

**Bhutan Power Corporation Limited**  
(An ISO 9001:2015, ISO 14001:2015 & OHSAS 18001:2007 Certified Company)  
**Distribution & Customer Services**  
**Department Electricity Services Division**  
**Trongsa : Bhutan**



**Tender No. BPC/ESD/Tro/Tech-05/2020**

**Bidding Document for**  
**Labour Contract of Plan and O&M Works,**  
**Package: Q12 – 2021**

**23<sup>rd</sup> March 2021**



## Preface

This Bidding Document has been adopted from the Ministry of Finance's Standard Bidding Document (Revised July 2015), Procurement of Works for Works Contracts below Nu. 4 (four) Million.

Procurement under projects financed by the Royal Government of Bhutan is carried out in accordance with policies and procedures laid down in the *Procurement Rules and Regulations 2009*.

To obtain further information on procurement you may contact:  
Public Procurement Policy Division  
Ministry of Finance



## INVITATION FOR BIDS

Date: 23<sup>rd</sup> March 2021  
 Tender No.: BPC/ESD/Tro/Tech-05/2021

1. BPC invites sealed bids from the below mentioned Class categories of Bhutanese National with W4 (Power and telecommunications) valid License and registered with the Construction Development Board for construction of electricity distribution infrastructure works under the following packages.

Name of Work Dzongkhag	Package	Contractor	Approximate Estimate (Nu.)
Plan and O&M Works -2021	Q12-2021	Small	1,996,418.67
<b>Bid Details</b> a) Sale of Bid Document 24 <sup>th</sup> March 2021 to 22 <sup>nd</sup> April 2021 b) Cost of Bid Document Nu. 1000.00 each (Non-refundable) c) Place of Sale Accounts Section, ESD, BPC, Trongsa d) Last Date of Submission 23 <sup>rd</sup> April 2021 (1200 Hours) e) Place of Submission Accounts section, ESD, BPC Trongsa f) Opening Date 23 <sup>rd</sup> April 2021 (1430 Hours) g) Place of Opening Conference Hall, ESD, BPC, Trongsa			

2. Interested eligible Bhutanese National Bidders Contractors may obtain further information on the bid form and inspect the bidding documents at the office of:

**Sr. Divisional Manager**  
**Electricity Services Division**  
**Bhutan Power Corporation Limited**  
**Trongsa : Bhutan**  
**Telephone No.: 03- 521102; 17643271 and Email – esdtrongsa@bpc.bt**

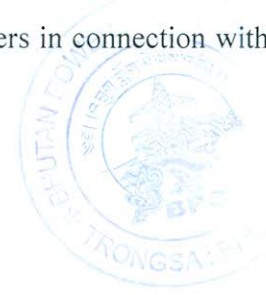
3. A complete set of bidding document may be purchased by any interested eligible Bidder on submission of a written application with copies of **valid Trade license, CDB registration certificate and Tax clearance certificates** to the above address and upon payment of a non-refundable fee of **Nu. 1000.00** (Ngultrum One Thousand only) payable to the **Divisional Manager, ESD, BPC, Trongsa**. The bidding document can also be downloaded from the BPC website ([www.bpc.bt](http://www.bpc.bt)) and need to register with ESD office during submission.
4. As per the prerequisite of Royal Government of Bhutan, interested Bidders should sign the Integrity Pact (IP) with Electricity Services Division, Trongsa at the time of purchase of bidding document. In order to sign the IP, the prospective Bidders should accompany a witness along with one legal stamp.



5. The date of sale of document shall be from **24<sup>th</sup> March 2021** to **22<sup>nd</sup> April 2021**.

**All bids must be accompanied by a Bid Security amount indicated against individual the package in Bhutanese Ngultrum (Nu.), and must be delivered in accordance with the Instructions to Bidders on the date indicated in the Bidding Documents and will be publicly opened thereafter.**

6. BPC will not be responsible for any expenses incurred by bidders in connection with the preparation or delivery of bids.



## Section I

### INTEGRITY PACT

#### 1 General:

Whereas,

\_\_\_\_\_ representing the Bhutan Power Corporation Limited, Royal Government of Bhutan, hereinafter referred to as the “Employer” on one part, and \_\_\_\_\_ (*Name of bidder or his/her authorized representative, with power of attorney*) representing M/s. \_\_\_\_\_ (*Name of Firm*) 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 “Small” 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.

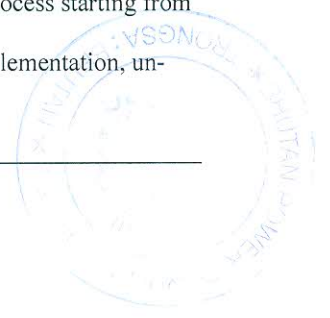
#### 4. Commitments of the Employer:

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 any material 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, unauthorized sub-contracting and contract handing/taking over.



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, mis-representation, 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 De-barment Rules.

including De-barment 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 \_\_\_\_\_

Affix

Affix

EMPLOYER

BIDDER/REPRESENTATIVE

CID:

CID:

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

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

Name:

Name:

CID:

CID:



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## Section-II

### Instructions to Bidders

#### A. General

##### 1. *Scope of Bid*

- 1.1 Bhutan Power Corporation Limited (BPC) (hereafter referred to as “the Employer”) wishes to receive sealed Bids for the Labor Contract for the Plan and O&M works, Package:Q12- 2021 for the Electricity Services Division, Trongsa. The scope of work include construction, erection, testing, commissioning of MV lines (33 kV and 11 kV), LV ABC lines, Distribution Substation, Clearing of Right of Way (ROW) for both MV and LV lines, Painting of MV and LV poles with fittings, including loading, transportation, delivery of all materials and equipment to sites from BPC, ESD stores, etc. (hereinafter referred to as “Works”).
- 1.2 The successful bidder will be expected to complete the works within the stipulated time from the date of commencement of works as indicated in Article III, Clause No. 2 of Conditions of Contract.

