasonable time, the Employer shall be entitled to employ and pay other persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.</p>
<b>Contractor to Search</b>	<b>50.1</b>	<p>If any defect, shrinkage or other fault in the Works appears at any time prior to the end of the Defects Liability Period, the Engineer may instruct the Contractor, with copy to the Employer, to search under the directions of the Engineer for the cause thereof. Unless such defect, shrinkage or other fault is one for which the Contractor is liable under the Contract, the Engineer shall, after due consultation with the Employer and the Contractor, determine the amount in respect of the costs of such search incurred by the Contractor, which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer. If such defect, shrinkage or other fault is one for which the Contractor is liable, the cost of the work carried out in searching as aforesaid shall be borne by the Contractor and he shall in such case remedy such defect, shrinkage or other fault at his own cost in accordance with the provisions of Clause 49.</p>

## Alterations, Additions and Omissions

<b>Variations</b>	<b>51.1</b>	<p>The Engineer shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:</p> <p>(a) increase or decrease the quantity of any work included in the Contract,</p> <p>(b) omit any such work (but not if the omitted work is to be carried out by the Employer or by another contractor),</p>
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- (c) change the character or quality or kind of any such work,
- (d) change the levels, lines, position and dimensions of any part of the Works,
- (e) execute additional work of any kind necessary for the completion of the Works, or
- (f) change any specified sequence or timing of construction of any part of the Works.

No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with Clause 52. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

<b>Instructions for Variations</b>	<b>51.2</b>	The Contractor shall not make any such variation without an instruction of the Engineer. Provided that no instruction shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an instruction given under this Clause, but is the result of the quantities exceeding or being less than those stated in the Bill of Quantities.
<b>Valuation of Variations</b>	<b>52.1</b>	All variations referred to in Clause 51 and any additions to the Contract Price which are required to be determined in accordance with Clause 52 (for the purposes of this Clause referred to as "varied work"), shall be valued at the rates and prices set out in the Contract if, in the opinion of the Engineer, the same shall be applicable. If the Contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as the basis for valuation so far as may be reasonable, failing which, after due consultation by the Engineer with the Employer and the Contractor, suitable rates or prices shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such rates or prices as are, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.
<b>Power of Engineer to Fix Rates</b>	<b>52.2</b>	<p>Provided that if the nature or amount of any varied work relative to the nature or amount of the whole of the Works or to any part thereof, is such that, in the opinion of the Engineer, the rate or price contained in the Contract for any item of the Works is, by reason of such varied work, rendered inappropriate or inapplicable, then, after due consultation by the Engineer with the Employer and the Contractor, a suitable rate or price shall be agreed upon between the Engineer and the Contractor. In the event of disagreement the Engineer shall fix such other rate or price as is, in his opinion, appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on-account payments to be included in certificates issued in accordance with Clause 60.</p> <p>Provided also that no varied work instructed to be done by the Engineer pursuant to Clause 51 shall be valued under Sub-Clause 52.1 or under this Sub-Clause unless, within 14 days of the date of such instruction and, other than in the case of omitted work, before the commencement of the varied work, notice shall have been given either:</p> <ul style="list-style-type: none"> <li>(a) by the Contractor to the Engineer of his intention to claim extra payment or a varied rate or price, or</li> <li>(b) by the Engineer to the Contractor of his intention to vary a rate or price.</li> </ul>
<b>Variations Exceeding 15 per cent</b>	<b>52.3</b>	<p>If, on the issue of the Taking-Over Certificate for the whole of the Works, it is found that as a result of:</p> <ul style="list-style-type: none"> <li>(a) all varied work valued under Sub-Clauses 52.1 and 52.2, and</li> </ul>

(b) all adjustments upon measurement of the estimated quantities set out in the Bill of Quantities, excluding Provisional Sums, dayworks and adjustments of price made under Clause 70,

but not from any other cause, there have been additions to or deductions from the Contract Price which taken together are in excess of 15 per cent of the "Effective Contract Price" (which for the purposes of this Sub-Clause shall mean the Contract Price, excluding Provisional Sums and allowance for dayworks, if any) then and in such event (subject to any action already taken under any other Sub-Clause of this Clause), after due consultation by the Engineer with the Employer and the Contractor, there shall be added to or deducted from the Contract Price such further sum as may be agreed between the Contractor and the Engineer or, failing agreement, determined by the Engineer having regard to the Contractor's Site and general overhead costs of the Contract. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer. Such sum shall be based only on the amount by which such additions or deductions shall be in excess of 15 per cent of the Effective Contract Price.

**Daywork 52.4** The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on a daywork basis. The Contractor shall then be paid for such varied work under the terms set out in the daywork schedule included in the Contract and at the rates and prices affixed thereto by him in the Tender.

The Contractor shall furnish to the Engineer such receipts or other vouchers as may be necessary to prove the amounts paid and, before ordering materials, shall submit to the Engineer quotations for the same for his approval.

In respect of such of the Works executed on a daywork basis, the Contractor shall, during the continuance of such work, deliver each day to the Engineer an exact list in duplicate of the names, occupation and time of all workmen employed on such work and a statement, also in duplicate, showing the description and quantity of all materials and Contractor's Equipment used thereon or therefor other than Contractor's Equipment which is included in the percentage addition in accordance with such daywork schedule. One copy of each list and statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor.

At the end of each month the Contractor shall deliver to the Engineer a priced statement of the labour, materials and Contractor's Equipment, except as aforesaid, used and the Contractor shall not be entitled to any payment unless such lists and statements have been fully and punctually rendered. Provided always that if the Engineer considers that for any reason the sending of such lists or statements by the Contractor, in accordance with the foregoing provision, was impracticable he shall nevertheless be entitled to authorise payment for such work, either as daywork, on being satisfied as to the time employed and the labour, materials and Contractor's Equipment used on such work, or at such value therefor as shall, in his opinion, be fair and reasonable.

## Procedure for Claims

**Notice of Claims 53.1** Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of these Conditions or otherwise, he shall give notice of his intention to the Engineer, with a copy to the Employer, within 28 days after the event giving rise to the claim has first arisen.

**Contemporary Records 53.2** Upon the happening of the event referred to in Sub-Clause 53.1, the Contractor shall keep such contemporary records as may reasonably be necessary to support any claim he may subsequently wish to make. Without necessarily admitting the Employer's liability, the Engineer shall, on receipt of a notice under Sub-Clause 53.1, inspect such contemporary records and may instruct the Contractor to keep

any further contemporary records as are reasonable and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this Sub-Clause and shall supply him with copies thereof as and when the Engineer so instructs.

<b>Substantiation of Claims</b>	<b>53.3</b>	Within 28 days, or such other reasonable time as may be agreed by the Engineer, of giving notice under Sub-Clause 53.1, the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further grounds upon which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event. The Contractor shall, if required by the Engineer so to do, copy to the Employer all accounts sent to the Engineer pursuant to this Sub-Clause.
<b>Failure to Comply</b>	<b>53.4</b>	If the Contractor fails to comply with any of the provisions of this Clause in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to Sub-Clause 67.3 assessing the claim considers to be verified by contemporary records (whether or not such records were brought to the Engineer's notice as required under Sub-Clauses 53.2 and 53.3).
<b>Payment of Claims</b>	<b>53.5</b>	The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to Clause 60 such amount in respect of any claim as the Engineer, after due consultation with the Employer and the Contractor, may consider due to the Contractor provided that the Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.

## Contractor's Equipment, Temporary Works and Materials

<b>Contractor's Equipment, Temporary Works and Materials; Exclusive Use for the Works</b>	<b>54.1</b>	All Contractor's Equipment, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Works and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent of the Engineer. Provided that consent shall not be required for vehicles engaged in transporting any staff, labour, Contractor's Equipment, Temporary Works, Plant or materials to or from the Site.
<b>Employer not Liable for Damage</b>	<b>54.2</b>	The Employer shall not at any time be liable, save as mentioned in Clauses 20 and 65, for the loss of or damage to any of the said Contractor's Equipment, Temporary Works or materials.
<b>Customs Clearance</b>	<b>54.3</b>	The Employer will use his best endeavours in assisting the Contractor, where required, in obtaining clearance through the Customs of Contractor's Equipment, materials and other things required for the Works.
<b>Re-export of Contractor's Equipment</b>	<b>54.4</b>	In respect of any Contractor's Equipment which the Contractor has imported for the purposes of the Works, the Employer will use his best endeavours to assist the Contractor, where required, in procuring any necessary Government consent to the re-export of such Contractor's Equipment by the Contractor upon the removal thereof pursuant to the terms of the Contract.

<b>Conditions of Hire of Contractor's Equipment</b>	<b>54.5</b>	With a view to securing, in the event of termination under Clause 63, the continued availability, for the purpose of executing the Works, of any hired Contractor's Equipment, the Contractor shall not bring on to the Site any hired Contractor's Equipment unless there is an agreement for the hire thereof (which agreement shall be deemed not to include an agreement for hire purchase) which contains a provision that the owner thereof will, on request in writing made by the Employer within 7 days after the date on which any termination has become effective, and on the Employer undertaking to pay all hire charges in respect thereof from such date, hire such Contractor's Equipment to the Employer on the same terms in all respects as the same was hired to the Contractor save that the Employer shall be entitled to permit the use thereof by any other contractor employed by him for the purpose of executing and completing the Works and remedying any defects therein, under the terms of the said Clause 63.
<b>Costs for the Purpose of Clause 63</b>	<b>54.6</b>	In the event of the Employer entering into any agreement for the hire of Contractor's Equipment pursuant to Sub-Clause 54.5, all sums properly paid by the Employer under the provisions of any such agreement and all costs incurred by him (including stamp duties) in entering into such agreement shall be deemed, for the purpose of Clause 63, to be part of the cost of executing and completing the Works and the remedying of any defects therein.
<b>Incorporation of Clause in Subcontracts</b>	<b>54.7</b>	The Contractor shall, where entering into any subcontract for the execution of any part of the Works, incorporate in such subcontract (by reference or otherwise) the provisions of this Clause in relation to Contractor's Equipment, Temporary Works or materials brought on to the Site by the Subcontractor.
<b>Approval of Materials not Implied</b>	<b>54.8</b>	The operation of this Clause shall not be deemed to imply any approval by the Engineer of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer.

## Measurement

<b>Quantities</b>	<b>55.1</b>	The quantities set out in the Bill of Quantities are the estimated quantities for the Works, and they are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfilment of his obligations under the Contract.
<b>Works to be Measured</b>	<b>56.1</b>	The Engineer shall, except as otherwise stated, ascertain and determine by measurement the value of the Works in accordance with the Contract and the Contractor shall be paid that value in accordance with Clause 60. The Engineer shall, when he requires any part of the Works to be measured, give reasonable notice to the Contractor's authorised agent, who shall:

(a) forthwith attend or send a qualified representative to assist the Engineer in making such measurement, and

(b) supply all particulars required by the Engineer.

Should the Contractor not attend, or neglect or omit to send such representative, then the measurement made by the Engineer or approved by him shall be taken to be the correct measurement of such part of the Works. For the purpose of measuring such Permanent Works as are to be measured by records and drawings, the Engineer shall prepare records and drawings as the work proceeds and the Contractor, as and when called upon to do so in writing, shall, within 14 days, attend to examine and agree such records and drawings with the Engineer and shall sign the same when so agreed. If the Contractor does not attend to examine and agree such records and drawings, they shall be taken to be correct. If, after examination of such records and drawings, the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor, within 14 days of such examination, lodges with the Engineer notice of the respects in which such records and drawings are claimed by him to be incorrect. On receipt of such notice, the Engineer shall review the records and drawings and either confirm or vary them.

<b>Method of Measurement</b>	<b>57.1</b>	The Works shall be measured net, notwithstanding any general or local custom, except where otherwise provided for in the Contract.
<b>Breakdown of Lump Sum Items</b>	<b>57.2</b>	For the purposes of statements submitted in accordance with Sub-Clause 60.1, the Contractor shall submit to the Engineer, within 28 days after the receipt of the Letter of Acceptance, a breakdown for each of the lump sum items contained in the Tender. Such breakdowns shall be subject to the approval of the Engineer.

## Provisional Sums

<b>Definition of "Provisional Sum"</b>	<b>58.1</b>	"Provisional Sum" means a sum included in the Contract and so designated in the Bill of Quantities for the execution of any part of the Works or for the supply of goods, materials, Plant or services, or for contingencies, which sum may be used, in whole or in part, or not at all, on the instructions of the Engineer. The Contractor shall be entitled to only such amounts in respect of the work, supply or contingencies to which such Provisional Sums relate as the Engineer shall determine in accordance with this Clause. The Engineer shall notify the Contractor of any determination made under this Sub-Clause, with a copy to the Employer.
<b>Use of Provisional Sums</b>	<b>58.2</b>	<p>In respect of every Provisional Sum the Engineer shall have authority to issue instructions for the execution of work or for the supply of goods, materials, Plant or services by:</p> <p>(a) the Contractor, in which case the Contractor shall be entitled to an amount equal to the value thereof determined in accordance with Clause 52, and</p> <p>(b) a nominated Subcontractor, as hereinafter defined, in which case the sum to be paid to the Contractor therefor shall be determined and paid in accordance with Sub-Clause 59.4.</p>
<b>Production of Vouchers</b>	<b>58.3</b>	The Contractor shall produce to the Engineer all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of Provisional Sums, except where work is valued in accordance with rates or prices set out in the Tender.

## Nominated Subcontractors

<b>Definition of "Nominated Subcontractors"</b>	<b>59.1</b>	All specialists, merchants, tradesmen and others executing any work or supplying any goods, materials, Plant or services for which Provisional Sums are included in the Contract, who may have been or be nominated or selected or approved by the Employer or the Engineer, and all persons to whom by virtue of the provisions of the Contract the Contractor is required to subcontract shall, in the execution of such work or the supply of such goods, materials, Plant or services, be deemed to be subcontractors to the Contractor and are referred to in this Contract as "nominated Subcontractors".
<b>Nominated Subcontractors; Objection to Nomination</b>	<b>59.2</b>	<p>The Contractor shall not be required by the Employer or the Engineer, or be deemed to be under any obligation, to employ any nominated Subcontractor against whom the Contractor may raise reasonable objection, or who declines to enter into a subcontract with the Contractor containing provisions:</p> <p>(a) that in respect of the work, goods, materials, Plant or services the subject of the subcontract, the nominated Subcontractor will undertake towards the Contractor such obligations and liabilities as will enable the Contractor to discharge his own obligations and liabilities towards the Employer under the terms of the Contract and will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities, and</p>

(b) that the nominated Subcontractor will save harmless and indemnify the Contractor from and against any negligence by the nominated Subcontractor, his agents, workmen and servants and from and against any misuse by him or them of any Temporary Works provided by the Contractor for the purposes of the Contract and from all claims as aforesaid.

**Design  
Requirements  
to be Expressly  
Stated**

**59.3** If in connection with any Provisional Sum the services to be provided include any matter of design or specification of any part of the Permanent Works or of any Plant to be incorporated therein, such requirement shall be expressly stated in the Contract and shall be included in any nominated Subcontract. The nominated Subcontract shall specify that the nominated Subcontractor providing such services will save harmless and indemnify the Contractor from and against the same and from all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities.

**Payments to  
Nominated  
Subcontractors**

**59.4** For all work executed or goods, materials, Plant or services supplied by any nominated Subcontractor, the Contractor shall be entitled to:

(a) the actual price paid or due to be paid by the Contractor, on the instructions of the Engineer, and in accordance with the subcontract;

(b) in respect of labour supplied by the Contractor, the sum, if any, entered in the Bill of Quantities or, if instructed by the Engineer pursuant to paragraph (a) of Sub-Clause 58.2, as may be determined in accordance with Clause 52; and

(c) in respect of all other charges and profit, a sum being a percentage rate of the actual price paid or due to be paid calculated, where provision has been made in the Bill of Quantities for a rate to be set against the relevant Provisional Sum, at the rate inserted by the Contractor against that item or, where no such provision has been made, at the rate inserted by the Contractor in the Appendix to Tender and repeated where provision for such is made in a special item provided in the Bill of Quantities for such purpose.

**Certification of  
Payments to  
Nominated  
Subcontractors**

**59.5** Before issuing, under Clause 60, any certificate, which includes any payment in respect of work done or goods, materials, Plant or services supplied by any nominated Subcontractor, the Engineer shall be entitled to demand from the Contractor reasonable proof that all payments, less retentions, included in previous certificates in respect of the work or goods, materials, Plant or services of such nominated Subcontractor have been paid or discharged by the Contractor. If the Contractor fails to supply such proof then, unless the Contractor:

(a) satisfies the Engineer in writing that he has reasonable cause for withholding or refusing to make such payments, and

(b) produces to the Engineer reasonable proof that he has so informed such nominated Subcontractor in writing,

the Employer shall be entitled to pay to such nominated Subcontractor direct, upon the certificate of the Engineer, all payments, less retentions, provided for in the nominated Subcontract, which the Contractor has failed to make to such nominated Subcontractor and to deduct by way of set-off the amount so paid by the Employer from any sums due or to become due from the Employer to the Contractor.

Provided that, where the Engineer has certified and the Employer has paid direct as aforesaid, the Engineer shall, in issuing any further certificate in favour of the Contractor, deduct from the amount thereof the amount so paid, direct as aforesaid, but shall not withhold or delay the issue of the certificate itself when due to be issued under the terms of the Contract.

## Certificates and Payment

### Monthly Statements

**60.1** The Contractor shall submit to the Engineer after the end of each month six copies, each signed by the Contractor's representative approved by the Engineer in accordance with Sub-Clause 15.1, of a statement, in such form as the Engineer may from time to time prescribe, showing the amounts to which the Contractor considers himself to be entitled up to the end of the month in respect of:

- (a) the value of the Permanent Works executed,
- (b) any other items in the Bill of Quantities including those for Contractor's Equipment, Temporary Works, dayworks and the like,
- (c) the percentage of the invoice value of listed materials, all as stated in the Appendix to Tender, and Plant delivered by the Contractor on the Site for incorporation in the Permanent Works but not incorporated in such Works,
- (d) adjustments under Clause 70, and
- (e) any other sum to which the Contractor may be entitled under the Contract or otherwise.

### Monthly Payments

**60.2** The Engineer shall, within 28 days of receiving such statement, deliver to the Employer an Interim Payment Certificate stating the amount of payment to the Contractor which the Engineer considers due and payable in respect of such statement, subject:

(a) firstly, to the retention of the amount calculated by applying the Percentage of Retention stated in the Appendix to Tender, to the amount to which the Contractor is entitled under paragraphs (a), (b), (c) and (e) of Sub-Clause 60.1 until the amount so retained reaches the Limit of Retention Money stated in the Appendix to Tender, and

(b) secondly, to the deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer.

Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retentions and deductions, would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract no amount will be certified by the Engineer for payment until the performance security, if required under the Contract, has been provided by the Contractor and approved by the Employer.

### Payment of Retention Money

**60.3** (a) Upon the issue of the Taking-Over Certificate with respect to the whole of the Works, one half of the Retention Money, or upon the issue of a Taking-Over Certificate with respect to a Section or part of the Permanent Works only such proportion thereof as the Engineer determines having regard to the relative value of such Section or part of the Permanent Works, shall be certified by the Engineer for payment to the Contractor.

(b) Upon the expiration of the Defects Liability Period for the Works the other half of the Retention Money shall be certified by the Engineer for payment to the Contractor. Provided that, in the event of different Defects Liability Periods having become applicable to different Sections or parts of the Permanent Works pursuant to Clause 48, the expression "expiration of the Defects Liability 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 Clauses 49 and 50, 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.

### Correction of Certificates

**60.4** The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificate which shall have been issued by him and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.



<b>Statement at Completion</b>	<b>60.5</b>	<p>Not later than 84 days after the issue of the Taking-Over Certificate in respect of the whole of the Works, the Contractor shall submit to the Engineer six copies of a Statement at Completion with supporting documents showing in detail, in the form approved by the Engineer:</p> <p>(a) the final value of all work done in accordance with the Contract up to the date stated in such Taking-Over Certificate,</p> <p>(b) any further sums which the Contractor considers to be due, and</p> <p>(c) an estimate of amounts which the Contractor considers will become due to him under the Contract.</p> <p>The estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.2.</p>
<b>Final Statement</b>	<b>60.6</b>	<p>Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration six copies of a draft final statement with supporting documents showing in detail, in the form approved by the Engineer:</p> <p>(a) the value of all work done in accordance with the Contract, and</p> <p>(b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.</p> <p>If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the "Final Statement").</p> <p>If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer an Interim Payment Certificate for those parts of the draft final statement, if any, which are not in dispute. The dispute may then be settled in accordance with Clause 67.</p>
<b>Discharge</b>	<b>60.7</b>	<p>Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Payment Certificate issued pursuant to Sub-Clause 60.8 has been made and the performance security referred to in Sub-Clause 10.1, if any, has been returned to the Contractor.</p>
<b>Final Payment Certificate</b>	<b>60.8</b>	<p>Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Payment Certificate stating:</p> <p>(a) the amount which, in the opinion of the Engineer, is finally due under the Contract or otherwise, and</p> <p>(b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled other than under Clause 47, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.</p>
<b>Cessation of Employer's Liability</b>	<b>60.9</b>	<p>The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.5.</p>

<b>Time for Payment</b>	<b>60.10</b>	The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall, subject to Clause 47, be paid by the Employer to the Contractor within 28 days after such Interim Payment Certificate has been delivered to the Employer, or, in the case of the Final Payment Certificate referred to in Sub-Clause 60.8, within 56 days, after such Final Payment Certificate has been delivered to the Employer. In the event of the failure of the Employer to make payment within the times stated, the Employer shall pay to the Contractor interest at the rate stated in the Appendix to Tender upon all sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to the Contractor's entitlement under Clause 69 or otherwise.
<b>Approval only by Defects Liability Certificate</b>	<b>61.1</b>	Only the Defects Liability Certificate, referred to in Clause 62, shall be deemed to constitute approval of the Works.
<b>Defects Liability Certificate</b>	<b>62.1</b>	The Contract shall not be considered as completed until a Defects Liability Certificate shall have been signed by the Engineer and delivered to the Employer, with a copy to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Works and remedy any defects therein to the Engineer's satisfaction. The Defects Liability Certificate shall be given by the Engineer within 28 days after the expiration of the Defects Liability Period, or, if different defects liability periods shall become applicable to different Sections or parts of the Permanent Works, the expiration of the latest such period, or as soon thereafter as any works instructed, pursuant to Clauses 49 and 50, have been completed to the satisfaction of the Engineer. Provided that the issue of the Defects Liability Certificate shall not be a condition precedent to payment to the Contractor of the second portion of the Retention Money in accordance with the conditions set out in Sub-Clause 60.3.
<b>Unfulfilled Obligations</b>	<b>62.2</b>	Notwithstanding the issue of the Defects Liability Certificate the Contractor and the Employer shall remain liable for the fulfilment of any obligation incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate which remains unperformed at the time such Defects Liability Certificate is issued and, for the purposes of determining the nature and extent of any such obligation, the Contract shall be deemed to remain in force between the parties to the Contract.