##### 2. *Eligible Bidders*

- 2.1 This Invitation for Bid is open to all “**Small Class**” Bhutanese registered Contractors with W4 (Power and Telecommunications) valid Trade License and CDB registration.
- 2.2 Bidders shall provide such evidence of their eligibility satisfactory to the Employer, as the Employer shall reasonably request.
- 2.3 A Bidder shall not have a conflict of interest. All Bidders found to have conflict of interest shall be disqualified. Bidders may be considered to have a conflict of interest with one or more parties in this bidding process, if:
  - (a) they have a relationship with each other, directly or through third parties, that puts them in a position to have access to information about or influence on the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
  - (b) a Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Works that are the subject of the Bid or in any other way provided consulting services in any aspect of the preparatory stages leading up to the issue of these bidding documents; or
  - (c) a Bidder lends, or temporarily seconds its personnel to firms or organizations which are engaged in consulting services for the preparation related to procurement for or implementation of the project, if the personal would be involved in any capacity on the same project.

##### 3. *Cost of Bidding and Site Visit*

- 3.1 The bidder shall bear all costs associated with the preparation and delivery of its Bid, and the Employer will in no case be responsible or liable for those costs.
- 3.2 The bidders are advised to visit and examine the Site of Works and its surroundings and obtain on their 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 their own risk.

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

- 3.3 The interested bidders shall make prior appointment for field visit before submitting the bid offer. For more information contact the Sr. Divisional Manager.

**Mr. Ugyen Thinley, Sr. Divisional Manager, ESD, BPC, Trongsa**  
**Mobile No. 17643271 / 77643271**

**4. Contractor Information Network (CiNET)**

- 4.1 The performance of the contractor shall be assessed as per the past performance of the BPC works guidelines (average performance scoring form) contained in the CiNET available in the CDB website. **(Not Applicable)**
- 4.2 The average performance scoring (APS) forms is provided in the Section VII (Sample forms) of the bidding document. The bidders are required to initial all the pages of APS form agreeing to the applicability of APS form. In case the APS form is not signed, the bid for that bidder shall be liable for rejection. **(Not Applicable)**

**B. The Bidding Documents**

**5 Bidding Documents**

- 5.1 The bidding procedures and contract terms are prescribed in the Bidding Document. In addition to the Invitation for Bid, the Bidding Document includes:

- I Integrity Pact
- II Instructions to Bidders;
- III Conditions of Contract;
- IV Technical Specifications & Drawings;
- V Price Schedules;
- VI Bid Form; and
- VII Sample Forms
  - Bid Security Form
  - Contract Form
  - Performance Security Form
  - Bank Guarantee for Advance Payment
  - Power of Attorney Form
  - Form of information for establishment of Bidders' Eligibility

Form of information for establishment of Bidders' Qualification  
Average Performance Scoring form  
Confirmation of Litigation History

- 5.2 The bidders are expected to examine the Bidding Document, including all instructions, forms, terms and specifications. Failure to furnish all information required by Bidding Document or submission of a Bid not substantially responsive to the Bidding Document in every respect will result in the rejection of the Bid.

**6 Clarification of Bidding Documents**

- 6.1 Prospective bidders requiring any further information or clarification of the Bidding Document may notify the Employer in writing at the Employer's mailing address indicated under Clause 20.2. The Employer will respond in writing to any request for information or clarification of the Bidding Documents, which it receives no later than ten (10) days prior to the deadline for submission of bids. The Employer's response including an explanation to the query will be sent in writing to all prospective bidders who purchased the Bidding Document.

**7 Amendments of Bidding Documents**

- 7.1 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 prospective bidder, modify the bidding Document by issuing addendum.
- 7.2 The amendment shall be part of the Bidding Document, pursuant to Sub-Clause 5.1, and it will be notified in writing or by fax to all prospective bidders who have received the Bidding Document, and will be binding on them.
- 7.3 In order to afford prospective bidders reasonable time in which to take the amendment into account in preparing their Bids, the Employer may, at its discretion, extend the dead line for the submission of Bids.

**C. Preparation of Bids**

**8 Language of Bid**

- 8.1 The Bids prepared by the bidder, and all correspondence and documents relating to the Bid exchanged by the Bidders and the Employer, shall be written in the English language.

**9 Documents Comprising the Bid**

- 9.1 The Bid prepared by the bidders shall comprise of the following components:
- (a) Bid Form and Price Schedule completed in accordance with Clause 10, 11, 12;
  - (b) Documentary evidence establishing, in accordance with Clause 13, that the bidder is eligible to bid.
  - (c) Documentary evidence establishing in accordance with Clause 14, that the bidder is qualified to perform the Contract if its Bid is accepted;
  - (d) Bid security furnished in accordance with Clause 16.

- (e) Written Power of Attorney authorizing the signature by bidders in accordance with Clause 19.2

**10 Bid Form**

- 10.1 The bidder shall complete **an original and a copy of the Bid Form and the appropriate Price Schedules** furnished in the Bidding Document.

Bid forms not duly filled and signed appropriately shall be treated as non-responsive and the bid shall be rejected.

**11 Bid Prices**

- 11.1 The bidders shall complete the appropriate Price Schedules included herein, stating the unit prices, total price per item and the total amount. Prices quoted shall follow strictly the format provided herein.

- 11.2 Unless stated otherwise in the bidding documents, the Contract shall be for the whole works, based on the schedule of unit rates and price submitted by the bidders.

- 11.3 The bidders shall fill in rates and prices for all items of the works described in the Bill of Quantities. Items against which no rate or prices is entered by the bidders 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.

- 11.4 All duties, taxes and other levies payable by the Contractor under the contract, or any other cause, as of the date twenty eight (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.

- 11.5 Rates quoted by the bidder shall remain fixed and valid until completion of the Contract performance and will not be subject to variation on any account. A bid submitted with price adjustment condition will be treated as non-responsive and will be rejected.

- 11.6 Conditional tenders shall be rejected without any further explanation.

**12 Bid Currencies**

- 12.1 Rates shall be quoted in Ngultrum.

**13 Documents Establishing Eligibility of the Bidder**

- 13.1 The bidder shall furnish, as part of its Bid, certification establishing the bidder's eligibility to bid pursuant to Clause 2.

- 13.2 The bidder is a registered qualified electrical contractor. If in case, the license and the CDB registration certificate have expired during the bid submission, the bidder shall submit letters from competent authorities validating the documents.

- 13.3 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).

- 13.4 The bidder shall submit proposals of work method and schedule, in sufficient detail to demonstrate the competency of the bidder's proposals to meet the completion schedule referred to in Sub-Clause 1.2 above.