## Remedies

<b>Default of Contractor</b>	<b>63.1</b>	<p>If the Contractor is deemed by law unable to pay his debts as they fall due, or enters into voluntary or involuntary bankruptcy, liquidation or dissolution (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or becomes insolvent, or makes an arrangement with, or assignment in favour of, his creditors, or agrees to carry out the Contract under a committee of inspection of his creditors, or if a receiver, administrator, trustee or liquidator is appointed over any substantial part of his assets, or if, under any law or regulation relating to reorganization, arrangement or readjustment of debts, proceedings are commenced against the Contractor or resolutions passed in connection with dissolution or liquidation or if any steps are taken to enforce any security interest over a substantial part of the assets of the Contractor, or if any act is done or event occurs with respect to the Contractor or his assets which, under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened Sub-Clause 3.1, or has an execution levied on his goods, or if the Engineer certifies to the Employer, with a copy to the Contractor, that, in his opinion, the Contractor:</p> <ul style="list-style-type: none"> <li>(a) has repudiated the Contract,</li> <li>(b) without reasonable excuse has failed <ul style="list-style-type: none"> <li>(i) to commence the Works in accordance with Sub-Clause 41.1, or</li> <li>(ii) to proceed with the Works, or any Section thereof, within 28 days after receiving notice pursuant to Sub-Clause 46.1,</li> </ul> </li> </ul>
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(c) has failed to comply with a notice issued pursuant to Sub-Clause 37.4 or an instruction issued pursuant to Sub-Clause 39.1 within 28 days after having received it,

(d) despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the Contract, or

(e) has contravened Sub-Clause 4.1,

then the Employer may, after giving 14 days' notice to the Contractor, enter upon the Site and the Works and terminate the employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and authorities conferred on the Employer or the Engineer by the Contract, and may himself complete the Works or may employ any other contractor to complete the Works. The Employer or such other contractor may use for such completion so much of the Contractor's Equipment, Temporary Works and materials as he or they may think proper.

<b>Valuation at Date of Termination</b>	<b>63.2</b>	<p>The Engineer shall, as soon as may be practicable after any such entry and termination by the Employer, fix and determine ex parte, or by or after reference to the parties or after such investigation or enquiries as he may think fit to make or institute, and shall certify:</p> <p>a) what amount (if any) had, at the time of such entry and termination, been reasonably earned by or would reasonably accrue to the Contractor in respect of work then actually done by him under the Contract, and</p> <p>(b) the value of any of the said unused or partially used materials, any Contractor's Equipment and any Temporary Works.</p>
<b>Payment after Termination</b>	<b>63.3</b>	<p>If the Employer terminates the Contractor's employment under this Clause, he shall not be liable to pay to the Contractor any further amount (including damages) in respect of the Contract until the expiration of the Defects Liability Period and there after until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any) and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer. The Contractor shall then be entitled to receive only such sum (if any) as the Engineer may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount exceeds the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.</p>
<b>Assignment of Benefit of Agreement</b>	<b>63.4</b>	<p>Unless prohibited by law, the Contractor shall, if so instructed by the Engineer within 14 days of such entry and termination referred to in Sub-Clause 63.1, assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the Contract, which the Contractor may have entered into.</p>
<b>Urgent Remedial Work</b>	<b>64.1</b>	<p>If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Works, or any part thereof, either during the execution of the Works, or during the Defects Liability Period, any remedial or other work is, in the opinion of the Engineer, urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other persons to carry out such work as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable from the Contractor by the Employer, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof.</p>

## Special Risks

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|---|-------------|--|
| <b>No Liability for Special Risks</b>             | <b>65.1</b> | <p>The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in Sub-Clause 65.2, whether by way of indemnity or otherwise, for or in respect of:</p> <ul style="list-style-type: none"> <li>(a) destruction of or damage to the Works, save to work condemned under the provisions of Clause 39 prior to the occurrence of any of the said special risks,</li> <li>(b) destruction of or damage to property, whether of the Employer or third parties, or</li> <li>(c) injury or loss of life.</li> </ul>   |
| <b>Special Risks</b>                              | <b>65.2</b> | <p>The special risks are:</p> <ul style="list-style-type: none"> <li>(a) the risks defined under paragraphs (a), (c), (d) and (e) of Sub-Clause 20.4, and</li> <li>(b) the risks defined under paragraph (b) of Sub-Clause 20.4 insofar as these relate to the country in which the Works are to be executed.</li> </ul>   |
| <b>Damage to Works by Special Risks</b>           | <b>65.3</b> | <p>If the Works or any materials or Plant on or near or in transit to the Site, or any of the Contractor's Equipment, sustain destruction or damage by reason of any of the said special risks, the Contractor shall be entitled to payment in accordance with the Contract for any Permanent Works duly executed and for any materials or Plant so destroyed or damaged and, so far as may be required by the Engineer or as may be necessary for the completion of the Works, to payment for:</p> <ul style="list-style-type: none"> <li>(a) rectifying any such destruction or damage to the Works, and</li> <li>(b) replacing or rectifying such materials or Contractor's Equipment,</li> </ul> <p>and the Engineer shall determine an addition to the Contract Price in accordance with Clause 52 (which shall in the case of the cost of replacement of Contractor's Equipment include the fair market value thereof as determined by the Engineer) and shall notify the Contractor accordingly, with a copy to the Employer.</p> |
| <b>Projectile, Missile</b>                        | <b>65.4</b> | <p>Destruction, damage, injury or loss of life caused by the explosion or impact, whenever and wherever occurring, of any mine, bomb, shell, grenade, or other projectile, missile, munition, or explosive of war, shall be deemed to be a consequence of the said special risks.</p>  |
| <b>Increased Costs arising from Special Risks</b> | <b>65.5</b> | <p>Save to the extent that the Contractor is entitled to payment under any other provision of the Contract, the Employer shall repay to the Contractor any costs of the execution of the Works (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of Clause 39 prior to the occurrence of any special risk) which are howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this Clause hereinafter contained in regard to outbreak of war, but the Contractor shall, as soon as any such cost comes to his knowledge, forthwith notify the Engineer thereof. The Engineer shall, after due consultation with the Employer and the Contractor, determine the amount of the Contractor's costs in respect thereof which shall be added to the Contract Price and shall notify the Contractor accordingly, with a copy to the Employer.</p>                              |
| <b>Outbreak of War</b>                            | <b>65.6</b> | <p>If, during the currency of the Contract, there is an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall, unless and until the Contract is terminated under the provisions of this Clause, continue to use his best endeavours to complete the execution of the Works. Provided that the Employer shall be entitled, at any time after such outbreak of war, to terminate the Contract by giving notice to the Contractor and, upon such notice being given, the Contract shall, except as to the rights of the parties under this Clause and Clause 67, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.</p>   |

**Removal of Contractor's Equipment on Termination**

**65.7** If the Contract is terminated under the provisions of Sub-Clause 65.6, the Contractor shall, with all reasonable dispatch, remove from the Site all Contractor's Equipment and shall give similar facilities to his Subcontractors to do so.

**Payment if Contract Terminated**

**65.8** If the Contract is terminated as aforesaid, the Contractor shall be paid by the Employer, insofar as such amounts or items have not already been covered by payments on account made to the Contractor, for all work executed prior to the date of termination at the rates and prices provided in the Contract and in addition:

(a) the amounts payable in respect of any preliminary items referred to in the Bill of Quantities, so far as the work or service comprised therein has been carried out or performed, and a proper proportion of any such items which have been partially carried out or performed;

(b) the cost of materials, Plant or goods reasonably ordered for the Works which have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery, such materials, Plant or goods becoming the property of the Employer upon such payments being made by him;

(c) a sum being the amount of any expenditure reasonably incurred by the Contractor in the expectation of completing the whole of the Works insofar as such expenditure has not been covered by any other payments referred to in this Sub-Clause;

(d) any additional sum payable under the provisions of Sub-Clauses 65.3 and 65.5;

(e) such proportion of the cost as may be reasonable, taking into account payments made or to be made for work executed, of removal of Contractor's Equipment under Sub-Clause 65.7 and, if required by the Contractor, return thereof to the Contractor's main plant yard in his country of registration or to other destination, at no greater cost; and

(f) the reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided that against any payment due from the Employer under this Sub-Clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Contractor's Equipment, materials and Plant and any other sums which, at the date of termination, were recoverable by the Employer from the Contractor under the terms of the Contract. Any sums payable under this Sub-Clause shall, after due consultation with the Employer and the Contractor, be determined by the Engineer who shall notify the Contractor accordingly, with a copy to the Employer.

## **Release from Performance**

**Payment in Event of Release from Performance**

**66.1** If any circumstance outside the control of both parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either or both parties to fulfil his or their contractual obligations, or under the law governing the Contract the parties are released from further performance, then the parties shall be discharged from the Contract, except as to their rights under this Clause and Clause 67 and without prejudice to the rights of either party in respect of any antecedent breach of the Contract, and the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under Clause 65 if the Contract had been terminated under the provisions of Clause 65.

## Settlement of Disputes

### Engineer's Decision

**67.1** If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with, or arising out of, the Contract or the execution of the Works, whether during the execution of the Works or after their completion and whether before or after repudiation or other termination of the Contract, including any dispute as to any opinion, instruction, determination, certificate or valuation of the Engineer, the matter in dispute shall, in the first place, be referred in writing to the Engineer, with a copy to the other party. Such reference shall state that it is made pursuant to this Clause. No later than the eighty-fourth day after the day on which he received such reference the Engineer shall give notice of his decision to the Employer and the Contractor. Such decision shall state that it is made pursuant to this Clause.

Unless the Contract has already been repudiated or terminated, the Contractor shall, in every case, continue to proceed with the Works with all due diligence and the Contractor and the Employer shall give effect forthwith to every such decision of the Engineer unless and until the same shall be revised, as hereinafter provided, in an amicable settlement or an arbitral award.

If either the Employer or the Contractor be dissatisfied with any decision of the Engineer, or if the Engineer fails to give notice of his decision on or before the eighty-fourth day after the day on which he received the reference, then either the Employer or the Contractor may, on or before the seventieth day after the day on which he received notice of such decision, or on or before the seventieth day after the day on which the said period of 84 days expired, as the case may be, give notice to the other party, with a copy for information to the Engineer, of his intention to commence arbitration, as hereinafter provided, as to the matter in dispute. Such notice shall establish the entitlement of the party giving the same to commence arbitration, as hereinafter provided, as to such dispute and, subject to Sub-Clause 67.4, no arbitration in respect thereof may be commenced unless such notice is given.

If the Engineer has given notice of his decision as to a matter in dispute to the Employer and the Contractor and no notice of intention to commence arbitration as to such dispute has been given by either the Employer or the Contractor on or before the seventieth day after the day on which the parties received notice as to such decision from the Engineer, the said decision shall become final and binding upon the Employer and the Contractor.

### Amicable Settlement

**67.2** Where notice of intention to commence arbitration as to a dispute has been given in accordance with Sub-Clause 67.1, the parties shall attempt to settle such dispute amicably before the commencement of arbitration. Provided that, unless the parties otherwise agree, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of intention to commence arbitration of such dispute was given, even if no attempt at amicable settlement thereof has been made.

### Arbitration

**67.3** Any dispute in respect of which:

(a) the decision, if any, of the Engineer has not become final and binding pursuant to Sub-Clause 67.1, and

(b) amicable settlement has not been reached within the period stated in Sub-Clause 67.2,

shall be finally settled, unless otherwise specified in the Contract, under the Rules of Conciliation and Arbitration of the International Chamber of Commerce by one or more arbitrators appointed under such Rules. The said arbitrator/s shall have full power to open up, review and revise any decision, opinion, instruction, determination, certificate or valuation of the Engineer related to the dispute.

Neither party shall be limited in the proceedings before such arbitrator/s to the evidence or arguments put before the Engineer for the purpose of obtaining his said decision pursuant to Sub-Clause 67.1. No such decision shall disqualify the Engineer from being called as a witness and giving evidence before the arbitrator/s on any matter whatsoever relevant to the dispute.

Arbitration may be commenced prior to or after completion of the Works, provided that the obligations of the Employer, the Engineer and the Contractor shall not be altered by reason of the arbitration being conducted during the progress of the Works.

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|---|-------------|---|
| <b>Failure to Comply with Engineer's Decision</b> | <b>67.4</b> | Where neither the Employer nor the Contractor has given notice of intention to commence arbitration of a dispute within the period stated in Sub-Clause 67.1 and the related decision has become final and binding, either party may, if the other party fails to comply with such decision, and without prejudice to any other rights it may have, refer the failure to arbitration in accordance with Sub-Clause 67.3. The provisions of Sub-Clauses 67.1 and 67.2 shall not apply to any such reference. |
|---|-------------|---|

## Notices

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|--|-------------|---|
| <b>Notice to Contractor</b>            | <b>68.1</b> | All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the Contractor's principal place of business or such other address as the Contractor shall nominate for that purpose. |
| <b>Notice to Employer and Engineer</b> | <b>68.2</b> | Any notice to be given to the Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, telex or facsimile transmission to or left at the respective addresses nominated for that purpose in Part II of these Conditions.   |
| <b>Change of Address</b>               | <b>68.3</b> | Either party may change a nominated address to another address in the country where the Works are being executed by prior notice to the other party, with a copy to the Engineer, and the Engineer may do so by prior notice to both parties.   |

## Default of Employer

- |  |             |  |
|--|-------------|--|
| <b>Default of Employer</b>               | <b>69.1</b> | <p>In the event of the Employer:</p> <p>(a) failing to pay to the Contractor the amount due under any certificate of the Engineer within 28 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract,</p> <p>(b) interfering with or obstructing or refusing any required approval to the issue of any such certificate,</p> <p>(c) becoming bankrupt or, being a company, going into liquidation, other than for the purpose of a scheme of reconstruction or amalgamation, or</p> <p>(d) giving notice to the Contractor that for unforeseen economic reasons it is impossible for him to continue to meet his contractual obligations,</p> <p>the Contractor shall be entitled to terminate his employment under the Contract by giving notice to the Employer, with a copy to the Engineer. Such termination shall take effect 14 days after the giving of the notice.</p> |
| <b>Removal of Contractor's Equipment</b> | <b>69.2</b> | Upon the expiry of the 14 days' notice referred to in Sub-Clause 69.1, the Contractor shall, notwithstanding the provisions of Sub-Clause 54.1, with all reasonable despatch, remove from the Site all Contractor's Equipment brought by him thereon.  |
| <b>Payment on Termination</b>            | <b>69.3</b> | In the event of such termination the Employer shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Clause 65, but, in addition to the payments specified in Sub-Clause 65.8, the Employer shall pay to the Contractor the amount of any loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.  |

**Contractor's  
Entitlement to  
Suspend Work**

**69.4** Without prejudice to the Contractor's entitlement to interest under Sub-Clause 60.10 and to terminate under Sub-Clause 69.1, the Contractor may, if the Employer fails to pay the Contractor the amount due under any certificate of the Engineer within 28 days after the expiry of the time stated in Sub-Clause 60.10 within which payment is to be made, subject to any deduction that the Employer is entitled to make under the Contract, after giving 28 days' prior notice to the Employer, with a copy to the Engineer, suspend work or reduce the rate of work.

If the Contractor suspends work or reduces the rate of work in accordance with the provisions of this Sub-Clause and thereby suffers delay or incurs costs the Engineer shall, after due consultation with the Employer and the Contractor, determine:

- (a) any extension of time to which the Contractor is entitled under Clause 44, and
- (b) the amount of such costs, which shall be added to the Contract Price,

and shall notify the Contractor accordingly, with a copy to the Employer.

**Resumption  
of Work**

**69.5** Where the Contractor suspends work or reduces the rate of work, having given notice in accordance with Sub-Clause 69.4, and the Employer subsequently pays the amount due, including interest pursuant to Sub-Clause 60.10, the Contractor's entitlement under Sub-Clause 69.1 shall, if notice of termination has not been given, lapse and the Contractor shall resume normal working as soon as is reasonably possible.

## **Changes in Cost and Legislation**

**Increase or  
Decrease  
of Cost**

**70.1** There shall be added to or deducted from the Contract Price such sums in respect of rise or fall in the cost of labour and/or materials or any other matters affecting the cost of the execution of the Works as may be determined in accordance with Part II of these Conditions.

**Subsequent  
Legislation**

**70.2** If, after the date 28 days prior to the latest date for submission of tenders for the Contract there occur in the country in which the Works are being or are to be executed changes to any National or State Statute, Ordinance, Decree or other Law or any regulation or bye-law of any local or other duly constituted authority, or the introduction of any such State Statute, Ordinance, Decree, Law, regulation or bye-law which causes additional or reduced cost to the Contractor, other than under Sub-Clause 70.1, in the execution of the Contract, such additional or reduced cost shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be added to or deducted from the Contract Price- and the Engineer shall notify the Contractor accordingly, with a copy to the Employer.

## **Currency and Rates of Exchange**

**Currency  
Restrictions**

**71.1** If, after the date 28 days prior to the latest date for submission of tenders for the Contract, the Government or authorised agency of the Government of the country in which the Works are being or are to be executed imposes currency restrictions and/or transfer of currency restrictions in relation to the currency or currencies in which the Contract Price is to be paid, the Employer shall reimburse any loss or damage to the Contractor arising therefrom, without prejudice to the right of the Contractor to exercise any other rights or remedies to which he is entitled in such event.

**Rates of  
Exchange**

**72.1** Where the Contract provides for payment in whole or in part to be made to the Contractor in foreign currency or currencies, such payment shall not be subject to variations in the rate or rates of exchange between such specified foreign currency or currencies and the currency of the country in which the Works are to be executed.



**Currency  
Proportions**

**72.2** Where the Employer has required the Tender to be expressed in a single currency but with payment to be made in more than one currency and the Contractor has stated the proportions or amounts of other currency or currencies in which he requires payment to be made, the rate or rates of exchange applicable for calculating the payment of such proportions or amounts shall, unless otherwise stated in Part II of these Conditions, be those prevailing, as determined by the Central Bank of the country in which the Works are to be executed, on the date 28 days prior to the latest date for the submission of tenders for the Contract, as has been notified to the Contractor by the Employer prior to the submission of tenders or as provided for in the Tender.

**Currencies of  
Payment for  
Provisional Sums**

**72.3** Where the Contract provides for payment in more than one currency, the proportions or amounts to be paid in foreign currencies in respect of Provisional Sums shall be determined in accordance with the principles set forth in Sub-Clauses 72.1 and 72.2 as and when these sums are utilised in whole or in part in accordance with the provisions of Clauses 58 and 59.

## **REFERENCE TO PART II**

As stated in the Foreword at the beginning of this document, the FIDIC Conditions comprise both Part I and Part II. Certain Clauses, namely Sub-Clauses 1.1 paragraph (a) (i) and (iv), 5.1 (part), 14.1, 14.3, 68.2 and 70.1 must include additional wording in Part II for the Conditions to be complete. Other Clauses may require additional wording to supplement Part I or to cover particular circumstances or the type of work (dredging is an example).

Part II Conditions of Particular Application with guidelines for the preparation of Part II are printed in a separately bound document.

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### **SECTION 3**

#### **CONDITIONS OF CONTRACT**

#### **PART II - CONDITIONS OF PARTICULAR APPLICATION**

## **SECTION 3**

### **CONDITIONS OF CONTRACT**

#### **PART II - CONDITIONS OF PARTICULAR APPLICATION**

##### **Notes on the Conditions of Particular Application**

The clause numbers in this section correspond to those in previous Section (Part I-FIDIC-General Conditions of Contract), except for clauses with numbers higher than 72. These conditions supplement the provisions in the General Conditions of Contract and where applicable the provisions stand amended in line with the conditions under this Section. In case of any discrepancies between Part I and Part II of FIDIC conditions, the provisions of this Section, i.e. Conditions of Particular Application-Part II shall govern.

**Sub-Clause 1.1 (a)  
Definitions**

- i. The Employer is Bhutan Power Corporation Limited (BPC).
- iv. The Engineer is Bhutan Power Corporation Limited. For the purpose of this Contract, the terms “Engineer” and “Employer” shall be treated synonymous.

Subpara (a)(iv) is also amended by the addition of the following words after the word "Conditions":

"or any other competent person appointed by the Employer, and notified to the Contractor, to act in replacement of the Engineer."

Subpara (b)(v) of Sub-Clause 1.1 is amended by the addition of the following words at the end :

The word 'Tender' is synonymous with 'Bid' and the words 'Tender Documents' with 'Bidding Documents'."

**Clause 2  
Engineer and Engineer's  
Representative**

For purposes of this Contract, the terms "Engineer" and "Employer" shall be treated synonymous. As such Clauses 2.1 to 2.6 stand deleted.

**Sub-Clause 5.1  
Language and  
Law**

- a) The language is the English language.
- b) The law is that in force in the Kingdom of Bhutan.

**Sub-Clause 5.2  
Priority of  
Contract  
Documents**

Delete the documents listed 1 - 6 and substitute:

- 1. The Contract Agreement;
- 2. The Letter of Acceptance;
- 3. The Tender;
- 4. The Conditions of Contract Part II;
- 5. The Conditions of Contract Part I;
- 6. The Specifications;
- 7. The Priced Bill of Quantities; and
- 8. Schedules of Supplementary Information.