**14 Documents Establishing the Bidder's Qualifications to Perform the Contract**

- 14.1 The technical qualification of bidder to perform the required works is the most important criteria and each bidder shall submit the list of skilled employee in line to the sample Form provided. A minimum of one supervisor with electrical Degree/Diploma with one year experience or electrical RTI/VTI graduate with three years of field experience shall be attached with the project for each package.
- 14.2 The bidder shall provide list of tools and equipment (Form No. 6 in Section VII) related to the works including vehicles to show that the bidder has enough tools and equipment to execute the work immediately.
- 14.3 The bidder shall submit list of experience certificates of works successfully done of similar nature (Form No. 5 in Section VII) along with certificates.

**15 Documents Establishing the Goods' and Services Conformity to the Bidding Documents**

- 15.1 Not applicable in this contract.

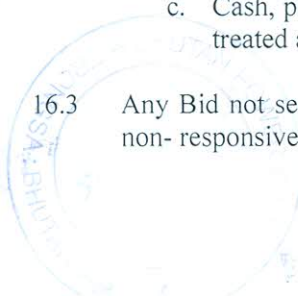
**16 Bid security**

- 16.1 The Bidder shall furnish, as part of its bid, a bid security in the amount as shown below:

Name of Work	Package	Bid Security Amount (Nu.)
Construction of MV line, Substation, LV line, Service connections & other related works at Mangdiphu village and O&M works: Right of way cutting & Pole painting works under ESD, Trongsa	Q12-2021	39,929.00

- 16.2 The bid security shall be denominated in the currency of the Bid. It shall be valid for **ninety (90) days** (that is from 23<sup>rd</sup> April 2021 to 21<sup>st</sup> July 2021) from the date of opening of bids and shall be in one of the following forms acceptable to the Employer:
- Cash Warrant/Bank Draft/Bank Guarantee issued by a reputable bank in Bhutan acceptable to the Employer in the form provided in the Bidding Documents or another form subject to prior approval of the Employer.
  - The Bank Guarantee shall be drawn in favor of Divisional Manager, Electricity Services Division, Bhutan Power Corporation Limited, Trongsa, Bhutan.
  - Cash, personal cheque, etc., will not be accepted as a bid security and the bid will be treated as non-responsive and will be rejected.

- 16.3 Any Bid not secured in accordance with Sub-Clause 16.1 and 16.2 above will be treated as non-responsive and will be rejected.



- 16.4 The unsuccessful bidder's bid security will be discharged/returned as promptly as possible upon award of Contract to the successful bidder, but in any event not later than thirty (30) days after the expiration of the period of bid validity.
- 16.5 The successful bidder's bid security will be discharged/returned upon furnishing the performance security and the bidder's executing the Contract.
- 16.6 The bid security may be forfeited:
1. if the bidder withdraws its Bid during the Period of the bid validity specified by the bidder on the Bid Form; or
  2. if the bidder does not accept the correction of its bid prices; or
  3. in the case of a successful bidder, if the bidder fails to comply with the specified time limit to;
    - (i) Sign the Contract; or
    - (ii) Furnish the performance security.

### **17 *Period of Validity of Bids***

- 17.1 Bids shall remain valid for a period of **90 days** from the date of opening of bids.
- 17.2 Notwithstanding Sub-Clause 17.1 above, the Employer may solicit bidder's consent to an extension of the period of bid validity. The request and the responses there to shall be made in writing or by email. If the bidder agrees to the extension request, the validity of the bid security provided under Clause 16 shall also be suitably extended. A bidder may refuse the request without forfeiting its bid security. A bidder granting the request will not 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 the Clause 16 in all respects.
- 17.3 In the case of fixed price contracts, if the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the Contract Price shall be adjusted by a factor as specified in the request for extension. Bid evaluation shall be based on the Bid Price without taking into consideration the above correction.

### **18 *Alternative Bids***

- 18.1 Not applicable in this contract.

### **19 *Format and Signing of Bid***

- 19.1 The Original Bid Form and accompanying documents (as specified in Clause 10), clearly marked "**Original Bid**", plus "**one copy**" must be received by the Employer at the date, time and place specified pursuant to Clause 20 and 21. In the event of any discrepancy between the original and the copies, the original will govern.
- 19.2 The original and the copies of the bid shall be typed or written in indelible ink and shall be signed by the bidder or persons duly authorized to sign on behalf of the bidder. Such authorization shall be by a written power-of-attorney accompanying the Bid. If the Bid is not accompanied by the written power of attorney, the bidder will be treated as non-responsive and the bid will be rejected All pages of the Bid, except for un-amended printed literature,

shall be initialed by the person or persons signing the Bid. The name and position held by each person signing must be typed or printed below the signature.

- 19.3 The Bid shall contain no interlineations, erasures or overwriting except 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 “Original” and “Copy”.

- 20.2 The inner and outer envelopes shall:

- a. Be addressed to the Employer at the following address:

**Sr. Divisional Manager,  
Electricity Services Division,  
Bhutan Power Corporation Limited  
Trongsa : Bhutan**

- b. Bear the following identification:

- **Bid for the Labour Contract Plan and O&M Works, Package:Q12- 2021**
- **Trongsa Dzongkhag.**
- **Bid Reference No. BPC/ESD/Tro/Tech-05/2021**
- **DO NOT OPEN BEFORE 1500 Hours on April 23, 2021**

- 20.3 In addition to the information required in Sub-Clause 20.2 above, the inner envelope 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 23.

- 20.4 If the outer envelope is not sealed and marked as required by Sub-Clause 20.2, the Employer will assume no responsibility for the bid misplacement or premature opening.

##### **21 Deadline for Submission of Bids**

- 21.1 The original Bid, together with the required copies, must be received by the Employer at the address specified in Sub-Clause 20.2 no later than **1200 Hours on 23<sup>rd</sup> April, 2021**

- 21.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the Bid Documents in accordance with Clause 7, in which case all rights and obligations of the Employer and the bidders previously subject to the deadline will thereafter be subject to the deadline as extended.

##### **22 One Bid per Bidder**

- 22.1 Each bidder shall submit only one Bid. A bidder who submits or participates in more than one Bid will be disqualified.

**23** *Late Bids*

23.1 Any Bid received by the Employer after the deadline for submission of Bids prescribed by the Employer, pursuant to Clause 21, will be declared "**Late**" and rejected and returned unopened to the bidder.

**24** *Modification and Withdrawal of Bids*

24.1 The bidder may notify or withdraw its Bid after the Bid's submission, provided that written notice of the modification or withdrawal is received by the Employer prior to the deadline prescribed for submission of Bids.

24.2 The bidder's modification or withdrawal notice shall be prepared, sealed, marked and delivered in accordance with 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 signed confirmation copy.

24.3 No Bid may be modified subsequent to the deadline for submission of Bids.

24.4 No Bid may be withdrawn in the interval between the deadline for submission of Bids and the expiration of the period of bid validity specified by the bidder on the Bid Form.

**E. Bid Opening and Evaluation**

**25** *Opening of Bids by Employer*

25.1 The Employer will open Bids, including modifications made pursuant to Clause 24, in the presence of bidder's representatives who choose to attend, at **1500 Hours on April 23, 2021** in the Conference Hall of Electricity Services Division, Bhutan Power Corporation Limited, Trongsa. The bidder's representatives who are present shall sign a register evidencing their attendance.

25.2 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 open but return to the bidder.

25.3 The Bidders' names, prices of bids, all discounts offered, modifications and bid withdrawals, and the presence or absence of the requisite bid security, and such other details as the Employer, at its discretion, may consider appropriate will be announced and recorded at the time of opening. Any bid Price, or discount which is not read out and recorded at bid opening will not be taken into account in bid evaluation. No bid shall be rejected at bid opening except for late bids, in accordance with Clause 21.3.

25.4 The Bidder's representative attending the Bid opening shall have an Authorization letter from the Bidder without which the representative may not be permitted to attend the Bid Opening.

25.5 The Bidder's representative shall sign on the attendance sheet evidencing presence at the time of public opening of the Bids.

**26** *Process to be Confidential*



26.1 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. Any effort by a bidder to influence the Employer's processing of Bids or award decision may result in the rejection of the bidder's Bid.

**27 Clarification of Bids**

27.1 To assist in the examination, evaluation and comparison of Bids, the Employer may, at its discretion, ask the bidder for a clarification of its Bid. All requests for clarification and the responses shall be in writing, and no change in the price or substance of the Bid shall be sought, offered or permitted.

**28 Preliminary Examination of Bids**

28.1 The Employer will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the bids are generally in order.

28.2 Prior to the detailed evaluation, pursuant to Clause 30, the Employer will determine the substantial responsiveness of each Bid to the Bidding Documents. A substantially responsive Bid is one which conforms to all the terms and conditions 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, completion schedule or performance of the Works;
- (ii) Which limits in any substantial way and is inconsistent with the provision of 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.

28.3 A Bid determined as not substantially responsive will be rejected by the Employer and may not subsequently be made responsive by the bidder by correction of the non- conformity.

28.4 Arithmetical errors will be rectified on the following bases;

- (i) If there is a discrepancy between the unit price and the total price per item that is obtained by multiplying the unit price and the quantity, the unit price shall prevail and the total price per item will be corrected.
- (ii) If there is a discrepancy between the Total Amount and the sum of the total price per item, the sum of the total price per item shall prevail and the Total Amount will be corrected.

28.5 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the corrections of errors and, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount to bid, its bid will be rejected, and the bid security will be forfeited.

**29 Conversion to Ngultrum (Not Applicable)**

29.1 The bid price shall be in Ngultrum.

**30 *Evaluation and Comparison of Bids***

30.1 The Employer will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause 28.

30.2 In evaluating the bids, the Employer will determine for each bid the evaluated bid price by adjusting the bid price as follows:

- (a) Making any correction for errors pursuant to Clause 28;
- (b) Applying any discounts offered by the bidder for the award;

30.3 The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variation, deviation, alternative offers 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.

30.4 The estimated effect of the price adjustment provision of the Condition of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.

30.5 If the bid of the successful bidder is seriously unbalanced in relation to the Employer's estimate of the cost of work to be performed under the Contract, the Employer may require the bidder to produce detailed price analysis 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 37 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.

30.6 The employer will evaluate and compare Bids on the basis of a package.

**31 *Contacting the Employer***

31.1 Subject to Clause 27, no bidder shall contact the Employer on any matter relating to its bid, from the time of bid opening to the time of the Contract is awarded.

31.2 Any effort by a bidder to influence the Employer in the Employer's decisions in respect of bid evaluation, bid comparison or Contract award will result in the rejection of the bidder's Bid.

**32 *Employer's Right to Accept Any Bid and to Reject Any or All Bids***

32.1 The Employer reserves the right to accept or reject any Bid and to annul the bidding process and reject all Bids at any time prior to 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.

**F. Award of Contract**

**33 *Award***

- 33.1 The Employer will determine to its satisfaction whether the bidder selected as having the lowest-evaluated, responsive Bid is qualified to satisfactorily perform the Contract.
- 33.2 The determination will take into account the bidder's financial and technical capabilities. It will be based upon an examination of the documentary evidence of the bidder's qualifications submitted by the bidder, pursuant to Clause 14, as well as such other information as the Employer deems necessary and appropriate.
- 33.3 An affirmative determination will be a prerequisite for award of the Contract to the bidder. A negative determination will result in rejection of the bidder's Bid.
- 33.4 The Employer will award the Contract to the successful bidder whose Bid has been determined to be the Lowest-Evaluated Responsive Bid, provided further that the bidder is determined to be qualified to satisfactorily perform the Contract.

**34 *Employer's Right to Vary Quantities at Time of Award***

- 34.1 The Employer reserves the right at the time of award of Contract to increase or decrease by up to twenty percent (20%) the quantity, without any change in rate or other terms and conditions.

**35 *Notification of Award***

- 35.1 The Employer will notify the successful bidder in writing by registered letter or email or by fax that its bid has been accepted. This letter (hereinafter and in the Conditions of Contract called the "**Letter of Acceptance**") shall name the sum which the Employer will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called "The Contract Price")
- 35.2 The notification of award will constitute the formation of a contract, until the Contract has been affected pursuant to Clause 36.
- 35.3 Upon the furnishing by the successful bidder of performance security or upon signing of the Contract Agreement, whichever is earlier, the Employer will promptly notify the other bidders that their bids have been unsuccessful.

**36 *Signing of Contract***

- 36.1 At the time of notification of award, the Employer will send the successful bidder the Contract form provided in the bidding Documents, incorporating all agreements between the parties.
- 36.2 The successful bidder shall be invited for contract signing at the venue and date specified in the Letter of Acceptance.

**37 *Performance Security***

- 37.1 Within ten (10) days of receipt of notification of the award from the employer, the successful bidder shall furnish the performance security in an amount of ten percent (10%) of the contract price, in accordance with the Conditions of Contract, in the Performance Security Form provided in the Bidding Documents or another forms acceptable to the Employer.