**Sub-Clause 10.1  
Performance  
Security**

Replace the text of Sub-Clause 10.1 with the following :

"The Contractor shall provide security for his proper performance of the Contract to the Employer within 28 days after the receipt of the Letter of Acceptance. The performance security shall be for 10% of the Contract Amount and shall be in the form of a bank guarantee issued by a bank or financial institution located in Bhutan. When providing such security to the Employer, the Contractor shall notify the Engineer of so doing.

"Without limitation to the provisions of the preceding paragraph, whenever the Engineer determines an addition to the Contract Price as a result of a change in cost and/or legislation or as a result of a variation amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor, at the Engineer's written request, shall promptly increase the value of the performance security in that currency by an equal percentage."

**Sub-Clause 10.2  
Period of Validity of  
Performance  
Security**

Replace the text of Sub-Clause 10.2 with the following :

"The Performance Security shall be valid until 30 days beyond the successful completion and issue of Taking Over Certificate of the whole of the works under the contract and for any extension thereto."

**Add  
Sub-Clause 10.4  
Cost of  
Securities**

The cost of complying with the requirements of this Clause shall be borne by the Contractor.

**Sub-Clause 14.1  
Program to be  
Submitted**

"The time within which the program shall be submitted shall be twenty one (21) days."

**Sub-Clause 14.3  
Cash Flow  
Estimate to be  
Submitted**

"The time within which the detailed cash flow estimate shall be submitted shall be twenty one (21) days."

**Add  
Sub-Clause 15.2  
Language Ability  
of Contractor's  
Representative**

Add the following Sub-Clause 15.2 :

"If the Contractor's authorised representative is not, in the opinion of the Engineer, fluent in the English language, the Contractor shall have available on site at all times a competent interpreter to ensure the proper transmission of instructions and information."

**Sub-Clause 16.3  
Language Ability  
of Superintending  
Staff**

Add the following Sub-Clause 16.3

"A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language or the Contractor shall have available on site at all times a sufficient number of competent interpreters to ensure the proper transmission of instructions and information."

**Sub-Clause 19.1  
Safety, Security  
and Protection of  
the Environment  
Sub-Clause 20.4  
Employer's Risks**

Add at the beginning of the clause "Contractor should note that some specific measures may be required during construction of the Works for the protection of the environment."

Sub-Clause 20.4 is amended to read as follows :

The Employer's risks are

- a) Insofar as they directly affect the execution of the Works in the country where the Permanent Works are to be executed :
  - i. war and hostilities (whether war be declared or not), invasion, act of foreign enemies;
  - ii. rebellion, revolution, insurrection, or military or usurped power, or civil war;
  - iii. ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof;
  - iv. pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds;
  - v. riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Sub-contractors and arising from the conduct of the Works;

- b) Loss or damage due to the use or occupation by the Employer of any Section or part of the Permanent Works, except as may be provided for in the Contract;
- c) Loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and
- d) Any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:
  - i. Could not have reasonably foreseen, or
  - ii. Could reasonably have foreseen, but against which he could not reasonably have taken appropriate measures to prevent loss or damage to physical property occurring.

**Sub-Clause 21.1  
Insurance of  
Works and  
Contractor's  
Equipment**

Add the following words at the end of sub-paras (a) and (b) of Sub-Clause 21.1 :

", it being understood that such insurance shall provide for compensation to be payable in currencies required to rectify the loss or damage incurred. The Contractor has to ensure that insurance coverage for the Project is made through a recognized and authorised Insurance company in Bhutan, acceptable to the Employer."

**Sub-Clause 21.2  
Scope of Cover**

Para (a) of Sub-Clause 21.2 is amended by deletion of the words "..... from the start of work at the Site....." and by the substitution therefor of the words "... from the first working day of the Commencement of Works ...".

**Sub-Clause 21.4  
Exclusions**

Sub-clause 21.4 is amended to read as follows :

"There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 paras a(i) to (iv)."

**Sub-Clause 25.1  
Evidence and  
Terms of  
Insurances**

Sub-Clause 25.1 is amended by inserting the words "... as soon as practicable after the respective insurances have been taken out but in any case..." before the words " ... prior to start of work at Site..."

**Clause 34**

Add the following Sub-Clauses

**Sub-Clause 34.2  
Rates of Wages  
and Conditions  
of Labour**

The Contractor shall strictly comply with the relevant Labor Act of the Kingdom of Bhutan. The Contractor shall pay rates of wages and observe conditions of labour not less favorable than those established for the trade or industry where the work is carried out. In the absence of any rates of wages or conditions of labour so established, the Contractor shall pay rates of wages and observe conditions of labor which are not less favorable than the general level of wages and conditions observed by other employers whose general circumstances in the trade or industry in which the Contractor is engaged are similar.

**Sub-Clause 34.3  
Repatriation of  
Labour**

The Contractor shall be responsible for the return to the place where they were recruited or to their domicile of all such persons as he recruited and employed for the purposes of or in connection with the Contract and shall maintain such persons as are to be so returned in a suitable manner until they shall have left the site or, in the case of persons who are not nationals of and have been recruited outside Bhutan shall have left Bhutan.

**Sub-Clause 34.4  
Housing for  
Labour**

Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain such accommodation and amenities as he may consider necessary for all his staff and labour, employed for the purposes of or in connection with the Contract, including all fencing, water supply (both for drinking and other purposes), electricity supply, sanitation, cookhouses, fire prevention and firefighting equipment, air conditioning, cookers, refrigerators, furniture and other requirements in connection with such accommodation or amenities. On completion of the Contract, unless otherwise agreed with the Employer, the temporary camps/ housing provided by the Contractor shall be removed and the site reinstated to its original condition, all to the approval of the Engineer.

**Sub-Clause 34.5  
Accident Prevention  
Officer; Accidents**

The Contractor shall have on his staff on Site an officer dealing only with questions regarding the safety and protection against accidents of all staff and labour. This officer shall be qualified for this work and shall have the authority to issue instructions and shall take protective measures to prevent accidents.

**Sub-Clause 34.6  
Health and  
Safety**

Due precautions shall be taken by the Contractor at his own cost, to ensure the safety of his staff and labour and, in collaboration with and to the requirements of the local health authorities, to ensure that medical staff, first aid equipment and stores, sick bay and suitable ambulance service are available at the camps, housing and on the Site at all times throughout the period of the Contract and that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

**Sub-Clause 34.7  
Measures Against  
Insect and Pest  
Nuisance**

The Contractor shall at all times take the necessary precautions to protect all staff and labour employed on the Site from insect nuisance, rats, and other pests and reduce the dangers to health and the general nuisance caused by the same. The Contractor shall provide his staff and labour with suitable prophylactics for the prevention of malaria, and take steps to prevent the formation of stagnant pools of water. He shall comply with all the regulations of the local health authorities in these respects and shall in particular arrange to spray thoroughly with approved insecticide all buildings erected on the Site. Such treatment shall be carried out at least once a year or as instructed by the Engineer. The Contractor shall warn his staff and labour of the dangers of bilharzia and wild animals.

**Sub-Clause 34.8  
Epidemics**

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government or the local medical or sanitary authorities, for the purpose of dealing with and overcoming the same.

**Sub-Clause 34.9  
Burial of the  
Dead**

The Contractor shall make any necessary arrangements for the transport, to any place as required for burial, of any of his expatriate employees or members of their families who may die in Bhutan. The Contractor shall also be responsible, to the extent required by the local regulations, for making any arrangements with regard to burial of any of his local employees who may die while engaged upon the Works.

**Sub-Clause 34.10  
Supply of  
Foodstuffs**

The Contractor shall arrange for the provision of a sufficient supply of suitable food at reasonable prices for all his staff and labour, or his Subcontractors, for the purposes of or in connection with the Contract.

**Sub-Clause 34.11  
Supply of Water**

The Contractor shall, so far as is reasonably practicable, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of his staff and labour.



**Sub-Clause 34.12  
Alcoholic Liquor  
Or Drugs**

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Subcontractors, agents, staff or labour.

**Sub-Clause 34.13  
Arms and  
Ammunition**

The Contractor shall not give, barter or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

**Sub-Clause 34.14  
Festivals and  
Religious  
Customs**

The Contractor shall in all dealings with his staff and labour have due regard to all recognized festivals, days of rest and religious and other customs.

**Sub-Clause 34.15  
Disorderly  
Conduct**

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his staff and labour and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same.

**Clause 35**

Add the following sub-clauses.

**Sub-Clause 35.2  
Records of Safety  
and Health**

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

**Sub-Clause 35.3  
Reporting of  
Accidents**

The Contractor shall report to the Engineer details of any accidents as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.

**Clause 36**

Add the following Sub-Clause.

**Sub-Clause 36.6  
Blasting Material**

All the materials required to complete the works shall be arranged by the Contractor. Only blasting materials shall be arranged and issued by the Employer. Employer would make necessary arrangement for procurement and issue of such explosive materials on demand from the Contractor at the State Trading Corporation of Bhutan Limited (STCBL) or other approved supplier of RGOB. The cost for the explosives will be borne by the Contractor.

It shall be the responsibility of the Contractor to arrange for picking up the materials from State Trading Corporation of Bhutan Limited (STCBL) or other approved supplier of RGOB to the work place, storage and restricted use. The record of use of blasting material shall be maintained by the Contractor, duly certified by the Employer, and under no circumstances shall the blasting material used without prior intimation to the Employer. On completion of the Works, it is the responsibility of the Contractor to return the material to the original supplier, under intimation to the Employer.

**Sub-Clause 43.1**  
**Time for Completion**

Add the following at the end.

“The Commencement Date shall be the date of Signing of the Contract Agreement unless otherwise specifically indicated”.

**Sub-Clause 47.1**  
**Liquidated Damages for Delay**

Add the following at the end.

“The cases for imposition of LD need to be dealt as per contract, logically and rationally, maintaining consistency in approach. The loss/ damages suffered by BPC due to delays by the contractor is the basic criteria for deciding a case for imposition of LD. Damages, with reference to a contract, in the context of LD, can be defined as the amount adjudged to be paid by Contractor to the Owner as compensation for the loss sustained by the latter in consequence of the breach of contractual obligations pertaining to time schedule. The fundamental principle underlying the theory of damages is not punishment but compensation.

The applicable rate and the ceiling indicated in the Appendix to Bid for the Liquidated Damages shall be applicable on the on the Contract Price signed in the Contract Agreement, unless the Contract provides for partial take-over and / or the Employer takes over part of the works for whatsoever reason. Such partial take-over is only at the discretion of the Employer for its own use and shall not be construed as a ground for request by the Contractor for partial-takeover. In the event of such provision or partial take-over, the provisions under sub-clause 47.2 shall govern.

**Sub-Clause 48.1**  
**Taking-Over Certificate**

Add the following at the end.

“Where the Scope of Work under the Contract covers Testing and Commissioning, in the absence of any specific provisions elsewhere in the Specifications, the following provisions shall apply.

- (i) In case such testing and commissioning works could not be completed due to non-readiness of other works not in the Scope of the Contractor, the Employer shall issue to the Contractor a provisional Taking-Over Certificate on substantial completion of the works (excluding such testing and commissioning).
- (ii) Issuance of such Taking-Over Certificate pursuant to (i) above does not absolve the Contractor to complete the Testing and Commissioning works if the notice of readiness by the Employer pursuant to (i) above is issued within 90 days of such Take-Over.
- (iii) The Testing and Commissioning works shall be commenced by the Contractor within 15 days of notice of the Employer about the readiness of other works, required for such testing and commissioning but not in the Scope of the Contractor, and completed within the scheduled time-duration provided in the original Bar Chart for such activity. Delay in completion of the same shall attract Liquidated Damages as per relevant clauses of the Contract, notwithstanding issuance of provisional Taking-Over Certificate pursuant to (i) above.
- (iv) The Defects Liability period shall be reckoned from the date of completion of testing and commissioning.
- (v) In the event the notice for readiness for Testing and Commissioning is not issued by the Employer within 90 days indicated in (ii) above, the same shall be carried out by the Contractor at mutually convenient time without any additional cost implications to the Employer. However, the Contractor will not be liable for any Liquidated Damages.

**Clause 49**

Add the following Sub-Clause.

**Sub-Clause 49.5  
Extension of Defects  
Liability**

The provisions of this Clause shall apply to all replacements or renewals of Plant carried out by the Contractor to remedy defects and damages as if the replacements and renewals had been taken over on the date they were completed. The Defects Liability Period for the Works shall be extended by a period equal to the period during which the Works cannot be used by reason of a defect or damage. If only part of the Works is affected, the Defects Liability Period shall be extended only for that part. In neither case shall the Defects Liability period extend beyond two years from the date of taking over.

When progress in respect of Plant has been suspended under Clause 40, the Contractor's obligations under this Clause shall not apply to any defects occurring more than one year after the Time for Completion established on the date of the Contract Signing.

**Sub-Clause 52.2  
Power of Engineer  
To Fix Rates**

Add a final sentence to the first paragraph as follows:

Provided further that no change in the rate or price for any item contained in the Contract shall be considered unless such item accounts for an amount more than 1% of the Contract Price, and the actual quantity of work executed under the item exceeds quantity set out in the Bill of Quantities by more than 20%. Quantities in excess of 20% shall be priced at fair and reasonable rate determined by the Engineer on the basis of materials, labour, use of construction equipment etc. required to execute the item. Unless notice of such intention of applying rates different from those in the contract is given by either party within 14 days of knowledge of such variation or the execution of works, it is deemed that both parties consent to carry out the works as per the rates in the Contract.

**Clause 59.4(c)  
Payments to  
Nominated  
Sub-contractors**

Not applicable

**Clause 60  
Certificates and  
Payment**

Clause 60 of the General Conditions is deleted and the following Sub-Clauses 60.1 to 60.16 are substituted therefor:

**Sub-Clause 60.1**  
**Terms of Payment**  
**Equipment**

Payment for Supply of Equipment will be made as under:

- a) 10 % advance pursuant to Sub Clause 60.9 below.
- b) 80% [90% if no advance is claimed by the Contractor] Payment against delivery of equipment/materials as quoted in Bill of Quantities. The invoice for claiming 80% payment should be accompanied by the following documents.
  - i. Proof of delivery: Submission of entry proof in Bhutan duly certified by the Revenue & Customs Department.
  - ii. Contractor's detailed invoice giving full particulars of the equipment/material.
  - iii. Detailed packing list.
  - iv. Approved Test Certificates.
  - v. Excise clearance voucher.
  - vi. A comprehensive statement giving the status of supplies made and payments due and received.
  - vii. Lorry Receipt(LR)
- c) Balance 10% Retention Payment after the "Taking over" of the works and issue of Taking Over Certificate by the Employer's representative and submission of Bank Guarantee by the Contractor of equivalent amount to cover defect liability period or on expiry of Defects Liability Period.

**Sub-Clause 60.2**  
**Terms of Payment for**  
**Equipment Erection**  
**and Civil Works**

Payment for Erection of Equipment and Civil Works will be made as under:

- a) 10 % advance pursuant to Sub Clause 60.9 below.
- b) 80% [90% if no advance is claimed by the Contractor]: This payment would be made periodically in each quarter on presentation of erection or civil works invoice giving full details of the work done during the quarter along with updated statement showing the status of payments due and received.
- c) Balance 10% Retention Payment after the "Taking over" of the works and issue of Taking Over Certificate by the Employer's representative and submission of Bank Guarantee by the Contractor of equivalent amount to cover defect liability period or on expiry of Defects Liability Period

**Sub-Clause 60.3**  
**Quarterly Statement**

The Contractor shall submit a statement in six (6) copies to the Engineer at the end of each quarter pursuant to sub-clause 60.2, in a tabulated form approved by the Engineer, showing the amounts to which the Contractor considers himself to be entitled. The statement shall include the following items, as applicable, which shall be taken into account in the sequence listed:

- a) the estimated contract value of the Temporary and Permanent Works executed up to the end of the quarter in question, at base unit rates and prices and in bid currency;
- b) the actual value certified for payment for the Temporary and Permanent Works executed up to the end of the previous quarter, at base unit rates and prices and in bid currency;
- c) the estimated contract value at base unit rates and prices of the Temporary and Permanent Works for the quarter in question, in bid currency, obtained by deducting (b) from (a);
- d) the value of any variations executed up to the end of the quarter in question, less the amount certified in the previous Interim Payment Certificate, expressed in the relevant amount of bid currency, pursuant to Clause 52;
- e) amounts approved in respect of Daywork executed up to the end of the quarter in question less the amount for Daywork certified in the previous Interim Payment Certificate, indicating the amount of bid currency as determined from the Daywork Schedule of the Bill of Quantities.
- f) amounts reflecting changes in cost and legislation, pursuant to Clause 70, expressed in the relevant amount of bid currency.
- g) any credit or debit for the month in question in respect of materials and Plant for the Permanent Works, in the relevant amounts, and under the conditions set forth in Sub-Clause 60.5;

- h) any amount to be withheld under the retention provisions of Sub-Clause 60.7, determined by applying the percentage set forth in Sub-Clause 60.7 to the amount in bid currency due under paragraphs 60.3 (d), (e),(f) and (g);
- i) any amounts to be deducted as repayment of the Advance under the provisions of Sub-Clause 60.9; and
- j) any other sum, to which the Contractor may be entitled under the Contract.

**Sub-Clause 60.4  
Quarterly Payment**

- a) The said statement shall be approved or amended by the Engineer in such a way that, in his opinion, it reflects the amounts due to the Contractor in accordance with the Contract, after deduction, other than pursuant to Clause 47, of any sums which may have become due and payable by the Contractor to the Employer. In cases where there is a difference of opinion as to the value of any item, the Engineer's view shall prevail. Within 28 days of receipt of the quarterly statement referred to in Sub-Clause 60.3, the Engineer shall determine the amounts due to the Contractor and shall issue to the Employer and the Contractor a certificate herein called "Interim Payment Certificate", certifying the amounts due to the Contractor.
- b) Provided that the Engineer shall not be bound to certify any payment under this Sub-Clause if the net amount thereof, after all retentions and deductions would be less than the Minimum Amount of Interim Payment Certificates stated in the Appendix to Tender.

Notwithstanding the terms of this Clause or any other Clause of the Contract, no amount will be certified by the Engineer for payment until the performance security has been provided by the Contractor and approved by the Employer.

**Sub-Clause 60.5  
Materials and Plant  
for the Permanent  
Works**

With respect to materials and plant brought by the Contractor to the Site for incorporation in the Plant Permanent works, the Contractor shall (i) receive a credit in the month in which these materials and Plant are brought to the Site and (ii) be charged a debit in the month in which they are incorporated in the Permanent Works, both such credit and debit to be determined by the Engineer in accordance with the following provisions:

- a) no credit shall be given unless the following conditions shall have been met to the Engineer's satisfaction:

- i. the materials and plant are in accordance with the specifications for the Works;
  - ii. the materials and plant have been delivered to the Site and are properly stored and protected against loss, damage or deterioration;
  - iii. The Contractor's records of the requirements, orders, receipts and use of materials and Plant are kept in a form approved by the Engineer, and such records are available for inspection by the Engineer;
  - iv. The Contractor has submitted a statement of his cost of acquiring and delivering the materials and Plant to the Site, together with such documents as may be required for the purpose of evidencing such cost; and
  - v. The origin of the materials and Plant and the currencies of payment therefor are as indicated in the Bid,
- b) The amount to be credited to the Contractor shall be the equivalent of 75 percent of the Contractor's reasonable cost of the materials and Plant delivered to the Site, as determined by the Engineer after review of the documents listed in paragraph (a) (iv) above, as determined by the Engineer.
- c) the amount to be debited to the Contractor for any materials and plant incorporated into the Permanent Works shall be equivalent to the credit previously granted to the Contractor for such materials and plant pursuant to Sub-Clause (b) above, as determined by the Engineer; and
- d) the currencies in which the respective amounts shall be credited or debited as set forth above shall be determined by the Engineer, provided (i) that in the case of a credit, the currencies shall be those indicated in the Bid for the relevant item of materials or Plant; and (ii) that in the case of a debit, the currencies shall be those in which the credit for the respective item of materials or plant had been given.

**Sub-Clause 60.6**  
**Place of Payment**

Payments to the Contractor by the Employer shall be made in the currency in which the Contract Price is payable, into a bank account or accounts nominated by the Contractor. All bank charges towards effecting the payment to the Contractor as above, including but not limited to Bank Charges for preparation of draft / cheque and / or transfer shall be at the cost of the Contractor.



**Sub-Clause 60.7**  
**Retention Money**

A retention amounting to 10 percent of the amount due in each currency shall be made by the Engineer:

- i) pursuant to sub-clause 60.1(c); and
- ii) sub-clause 60.2(c) determined in accordance with the procedure set out in Sub-clause 60.3 (h) for quarterly payments.

**Sub-Clause 60.8**  
**Payment of**  
**Retention Money**

After the “Taking over” of the works and issue of Taking Over Certificate by the Employer’s representative and submission of Bank Guarantee by the Contractor of equivalent amount to cover defect liability period.

Upon the expiration of the Defects Liability Period 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 Liability Periods being applicable to different Sections or parts of the Permanent Works pursuant to Clause 48, the expression “expiration of the Defects Liability 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 Clauses 49 and 50, 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, where the duration is more than 12 months, the Procuring Agency may also provide for release of such retention money on completion of 50% of the contract value, subject to the contractor providing the unconditional Bank Guarantee for such retention valid till the issue of Defects Liability Certificate.

The Bank Guarantee for Defects Liability, if applicable, shall be furnished from banks/financial institutions located in Bhutan.

**Sub-Clause 60.9**  
**Advance**  
**Payment**

- a) The Employer will make an interest-free advance payment to the Contractor exclusively for the costs of mobilization in respect of the Works in an amount equivalent to 10 percent of the relevant components of the Contract Price. Payment of such advance amount will be due under separate certification by the Engineer after (i) execution of the Form of Agreement by the parties hereto; (ii) provision by the Contractor of the performance security in accordance with Sub-Clause 10.1; and (iii) provision by the Contractor of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amount equal to the advance payment. Such bank guarantee shall remain effective until the advance payment has been repaid pursuant to paragraph (b) below, but the amount thereof shall be progressively reduced by the amount repaid by the Contractor as indicated in Interim Payment Certificates issued in accordance with this Clause.

The Bank Guarantee for Advance Payment shall be furnished from banks/financial institutions located in Bhutan.

- b) The advance payment shall be repaid through percentage deductions from the interim payments certified by the Engineer in accordance with the Clause. Deductions shall commence in the first Interim Payment Certificate, and shall be made at the rate of 10 percent of the amount of all Interim Payment Certificates in the currency of the advance payment until such time as the advance payment has been repaid; always provided that the advance payment shall be completely repaid prior to the time when 80 percent of the Contract Price has been certified for payment.

**Sub-Clause 60.10**  
**Time of Payment**  
**and Interest**

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other term of the Contract, shall subject to Clause 47, be paid by the Employer to the Contractor within 56 days after the Contractor's quarterly statement has been submitted to the Engineer for certification or, in the case of the Final Certificate pursuant to Sub-Clause 60.13, within 84 days after the agreed Final Statement and written discharge have been submitted to the Engineer for certification.

**Sub-Clause 60.11  
Correction of  
Certificates**

The Engineer may by any Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificates which has been issued by him, and shall have authority, if any work is not being carried out to his satisfaction, to omit or reduce the value for such work in any Interim Payment Certificate.

**Sub-Clause 60.12  
Statement at  
Completion**

Not later than 84 days after the issue of the Taking-Over Certification in respect of the whole of the Works, the Contractor shall submit to the Engineer six copies of a Statement at Completion with supporting documents showing in detail, in the form approved by the Engineer.

- a) The final value of all work done in accordance with the Contract upto the date stated in such Taking-Over Certificate;
- b) Any further sums which the Contractor considers to be due; and
- c) an estimate of amounts which the Contractor considers will become due to him under the Contract.

The estimated amounts shall be shown separately in such Statement at Completion. The Engineer shall certify payment in accordance with Sub-Clause 60.4.

**Sub-Clause 60.13  
Final Statement**

Not later than 56 days after the issue of the Defects Liability Certificate pursuant to Sub-Clause 62.1, the Contractor shall submit to the Engineer for consideration six copies of a draft final statement with supporting documents showing in detail, in the form approved by the Engineer,

- a) The value of all work done in accordance with the Contract; and
- b) Any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed (for the purposes of these Conditions referred to as the “Final Statement”).

If, following discussions between the Engineer and the Contractor and any changes to the draft final statement which may be agreed between them, it becomes evident that a dispute exists, the Engineer shall issue to the Employer an Interim Payment Certificate for those parts of the draft final statement which are not in dispute. The dispute shall then be settled in accordance with Clause 67. The Final Statement shall bear agreed upon settlement of the dispute.

**Sub-Clause 60.14  
Discharge**

Upon submission of the Final Statement, the Contractor shall give to the Employer, with a copy to the Engineer, a written discharge confirming that the total of the Final Statement represents full and final settlement of all money due to the Contractor arising out of or in respect of the Contract. Provided that such discharge shall become effective only after payment due under the Final Payment Certificate issued pursuant to Sub-Clause 60.15 has been made and the performance security referred to in Sub-Clause 10.1 has been returned to the Contractor.

**Sub-Clause 60.15  
Final Payment  
Certificate**

Within 28 days after receipt of the Final Statement, and the written discharge, the Engineer shall issue to the Employer (with a copy to the Contractor) a Final Payment Certificate stating

- a) the amount which, in the opinion of the Engineer, is finally due under the Contract or otherwise, and
- b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, other than Clause 47, the balance, if any, due from the Employer to the Contractor or from the Contractor to the Employer as the case may be.

**Sub-Clause 60.16  
Cessation of  
Employer's  
Liability**

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and (except in respect of matters or things arising after the issue of the Taking-Over Certificate in respect of the whole of the Works) in the Statement at Completion referred to in Sub-Clause 60.12.

**Sub-Clause 65.2  
Special Risks**

Sub-Clause 65.2 is amended to read as follows:

“The Special Risks are the risks defined under paragraph (a), sub-paras. (i) to (v) of Sub-Clause 20.4”.

**Sub-Clause 68.2  
Notice to  
Employer and  
Engineer**

For the purpose of this Sub-Clause the respective addresses are:

a) The Employer:

Senior Manager  
Construction Section  
Construction Division  
Construction & Procurement Department  
Bhutan Power Corporation Limited  
Thimphu, Bhutan  
Email: ugyentempa@bpc.bt

b) The Engineer:  
*“Same as Above”*

**Sub-Clause 69.1  
Default of  
Employer**

In Sub-Clause 69.1(a), substitute “56 days” for “28 days”.

**Clause 70  
Changes in Cost  
and  
Legislation**

Delete Clause 70 in its entirety and substitute.

**Sub Clause 70.1  
Price  
Adjustment**

The bidders shall quote firm prices. No price adjustment is applicable for any of the items.

## **Additional Clauses (\*)**

## **Clause 73**

### **Taxation**

#### **Sub-Clause 73.1**

##### **Foreign Taxation**

The prices bid by the Contractor shall include all taxes, duties and other charges imposed inside and outside the Employer's country on the production, manufacture, sale and transport of the Contractor's Equipment, Plant, materials and supplies to be used on or furnished under the Contract, and on the services performed under the Contract. As per the norms of the Government of India, the GST is not applicable for export of the materials to Bhutan and abroad, the same shall be not be loaded in the offer so that benefits shall be transferred to BPC.

#### **Sub-Clause 73.2**

##### **Local Taxation**

The prices bid by the Contractor shall include all custom duties, import duties, business taxes, income and other taxes that may be levied in accordance to the laws and regulations in being as of the date 28 days prior to the closing date for submission of bids in the Employer's country on the Contractor's Equipment, Plant, materials and supplies (permanent, temporary and consumable) acquired for the purpose of the Contract and on the services performed under the Contract. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in the Employer's country on profits made by him in respect of the Contract.

#### **Sub-Clause 73.3**

##### **Customs Duty & Bhutan Sales Tax**

The Contractor shall be responsible for payment of all levies, royalty, taxes, etc. as applicable in Bhutan. Bhutan Sales Tax (BST) and Customs Duty are applicable at the entry check post. The applicable BST/CD rates will have to be obtained by the Bidder from the relevant authorities before submission of Bids. The payment towards BST/CD will be made by BPC at actual against proof of payment at the check post subject to ceiling of the value quoted by the Bidder against various items. However, in the event there is any change in BST/CD rates during the period of 28 days prior to the deadline for submission of Bids till scheduled completion (delays in Contract execution, which are attributable to Contractor will not be considered for payment towards any additional BST/CD) due to Royal Government of Bhutan (RGOB) regulations, the provisions of clause 13.4 of section 1, Instructions to Bidders shall govern for additional payment/recovery.

As far as possible, the Contractor shall procure the materials required for the construction works such as cement, steel rods etc. within Bhutan. However, in case if it is found necessary to procure materials from outside Bhutan, an indent shall have to be made by the Contractor and presented to Employer's Representative which will be examined and cleared for purchase by the Employer/ Engineer before initiating procurement process by the Contractor.

The Contractor will have to pay the BST and Customs Duty at the entry check post and submit the following documents for reimbursement claims to Employer's Representative.

- a) Original money receipt of Revenue and Customs Divisions.
- b) Original source vendor invoice/ bill/ cash memo of the materials for which BST & Customs Duty is paid as reflected in the above receipt duly stamped by Custom authorities in Bhutan.

In case of misuse of the permit/material, suitable penal deduction shall be made from the Contractor's bill upto 5 times the BST leviable on such materials.

On completion of works, if it is observed that excess goods/ materials have been procured by the Contractor, the BST/ Customs Duty reimbursed to the Contractor in case of these materials will have to be refunded to the Employer by the Contractor. These excess goods/ materials will be assessed based on the consumption statement entered in the Books of Measurement (MBs).

**Sub-Clause 73.4**  
**Business Income Tax &**  
**Foreign Contractor Tax**

The Contractor, whether Bhutanese or International will have to pay Business Income Tax in Bhutan. The Business Income Tax is applicable on all supplies and erection works i.e. on the gross amounts of the bills/ invoices. The statutory provisions require deduction of tax at source and presently the same is deducted at 3% for Foreign Contractors and 2% for Bhutanese contractors on the gross amount of the bills/ invoices. This will be deducted at source at the time of payment of Invoices. A Tax Deduction Certificate will be issued to the Contractor for the Tax Deducted at Source (TDS) by the Employer. The rate of TDS by the Employer will be based on the nationality of the lead partner and it is for the lead partner ( in case of JV) to ensure the necessary deductions to payment made to his partners. The provisions of sub-clause 70.7 shall not apply for any changes in the rates of TDS/Business Income Tax.



**Sub-Clause 73.5**  
**Income Tax on Staff**

The Contractor's staff, personnel and labour will be liable to pay Personal Income Tax in Bhutan in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations.

**Sub-Clause 74.1**  
**Bribes**

If the Contractor, or any of his Subcontractors, agents or servants gives or offers to give to any person any bribe, gift, gratuity or commission as an inducement or reward for doing or forbearing to do any action in relation to the Contract or any other contract with the Employer, or for showing or forbearing to show favour or disfavour to any person in relation to the Contract or to any other contract with the Employer, then the Employer may enter upon the Site and the Works and expel the Contractor and the provisions of Clause 63 hereof shall apply as if such entry and expulsion had been made pursuant to that Clause.

**Sub-Clause 75.1**  
**Termination of**  
**Contract for Employer's**  
**Convenience**

The Employer shall be entitled to terminate this Contract at any time for the Employer's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor

- a) shall proceed as provided in Sub-Clause 65.7; and
- b) shall be paid by the Employer as provided in Sub-Clause 65.8

**Clause 76**

VOID

**Sub-Clause 77.1**  
**Joint and Several**  
**Liability**

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally liable to the Employer for the fulfillment of the terms of the Contract and shall designate one of such persons to act as a leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Employer.

**Sub-Clause 78.1**  
**Details to be**  
**Confidential**

The Contractor shall treat the details of the Contract as private and confidential, save insofar as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the previous consent in writing of the Employer or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract the same shall be referred to the decision of the Employer whose award shall be final.

**Sub-Clause 79.1**  
**Limitation of Liability**

Except in cases of criminal negligence or willful misconduct:

- (a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract; and
- (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

**Sub-Clause 80.1**  
**Incentive against early completion of the project**

If the contractor achieves completion of the whole of works and takeover of the project, prior to the project completion schedule, the Employer shall issue certificate of appreciation and recognition.

**SECTION 4**  
**TECHNICAL SPECIFICATIONS**

## SECTION 4

## PART I - GENERAL TECHNICAL REQUIREMENTS

## 1.0 Project Description

Bhutan Power Corporation Ltd., Royal Government of Bhutan intends to construct 132 kV Double Circuit LILO at Yungichu, Lhuntse (approximately 5.69 km). This is a priority and project of National significance. The completion of the project in schedule is of paramount importance.

Particular details relevant to this Project

Sl.#	Description	Detail/data/information
1	Single/Double Circuit	Double Circuit Tower
2	Voltage Level	132 kV
3	Line Length(approx.)	5.69 km
4	Type of Conductor to be used	ACSR PANTHER
5	Terrain Type	Mountainous
6	Snow or Non Snow Zone	Non - Zone
7	Closest Airport	Paro International Airport (Bhutan) / Bagdogra / Guwahati (India)

The particulars of the route are detailed in relevant portions of these tender documents.

### 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	500 - 4000 metres
Ambient Air Temperature      min Max	32.0°C 40.0°C
Average Annual Isokeraunic level	75-80 days
Average Annual Rainfall*	1400 mm
Climate	Varies from moderately hot and humid tropical to cold winters
Relative Humidity	20 – 100%
Seismic Acceleration Level <i>Horizontal</i> <i>Vertical</i>	0.1 g 0.05 g
Snow Incidence in Winter **	0 mm
Basic Wind Speed	47 m/s (As per IS 875 / 802)
Wind Zone	4 (As per IS 875 / 802)

<b>Basic Design Parameter</b>	<b>Basic Design Value</b>
Terrain Category	2 (As per IS 802)
Reliability Level	1 (As per IS 802)
Earthquake Zone Category	5

\*Monsoon period is generally from May to September.

## 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.

## 1.3 Access

The general transmission line route with possible access points 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 three (3) copies of 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 Employer (BPC) has already carried out the detailed survey 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 tower and foundation design will be the responsibility of the 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. The works 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 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 provided by the Employer. The Contractor shall be responsible to ensure 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 Works under this Project:

- (i) Check survey shall be conducted to locate towers on ground conforming to the approved profile and tower schedule.

The co-ordinates of all the tower locations shall also be recorded using GPS/DGPS of positional accuracy of at least 1m for easy relocating. The position of all tower locations shall be marked in the final digitized route alignment drawing with relative distances from any permanent benchmark.

- (ii) Soil Investigation: The contractor shall also collect required data at each tower location in respect of soil strata, ground water level, history of water table in adjacent areas/surface water, distance from permanent bench mark (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 survey, stringing and foundation works and to achieve required ground clearance and ROW.
- (iv) Manufacture, fabrication, galvanizing, supply, delivery, insurance, storage at site, transportation of materials to 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) 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.
- (vi) Classification of foundation for different type of tower and casting of foundation as per Employer supplied foundations drawing;
- (vii) 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 OPGW along with all necessary line accessories,
- (viii) Painting of towers (where required) & supply and erection of span markers, obstruction lights (wherever applicable) for aviation requirements (as required).
- (ix) Testing and commissioning of the erected transmission lines; and
- (x) 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 entire tower and foundation designs are in the scope of Employer. The Employer shall provide engineering documents like sag tension calculation, tower spotting data, single line and clearance diagrams. The Employer shall also provide structural drawings, & Bill of Materials of all type of transmission line towers and its 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 Employer to the Contractor. However, the shop drawings shall be prepared by the Contractor.
- 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 appropriate Schedule of Prices. However, the work shall be executed as per approved construction drawings. Payment of towers shall be made based on the black weight without 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 satisfactory completion of various works.
  - (e) All measurements for payment shall be in S.I. units, 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 Employer and design rights will be strictly reserved with Employer. Bidder shall quote the unit rates for various items of towers and foundations as per units mentioned in appropriate Schedule of Prices. However, payment of these items identified in the schedule of prices shall be made as follows:

<b>A)</b>	<b>TOWER</b>	
i)	Supply items	On supply of respective complete tower
ii)	Erection items	On erection of respective complete tower
<b>B)</b>	<b>Foundation items:</b>	On completion of respective foundation in all respect

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.

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 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. However, the Bidder having requisite experience has freedom to use helicopter for stringing. The Bidder intending to use 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 area with site constraints, where deployment of tension stringing machine is not possible, manual stringing may be adopted after getting approval of Employer's site Engineer. The contractor shall deploy appropriate tools / equipments / machinery to ensure that the stringing operation is carried out without causing damage to conductor / earth wire / OPGW and conductor / earthwire / OPGW is installed at the prescribed sag-tension as per the approved stringing charts.
- c) The stringing works include the slack span stringing between 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 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 relevant latest BIS specifications.

## 5.0 Electrical Characteristics

### 5.1 High Voltage

<b>Nominal System Voltage (kV)</b>	<b>66</b>	<b>132</b>	<b>220</b>
Maximum system voltage kV	72.5	145	245
Basic Insulation Level (BIL) kV Peak (*)	325	550	1050
Rated one-minute power-frequency withstand voltage (kV rms) (*)	140	230	460
Rated short-time current (1 sec rms) kA	50	50	50
Rated Peak short-circuit current (peak value)kA	127.5	127.5	127.5

(\*)These values apply upto 1000 m above Mean Sea Level (MSL).

#### 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)	440/254
System frequency (Hz)	50
Rated 1-minute power-frequency withstand Voltage (V)	2000
Rated impulse voltage withstand - peak (V)	6000

## 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.

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 galvanised 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 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 the 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 Employers 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 site.

Each item shall be clearly and permanently labeled 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 labeled 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 plant, 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 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 are to 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. Crating of 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 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 peened in such a way that the nut can be tightened but cannot be readily removed.

### **13.0 Equipment Labels**

All equipment shall be provided with labels or name plates, 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 labeling shall be provided on packaging to the Employer's approval.

Such nameplates or labels are to be of incorrodible 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 galvanising and are to be clearly readable afterwards. In addition, these erection marks shall be duplicated in block painted lettering of minimum 30mm height on the outer galvanised surfaces of all

tower members. Before leaving the factory, the ends of all towers members shall be painted to a nominated colour code to clearly distinguish the tower types and all like members shall be appropriately bundled and tied for identification and handling during shipment, transport and stacking at 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 conforms generally with the requirements of ISO 9002. Approval to proceed with 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 standardised 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 are to 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 is to provide such temporary buildings as may be necessary for office accommodation for his and employer's Site staff during the erection of the Works and the cost of these shall be deemed to be included in the Contract Price.

### **15.3 Medical Facilities**

These will not be provided by the Employer 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 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. Plant 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 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, the 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 on 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 live, 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 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 separately the erection, 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 local village/ Head of various organizations/agencies on matters concerning the impact of his operations on the local communities. Any problems which cannot be resolved by the Contractor shall be referred to the Employer.

## 16.7 Public Relations

The Contractor shall not publish or provide any information relating to 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, 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 locations.

## 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 to environmental laws and regulations and any other requirements governing the project;

The Contractor should as far as possible ensure to avoid occurrence of accidents at the work site. The Contractor shall ensure to provide reports on incidents and cases of accidents occurred at work site and its corresponding corrective and preventive measures taken to deal with such issues;

Managers and supervisors will participate in environmental self assessments, monitoring and audits, 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 "house keeping" 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. 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 equipments;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.

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 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 report/documents such as achievement on 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 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, the function, the amenities, or the 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, bird 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. This review by the Employer shall not be considered by the Contractor, 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 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, 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, noting, 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 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 out of failure by 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 there upon furnish the Employer additional prints as may be required along with one reproducible in 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 Contractor, prior to the approval of the 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 requirements of 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 any time during the validity of the contract, then the Contractor shall be responsible for consequences.

All drawings shall be prepared using AutoCAD software version 2000 or later only. Drawings, which are not compatible to 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 CDs.

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.
- 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, name plate 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.

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, the Contractor shall be allowed to use/offer above designs/drawings/data sheets to any other authority without prior written permission of the Employer. Any deviation to 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 the 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 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 out 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 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 meeting will be held generally four times in 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 site or at any other place of work are in accordance with the specifications. The Contractor shall adopt suitable quality assurance programme to control such activities at all points necessary. Such programme shall be broadly outlined by the Contractor and shall be finalised after discussions before the award of Contract. The detailed programme shall be submitted by the contractor after the award of contract and finally accepted by the Employer after discussion. A quality assurance programme of the Contractor shall generally cover but not limited to the following:

- (a) His organization 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 equipments.
- (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 release of manufactured product to the Employer.
- (l) System for maintenance of records.
- (m) System for handling storage and delivery and
- (n) A quality plan detailing out 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, and 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.

## **SECTION 4**

### **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 along with tentative and/or final route alignment are enclosed with these specifications. The bidder is required to assess the complexity of the line route and advised to visit the project site for a first hand assessment of the same under intimation to the Employer. All cost associated for site visits shall be borne by the bidder.

#### **1.2 General Constructional Details**

The project requires supply of towers from contractor and other accessories, conductors and hardware, OPGW etc. shall be issued by BPC as detailed elsewhere in the bid documents.

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 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 and 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 apply for altitude upto 1000m above Mean Sea Level (MSL) and 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 highest object	4.0	4.6	5.5
2)Horizontal: from 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 highest part of 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 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
Upto 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 as 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.

<b>Nominal System Voltage (kV)</b>	<b>Right of Way (Meters)</b>
66	18
132	27
220	35

It may not be necessary to cut down all trees/obstacles to maintain the full corridor requirement especially in sloppy area. Instead it may be necessary to cut down trees that may fall outside the range of 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 steelwork shall not be less than those specified below under still air conditions and at 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 angle tower crossarms 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 may be used, if required, on towers with line deviation angles in excess of 30°. The tower prices are deemed to include such requirements, unless the designs are provided by the Employer.

Allowance shall be made for increasing or decreasing the length and varying the arrangements of all terminal crossarms to enable down lead span connections to be made in any desired phase sequence. Crossarms shall be arranged in 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 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
<b>For Single Suspension String:</b>			
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
<b>For Double Suspension String:</b>	915	1530	2130
<b>For Tension String (Single/Double):</b>	915	1530	2130
<b>For Jumper Loops</b>			
Still air - no swing	915	1530	2130
For 10° swing	915	1530	2130
For 20° swing	610	1070	1675

The above requirements refer to altitudes upto 1000m above MSL. For higher altitudes, 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 altitude upto 1000m above MSL. For altitudes more than 1000m above sea level, 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 b) Snow Zone Area	0 -10
Average ambient temperature/Everyday temperature a) Non Snow Zone Area b) Snow Zone Area	32 15
Maximum ambient temperature	40
Maximum conductor temperature	75
Maximum Groundwire/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 18mm.

## 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 else-where in these Specifications. It shall be noted that the transmission lines encounters hills/ridges and accordingly the factors for wind load computations shall consider relevant corrections in adoption of 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 ( $V_d$ )	$V_r \times K_1 \times K_2=36.91$ m/s; ( $K_1=1$ ; $K_2=1.08$ )
Design Wind Pressure( $P_d$ )	$0.6 \times V_d \times V_d=818$ N/Sq.m
Design Radial Thickness of ice	18 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 Employer for approval and 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 anyone tower.

The term Weight Span shall mean the equivalent length of the weight of conductors supported at anyone tower at minimum temperature in still air. At suspension positions, the minimum weight of conductor supported shall not be less than 25 per cent of the total weight of 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 which would produce high electrical stress in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surfaces and to maintain good electrical contact under service conditions.

Particular care shall be taken during manufacture of conductors and fittings and during subsequent handling to ensure smooth surfaces free from abrasion.

## **CHAPTER 2**

### **SURVEY & ALIGNMENT**

#### **1.0 General**

A detail survey has already been carried out by the Employer. 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 final route alignment as per the requirement, detail survey, tower spotting, profiling, check survey, etc. PLS CADD software shall be used for this purpose and the documents / schedules submitted for approval shall be along with the soft copies of the PLS CADD 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 reserve 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 computer, using AutoCAD. The Report shall be prepared by a qualified and experienced surveyor.