37.2 Failure of the successful bidder to comply with the requirements of Clause 36 or 37.1 above shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security.

**38 *Corrupt or Fraudulent Practices***

38.1 The Bhutan Power Corporation Limited (BPC) requires that bidders observe the highest standard of ethics during execution of contracts. In pursuance to this policy, the BPC;

- (a) Will reject a proposal for award if it determines that the bidder recommended for award has, engage in corrupt or fraudulent practices in competing for the contract in question; and
- (b) Will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract if at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing contract.
- (c) For the purposes of this provision, BPC defines the terms set forth below as follows:
  - (i) "Corrupt practice" means behavior on the part of officials in the public or private sectors by which they improperly and unlawfully enrich themselves and/or those close to them, or induce others to do so, by misusing the position in which they are placed, and it includes the offering, giving, receiving, or soliciting of anything of value to influence the action of any such official in the procurement processes or in contract execution; and
  - (ii) "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the BPC, and includes collusive practice among bidders (prior to or after bid submission or in contract execution) designed to establish bid prices at artificial non-competitive levels and to deprive the BPC of the benefits of free and open competition.

**39 *Labour***

39.1 The bidder shall commit that no child labour shall be engaged in the construction works.

**40 *Equal Pay***

40.1 The men and women shall be paid equal for work of equal value.



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### Section III

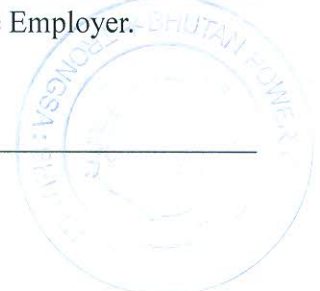
#### Conditions of Contract

#### ARTICLE I GENERAL PROVISIONS

##### A. Definitions

The following words shall be construed in accordance with the meanings assigned to them, except when a different meaning is clearly intended:

- (a) Contract - The signed Agreement entered into between the Employer and the Contractor is deemed to include the following:
  - 1) Invitation for Bid;
  - 2) Instructions to Bidders;
  - 3) Letter of Acceptance;
  - 4) Conditions of Contract;
  - 5) Technical Specifications & Drawings;
  - 6) Price Schedule and Sample Bill of Quantities; and
  - 7) Bid Form
  - 8) Schedule of Supplementary Information
  - 9) Such further documents as may be expressly incorporated in the Letter of Acceptance.
- (b) Employer - The party who employs the contractor to carry out the works or his duly authorized representative who can act on his behalf in supervising the implementation of the contract.
- (c) Engineer - Same as Employer.
- (d) Contractor - The party (a person or corporate body) who is employed by the Employer to carry out the works.
- (e) Parties - Refer to both Employer and Contractor.
- (f) Works - What the Employer requires the Contractor to do under the Contract, which may involve the use of labour, process technology, equipment, materials and suppliers.
- (g) Plant - Means machinery, apparatus, or instrument intended to form part of the works.
- (h) Specifications - Means the specifications of the works included in the Contract and any modification or addition made or approved by the Employer.



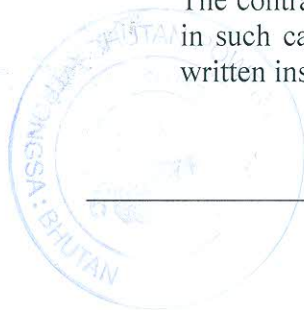
- (i) Contract Price - For determining the applicable Liquidated Damages, the value refers the executed contract price.
- (j) Priced Bill of Quantities - The quantities of works to be done together with their corresponding unit prices. Includes also the kind of labour to be employed and their day/hour rates.
- (k) Drawings - Include drawings, calculation, samples, patterns, models, manuals and other technical information provided by the Employer to the Contractor under the Contract for the execution of the Works.
- (l) Unit Rate - The price for a given measurement of Works or materials or labour used in the Works.
- (m) Sub-Contract - Is a person or corporate body who has a contract with the Contractor to carry out a part of the Work under the Contract.
- (n) Commencement Date - The date indicated in the Notice to Proceed as the date for commencement of Work.
- (o) Completion Date - Is the date stated in the Taking-Over Certificate that the Works were substantially completed on this date in accordance with the Contract.
- (p) Taking-Over Certificate - Is the certificate issued by the Employer in accordance with the provisions of the Clause 1, Article V, when the whole of the Works was completed or for any part of the works at different Dzongkhag that has been taken over by the Client. (q) Variation Order - An order issued by the Employer which involves changing any aspect of the Works.
- (r) Defect - Any part of the Works not executed and completed in accordance with the provisions of the Contract.
- (s) 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.

## **B. Language and Enforcement of Contract**

The Contract is executed in English language. Enforcement of the contract will be in accordance with Bhutan laws and any dispute not settled by arbitration shall be brought to a Bhutan court having jurisdiction thereof.

## **C. Amendments**

The contract shall be amended only by written agreement between the Parties, except in such cases where the Employer may, under the provisions of the Contract, issue written instructions which shall be accepted by the Contractor.





#### **D. Settlement of Disputes**

Disputes arising from the implementation of the provisions of the contract shall be settled first by negotiations between the Parties in order to arrive at an amicable settlement. If negotiations fail, the matter will be settled by arbitration, whereby each of the parties will be entitled to appoint one arbitrator, and a third one to be appointed by mutual agreement to the parties. If either the Employer or Contractor fails to appoint a representative or if both of them cannot agree on the appointment of a third member within 30 days from the date of agreement to refer the matter for arbitration, then the case will be referred to the concerned Dzongkhag Court for adjudication.

### **ARTICLE II EMPLOYER'S AND CONTRACTOR'S OBLIGATIONS**

#### **E. Employer's General Obligations**

##### **1.Payment of the Contract Price**

The Employer shall pay the Contractor the contract Price in Ngultrum as stipulated in the contract. Payment(s) shall be made in accordance with the terms of payment and it is the Employer's obligation to ensure that funds are released on time and are made available as needed. The Employer must also ensure that issuance of certifications, authorizations, or pre-audit procedures are not unnecessarily delayed and that no undue inconvenience is suffered by the Contractor in obtaining payments.

##### **2.Measures for Commencement of Works**

The Employer shall take all the steps necessary to enable the Contractor to commence work in accordance with the Commencement Date. These include giving the Contractor possession of the site of work and access thereto, acquisition of rights-of-way if needed, provision of data on hydrological and sub-surface conditions, drawings and specifications, supply of equipment, materials or supplies if to be provided by the Employer, and appointment of the Employer's representative who will act as the Engineer on behalf of the Employer.

##### **3. Approvals and Authorizations**

The employer shall not unnecessarily withhold or delay giving any approval, authorization, instructions or notices as may be required by him under the provisions of the contract. Any issue, problem, or matter submitted to him for consideration or decision must be addressed promptly and decisively.

#### **F. Contractor's General Obligations**

##### **4. Execution of the Works**

The contractor shall execute and complete the Works and remedy any defects therein to the satisfaction of the Employer in accordance with the provisions of the Contract. He shall provide all the technical expertise, labour, materials, machinery and equipment, plant and temporary facilities necessary for the execution and completion

of the Works in accordance with the drawings, specifications, and instructions provided by the Employer under the terms of the Contract.

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 Equipments 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.

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 executing the work.

### **5. Early Warning**

The Contractor shall warn the Employer at the earliest opportunity of specific likely future events or circumstances which may adversely affect the quality of the works, increase the Contract Price or delay the Intended Completion Date. The Employer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Intended Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible. The Contractor shall cooperate with the Employer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the Works and in carrying out any resulting instruction of the Employer.

### **6. Performance Security**

On issuance of the Letter of Acceptance, the Contractor shall submit a performance security in favour of the Employer in the amount equivalent to Ten percent (10%) of the contract price to guarantee the faithful compliance of his obligations under the contract at the time of signing of the Contract Agreement. He shall provide such security in the form of a Bank Guarantee or irrevocable letter of credit acceptable to the Employer, issued by a bank in Bhutan. The performance security shall be valid until the date of issue of the Taking over Certificate. The cost of complying with the requirements of this clause shall be borne by the contractor.

### **7. Compliance with Laws, Rules and Regulations**

The Contractor shall, in the execution of the works, comply with all existing applicable laws, rules and regulations, and shall obtain the necessary permits, pay the required fees and taxes, and indemnify the Employer against any claim or liability arising from the violation of any law, rule or regulation.

### **8. Representation against Material Favors**

The Contractor declares that it has not given, nor promised to give; any money, gift or material favor or consideration to any government official, employee or any other bidder to secure the contract and that contrary action shall be sufficient ground for

revocation of cancellation of the contract.

### 9. Taxation

The prices bid by the Contractor shall include all customs duties, import duties, business taxes, income and other taxes that may be levied in accordance to the laws and regulations. Nothing in the contract shall relieve the Contractor from his responsibility to pay any tax that may be levied by the Government.

## ARTICLE III CONDITIONS FOR EXECUTION OF THE WORKS

### 1. Commencement Date

The employer shall issue a Notice to Proceed, which will be the basis for commencement of work by the contractor. The Contractor should start work not later than the date indicated in the Notice to Proceed. For justifiable reasons, the Employer and Contractor may subsequently agree on another commencement date.

### 2. Time for Completion

The Employer shall issue notice to proceed, which shall be the basis for commencement of work by the contractor. The contractor should start work not later than the date indicated in the notice to proceed. The contractor shall begin the Works on the Start Date and shall perform and complete the Works in accordance with the program submitted by him, as updated with the approval of the Employer, by the intended completion date as below:

SI No	Name of Work	Package Code	Duration in months
1	Plan and O&M works under ESD Trongsa	Q 12-2021	7

### 3. Extension of Time for Completion

An extension of the time for Completion may be allowed by the Employer for the following reasons:

- (a) Additional work has to be done;
- (b) Adverse climate conditions or other natural calamities have caused work stoppages;
- (c) Delay or impediment on the part of the Employer; and
- (d) There are unusual circumstances that have occurred which are not directly attributable to the Contractor.

The Contractor must give notice of any event causing a delay within twenty one (21) days of such occurrence and the Employer must within reasonable time decide on the extended date for completion.

#### **4. Sub-contracting of the Work**

The Contractor shall not sub-contract the work or any part of the work under any circumstances. Sub-contracting of works shall lead to termination of the contract and will lead to the forfeiture of performance security deposit.

#### **5. Work Program**

The Contractor shall prepare the Work Program for the execution of the works, if advisable, with the use of spread sheet or any other networks or equivalent. One original and two copies of such diagram must be provided to the Employer not later than twenty-one (21) days after the commencement Date. The work must cover all the activities for which the contractor is responsible and must ensure that the resource required for the execution of each activity are or will be available and taken into account in setting activity duration.

#### **6. Transportation of Materials**

Materials required for the execution of the Contract are to be transported to the work sites for all Packages by the Contractor at his own arrangements from the Regional Stores Division/ ESD Stores as detailed in the attached Annexure-I.

The contractor shall transport the materials to the sites in such a manner that materials required at the earliest will be first transported.

#### **7. Insurance**

The contractor shall obtain the following insurance coverage:

- (a) For the works (including plants and materials incorporated therein) and Contractor's equipment against loss or damage;
- (b) Against liability for accidental death or injury of any person, or loss or damage to any property arising out of the performance under the Contract. The Loss or damage of any material arising out of the performance under the contract shall be made good;
- (c) Against liability arising from accident suffered by the Contractor's workers while performing their work in accordance with Government rules and regulations. The insurance coverage shall be in such forms and amount as may be considered sufficient for the risk or liability insured against, and must be in force until the acceptance of the works; and
- (d) The Contractor shall avail full road accident insurance of goods during transportation from stores to work sites. The insurance policy should protect the goods during the vehicle accident viz. vehicle off road, head on collision, etc. The Contractor shall assume full responsibility for the care and protection of the works, materials and plants from the Commencement Date to the date of acceptance of the whole of the Works, or of any section thereof incase of partial completion. Any loss or damage of the works occurring during this period shall be from the contractor's account. However, if the loss or damage is caused by Force Majeure, including war,

civil insurrection, fires, floods, epidemics and earthquakes, the cost of restitution therefore may be considered as an addition to the Contract Price to the extent that it is not recoverable from the proceeds of any insurance coverage.

#### **8. Contractor's Superintendence**

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 authorized 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 authorized representative shall receive, on behalf of the Contractor, instructions from the Engineer. 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 hereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Engineer.

#### **9. Engineer at Liberty to Object**

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.