#### **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 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 line is made, cutting after completion of 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 way-leaves have been obtained by the Employer.

It shall be noted and remembered that unauthorized tree cutting being 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 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 report will be provided to the successful bidder.

The Contractor shall make immediate arrangements to set out 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 off line, in such a way that the angle and terminal pegs can be conveniently and accurately replaced in event of 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 to 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 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. All efforts shall be made by the Employer to limit such changes to the minimum.

Employer's Representative will accompany the Contractor's staff during preliminary survey. 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 to the preliminary routes, the Contractor will proceed to peg out the centerline and carry out profile survey in convenient sections and shall not await 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 a manner that pegs are not easily removable. As a safeguard it may be necessary to locate and tie-in permanent features near to 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 ground and projecting 300 mm above ground. After concreting the concrete block to the required height, the top surface should be finished smooth, with slight slope from the center towards the 4 outer edges to drain off the rainwater falling on the coping.

The rate for Survey shall be deemed to include center-pegging and reinstatement of any lost, removed or otherwise destroyed pegs.

Strip plans and longitudinal sections shall be prepared by the Contractor 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. Supports shall be so located that the wind and weight span loading specified in these Specifications are not contravened. Before submitting profiles for approval the Contractor shall provide the Employer with three sets of transparent sag templates for each line type in Perspex or similar material 3 to 4mm thick, based on the range of equivalent spans required and for the conductor types and scales. The templates shall show the sag in still air at maximum temperature, the ground clearance line, and a line showing the sag in still air at minimum temperature. Each template shall be clearly endorsed with the design loading conditions, particulars of conductors, equivalent span and the scales.

Failure to provide accurate and approved templates before submitting profile may result in a delay in the approval of profiles which shall be the responsibility of the Contractor.

Each sag template shall be used over a range of equivalent spans commencing at a span equal to 76% of the difference between that template and one of a smaller equivalent span and up to 75% of the difference between that template and one of a

higher equivalent span, e.g. for a set of templates of 200m, 300m and 400m equivalent spans, the 300m template would be used from 276 to 375m.

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, ground line, ground clearance line, line of lowest conductor at maximum sag, 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 be deviated, pipe lines, sections unsuitable for support positions, vegetation, and any other features affecting the line construction.

High voltage power line crossings shall be surveyed and drawn 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 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 for 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 tower location shall include contours with interval of 0.5 m at least 6 m beyond 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 tower legs, four lines in transverse and longitudinal directions of tower and the other four lines in the directions of four tower legs. The Contractor shall prepare the plan and cross-section at scale of 1:100 horizontal and vertical.

The Contractor shall indicate on 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 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 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 Employer shall be withheld after the completion of 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 crop 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, damages 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 erection of the lines, the Employer will initiate relocation procedures, obtain necessary consents 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 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 profile survey and showing the relative position of the lines and the services. Where the Contractor is about to erect 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 is to be carried out.

Existing LV lines (400/230V) will generally be switched off during working (daylight) hours while conductor erection is in progress at crossing points. The Contractor shall provide 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 400/230 V, 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 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 holiday. 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 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 with his Bid, 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

Adequate provision shall be made by the Contractor to prevent the straying of or damage to livestock during the execution of the Contract Works and until permanent reinstatement of fences, walls, hedges, gates and the like is completed, the Contractor shall be held responsible for any loss or damage to live stock due to failure to comply with 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 onto the final Drawings. The Detailed Survey Drawing shall identify and depict all prominent features and details with their sizes, elevations/ depths, bearings and co-ordinates. The Contractor shall mention and acknowledge on all the drawings, all the reference survey and other data used for the Survey and for compilation of the drawings. All drawings shall have their respective scales drawn upon them. Name-plates 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 along with one reproducible and 6 prints of each map. The Contractor shall also submit all the drawing information on CD s, 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 accurate 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  $\pm (5 K)$  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 proper field and level books in accordance with the standard practice. Any wrong entries shall be neatly struck out and rewritten. All such books shall be made available for inspection by 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, area of the plot and such other calculations that may be necessary.

#### 4.13 Measurements

Measurement of all transmission line work shall be on 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 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 due performance of work under this Contract complete as specified.

#### 4.14 Submission of Reports

On completion of work, a full report of the works 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 detail Soil Investigation is in the scope of the Contractor, which shall be carried out in strict compliance to 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. 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 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 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 site by the Contractor from two established reference grid lines.

The ground level shall be related to an established bench mark or to a GTS bench mark 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 upto 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, in cohesive soils only. In situ densities shall be determined for the sample locations: The samples should be tested in laboratory to find out the various parameters as detailed further ahead in this Specification. Ground water sample 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 river or water body crossings, at critical angle points or dead end points, the bore holes may be carried out depending upon terrain and type of soil as decided by 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 collection of undisturbed sample (UDS) of 90mm to 100mm diameter.

Selection of sampling tube and method of sampling, recording of boring, protection, handling and leveling of samples shall be done as specified in IS 1892 -1979 with latest revision, if any, after obtaining approval from the Employer or his authorized representative. The Contractor shall furnish in the Geotechnical report in details 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 barrel. 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 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 correct sequence from top downwards. Core boxes shall be made according Specifications laid down in IS:4078.

- (c) Depth of boring below ground level shall be 10m unless continuous bed rock is encountered earlier. In case rock is encountered within 10m, minimum drilling in rock



shall be 2m. Adequate study of rock and assessment of strength characteristics shall be done and recommendation 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 and with thickness less than 0.5m, will be considered as hard rock for payment purpose. The soft or weathered rock underlying hard rock and with 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 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 become difficult/ impossible, detailed soil testing on remoulded soil sample is to be considered upon approval of 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, 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 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 remaining portion of penetration shall also be given.
- (i) Water samples shall be collected from boreholes before addition of water to the hole. Care shall be taken to see that water sample is not contaminated by surface water or rain water. The water sample shall be collected in an air tight, scrupulously clean glass or inert plastic bottle or jerry can. The bottle/ can 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 boring operation and incorporated in the bore log. To ascertain the general ground water table inquiries in surrounding villages could be made to find out the highest ground water 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 two copies of data from the field work. As soon as each borehole/ trial pit is completed, the borelog / pitlog with all relevant field details shall be submitted.

## **1.2 Soil Resistivity Measurement**

Soil resistivity measurements shall be carried out at every third tower or at angle point tower location whichever is closer. 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**

Adequate volume of test samples shall be collected from site. Samples shall be properly sealed immediately after recovery and transported carefully to laboratory for carrying out necessary laboratory tests to find out the following parameters in respect of each sample, all as specified in relevant IS code. The Employer will direct the Contractor on samples to be tested and on type of tests to be conducted. 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  $C_c$ , 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 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.

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 not available).

#### **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 site including 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 design earthquake.
- (c) Special considerations, if any, adopted in design of previous structures of the region because of seismicity, faults, folds etc.
- (d) Behaviour of proposed foundations under seismic conditions including analysis for possibility of liquefaction and expected settlement under earthquake.
- (e) Analysis and recommendations for foundations subject to vibratory actions.
- (f) Recommendations in regard to use of subsurface material for various construction activities and methods for quarrying the same.
- (g) Topographical details of 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 above data and subsurface stratification, definition of foundation types to be adopted along the route, including 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 chemical nature of soil and ground water with respect to potential deleterious effects on concrete and steel and recommended protective measures.
- (m) Seismic history of the site including brief description of previous earthquakes,
- (n) Study on probability of landslide (slope stability analysis) and erosion for individual tower location and recommendation on remedial measure.
- (o) Specific recommendations regarding 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 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 is necessary.

## **1.5 Submission of Soil Investigation Report**

The Contractor shall submit a detailed Geotechnical Investigation report (in SI units) in five copies. The report shall generally contain 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 upto 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 upto 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 upto 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 not suitable.

##### 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.

### 1.3 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 upto the lowest conductor attachment (metre)
66	11.0
132	14.0
220	18.0

Height and span of SP and SSP type of towers shall be decided as per site requirement, after topographical survey and tower spotting are completed.

Towers for each type of construction shall be capable of being extended by 3, 6, 9, 12, 15 m without alteration to the standard body and individual legs shall be capable of being extended in 1.5 metre intervals for hillsides and side slopes. 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 independent 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, 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 center to center distance between tower legs at point of connection between 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	SB+9	4
C+9	3.5	SC+9	5
D+9	4	SD+9	6
SP+9	5	SSP+9	7

b) **132 kV line**

Non Snow Towers		Snow Towers	
Tower Type	Base Width (m)	Tower Type	Base Width (m)
B+9	4	SB+9	5
C+9	5	SC+9	6
D+9	6	SD+9	7
SP+9	7	SSP+9	9

c) **220 kV line**

Non Snow Towers		Snow Towers	
Tower Type	Base Width (m)	Tower Type	Base Width (m)
B+9	4	SB+9	5
C+9	5	SC+9	6
D+9	6	SD+9	7
SP+9	8	SSP+9	9

#### 1.4.2 Base Width for Double Circuit Towers

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 Double Circuit 220kV Tower is 1.6 times the base width of 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 edition, 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 condition (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 conductor and OPGW will be taken based on maximum weight span. However, in evaluating the tension or uplift, the weight of conductor and OPGW will be taken based on the minimum weight span and weight of insulator string only is to be considered. Effect of unbalanced vertical loads will also be taken into account for design of tower members.

## 2.3 Longitudinal Loads

The loads due to mechanical tension of conductor and OPGW shall be resolved into longitudinal and transverse components. This shall be taken for 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 confirm 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. Diameter of bolts used shall be of 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 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 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 detailed design of tower, extensions, stub template, clearance diagram, outline diagrams and their structural drawings etc.
- b) After testing of the tower, the Contractor shall furnish final design calculations and drawings, detailed assembly drawing, 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. Reproducible of all design/drawings will also be submitted to Employer after the same have 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 in 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 use of gusset plates, wherever practicable.
- d) All the connections shall be detailed to minimise 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 upto  $45^\circ$  may be done. In case where clearances are critical, the minimum sheared edge distance from bolt hole centres shall be retained.
- f) At all places where there is gap between two connected members, mild steel packing washers or wrought iron tapered washers shall be provided, wherever possible. The size of washer shall be determined as follows:
  - i) Thickness: Equal to gap
  - ii) Length and breadth: As per edge security considerations for sheared edge.
- g) The gap between the ends of two connected members in a butt joint shall not be more than 6 mm and not 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 be different, but same stub should be suitable for all types of foundations for one type of tower.
- j) For members of double diagonal web system which are bolted at their point of intersection, 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 distance between end connections and 'r' is the radius of gyration of the members for its axis parallel to the plane of 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 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 followings may be considered to be offering restraint in axial direction.

- iii-1) 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.
  - iii-2) 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 distance between end connections (on legs) and 'r' is radius of gyration of member for its axis parallel to the plane of connected legs.
  - iii-3) Corner plan bracings shall not be considered to be effective in offering restraint in axial direction.
- k)
- i) In case of K-bracings the  $KL/r$  of horizontal main bracing member shall not exceed 200 where 'L' is distance between end-connections (on main leg members) and 'r' is radius of gyration of the members for its axis parallel to plane of connected legs.
  - ii) If plan bracing with complete and perfect framing and giving support to 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 axial direction.
- l) The angle between any two members common to a joint of a trussed frame shall preferably be greater than  $20^\circ$  and never less than  $15^\circ$  due to 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 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 negative side to the extent of 2.5 percent of flange width. The distance from the centre of a bolt hole to the face of the over hanging 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 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 shank of bolt connects the head. No bolt shall connect aggregate thickness of more than three times the bolt diameter and also number of members carrying stress to be connected by a single bolt shall not generally exceed three (including gussets and packing). 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 correct setting of tower stubs, stub templates shall be designed, fabricated and supplied by the Contractor for normal towers, towers with extensions and special towers/structures. The templates shall be made out of 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 galvanised.

The slenderness ratio of any member in template shall not exceed 250.

In case of towers with unequal legs props shall be used properly to achieve correct alignment of the stubs.

## **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 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 tower, 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 out-door 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.

Contractor may offer materials manufactured in accordance with other well-recognised 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 specification differ from corresponding Indian Standard Specifications. However, material quality and strength should in no case 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 erection of EHV/UHV lines, with the best erection equipments so as to give satisfactory result.

## **7.1 Details of Tower Fabrication and Workmanship**

The tower members shall be fabricated in accordance with IS:802 (Part-II)-1992. The following important points 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 sub-Contractor's works.

- a) All parts of towers shall be fabricated in accordance with the shop drawings as provided by the Employer or prepared from approved detailed assembly drawing.
- b) Towers shall have bolted connection. 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 could be bolted together easily at 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 would 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 the manufacture of transmission line towers by using power driven cropping, punching, shearing and drilling machines. The extent of various operations shall be governed by relevant Indian Standards 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 its fouling with other members

or if they cause difficulty in 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 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 effected by shearing, cropping, flame cutting or sawing. Members over 10 mm thickness 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 upto 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 lobbed forms of holes shall not be permitted. The diameter of hole shall be 1.5 mm more than the diameter of bolts.
- n) The holes shall be perpendicular to the plates or angles.
- o) The accuracy of 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 bending 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 slope above 45°.
- q) When members are spliced by a lap joint, heel of 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 heeling will not be allowed.

## **8.0 Tolerances**

The following fabrication tolerances shall be allowed as per IS:7215-1974.

- i) The maximum allowable difference in diameter of the holes on the two sides of plate or angle shall not exceed 0.8 mm i.e. allowable taper in punched hole shall not exceed 0.8 mm on diameter.
- ii) The tolerance cumulative and between consecutive holes shall be within  $\pm 0.5$  mm.
- iii) The tolerance on the overall length of members shall be within  $\pm 1.6$  mm.
- iv) The tolerance on back mark shall be within  $\pm 0.5$  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 sizes 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 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 line, delay in payment of 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. 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 stay of zinc.

The Contractor shall submit before taking up mass fabrication and galvanising, 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 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 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 strict inspection of the galvanised material shall be carried out by the Contractor before despatch 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 attachment 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 so 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.



## **CHAPTER 5**

### **TESTS & INSPECTION OF MATERIALS**

For this Project, the tested tower designs would be furnished by the Employer and 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. Every facility shall be provided by the Contractor 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 records shall be deemed to be included in the Scheduled Rate of the item, unless separately provided for in the schedule. Apart from the tests specified here in 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 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 works. 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 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 confirm 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 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 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-up 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 Employer shall be carried out by the Bidder as per relevant standards codes both at the factory before dispatch and at 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 approved FAT plan. FAT plan should be submitted at least two months before the proposed date of carrying out 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. Transmission loss test, tension test to check 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 site, before stringing of the cable, the Bidder shall carry out 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 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 characteristic 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 in cases of all standard type 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 could 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 and 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 steel work and shall be provided all reasonable facilities for satisfying himself that the fabrication, galvanising and packing is 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.

All gauges and templates necessary for inspection of fabricated material shall be supplied by the Contractor. 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 structure and extensions will be manufactured and assembled for inspection by 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 towers 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, 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 tower, 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 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 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 tower at his own test bed, the Employer has every right to ask the Contractor to test the tower at such 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 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 upto the specified loads under the specified conditions as a result of the above test shall be done at 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. In case any deviation is detected, the Contractor shall replace such defective tower parts immediately. All expenditure incurred on account of use of such defective part(s), including its appropriate replacement, 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 rigid foundation with as much unbraced portion of the stub protruding above ground level as approved in the design. The tower erected on 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 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 the blank holes for step bolts on one leg. The tower under test should be so erected that blank step bolt holes are on compression leg of 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 suspension type tower the loads shall be applied through flexible ropes on plates of the same size used in 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 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 bolt slip test, the test loads are gradually applied upto the 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 upto the ultimate design loads in the following steps of percentage of limit and shall be released in 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 sign of failure for two minutes (excluding the time for adjustment of loads) for all the intermediate steps of loading upto and including 95 percent of 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 upto 100% ultimate design loads. The counting of waiting time shall start when all the loads are fully applied. In this respect 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, and if it shows any tendency of failure anywhere, the loading shall be immediately

stopped, released and then 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 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 upto 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, buckling) and no breakage of elements.

### 8.3 Material Test

Steel materials used for tested tower shall be subjected to tensile load or bend test in accordance with the Indian standards. Test shall be performed by the Contractor without any additional cost. The test specimens shall be selected as follows:

- i) Two samples selected from destructed members of each tower.
- ii) Two samples selected from the undestructed 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 Client
- d) The dates and location of testing
- e) The name of persons present during 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 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 for all necessary manpower and labor, transport, works, 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 sample of concrete from the foundation works, as required by the Employer. No separate payment shall be paid for Concrete test.

The test specimens shall be cubes of 150 mm side and the mould shall be of metal with 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 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 test 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<sup>2</sup> per minute. One compression plate of the testing machine shall be provided above seating in the form of a proportion of a sphere, the center 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 ultimate strength of steel.

Anchor 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.

## **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 more be preferred foundations for all towers, particularly on the mountains where transport of material is difficult. However where the same are 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 Hard Soil (Normal Dry 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 chimney to be adopted.

##### **2.2 Wet Type Foundations**

To be used for locations where 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 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 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 chimney 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 topographical survey and tower-spotting is over. The foundations for these tower types shall be decided from amongst the other types listed here, after completion of Geo-technical Survey. These foundations shall be paid for, 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 effect more economy. These will be decided by the Employer on reviewing the results of Geo-Technical investigation and when asked to do so, the Contractor shall submit design to suit site conditions, for the approval of the Employer. Examples of such intermediate conditions are: Soils with water table at other 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 sub-soil 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 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 in earth:

- (a) Resistance against Uplift:

The uplift loads will be assumed to be resisted by the weight of 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 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.

Inverted frustum of 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 strength of the soil assumed to be acting on the total area of the bottom of the footings.

In the design of foundation for down-thrust, weight of concrete in the footing above and below ground level and embedded steel parts shall correctly be accounted for, giving due consideration to 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. In case this pressure is inadequate to resist the side thrust, help shall be taken of the friction of foundation against the ground. In case the passive pressure on the chimney face is less than the side thrust, effect of the moment at the base of 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 case of back filling by Rocky Soils, horizontal soil pressures on chimney and foundation shall be taken as zero.

In 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 case.

### 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 <sup>3</sup>	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/m <sup>3</sup>	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/m <sup>3</sup>	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/ m <sup>2</sup>	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).	-	30°	15°	-	-	15°
Ultimate Plain Concrete Bearing Stress	Kg/cm <sup>2</sup>	60	60	60	60	60
Ultimate Adhesion Value between Galvanized Steel and Concrete.	kg/cm <sup>2</sup>	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 part only.

The soil parameters given above shall further be confirmed / modified as per the findings of geo-technical investigations to be carried out by the Contractor as specified, after award of 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 depths 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 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 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 450 mm square section.

The chimney top or muffing must be at least 225 mm above ground level and also the coping shall be extended upto the lower most joint level between the bottom lattices and the main corner leg of the tower. At least 50 mm thick lean concrete pad of 1:3:6 nominal mix of the size of 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 case of submerged type foundation referred to below. No separate charges shall be paid for this lean concrete pad.

In case of submerged type 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 concrete footing shall not be less than 100 mm or more than 150 mm in case of dry locations and not less than 150 mm or more than 200 mm in case of wet locations.

The foundation shall be so designed that the Center of Gravity (C.G.) of tower leg coincides with the C.G. of chimney & C.G. of chimney coincides with the C.G. of 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 stub angle and concrete in 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.



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 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 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  $90^\circ$  near the edge of step (keeping the minimum cover required) and brought to the bottom of 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 composite section for combined action of compression or tension force and associated bending moments due to horizontal shear. Minimum four bars of diameter not less than 12mm shall be provided running throughout the chimney portion to the bottom of footing and bent there at  $90^\circ$  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 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. Minimum concrete cover provided shall not be less than 50mm clear in any case.

- f) The footings shall be cast monolithically and designed as rectangular or T-beam as the case may be depending upon the shape at 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 pick-axe or bar, or flakes on exposure to air or water. These rocks can be excavated using normal tools without drilling or blasting. However, before classification of material as soft rock, the Contractor shall demonstrate to the satisfaction of the Employer about its properties, fabric and compactness.

The size of the excavation shall be no larger than that for 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 round at an angle between 45° and 60° to the horizontal. The thickness of the slab at the edge will at least be 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 earth having the same plan area at its base as the undercut. 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 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 a minimum depth of 0.9 m into a concrete block and sufficient stub cleats 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 adequate bond length within the concrete block. Other constructional details like design of chimney etc. shall be as given in 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 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, and 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 foundation, excavation paid for will be of the exact size of the foundation, 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 back-filled with lean concrete 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 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 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 that 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 requisite blasting material and shall be responsible for the purchase, transport and storage and the use of the blasting material.

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 case where unnecessarily large quantities are excavated / blasted, resulting in 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 case where drilling is done, the stubs may be shortened suitably with the approval of the Employer.

Shoring of pits with shuttering will be admissible when the soil condition is so bad that there is likelihood of accident due to the falling of 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.

#### **4.2 Setting of stubs**

The stub shall be set correctly in accordance with approved method at the exact location and alignment and in precisely correct levels. Approved stub setting templates shall be used for proper setting of stubs. Stubs shall be set in the presence of

the Employer's representative available at site for which adequate intimation shall be given to the Employer by the Contractor.

The Employer's representatives shall approve setting of stub 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 expenses.

The Employer reserves the right to uncover the foundations subject to 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 faulty foundation and bear all the expenses there of as well as the expenses of rectifying all inadequate or faulty foundations thereby disclosed and putting all these back in order.

#### 4.3 Concrete

All cement to be used shall be Portland cement meeting the requirements of the relevant Indian Standards (mainly IS 269 – 1989), from an approved manufacturer. Cement shall be adequately protected from moisture or contamination during transportation and storage at site. Cement in bags shall be limited within a heap of 13 bags in store and 7 bags at 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<sup>2</sup> cube compression strength at the end of 28 days), with 20 mm downgraded stone metal for chimney portion and slab portion and 40 mm downgraded stone metal for 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 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.