#### **10. Setting Out**

The Contractor shall be responsible for setting out the works and for ensuring the correctness of the positions, levels, dimensions and alignment of the works. The route alignment, identification of locations for the construction of substations and pole fixing will be conducted by the Contractor in the presence of the representative engineer from the Employer. All the above settings have to be approved by the Site Engineer of the Employer prior to the commencement of works. All the measurements will be taken by the Site Engineer only for the works approved by the Employer. At any time during the execution of the works, the Contractor shall correct any error at his own expense when required to do so by the Employer. Boreholes, exploratory excavations or soil testing may be done if instructed by the Employer. In case, costs of boreholes or explanatory excavations or soil testing are not included in the Contract Price, the cost shall be borne by the Employer.

#### **11. Safety of Operations and Protection of Environment**

The Contractor shall assume full responsibility for the adequacy and safety of site operations and the methods of construction and he shall adopt measures to prevent

injuries to persons or damage to properties of utilities. The Contractor shall hold the Employer harmless from any liability for loss or damage resulting from his failures to take necessary precautions. The Contractor shall avoid undue interference with private business, public travel, or with the work of other contractors. The Contractor shall take steps to protect the environment and to minimize noise, pollution or other undesirable effects resulting from his method of operation.

The Contractor shall, throughout the execution and completion of the Works and the remedying of any defects therein:

- (a) have full regard for the safety of all persons entitled to be upon the Site and keep the Sites (so far as the same is under his control) in an orderly state appropriate to the avoidance of danger to such persons;
- (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 other; and
- (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 other resulting from pollution, noise or other causes arising as a consequence of his method of operation.

## **12. Provision of Competent Personnel**

The Contractor shall provide adequate qualified technical personnel to supervise the Works and such skilled and semi-skilled labour as necessary to complete the Works within the time specified. He shall, subject to the approval of the Employer, appoint a competent authorized representative who will act on his behalf in receiving instructions from the Employer and in supervising the execution of the works.

## **13. Compliance with Standards**

The Contractor shall ensure that the quality of the materials, plants and workmanship meet all standards as specified in the Contract. Whenever a specific standard is mentioned in the specifications, it is intended only as a reference and equivalent or superior standards are equally acceptable subject to prior approval of the Employer. The execution procedure should be strictly adhered as specified in Section-IV, Technical Specification.

## **14. Responsibility to Rectify Loss or Damage**

If any loss or damage happens to the Works, or any part thereof, materials or Plant for incorporation therein, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, 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 Employer. 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.

### **15. Examination of Work**

The Employer shall have the right to conduct whatever tests or inspections it may consider necessary to determine whether or not the work is being executed in accordance with the provisions of the contract. Such right may include testing of samples of materials used in the works, examination of the quality of the workmanship and conformity of the works to drawings and specifications.

The Contractors shall provide such facilities, apparatus and instruments, sample of materials, manpower and other forms of assistance that are needed in conducting the tests or inspections. Tests may be done in the workshops or at the site of operations and the date and time for carrying them out should be agreed upon between the Employer and the Contractor.

If the Employer determines, after inspections, that materials used or the work done are defective in any respects, he may reject the said materials or Works and demand that the Contractor rectifies the defects by replacing the materials or by re-executing the works. If the Contractor fails within a reasonable period of time to such action as instructed by the Employer, the Employer shall have the right to employ other persons to carry out the same and the cost shall be borne by the Contractor.

### **16. Monitoring of Work Progress**

At such time as will be agreed upon between the Employer and the Contractor, a periodic review meeting of the progress made will be undertaken. Based on the actual progress achieved, if necessary, an up-date of the work program for the execution of the remaining works will be prepared by the Contractor taking into account the effect of variations and additional works to be undertaken. Failure to submit an up-dated work Program will entitle the Employer to withhold payment of the next amount due as progress payment.

If delay is being encountered in the execution of the Works as determined against the approved Work program, the Employer and the Contractor shall, after examining the causes of the delay, agree on appropriate measures to be taken in order to make up the delay and to avoid further work slippages.

The Employer's acceptance of any revised Work Program shall not relieve the Contractor of his obligations under the contract.

### **17. Variation Orders**

The Employer may, at any time during the progress of the Works, make variations in the form, quality or quantity of the works. Such variations may consist of the following:

- (a) Increase or decrease in the quantity of work to be done as indicated in the Contract;
- (b) Omission or insertion of any item of work;
- (c) Change in the level, lines, positions and dimensions of any part of the works;

- (d) Change in the character, quality, or kind of any work;
- (e) Additional work of any kind; and
- (f) Change in the sequence or timing of construction activities.

The Employer can order a variation by issuing a written instruction to the Contractor. A variation made shall not, in any way, vitiate or invalidate the Contract.

All variations, except under item (a) above, shall be valued at the rate and prices set out in the Contract ("Bill of Quantities"). If the Contract does not contain any rate(s) applicable to the variations, suitable rates or prices will be agreed upon between the Employer and the Contractor. In the event of disagreement between the parties, the Employer shall fix the rates as may consider fair and appropriate and shall notify the contractor.

The Contractor shall not make any such variation without an instruction of the Engineer.

For variations under item (a) increase or decrease in the quantities of work, variations shall be valued at the rates and prices set out in the Contract, if the variation in quantity is within the limit of (+/-20%) for each item of work. If the final quantity of the work executed varies from the quantity in the Bill of Quantities of the Contract for that item by more than +/-20%, and the value of this variation exceeds one percent (1%) of the Original Contract Prices stated in the Letter of Acceptance, the excess quantity over the limit shall be paid to the Contractor at a suitable rate or price agreed upon between the Employer and the Contractor. In the event of disagreement between the parties, the Employer shall fix the rates and prices as may be considered fair and appropriate and shall notify the Contractor. If the value of this variation is less than one percent (1%) of the Original Contract Price, the excess quantity shall be paid to the Contractor at the unit rate or price set out in the Contract.

The value of all variations shall be taken into account in determining the final Contract Price.

Note: It may however, be noted that even in the event of any variation beyond this limit, payments are made strictly based on the actual volume of work executed and at the same rate or price set out in the Contract.

## **18. Instructions for Variations**

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 Quantity.

## **19. Measurement of works**

The quantities set out in the Bill of Quantities should be considered as estimates and may not necessarily be the actual and correct quantities of work to be performed under the Contract.



The Contractor shall be responsible for the measurements of Works and the preparation of its bills. The measurement of works shall be carried out jointly by the Employer's representative and the contractor. The Employer's Representative shall record the measurements in the measurement book in accordance with the Financial Manual. The record entered in the measurement book shall be signed by the Employer's representative and countersigned by the contractor. The works shall be measured net except otherwise provided for in the specifications.