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 cements will not be permitted.

#### 4.4 Batching & Mixing of Concrete

It shall be Contractor's responsibility to carry out tests on samples for 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 specimen tested at 28 days exceeds 21 N/mm<sup>2</sup>, with not more than 3 specimen being less than 20 N/mm<sup>2</sup>, and no single specimen being less than 17 N/mm<sup>2</sup>.

The Contractor shall be responsible for maintaining the mixture, control and testing of concrete throughout the working period. Neither the mix 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 recommencing, 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 difficult location, where it is not possible 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 foundation where mixer is being used. Additional cost in such cases shall be borne by the Contractor.

Mixing shall be continued until there is 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 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 setting commences.

The concrete should be mixed as stiff 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 the work. No ready mixed concrete shall be used in foundation work if it has been mixed in the lorry during its journey to site for more than 45 minutes prior to placing. At the discretion of the Employer, ready mixed concrete may be used in foundation if the journey to site is in excess of 45 minutes, if the cement is added to the drum at 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 more than 1.5 m to avoid mix segregation.

Proper forms or moulds adequately braced to retain proper shape while concreting should be used for chimney and pyramid or slab portions. The mould should be water tight so that cement cream should not come out leaving only sand and jelly consequently forming of honeycombing in the concrete. The form boxes shall be cleaned and oiled before these are used for concreting.

The stub angle shall be free of rust and cleaned thoroughly and painted with cement paste, made of 1 part of cement and  $\frac{3}{4}$  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, and inspection of formwork and completion of all preparation work. Adequate chutes or other approved method shall be employed to place concrete. All concrete shall be consolidated to the maximum practicable density with a concrete vibrator and make 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 are left in the concrete. Concreting is

to be done continuously so that the subsequent layers are laid before the final setting 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 wire brush and washed with a layer of thick cement slurry before the new concrete is laid. If, however, the concrete is more than 10 days old, the top layer of the set concrete should be chipped and cleaned thoroughly with wire brush and water and 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 smooth, with 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 a 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<sup>2</sup>). The Contractor shall provide certificates stating origin and process of manufacture of reinforcing steel, and submit test certificates from 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 supports 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.

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 support or spacing of steel bars.

Wood supports or spreaders shall not be used.

Splicing of bars except where shown on the Drawings shall not be permitted without the prior written consent of the Employer. Bar splicing shall be by overlapping, as indicated on the Drawings, and the lap lengths shall not be less than 52 times the diameter of the smaller bar.

#### 4.6 Backfilling and Removal of Stub Templates

Following opening of formwork and removal of shoring and shuttering, back filling 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, 50 mm high earthen embankment will be made along the sides of excavation pits and sufficient water will be poured in the back-filled earth for at least 10 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 size, mixed with properly graded fine material consisting of earth to fill up the voids and the mixture used for filling. If any selected fill material is required to be borrowed Contractor shall make arrangements for bringing such material from outside borrow

pits. The material as well as 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. Contractor shall make necessary access road to borrow 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 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 material when compacted will be blended sufficiently to secure 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 concrete wet continuously for a period of 10 days after laying. The pit may be backfilled with selected earth sprinkled with 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 water fully wrapped around the concrete chimney for curing and ensuring that the bags are kept wet by frequent pouring of 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 tower foundation as 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 empty space between revetment and foundation shall be filled by earth. Alternatively, RCC retaining wall, 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.

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 of 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 upon the Contractor.

For dry stone and stone masonry revetment, separate rates shall be quoted per cum. of the wall. These rates shall be inclusive of supply of all materials, items of work involved (like excavation, laying etc.) and all costs of workmanship, labour, etc. necessary to complete revetment works.

#### 4.10 De-watering

Contractor shall furnish all materials and equipment and perform all work required for de-watering the footing excavation as required to enable 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. concreting 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 site, and of all operational costs like skilled and unskilled man-power, fuel, maintenance charges, etc.

Note:

Locations requiring de-watering are expected to be few in number. Nevertheless the Contractor should follow the above Specifications as and when de-watering is required.

## **CHAPTER 7**

### **ASCR CONDUCTOR**

ACSR ZEBRA conductor shall be issued by BPC to the successful contractor.

The conductor specifications shall comply with IS-398(part-II)-1996 or such other standard as may be approved.

Each conductor inner layer shall be covered with an approved grease (if specifically provided in the Principal Technical Parameters), such as Shell Ensis 356 or equivalent, which shall also completely fill the interstices between the strands of the outer layer. There shall be no excess grease remaining on the outside surface of the conductor, which may cause sand and dust particles to adhere during pulling out and erection of conductors.

The outermost layer of the conductors shall be stranded with a right hand layer.

Aluminum shall be of the highest purity commercially obtainable and shall not be less than 99.5 per cent. The contractor shall submit certificates of analysis giving the percentage and nature of any impurities in the metal from which the wires are made.

Joints in individual wires are permitted in any layer except the outermost, in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 metres apart in the complete stranded conductor. Such joints shall be made by resistance butt welding and shall be annealed after welding over a distance of at least 25 cm on each side of the joint. They shall be required to fulfill the mechanical and electrical requirements for un jointed wires.

The conductors shall be supplied on drums constructed to enable the conductors to be run smoothly and in lengths as long as can be conveniently handled and erected.

The cut ends of conductors, together with the joints, clamps and fittings attached to the conductors themselves, shall be treated in an approved manner to prevent the ingress of moisture.

## **CHAPTER 8**

### **OPTICAL GROUND WIRE (OPGW)**

OPGW shall be issued by BPC to the successful contractor.

#### **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) 24 cores, monomode, 1310nm wavelength armoured Non-Slotted OPGW complete with jointing material and accessories.
- b) The minimum drum lengths of OPGW shall be 3.5 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 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 route survey.

It shall be the sole responsibility of the Bidder/vendor to ascertain the applicable restrictions on 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 size and weight selected.

#### **5.0 General**

For all OPGW equipment the Bidder shall furnish the following information along with his offer:

Standing of firm as manufacturer of OPGW and accessories and experience of OPGW installation, testing and commissioning.

Details of testing facilities at manufacturer's works.

#### **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 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 under supply is over. Any design undertaken by the licensee shall be approved by the licensor. Manufacture by the licensee shall be done under Quality Assurance Program approved and monitored by the licensor. Licensor must guarantee the sequential and timely supply of equipment to meet the overall project program. Licensor must guarantee the individual and overall performance of all the equipment supplied under the Contract.

The Employer reserves the right to request for 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 latest editions of codes and standards of ITU-T- G.652D, Bureau of Indian Standards (BIS) and International Electro technical 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 and the Optical Time Domain Reflectometer (OTDR) reading along with 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 suitably 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 marking 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 clearly 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 Employer.

- a) Wave guide dispersions
- b) Microbending losses
- c) Material dispersions
- d) Ultra violet 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 primary 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 center core of the cable for the 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 from 0.2dB from the attenuation at 20°C.

The performance of the cable shall be guaranteed for an expected life of above 25 years.

## **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/patchcords 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 outage.
- Recommended method for location of all types of cable and system fault.
- 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 preparation of 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 site with all other details for OPGW.

## **CHAPTER 9**

### **INSULATORS & HARDWARE ACCESSORIES**

Long rod polymer insulator and hardware accessories shall be issued by BPC to the successful contractor.

#### **1.0 Long Rod Polymer Insulators**

Twin insulator strings and fittings shall be used for all spans, road and river crossings etc.

#### **2.0 Joints and Clamps**

Conductor and Insulator fittings shall be designed in accordance with BS 3288: Part 1 and IEC 120 and insulator fittings shall be suitable for fitting or removal under live line conditions. The electrical conductivity and current carrying capacity of each joint in the conductor shall be not less than an equivalent length of conductor.

Full tension joints shall preferably be of the compression type and shall be made so as not to permit slipping of or cause damage to or failure of the complete conductor at a load less than 95 per cent of the ultimate strength of the conductor.

All aluminium full tension compression dead-ends and joints for conductors shall be of aluminium of a purity of not less than 99.5 per cent. Non-ferrous alloys shall be such as to withstand atmospheric conditions without painting or other protection. The Contractor shall submit certificates of analysis for the various parts.

The design of joints and clamps, and any special tools to be used in their assembly, shall be such as to reduce the possibility of faulty assembly to a minimum. All external nuts shall be locked in an approved manner. There shall be no relative movement within the clamp between individual layers of the conductor itself. Where mating faces of jumper terminals are to be bolted together, they are to be protected at the manufacturer's works by strippable plastic or other approved means.

Suspension and tension clamps shall be as light as possible and shall be of non-magnetic aluminium alloy. All clamps shall be designed to avoid any possibility of deforming the stranded conductors and separating the individual strands.

Suspension clamps shall be free to pivot in the vertical plane containing the conductor and shall permit the complete conductor to slip at approximately 70% of the breaking load of the conductor. The conductor supporting groove shall be curved at its ends in the vertical plane to a radius of 150 mm and for a sufficient distance to allow for the conductor leaving the clamp at a minimum angle of inclination obtained in service. The mouth of the supporting groove shall be slightly flared in plan.

The grooves in the clamping piece or pieces shall be bell-mouthed at each end and all conductor grooves and bell-mouths shall be smooth and free from waves, ridges or other irregularities. Particular attention shall be paid to the elimination of corona emission from all parts of suspension clamps. The mechanical efficiency of tension

clamps shall not be affected by methods of erection involving the use of “come along” or similar clamps before, during and after assembly, nor by erection of the tension clamp itself. The maximum torque to be applied to the greased bolts (assumed 12 mm) of suspension clamps should not exceed 40 Nm. Light duty tension sets at the lower ends of slack spans shall be provided with turnbuckle adjusters.

Bolts and nuts shall be locked in an approved manner. Bolt threads shall be coated with approved grease immediately before tightening down at erection. Split pins for securing attachment of fittings of insulator sets shall be of stainless steel and shall be backed by washers of approved size and gauge.

As an acceptable alternative to bolted suspension clamps, Armour-grip suspension units of approved design and manufacture may be used for line or earth conductors. The Contractor shall submit samples of all units for examination and testing by the Employer before approval will be given. All insulator strings shall be attached to crossarms by means of shackles. Hooks shall not be used.

### **3.0 Insulator and Construction Attachments**

Hangers or swivels shall be fabricated or forged in such a manner and made from materials which ensure that they will remain free from fatigue or rapid wear with the specified working loads.

For light angles ( $0 - 5^\circ$ ), the insulator string attachments shall take the form of either solid swivels or hanger brackets each of which shall be located by a pin and supported between two flanges. The flanges could be fabricated from channels or angles or plates.

For angle and terminal towers, the insulator string attachments shall also take the form of solid swivels or hanger brackets supported between two flanges. In addition the conductor swivels or hanger brackets shall be capable of taking conductor pulls at  $30^\circ$  above the horizontal plane through the axis of the pin and also shall be capable of hanging vertically to support suspension insulator strings as required.

The attachments for each phase shall be capable of taking all the combinations of transverse, vertical and longitudinal loads specified for that phase, when applied to any one hanger bracket, suspension swivel, strain, swivel, special attachment swivel or special attachment hole associated with that phase.

All parts of the insulator string and the conductor special attachments, and the bolts which connect them to the tower crossarm, shall have a load factor of 3.0 for all the combinations of loads applied. The bolts used to connect the attachments to the tower or the crossarm shall be provided with extra thread length, sufficient for two full nuts. Two full nuts shall be supplied for each bolt and threads shall be coated with approved grease immediately / before tightening down at erection.

Pilot insulator strings may be used if required due to site conditions.

### **4.0 Arcing Horns**

Arcing horns will be provided on each tower. The design of arching horns shall be furnished by the Contractor during execution stage and the same shall be approved by the Employer before implementation.

## **5.0 Vibration Dampers**

Heliformed spiral type or stockbridge type dampers of approved manufacture shall be fitted to all line conductor and OPGW suspension and tension points where at a temperature of 25°C without wind, the mass of conductor carried by any insulator set is less than 40% of the total mass of the corresponding line conductors included in the two adjacent spans.

One vibration damper shall be installed at each end of the span with the gripping section being set at approved distance from the end of the armour-rod or other hardware. Two vibration dampers shall be installed at approved distance, on each side of the support where spans exceed 400 meters. The Employer may request further installations at selected locations after vibration experience has been observed through line inspections.

## **6.0 Armour Rods**

Excepting where armour-grip suspension units are approved and used, armour-rods shall be fitted at all suspension points. They shall be supplied by the Contractor and fitted strictly in accordance with the manufacturer's instructions.

## **7.0 Mid Span Clamp & Repair Sleeve**

Accessories like mid-span joints, repair sleeves, flexible copper bonds etc. are not separately indicated in the price schedule, since use of such accessories in new lines shall be avoided. At the time of actual erection and stringing, if the need arises at all and the same is considered acceptable to the Employer at that time at his sole discretion, such an approval shall be treated as a concession and no additional payment shall be made.

## **CHAPTER 10**

### **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 labour, 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 site, proper storage and preservation at this 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 Employer.

Contractor shall setup required number of stores along the line and 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 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. Suitable means shall be adopted by the Contractor 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 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 in alignment. Tolerance allowed for verticality will be 1 in 360 of tower height.

While erecting the towers 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 tower shall be placed in position before assembly of upper section is taken up.

#### 1.4 Tightening and Punching of Bolts and Nuts

All nuts shall be tightened properly using 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 use 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 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 effected 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 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 in one of the legs of every tower as per the standards.

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 4 lengths of 30m counterpoise wire. Otherwise, for soil resistivity greater than 1500 ohms meter earthing shall be established by providing 4 length of 70m counterpoise wire.

The provisional quantities for pipe type earthings and counterpoise earthing are indicated in the SCHEDULE OF PRICE. The bidders are required to quote unit rates for the same in 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 case of counterpoise type earthing, the unit rates shall correspond to 120 meters of counterpoise wire per tower.

### **3.0 Anti-Climbing Devices (where applicable)**

All towers shall be fitted with barbed wire type anti climbing device.

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 umbrella of barbed wire put on outer side and 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 4 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 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 enamelled at back and front, circular in shape and diameter 75 mm. One set of phase plates shall be consisting of three plates colored 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**

To caution low flying aircrafts, high towers used at river crossings and any other long span shall be painted and provided as markers as stated below:

- a) Light disc 0.6 m square in size, shall be provided on OPGW. Each face of the disc shall be divided into two triangles, by drawing a line along one of the diagonals of the disc. One of the triangle shall be painted with the luminous paints such as phosphorescence white and the other signal red.
- b) These discs shall be fixed at intervals of 36m with the top of the disc not below the level of the ground wire at the points of attachment. The design of the disc and their fixing arrangement shall be such that they can withstand the wind pressure. Details of arrangement shall be submitted by the Contractor for approval of Employer.
- c) Full height of the towers shall be painted above the galvanized surface in the contrasting bands of red and white. The bands shall be horizontal and not less



than 0.5m and not more than 6m wide. The bands on the extremities shall be red in color.

Employer 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 following erection equipment shall be supplied by the Contractor 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 accessories 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 conductor.
- Dead-end stocking for conductor.
- Midspan stocking for conductor.

Cost of supplying above erection equipment shall be deemed included in the contract and no separate payment would be applicable.

## **7.0 Final checking, Testing & Commissioning**

After completion of 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 back filled 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 to 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 are 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 11

### 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 line. 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. 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 conductor in various voltage level. 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

##### a) 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 ZEBRA Conductor

1. Conductor Code Name	:	'ZEBRA' ACSR
2. IS applicable	:	IS-398 (part-II)-1996
3. Wire diameter		
Aluminium	:	54/3.18 mm.
Steel	:	7/3.18 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)	:	$\geq 6.32$ kA
Modulus of Elasticity	:	12674 kg /sq.mm
Cross Sectional Area	:	74 sq.mm
Coefficient of Linear Expansion ( $^{\circ}\text{C}$ )	:	$14.3 \times 10^{-6}$

###### b) For 220 kV

Overall Diameter	:	<16.75mm
Weight	:	<0.595 kg/m
Breaking Load	:	>8005 kg
Short time current rating(1 sec)	:	$\geq 16$ kA
Modulus of Elasticity	:	8,588 kg /sq.mm
Cross Sectional Area	:	159 sq.mm
Coefficient of Linear Expansion	:	$18.7 \times 10^{-6}$

##### 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	:	$9.5 \mu\text{mtr} + 10\%$
Cladding diameter	:	$125 \mu\text{mtr} + 2.4\%$
Non-Concentricity	:	$< 1 \mu\text{mtr}$ at 1300 nm
Core/cladding		
Non-circularity of cladding	:	$< 2.5 \mu\text{mtr}$
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 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 frequency in Hz

#### 4.1.6 Shield Wire Joint Boxes

1. Sturdy, all-weather proof units
2. Complete with all necessary hardware to retain, terminate, protect and splice the fibres.
3. Suitable clamps for fixing to the tower without drilling holes in 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	20
3	Core diameter	mm	20 ±0.5
4	Nominal length (Section length)	mm	2175 ±50
5	Dry Arcing distance	mm	1933
6	Shed Profile		Aerodynamic
7	Shed profile (Regular or alternating)		Alternate
8	Shed diameter – Big/small	mm	139/108, tolerance as per IEC
9	Minimum creepage distance	mm	7595, No negative tolerance
10	Guaranteed mechanical strength	kN	120
11	Routine mechanical load	kN	60
12	Rated system Voltage	kV	220
13	Highest system voltage	kV	245
14	Rated frequency	Hz	50
15	<b>Insulator material:</b>		
	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		Aluminium Alloy
16	Minimum thickness of sheath covering over the core	mm	3
17	Power frequency withstand voltage (Wet/Dry)	kV <sub>rms</sub>	460/480
18	Impulse withstand voltage (Dry)		

	a. Positive	kV <sub>(peak)</sub>	1050
	b. Negative	kV <sub>(peak)</sub>	1050
19	Galvanizing – Minimum mass of zinc coating	gms/sq.mt	620
20	Packing		Corrugate tube
21	Applicable standard for manufacture and testing		As per IEC 61109

## **ANNEX A**

### **LIST OF APPROVED MAKES**

#### **A. Steel (\*)**

1. M/s Steel authority of India (SAIL)
2. M/s TISCO, Jamshedpur
3. M/s State Trading Corporation of Bhutan
4. Authorized Dealers in Bhutan

(\*) The Employer will monitor purchases of structural steel and reinforcement steel bars and hence Contractor shall inform the Employer prior to purchase of steel.

#### **B. Cement**

Cement shall be from manufacturers in Bhutan.

**(NOTE:** Employer may accept other makes at his discretion, if at the time of BID, the bidder seeks the approval of the same with all relevant documents of successful adoption of the same elsewhere to the satisfaction of the Employer)

## ANNEX B

### LIST OF STANDARDS & CODES RELATED TO TRANSMISSION LINE

The list of Standards and Codes given below as amended upto date 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 Galvanised 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 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 use of structural steel in overhead transmission line : Fabrication, galvanising, inspection and packing
8	IS 802-(Part-III) Latest Edition	Code of practice for 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 galvanising 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 galvanised 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/700/19 63	Regulation for electrical crossings for Railway tracks.

## 2.0 ERECTION, TESTING & COMMISSINING

Except where otherwise specified or implied the erection, testing and commissioning shall conform to the provisions of IS: 5613 (part 2 / Section-2) -1985 (as amended upto 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 over head 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 weight of zinc 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 Electro technical 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 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.

<b>1. GTP OF GALVANISED STEEL TOWERS(GENERAL)</b>			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	
<b>MATERIAL</b>	Rolled shapes			
	Plates			
	Connection bolts & nuts			
	Lock nuts			
	U-bolts or shackles			
	Step bolts & nuts			
	Ladders			
	Spring washers			
<b>GALVANISIN</b>	<b>TOWER</b>	Standard		
		Weight of zinc coating g/m <sup>2</sup>	Thickness 6 mm and below	Thickness over 6 mm

			average.....minimum .....	average.....minimum.
	BOLTS, NUTS AND LOCK NUT	Standard		
		Weight of zinc coating g/m <sup>2</sup>	average.....minimum .....	average.....minimum.
		Method of coating for bolt	<input type="checkbox"/> hot-dipped <input type="checkbox"/> other (state).....	
		Method of coating for nuts and lock nuts	<input type="checkbox"/> hot-dipped <input type="checkbox"/> other (state).....	
		Retapping of nuts after galvanized	<input type="checkbox"/> yes <input type="checkbox"/> no	
	SPRING WASHERS	Standard		
		Method of coating	<input type="checkbox"/> hot-dipped <input type="checkbox"/> other (state).....	
		Weight of zinc coating g/m <sup>2</sup>	Thickness ≤ 4.76 mm	4.76mm ≤ thickness ≤ 6.35mm
			average.....minimum m.....	average.....minimum.
DESIGN	DESIGN METHOD	<input type="checkbox"/> Three –dimensional indeterminate method : Computer program ..... Developed by ..... <input type="checkbox"/> Other method : ..... .....		

<b>1. GTP OF GALVANISED STEEL TOWERS(TOWER WEIGHT)</b>  <b>2. Indicate 66, 132 or 220kV :</b>  <b>3. Indicate Single or Double Circuit Towers</b>							Bidder						
							Item No.						
TOWER TYPE	WEIGHTS IN KILOGRAMS												
	BASIC BODY	BODY EXTENSION					SINGLE LEG EXTENSION						
		3m	6m	9m	12m	15m	1.5 m	3.0 m	4.5 m	6.0 m			
B													
C													
D													
SP													
SB													
SC													
SD													

<b>SSP</b>													
TOTAL ESTIMATED WEIGHT TO BE SUPPLIED FOR THIS PROJECT													
Complete tower = Basic Body + Body Extension (if required) + 4 Leg Extensions (if required)													
<b><i>THIS SCHEDULE IS NOT APPLICABLE, WHERE THE TOWER DESIGN IS NOT IN BIDDER'S SCOPE.</i></b>													

## **SECTION 5**

### **FORMS OF BID, APPENDIX TO BID, FORM FOR BID SECURITY & INTEGRITY PACT**

## Form of Bid

Name of Contract :

---

---

To : Bhutan Power Corporation Limited  
Thimphu, Bhutan

Gentlemen :

1. Having examined the Conditions of Contract, Specification, Drawings, and Bill of Quantities and Addenda Nos. \_\_\_\_\_ for the execution of the above-named Works we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract, Specification, Drawings, Bill of Quantities and Addenda for the sum of  
( \_\_\_\_\_ )  
  
as specified in the Appendix to Bid or such other sums as may be ascertained in accordance with the said Conditions.
2. In line with the requirements of the Bidding Documents, we enclose herewith the following Price Schedules, duly filled – in as per the proforma /schedules given in the Bidding Documents.
3. We are aware that the schedules and the Bidding Documents do not generally give a full description of Plant & Equipment to be supplied and services to be performed under each item and we shall deem to have read the Technical Specifications and other sections of the Bidding Documents and reviewed the drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices in the Price Bid. We agree that the rates and the prices to be quoted in the Price Bid shall be deemed to include and account for the full scope as aforesaid, including overheads and profit.
4. We declare and confirm that as mentioned in the Bidding Document, prices quoted by us in the Price Schedules shall be fixed and firm and shall not be subject to any Price Adjustment during the currency of the contract, except as otherwise stipulated in the Employer's Bidding Document.
5. We acknowledge that the Appendix to Bid forms part of our Bid.
6. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works comprised in the Contract within the time stated in the Appendix to Bid.
7. We agree to abide by this Bid till \_\_\_\_\_, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

8. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
9. We understand that you are not bound to accept the lowest or any bid you may receive.

Dated this \_\_\_\_\_ day of \_\_\_\_ \_\_\_\_ 20\_\_\_\_

Signature \_\_\_\_\_ in the capacity of  
\_\_\_\_\_ duly authorised to sign bids for and on behalf of

\_\_\_\_\_

Witness

\_\_\_\_\_

\_\_\_\_\_



## Appendix to Bid

Bidders shall duly sign, seal and submit the Appendix to Bid.

<b>Description</b>	<b>Clause of Conditions of Contract</b>	<b>Data</b>
Amount of Performance Security	10.1	Ten (10) Percent of the Contract Price.
Time for issue of the Notice to commence	41.1	28 Days
Time for Completion	43.1	18 (eighteen) months from the date of commencement of the work
Amount of liquidated Damages	47.1	0.1% (zero point one percent) of the Contract Price signed in the Contract Agreement Per day of delay
Limit of liquidated Damages	47.1	Ten (10) Percent of the Contract Price signed in the Contract Agreement
Defects Liability Period	49.1	365 days
Minimum amount of Interim Payment Certificates	60.4	Nu. 1.5 million
Retention Money	60.7	10 (ten) Percent of Interim Payment Certificates.
Advance Payment	60.9	Ten (10) Percent of the Contract Price signed in the Contract Agreement
Quarterly amortization Quarterly Interim	60.9	Ten (10) percent

## SAMPLE

### INTEGRITY PACT

#### 1 General:

Whereas, **Dorji Kinley, Senior Manager, CMS** representing the **Bhutan Power Corporation Ltd. (BPC)**, hereinafter referred to as the “**Employer**” on one part, and \_\_\_\_\_ representing

as the other part hereby execute this agreement as follows:

This agreement should be a part of the tender document, which shall be signed by both the parties at the time of purchase of bidding documents and submitted along with the tender document. This IP is applicable only to “**large**” scale works, goods and services, the threshold of which will be announced by the government from time to time. The signing of the IP shall not apply to framework contracting such as annual office supplies etc.

#### 2 Objectives:

Whereas, the Employer and the Bidder agree to enter into this agreement, hereinafter referred to as IP, 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**<sup>1</sup> and **contract administration**<sup>2</sup>, 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, favor or

---

<sup>1</sup> Bidding process, for the purpose of this IP, shall mean the procedures covering tendering process starting from bid preparation, bid submission, bid processing, and bid evaluation.

<sup>2</sup> Contract Administration, for the purpose of this IP, shall mean contract award, contract implementation, un-authorized sub-contracting and contract handing/taking over.

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 has not favored 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 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.

## **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, favor, any material or immaterial benefit or other advantage, 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 in whatsoever form or manner, the bidding process and contract administration.
- 5.3 If the bidder(s) have observed or noticed or have reasonable suspicion that the provisions of the IP have been violated by the procuring agency or other bidders, 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.

- 6.1 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 any one 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.

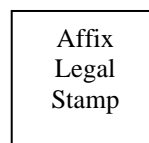
- 6.2 The breach of the IP or commission of any offence by the officials of the procuring agency shall be dealt with as per rules and laws of the land in vogue.

**7. Monitoring and Administration:**

- 7.1 The respective procuring agency shall be responsible for administration and monitoring of the IP as per the relevant laws.
- 7.2 The bidder shall have the right to appeal as per the arbitration mechanism contained in the relevant rules.

We, hereby declare that we have read and understood the clauses of this agreement and shall abide by it.

The parties hereby sign this Integrity Pact at \_\_\_\_\_  
on \_\_\_\_\_.



(Dorji Kinley)

CID: 11407001986

CID:

Witness: \_\_\_\_\_

Witness: \_\_\_\_\_

CID:

CID: \_\_\_\_\_

## FORM OF BID SECURITY (BANK GUARANTEE)

WHERE AS, \_\_\_\_\_ ----- [*Name of Bidder*] (hereinafter called "the Bidder") has submitted his bid dated \_\_\_\_\_ [*Date*] for the construction of \_\_\_\_\_ [*Name of Contract*] (hereinafter called "the Bid").

KNOW ALL MEN by these presents that We \_\_\_\_\_ [*Name of Bank*] of \_\_\_\_\_ [*Name of Country*] having our registered office at \_\_\_\_\_ (hereinafter called "the Bank") are bound unto \_\_\_\_\_ [*Name of Employer*] (hereinafter called "the Employer") in the sum of \_\_\_\_\_ for which payment well and truly to be made to the said Employer the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

THE CONDITIONS of this obligation are:

- (1) If the Bidder withdraws his Bid during the period of bid validity specified in the Form of Bid; or
- (2) If the Bidder does not accept the correction of arithmetical errors of his bid price in accordance with the Instructions to Bidders; or
- (3) If the Bidder having been notified of the acceptance of his Bid by the Employer during the period of bid validity:
  - (a) fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or
  - (b) fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders.

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand, provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date \_\_\_\_\_ or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived.

Any demand in respect of this Guarantee should reach the Bank not later than the above date.

DATE \_\_\_\_\_ SIGNATURE OF THE BANK \_\_\_\_\_

WITNESS \_\_\_\_\_ SEAL \_\_\_\_\_

\_\_\_\_\_  
(Signature, Name and Address)

**FORM OF POWER OF ATTORNEY FOR JOINT VENTURE (IF APPLICABLE)**

**(On Non-judicial Stamp Paper of Appropriate value, if required as per laws of the country of the bidder, to be Purchased in the Name of Joint Venture)**

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Partners whose details are given hereunder ..... have formed a Joint Venture under the laws of .....(\*)/intend to form a Joint Venture(\*) [(\*) delete whichever is not applicable] and having our Registered Office(s)/Head Office(s) at ..... (hereinafter called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s ..... being the Partner in-charge do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of ..... and having its Registered/Head Office at ..... as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorised Representative" or "Partner In-charge") to exercise all or any of the powers for and on behalf of the Joint Venture in regard to Specification No..... Package ..... the bids for which have been invited by Bhutan Power Corporation Ltd. (hereinafter called the '**Employer**') to undertake the following acts :

- i) To sign and submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Joint Venture".
- ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Joint Venture".
- iii) To do any other act or submit any document related to the above.
- iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture".

For the above purpose, the person(s) authorized by the Partner In-charge shall be the person(s) authorized to act on behalf of the "Joint Venture" as per the Power of Attorney given to him/her/them by the Partner In-Charge.

It is clearly understood that all the partners of the joint venture shall be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and the Partner In-charge (Lead Partner) shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Partners.

It is expressly understood that this Power of Attorney shall remain valid, binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/Authorised Representatives/Partner in-charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Joint Venture by virtue of this Power of Attorney and the same shall bind the Joint Venture as if done by itself.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this ..... day of ..... under the Common Seal(s) of their Companies.

for and on behalf of the  
Partners of Joint Venture

.....

.....

The Common Seal of the above Partners of the Joint Venture :

The Common Seal has been affixed there unto in the presence of :

WITNESS

1. Signature.....

Name .....

Designation .....

Occupation .....

2. Signature.....

Name .....

Designation .....

Occupation .....

## FORM OF UNDERTAKING BY THE JOINT VENTURE PARTNERS

**(On Non-Judicial Stamp Paper of Appropriate Value, if required as per laws of the country of the bidder, to be Purchased in the Name of Joint Venture)**

THIS JOINT DEED OF UNDERTAKING executed on this ..... day of ..... Two Thousand and ..... by ..... a company incorporated ..... under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No.1" which expression shall include its successors, executors and permitted assigns) and M/s..... a company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No.2" which expression shall include its successors, executors and permitted assigns ) and M/s..... a Company incorporated under the laws of ..... and having its Registered Office at ..... (hereinafter called the "Party No.3" which expression shall include its successors, executors and permitted assigns) for the purpose of making a bid and entering into a contract [hereinafter called the "Contract" (in case of award)] against the Specification No..... for ..... (Package) ..... associated with ..... of *Bhutan Power Corporation Ltd. (hereinafter called the 'Employer')*.

WHEREAS the Party No.1, Party No.2 and Party No.3 have entered into an Agreement dated .....

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the design, manufacture, Supply of Equipment Materials stipulated in the bidding documents under ..... (Package) ..... associated with .....

AND WHEREAS Clause 4.1, Section-ITB and 'Qualification Requirement of the Bidder', Evaluation and Qualification Criteria forming part of the bidding documents, inter-alia, stipulates that an Undertaking of two or more qualified partners, meeting the requirements of 'Qualification Requirement of the Bidder', Evaluation and Qualification Criteria, as applicable may bid, provided, the Joint Venture fulfills all other requirements under Clause 4.2 of ITB and 'Qualification Requirement of the Bidder', Evaluation and Qualification Criteria and in such a case, the Letter of Bid (Bid Form) shall be signed by the Partner –In Charge so as to legally bind all the Partners of the Joint Venture, who will be jointly and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that this Undertaking shall be attached to the bid and the Contract performance guarantee will be as per the format enclosed with the bidding document without any restrictions or liability for either party.

AND WHEREAS the bid is being submitted to the Employer vide proposal No..... dated ..... by Party No.1 based on this Undertaking between all the parties; under these presents and the bid in accordance with the requirements of Clause 4.1, Section-ITB and 'Qualification Requirement of the Bidder', Evaluation and Qualification Criteria, has been signed by all the parties.



NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties of this Deed of Undertaking do hereby declare and undertake:

1. In requirement of the award of the Contract by the Employer to the Joint Venture Partners, we, the Parties do hereby undertake that M/s..... the Party No.1, shall act as Lead Partner and further declare and confirm that we the parties to the Joint Venture shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, Supply, and successful performance of the equipment in accordance with the Contract:
2. In case of any breach or default of the said Contract by any of the parties to the Joint Venture, the party(s) do hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of these presents undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to these presents before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.
4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims rising out of the performance or non-performance of the obligations set forth in this Deed of Undertaking, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this Deed of Undertaking.
5. It is expressly understood and agreed between the Parties to this Undertaking that the responsibilities and obligations of each of the Parties shall be as delineated in Appendix – I (to be suitably appended by the Parties along with this undertaking in its bid). It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.
6. It is also understood that this Undertaking is provided for the purposes of undertaking joint and several liabilities of the partners to the Joint Venture for submission of the bid and performance of the Contract if awarded and that this Undertaking shall not be deemed to give rise to any additional liabilities or obligations, in any manner or any law, on any of the Parties to this Undertaking or on the Joint Venture, other than the express provisions of the Contract.
7. This Undertaking shall be construed and interpreted in accordance with the provisions of the Contract.
8. In case of an award of a Contract, we the parties to this Deed of Undertaking do hereby agree that we shall be jointly and severally responsible for furnishing a

Contract performance security from a bank in favour of the Employer in the currency/currencies of the Contract.

9. It is further agreed that this Deed of Undertaking shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Deed of Undertaking have through their authorised representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of .....  
has been affixed in my/ our  
presence pursuant to Board of  
Director's Resolution dated .....

For Lead Partner (Party No.-1)  
For and on behalf of M/s  
.....

Name .....

Designation .....

Signature .....

(Signature of the authorized  
representative)

WITNESS :

I. ....

II. ....

Common Seal of .....  
has been affixed in my/ our  
presence pursuant to Board of  
Director's Resolution dated .....

For Party No.-2  
For and on behalf of  
M/s.....

Name .....

(Signature of the authorized  
representative)

Designation .....

Signature .....

WITNESS :

I. ....

II. ....

Common Seal of .....  
has been affixed in my/ our  
presence pursuant to Board of

For Party No.-3  
For and on behalf of M/s.  
.....

Director's Resolution dated .....

Name .....

Designation .....

Signature .....

(Signature of the authorized  
representative)

WITNESS :

I. ....

II. ....

## **SECTION 6**

### **SAMPLE FORM OF AGREEMENT**

## SECTION 6

### SAMPLE FORM OF AGREEMENT

(Bidder should not complete this Form of Agreement at this time)

**BHUTAN POWER CORPORATION LIMITED**  
**THIMPHU : BHUTAN**

**CONTRACT AGREEMENT FOR** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(**CONTRACT NO.** \_\_\_\_\_)

**This Agreement** made this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_ between **Bhutan Power Corporation Ltd. (BPC)** having its headquarters at Thimphu, Bhutan (hereinafter called "the Employer" or "BPC") on the one part and \_\_\_\_\_ having its registered office at \_\_\_\_\_ and (hereinafter called "the Contractor") on the other part.

Whereas the Employer is desirous that certain Works should be executed by the Contractor, viz. \_\_\_\_\_ and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

Now this Agreement witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. All documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole. The following documents in the following order shall be deemed to form and be read and construed as part of this Agreement viz:
  - (a) This Agreement;
  - (b) The Integrity Pact;
  - (c) The Letter of Acceptance;
  - (d) Priced Bill of Quantities;
  - (e) The said Bid along with the clarifications and correspondence from the date of Bid Opening to signing of Contract;

Contract No. \_\_\_\_\_

Page 1 of 3

- (f) The Conditions of Contract (Part II – Conditions of Particular Application) along with Appendix to Bid;
  - (g) The Conditions of Contract (Part I – General Conditions of Contract);
  - (h) The Instruction to Bidders;
  - (i) The Technical Specifications and the Scope of Works as indicated in BPC's bid document read along with all amendments thereof;
  - (j) The Schedules of Supplementary Information as submitted by the Contractor along with the Bid read in conjunction with clarifications and correspondence till the signing of the Agreement;
  - (k) Standards and Quality Requirements; and
  - (l) Any other document forming Part of the Contract.
3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all respects with the provisions of the Contract.
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. The total contract price shall be \_\_\_\_\_ .
5. For the purpose of this Agreement, all the correspondence shall be in the form of a letter or facsimile. Correspondence to either party shall be addressed as below unless subsequently modified by either party in writing:

**Employer's Address**

**Contractor's Address**

**IN WITNESS WHEREOF**, the parties hereto have caused this agreement to be signed in their respective names on the date written.

SIGNED, SEALED AND DELIVERED

**Binding Signature of Employer**

**Binding Signature of Contractor**

**Signed in the presence of**

**Witness of Employer's Signature**

**Witness of Contractor's Signature**

Contract No. \_\_\_\_\_

Page 3 of 3

## **SECTION 7**

### **SAMPLE FORMS OF SECURITIES**



## **SECTION 7 - SAMPLE FORMS OF SECURITIES**

Samples of acceptable forms of guarantee are annexed. Bidders should not complete the forms at this time. Only the successful bidder will be required to provide guarantee(s) in accordance with the samples, or in a similar acceptable to the Employer.

- a) Performance Bank Guarantee
- b) Bank Guarantee for Advance Payment

## PERFORMANCE BANK GUARANTEE

To : \_\_\_\_\_ (name of Employer)  
\_\_\_\_\_ (address of Employer)

WHEREAS \_\_\_\_\_ [*name and address of Contractor*] (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. \_\_\_\_\_ dated \_\_\_\_\_ to execute the complete works related to -----(hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of \_\_\_\_\_ (*amount of Guarantee*)  
\_\_\_\_\_ [*in words*], such sum being payable in the currency in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of \_\_\_\_\_ [*amount of Guarantee*] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until the date as per the terms and conditions.

SIGNATURE AND SEAL OF THE GUARANTOR	_____
NAME OF BANK	_____
ADDRESS	_____
DATE	_____

## BANK GUARANTEE FOR ADVANCE PAYMENT

To : \_\_\_\_\_ (name of the Employer)  
 \_\_\_\_\_ (address of the Employer)  
 \_\_\_\_\_ (name of the Contract)

Gentlemen :

In accordance with the provisions of the Conditions of Contract, Article IV sub-clause 2 ("Advance Payment") of the above mentioned Contract, \_\_\_\_\_ *[name and Address of Contractor]* (hereinafter called "the Contractor") shall deposit with the \_\_\_\_\_ (name of Employer), a bank guarantee to guarantee his proper and faithful performance under the said Clause of the Contract in an amount of \_\_\_\_\_ *[amount of Guarantee]*  
*[in words]*.

We, the \_\_\_\_\_ [bank or financial institution],  
as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as  
primary obligator and not as Surety merely, the payment to \_\_\_\_\_ (name of  
Employer), on his first demand without whatsoever right of objection on our part and  
without his first claim to the Contractor, in the amount not exceeding  
\_\_\_\_\_ [amount of Guarantee]  
\_\_\_\_\_ [in words].

We further agree that no change or addition to or other modification of the terms of the Contract or of Works to be performed thereunder or of any of the Contract documents which may be made between, \_\_\_\_\_(name of Employer), and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until \_\_\_\_\_ (name of Employer), receives full repayment of the same amount from the Contractor.

Yours truly : \_\_\_\_\_  
SIGNATURE AND SEAL : \_\_\_\_\_  
Name of Bank/ Financial Institution : \_\_\_\_\_  
Address : \_\_\_\_\_  
Date : \_\_\_\_\_

## **SECTION 8**

### **SCHEDULES OF SUPPLEMENTARY INFORMATION**

## **SECTION 8 - SCHEDULES OF SUPPLEMENTARY INFORMATION**

### **TABLE OF SCHEDULES**

SCHEDULE 8-1	-	TENDER INFORMATION
Schedule 8-1-1	-	Addendum Receipt
Schedule 8-1-2	-	Deviations from and Exceptions to Tender Document
Schedule 8-1-3	-	Proposed Subcontractors
Schedule 8-1-4	-	Contractor's Key Personnel
Schedule 8-1-5	-	Site Establishment
SCHEDULE 8-2	-	NAME AND PLACE OF MANUFACTURE TESTING AND INSPECTION
SCHEDULE 8-3	-	TENDERER'S EXPERIENCE
SCHEDULE 8-4	-	QUALIFICATION REQUIREMENT OF TENDERER'S EXPERIENCE
SCHEDULE 8-5	-	STATUS OF CONTRACTS IN PROGRESS
SCHEDULE 8-6	-	FINANCIAL STATUS OF TENDERER
SCHEDULE 8-7	-	STANDARDS
SCHEDULE 8-8	-	WORK SCHEDULE
SCHEDULE 8-9	-	SCHEDULE OF PLANT & MACHINERY AVAILABLE
SCHEDULE 8-10	-	CURRENT/PENDING LITIGATION

**ADDENDUM RECEIPT**

Tenderers shall acknowledge receipt of each addendum by listing hereunder each Addendum received.

Receipt of the following addenda is acknowledged.

Addendum numbered \_\_\_\_\_ dated \_\_\_\_\_  
\_\_\_\_\_ dated \_\_\_\_\_  
\_\_\_\_\_ dated \_\_\_\_\_  
\_\_\_\_\_ dated \_\_\_\_\_  
\_\_\_\_\_ dated \_\_\_\_\_  
\_\_\_\_\_ dated \_\_\_\_\_

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**(TO BE FILLED IN AND SIGNED BY THE TENDERER)**

**SCHEDULE OF DEVIATION**

We/I have carefully gone through the Technical Specification and General Conditions of contract and have satisfied ourselves/myself and hereby conform that our / my offer strictly conforms to the requirements of the Technical Specification and General Conditions of contract except for the deviations which are given below:

<b>Section</b>	<b>Chapter</b>	<b>Clause No.</b>	<b>Page No.</b>	<b>Statement of Deviation/Variation</b>

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**PROPOSED SUBCONTRACTORS**

Tenderers shall be submit a list of all Sub-Contractor's they propose to employ together with a brief description of the Plant of Works they propose to sublet based on the qualifying criteria as mentioned in this tender document.

<b>Details of Equipment</b>	<b>Proposed Sub-Contractor</b>

**Place :****Signature of Bidder:****Date :****Name of the Bidder :****Seal of the Company :**



**Schedule :8-1-4**

**(TO BE FILLED IN AND SIGNED BY THE TENDERER)**

**SCHEDULE OF TECHNICAL PERSONNEL OF TENDERER**

<b>Sl No</b>	<b>Description</b>	<b>Name</b>	<b>Length of Service in firm</b>	<b>Qualification Status</b>	<b>Professional Experience and details of work carried out</b>	<b>Remarks</b>

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**SITE ESTABLISHMENT**

The Tenderer shall submit the estimated number and classification of all workmen and staff expected to be employed on site for erection and commissioning purposes.

This data shall be broken down into skilled and unskilled workmen by trade, erection engineers and technicians, administration project management, clerical and other staff, operating and commissioning engineers, technicians and others, for each month from commencement of operations.

Further, the Tenderer should indicate:

(a) Average working week	Hrs	
(b) Number of days worked per week	Days	
(c) Number of shifts per day		
(d) Number of hours per shift	hrs	

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**NAME AND PLACE OF MANUFACTURE, TESTING AND INSPECTION**

Tenderers shall complete the following for each item or group of items to be supplied under the Contract.

<b>Item/Group of Items</b>	<b>Name of Manufacturer and Place of Manufacture (Town/City, Country)</b>	<b>Place of Testing and Inspection (Town/City, Country)</b>

**Place :****Signature of Bidder:****Date :****Name of the Bidder :****Seal of the Company :**

**TENDERER'S EXPERIENCE**

Tenderers shall state below the relevant project experience in the supply and maintenance and that of their sub-contractors of items or group of items to be supplied under the Contract.

<b>Item/Group of Items</b>	<b>Details of Tenderer's Experience</b>	<b>Details of Sub-Contractor's Experience</b>

**Place :**                      **Signature of Bidder:**

**Date :**                      **Name of the Bidder :**

**Seal of the Company :**

**QUALIFICATION REQUIREMENT OF TENDERER'S EXPERIENCE**

Tenderer shall furnish this information for such Works/ supplies which have been carried out during last ten (10) years and which are under successful operation for at least one year as on date of bid opening. The information in respect of Joint Venture Partner, if any, shall also be furnished. Supporting documents shall be enclosed in respect of a minimum quantum of works as per Qualification Criteria given in Section 1 of this tender document.

**A. DETAILS OF PROJECTS (OF SIMILAR NATURE & COMPLEXITY OF SUBJECT PROJECT) EXECTED DURING THE LAST 10 YEARS.**

Sl. No.	Name & Address of Client	Name of Line	No. of Circuits	Voltage Class	Length of Line		Scope of Work	Contract Duration	
					In Hilly terrain	In Plain terrain		Commencement	Completion
<b>A</b>	<b>Lead Partner</b>								
<b>B.</b>	<b>JV Partner</b>								

**Place :** **Signature of Bidder:**

**Date :** **Name of the Bidder :**

**Seal of the Company :**

**B. DETAILS OF LINES MEETING THE ERECTION EXPERIENCE**  
**CRITERION AT Clause 4.5(a) (i) of SECTION-1**

Sl. No.	Name & Address of Client	Name of Line	No. of Circuits	Voltage Class (400kV or higher)	Length of Line		Scope of Work	Date of Commissioning	whether in operation as on date of bid opening
					In Hilly terrain	In Plain terrain			
							Survey: <b>Yes / No</b> Optimisation of Locations: <b>Yes / No</b> Foundations: <b>Yes / No</b> Erection: <b>Yes / No</b> Stringing : <b>Yes / No</b>		
							Survey: <b>Yes / No</b> Optimisation of Locations: <b>Yes / No</b> Foundations: <b>Yes / No</b> Erection: <b>Yes / No</b> Stringing : <b>Yes / No</b>		
Total length of lines executed in hilly terrain									

**Place :** **Signature of Bidder:**

**Date :** **Name of the Bidder :**

**Seal of the Company :**

**C. DETAILS OF SUPPLIES OF TRANSMISSION LINE TOWERS:**

**Details of Lines to which the tower parts have been supplied :**

S. No.	Name & Address of Client	Name of the line	Supply of Tower		Date of commencement of supplies	Date of completion of supplies	Date of commissioning of Line	whether in operation as on date of bid opening
			Nos.	Weight (MT)				

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**Schedule-8.5****STATUS OF CONTRACTS IN PROGRESS**

Give full information of all the uncompleted works on the Contracts now in Progress/in Hand.

<b>Name of the Project</b>	<b>Country</b>	<b>Owner/ Client</b>	<b>Contract Amount (Currency)</b>	<b>Amount Completed (Currency)</b>	<b>Date of Commencement</b>	<b>Schedule date of completion</b>
<b>TOTAL</b>						

**Place :**                      **Signature of Bidder:**

**Date :**                      **Name of the Bidder :**

**Seal of the Company :**



**FINANCIAL STATUS OF TENDERER**

Fill in the blanks for the last five (5) years in the original currency and also attach copies of the Balance Sheets for these years.

1.	Share capital	_____
2.	Total current assets	_____
2.1	Total cash and deposit	_____
2.2	Deposits with bids or otherwise as guarantees (due within 90 days)	_____
2.3	Accounts receivable from completed contracts (due within 90 days)	_____
2.4	Amounts receivable after deducting retention from uncompleted contracts (due within 90 days)	_____
2.5	Stocks and bonds at present market value	_____
2.6	Buildings and loans at present market value	_____
2.7	Life insurance at cash surrender value (for an individual or partnership only)	_____
2.8	Other current assets	_____
3.	Total current liabilities	_____
3.1	Notes payable (to banks, regular and for certified checks and to others)	_____
3.2	Accounts payable	_____
3.3	Other current liabilities	_____
4.	Total assets	_____
5.	Total Liabilities	_____
6.	Current credit resources	_____
7.	Net worth	_____
8.	Total profit before tax	_____

9. Turnover in the previous five financial years      Year 1 \_\_\_\_\_  
    Year 2 \_\_\_\_\_  
    Year 3 \_\_\_\_\_  
    Year 4 \_\_\_\_\_  
    Year 5 \_\_\_\_\_

10. Amount of balance      \_\_\_\_\_

11. Date of balance      \_\_\_\_\_

12. Bank references and address      \_\_\_\_\_

13. Bonding capacity      List names of institutions and bondable  
    amounts: attach respective letters from  
    surities

<u>Institution</u>	<u>Currency</u>
_____	_____
_____	_____
_____	_____
_____	_____

**Remarks**

Item 1:      The amount for share capital shall include retained earnings.

Item 6:      The maximum current credit resources the Tenderer's bank(s) hold(s) available for  
                  the fulfillment of Tenderer's obligation for the Project if the Tenderer is awarded the  
                  contract shall be stated and certified by the Bank.

Item 13: Attach respective letters from the banks.

**Place :**      **Signature of Bidder:**

**Date :**      **Name of the Bidder :**

**Seal of the Company :**

**FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY  
OF CREDIT/FACILITIES**

**BANK CERTIFICATE**

To

Date: .../.../...

.....  
.....

This is to certify that M/s..... (hereinafter referred to as Bidder), who are participating in the tender for Bhutan Power Corporation Limited (BPC) for Tender No....., is our customer for the past .....years.

Their financial transaction with our Bank has been satisfactory. They enjoy the following fund based credit facilities with us against which the extent of utilization as on date is indicated below.

Sl no	Type of Facility	Sanctioned limit as on Date (.../.../...)	Utilization as on Date (.../.../...)	Balance as on Date (.../.../...)
1	<b>Fund Based</b>			
	(a).....			
	(b).....			
2	<b>Total Amount</b>			

We further undertake that in the event of award of the Contract for the above tender to the Bidder, we shall provide credit facilities to the extent of ..... (mention amount to meet the construction cash flow requirement) towards the above project specifically, to tide over any shortage of cash flow during the execution of the Contract.

Name of Bank :  
Name of Authorized signatory :  
Designation :  
Phone no :  
Address :

**SEAL OF THE BANK**

**SCHEDULE-8.7****STANDARDS**

Standards Used by the Tenderer

If for any major reason the Tenderer wishes to supply equipment to Standards other than those referred to in the Specification, especially in respect of detailed or dimensional standards, these shall be listed below, along with any standards used by the Tenderer which have not been referred to in the Specification.

<b>Standard No. and Year</b>	<b>Title</b>	<b>Deviations Yes/No standard specified</b>	<b>Equivalence Yes/No/Partial</b>

**Place :**

**Signature of Bidder:**

**Date :**

**Name of the Bidder :**

**Seal of the Company :**

**WORK SCHEDULE**

The bidder shall provide a detailed programme covering design, manufacture, installation and commissioning phases of the project. This programme shall conform to the key dates in the Tender Document.

The programme shall include a bar chart of the principal quantities of work forecast for execution monthly, and payments expected to be made in connection herewith in accordance with the Conditions of Contract.

The programme shall be made using a Project Management software like Microsoft Project. The Bidder shall also submit soft copy of the programme to the Engineer/ Purchaser for approval.

The bidder should also include a schedule of all major items of plant and identify the Country of Origin.

**Place :**                      **Signature of Bidder:**

**Date :**                      **Name of the Bidder :**

**Seal of the Company :**

**Schedule-8-9****(TO BE FILLED IN AND SIGNED BY THE TENDERER)****SCHEDULE OF PLANT & MACHINERY AVAILABLE**

<b>Sl No</b>	<b>Description of plant /machinery</b>	<b>No.</b>	<b>Make</b>	<b>Age &amp; condition</b>	<b>Location where installed</b>	<b>Remarks</b>

**Place :****Signature of Bidder:****Date :****Name of the Bidder :****Seal of the Company :**

**CURRENT/PENDING LITIGATION (in accordance with Section-I, clause 4.1.d. vii)**

<b>Nature of Dispute</b>	<b>Matter in Dispute</b>	<b>Year of Dispute</b>
Arbitration cases pending		
Disputed incomplete works		
Pending civil cases against the firm and/or its Proprietor / Partner (s) involving moral turpitude in relation to business dealings.		
Pending criminal cases against the firm and/or its Proprietor /Partner(s) involving moral turpitude in relation to business dealings.		
Punishments received under civil cases and/or criminal cases involving moral turpitude in relation to business dealings to the firm and/or its Proprietor/ Partner(s)		

Each Bidder or member of a JV must fill in this form.

**Place :** **Signature of Bidder:**

**Date :** **Name of the Bidder :**

**Seal of the Company :**

## **SECTION 9**

### **PREAMBLE TO PRICE SCHEDULE AND SCHEDULE OF PRICES (INCLUDING BILL OF QUANTITIES)**



## **PRICE SCHEDULES**

### **Preamble**

1. The Contract is of “Item Rate–Turnkey” nature and includes the definitive engineering, and design that shall ultimately define actual quantities of work.

The provisional quantities of various materials, accessories, for the proposed line are given in the price-schedule. However, the quantities may vary consequent to actual execution of the work. The payment shall be made for the actual quantities used for various items. The Contract Price shall be adjusted for the actual and correct quantities as executed and duly approved by the Employer on the basis of the proposed all inclusive unit rates to arrive at the final Contract Price. Wherever no quantity is given against any item in the Schedule of Prices, a rate shall nevertheless be entered against that item. This rate shall be used, in case the item is required to be used during actual execution of the contract.

It shall be a condition of this contract that the all-inclusive rates quoted in Schedule of Rates / Prices shall not be varied for reasons of change in respective quantities. The only exception shall be the items where variation is allowed in the conditions, and this shall be done in accordance with the conditions. Further, it shall also be an important condition of this contract that there shall not be any change in Unit Rates of items consequent to revision of labour rates by the Government of Bhutan.

2. The supply rate against each item shall be an all-inclusive rate, and be inclusive of engineering, manufacture, supply, freight, landing, insurance. The Bidder shall indicate the all-inclusive rate separately for each item. Further, the all-inclusive unit rates shall be on FAS (Free-At-Site) basis inclusive of ex-works price, packing and forwarding charges, freight, transport charges to actual work site, storage where necessary, charges for transit insurance, insurance of material/ goods at site, pandemic related costs, etc.. Bidder shall indicate Bhutan Sales Tax (BST) and Customs Duty (CD) applicable on the item separately.
3. All items of work specified in the specifications may not have been included in the price-schedule. The items of work not specifically called for in the Schedules are deemed to have been covered under the items called for, to leave the works complete, as per the specifications. The rate quoted by the Contractor shall be deemed to be all-inclusive, to cover the smaller items specified / normally required but not separately called for in the Price-Schedule.
4. In addition to the points stipulated / highlighted in these clauses, all the conditions mentioned in the specifications, pertaining to measurement of quantities and unit rates of scheduled items, shall apply.
5. During the execution of Works the Employer shall be within his rights to instruct the Contractor for the immediate execution of extra work without waiting for the sanction

/ approval of the extra item rate. Extra item rates shall be derived from the tendered rate for similar items of work where such rates exist. Only where this is not possible, other methods for deriving unit rates for such additional works shall be adopted and these would normally be based on joint observation of cost as recorded and payment shall be made on the basis of quotation or the actual observed cost plus 20% (twenty percent) towards Contractor's overheads & profit, whichever is less.

6. The measurement of quantities shall be in terms of the executed quantities of supply and works at the rates indicated in the Price Schedules.
7. In case of any discrepancy between this Preamble to Price Schedule and provisions elsewhere in the tender documents, the provisions under this Preamble govern.

**SUPPLY & CONSTRUCTION OF A 132 kV DOUBLE CIRCUIT TRANSMISSION LINE LILO AT YUNGICHU**  
**TENDER No. BPC/C&PD/CMS/TENDER-2023/07**

**SUMMARY OF COST**

S.No.	COMPONENTS	PRICE (Nu./Rs.)
1.0	Total for Schedule 1: Supply of Materials	
2.0	Total for Schedule 2 : Survey, Soil Investigation, Erection, Testing & Commissioning	
	<b>TOTAL</b>	

Total figure in Words :

Date:

Signature of Bidder :\_\_\_\_\_

Name of Bidder :\_\_\_\_\_

Place:

Seal of the Company :\_\_\_\_\_

**SUPPLY & CONSTRUCTION OF A 132 kV DOUBLE CIRCUIT TRANSMISSION LINE LILO AT YUNGICHU**  
**TENDER No. BPC/C&PD/CMS/TENDER-2023/07**

**SCHEDULE 1 - SUPPLY PORTION**

Price in Nu./Rs.											
Item	Description	Unit	Provisional Quantity	Unit Rate for Supply and Delivery per finish tower			Total FAS Price (excluding BST/CD)	Provision for BST/CD			Total FAS Price (Including BST/CD)
				Ex-Works Price	FAS(excluding BST/CD)	FAS (including BST/CD)		BST%	CD%	Value(BST+CD)	
				1.00	2.00	3		6	7	8=(6+7) x 1 x 2	
<b>1.0</b>	<b>Supply of Tower Materials</b>										
1.1	Fabrication, galvanising 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	76.60					10%			
	i i) Mild Steel	MT	100.21					10%			
1.2	Fabrication, galvanising & supply & delivery of stubs for various types of towers with pack washers excluding supply of bolts & nuts										
	i ) HT Steel	MT	9.79					10%			
	i i) Mild Steel	MT	0.82					10%			
1.3	Fabrication, galvanising, supply & delivery of Nuts & Bolts for towers except for stubs										
	i) Hexagonal Bolts & Nuts including Step Bolts	MT	9.31					10%			
1.4	Fabrication, galvanising, supply & delivery of Nuts & Hex. Bolts for stubs including plain washers	MT	0.21					10%			
<b>2.0</b>	<b>Supply of the following tower accessories</b>										
2.1	Danger Plate	Nos.	23.00					10%			
2.2	Number Plate	Nos.	23.00					10%			
2.3	Phase Plate (Set of three)	Sets	23.00					10%			
2.4	Aviation Signal/Obstruction Signal	Sets	3.00					10%			
2.5	Span Marker	Sets	3.00					10%			
2.6	Counterpoise Earthing - 120 mtr ( 40 x 3 legs)	Sets	23.00					10%			
2.6	Pipe Type Earthing (one of the Legs of each tower)	Sets	23.00					10%			
2.7	Circuit plate ( Set of three for double circuit)	Sets	23.00					10%			
<b>3.0</b>	<b>Design, Manufacturing, Supply Conductor Accessories</b>										
3.1	ACSR PANTHER Conductor	Linear Km (*)	38.00					10%			
3.2	Vibration Dampers for Conductor	No.	276.00					10%			

Item	Description	Unit	Provisional Quantity	Unit Rate for Supply and Delivery per finish tower			Total FAS Price (excluding BST/CD)	Provision for BST/CD			Total FAS Price (Including BST/CD)
				Ex-Works Price	FAS(excluding BST/CD)	FAS (including BST/CD)		BST%	CD%	Value(BST+CD)	
				1.00	2.00	3		6	7	8=(6+7) x 1 x 2	
4.0	Design, Manufacturing, Supply & delivery of OPGW & Accessories										
4.1	24 core Non-slotted composite (OPGW) in three tubes as per specification	Linear Km (*)	6.14					10%			
4.2	Jointing kits for OPGW/ In-line splice enclosure for OPGW including download c-clamps, earthing clamps, etc complete	Set	2.00					10%			
4.3	OPGW tension assemblies with armour rods ( 2 x 339 locations)	Set	46.00					10%			
4.4	Vibration Dampers for OPGW	No.	276.00					10%			
4.5	Bonding connections for OPGW	Set	23.00					10%			
5.0	Design, Manufacturing, Supply & delivery of Insulators & Hardwares										
5.1	Tension Insulators Strings including Hardware Fittings, Arching Horns, etc										
5.1.1	Single string tension insulator assemblies	Set	138.00					10%			
5.1.2	Double string tension insulator assemblies	Set	24.00					10%			
5.1.3	Single string tension inverted insulator assemblies with sag adjuster plates (without insulator)	Set	6.00					10%			
TOTAL FOR SCHEDULE 1											

Date:

Signature of Bidder : \_\_\_\_\_

Name of Bidder : \_\_\_\_\_

Place:

Seal of the Company : \_\_\_\_\_

**SUPPLY & CONSTRUCTION OF A 132 kV DOUBLE CIRCUIT TRANSMISSION LINE LILO AT YUNGICHU**  
**TENDER No. BPC/C&PD/CMS/TENDER-2023/07**

**SCHEDULE 2: SURVEY, SOIL INVESTIGATION, ERECTTION, TESTING & COMMISSIONING**

Item	Description	Unit	Provisional Quantity	Unit Rate (Nu.)	Total Price (Nu.)
		1	2	3	4 = 2 x 3
<b>1.0</b>	<b>Access, Clearing &amp; Survey</b>				
1.1	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, clearing of ROW, submission of drawings etc all as specified.	Route km	5.96		
<b>2</b>	<b>Geotech Investigation</b>				
2.1	Excavation of trial pits at locations including necessary shoring, dewatering, collecting samples, and conducting penetrometer tests (if possible), backfilling, etc., as per standard practice and to specifications.	No.	23		
2.2	Conducting Electrical Resistivity test of soil as per standard practice and to specifications.	No.	23		
2.3	Conducting laboratory tests on selected soil, rock and water samples including transporting the same to the approved laboratory, as per standard practice and to specifications.	Lump sum	1		
2.4	Preparation & submission of three(3) copies of final report of geotechnical investigation as detailed in specifications	Lump sum	1		
<b>3</b>	<b>Benching Works for Tower foundations, retaining walls, revetment walls, etc</b>				
3.1	In all types of Soil except Soft & Hard Rock	Cu.M	3,871.19		
3.2	In Soft/fissured Rock	Cu.M	1,290.40		
3.3	In Hard Rock	Cu.M	1,290.40		
<b>4</b>	<b>Tower/ Retaining wall/ Revetment wall Foundationworks</b>				
4.1	Excavation, backfilling in tower foundation and protection works including all related items og work like shoring, de -watering etc. all complete as apeified in various types of soil				
4.1.1	Dry Soil	Cum	1,798.81		
4.1.2	Wet Soil	Cum	149.90		
4.1.3	Dry Fissured Rock	Cum	599.60		
4.1.4	Hard Rock	Cum	449.70		
4.2	Supply & Concreting (including all associated works related to foundation and retaining walls. The rates shall be inclusive of transportation, head loading to location, centering and shuttering etc.				
4.2.1	M20 Concrete Nominal Mix 1:1.5:3	Cum	328.84		
4.2.2	M10 Lean Concrete Nominal Mix 1:3:6	Cum	37.56		
4.3	Supply & placement of reinforcement steel (Fe 500)	MT	35.16		
4.4	Installation of Stubs including nuts and bolts	MT	10.33		

Item	Description	Unit	Provisional Quantity	Unit Rate (Nu.)	Total Price (Nu.)
		1	2	3	4 = 2 x 3
5	Erection of various type of towers, complete body with approved extensions / leg (equal / unequal) extensions (complete) including bolts & nuts, step bolts. Hangers, D shackles, etc including punching up to ACD	MT	174.58		
<b>6</b>	<b>Installation of following tower accessories in complete respect</b>				
6.1	Danger Plate	Nos.	23.00		
6.2	Number Plate	Nos.	23.00		
6.3	Phase Plate (Set of three)	Sets	23.00		
6.4	Aviation Signal/Obstruction Signal	Sets	3.00		
6.5	Span Marker	Sets	3.00		
6.6	Counterpoise Earthing (120mtr * 3 legs)	Sets	23.00		
6.7	Pipe Type Earthing (one of the Legs of each tower)	Sets	23.00		
6.8	Circuit plate ( Set of three for double circuit)	Nos.	23.00		
<b>7</b>	<b>Supply &amp; Installation of following items for tower protection works</b>				
7.1	RRM in (1:5 Cement: Mortar) complete work including excavation in foundation, providing and erection of scaffolding, centering and shuttering, weep holes & back filling with selected materials	Cum	783.40		
7.2	Gabion wall stone bound in G.I mesh 4mm (8SWG) including weaving of mesh, excavation & backfilling	Cum	522.27		
7.3	M15 (1:2:4) nominal mix concrete for top seal cover pf revetment including centering and shuttering	Cum	10.55		
<b>8</b>	<b>String of Conductors</b>				
8.1	Laying, stringing, tensioning, clamping, jointing, etc. complete of ACSR PANTHER Conductor including hoisting of insulators, dampers and all other accessories for complete route of three phase double circuit power conductors for complete route	Linear km (*)	5.96		
<b>9</b>	<b>String of OPGW</b>				
9.1	Laying, stringing, tensioning, clamping, jointing, bonding etc. of OPGW including all fittings of accessories for complete route	Linear km (*)	5.96		
	<b>TOTAL FOR SCHEDULE 2</b>				

(\*) Linear km is the horizontal distance measured between the conductor / OPGW attachment points of adjacent towers.

Date:

Signature of Bidder : \_\_\_\_\_

Name of Bidder : \_\_\_\_\_

Place:

Seal of the Company : \_\_\_\_\_

## **LINE ROUTE**



## 132 kV Yungichhu Line

### Legend

- 132 kV Existing Line
- 132 kV Yungichhu Line
- 33 kV Existing Line
- Dzongkhag Road
- National Highway



Proposed Switchyard

Yungichhu Hydroproject Campsite

Dowazhing Lhakhang

Gorgan

LULO Point

Native Poultry and Heifer Production...

Zangkhar pri school

Google Earth

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1 km