No part of the Works shall be covered up or put out of view without the approval of the Employer's representatives and the Contractor afford full opportunity for the Employer's representative to examine and measure any such part of the works which is about to be covered up or out of view. The contractor shall give due notice for examination and measurement. The Employer's representative shall, without unnecessary delay, arrange for examining and measuring such part of the works, unless he considers it unnecessary and advises the Contractor accordingly.

#### **20. Guarantee of Works after Completion Date**

The contractor guarantees that the work performed, and the materials and equipment furnished shall be free from defects, that they comply with the prescribed specification and that they passed the required performance tests. This guarantee shall be for a period of twelve (12) months after the Completion of the whole Works known as defects liability period and within that period, the Contractor commits itself to repair or replace, promptly and without charge, any work, equipment and materials or part thereof which fail to meet the aforementioned guarantee.

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.

#### **21. Indemnity for Infringement of Property Rights**

The Contractor shall indemnify the Employer for any claim, cost or liability on account of any infringement of any patent, trademark, trade name or any protected right in respect of equipment, materials or plants used in the Works except where such infringement results from compliance with the design or specifications provided by the Employer.

#### **22. Storage of Plant and Materials**

The Contractor shall provide adequate and safe facilities for storing Plant and materials that will be used in the execution of the works. They must be neatly piled and compactly stored in the places that provide clear access to the site and without causing any inconvenience or create any danger to the public.



Excavated materials, wreckage and waste products, shall be disposed-off quickly so as not to cause unnecessary obstruction or create sanitation/environmental problems.

The loading of materials to their trucks will also be arranged by the Contractor and will comply with the instruction issued by the Stores Officer of the Employer.

If there is any balance material or materials to be returned, the Contractor shall hand over the same as per Annexure I after 90% of the work Completion. The Contractor should meet all associated cost to this effect and the Employer shall not be responsible for any cost involved.

If the Contractor fails to return the balance materials in full set of each item, the Contractor shall pay employer's purchasing cost of the items plus 50% on the purchasing cost to the Employer. Final bills shall be released only after return of all balance materials.

Any excess materials returned by the Contractor will not be taken by the Employer and paid for.

### **23. Facilities for Other Contractors**

The Contractor shall, upon the instructions of the Employer, provide other contractors and workmen employed by the Employer, reasonable opportunity for carrying out the works and if required, to make available the use of roads, equipment and labour subject to additional compensation as may be determined by the Employer.

### **24. Unforeseen Obstacles**

If during the execution of the works, the Contractor encounters physical obstructions or adverse geological or hydrological conditions on the site that could not have been reasonably foreseen, he shall give notice to the Employer, and both the Contractor and the Employer will determine:

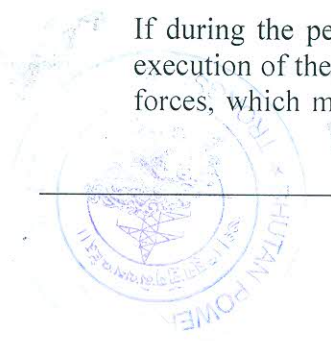
- (a) To what extent and extension of time will be necessary, and
- (b) The amount of additional costs which have been incurred by reason of such obstructions or conditions and how, and by whom the cost will be borne.

### **25. Discoveries**

Anything of historical or other interest or of significant value discovered on the site shall be the property of the Employer. The Contractor shall notify the employer of such discoveries and carry out in accordance with the instructions of the Employer for dealing with such discoveries.

### **26. Outbreak of Hostilities**

If during the period when the contract is in force, which may be before or during the execution of the works, there is an outbreak of hostilities between the armed opposite forces, which may impede or render impossible the commencement, continuance or



completion of works, then the parties shall agree between themselves as to what steps will be taken under the circumstances, including a deferment or temporary suspension of the works or even termination of the Contract. However, the Contractor shall, until the decision has been reached, endeavor to start or complete the execution of the works to the best to his ability in close consultation with the Employer.

In case of termination by reason of outbreak of hostilities, the Employer shall pay the Contractor whatever amounts are due for Work already performed and for such other expenditures which the Contractor has incurred in accordance with the provisions of the Contract.

## **27. Suspension of work**

The Employer may suspend the execution of the Works or any part thereof and the Contractor shall, during such suspension, protect the Works against loss or damage due to adverse external conditions. If the suspension is not due to default or breach of Contract on the part to the Contractor, an extension of time for the completion of works will be allowed, as may be determined by the Employer. The Employer and the Contractor may also agree on the amount to be added to the Contract Price by reason of such suspension.

Should the suspension which is not caused by the default of the Contractor last for more than forty five (45) days, the Contractor may request thereafter permission to continue with the works giving his reasons thereof. If permission is not granted without justifiable reason within twenty one (21) days after permission has been requested, such denial may be treated as Employer's default and the Contractor shall be entitled to terminate his employment under the Contract.

The Contractor shall be entitled to suspend the execution of the works if the Employer fails or refuses to pay the Contractor any amount due under the Contract within sixty (60) days after the amount becomes due and payable, after prior presentation of Notice for Payment. Should the Employer pay subsequently after such suspension or reduction of Work, the Contractor shall resume normal work as soon as is reasonably possible.

## **28. Liquidated Damages**

If the Contractor fails to complete the whole of the works, or any part thereof within the time agreed upon for completion, the Employer shall have the right to collect from the Contractor liquidated damages equivalent to 0.1 percent of the Contract Price for every Day of delay. However, the total amount of liquidated damages shall not exceed ten percent (10%) of the Contract Price. In case of the works being under different Dzongkhags and the contract terms providing for taking over of each of the Dzongkhag separately, the computation of Liquidated Damages would be based on the above for each Dzongkhag independently.

## **29. Termination of Contract by Employer**

The Employer may terminate the Contract upon thirty (30) days notice to Contractor on the ground that:



- (a) Contractor has stopped working continuously for ten (10) days and in spite of repeated (three times) notice by Employer to start the work.
- (b) In the opinion of the Employer, in spite of repeated notice, Contractor was not able to deploy sufficient manpower at site to execute the Contract and may not be in position to complete the work as per schedule.
- (c) Continuance of the work has become impossible, or will work adversely against the Employer's interest.
- (d) The Contractor has become insolvent or financially incapable of completing the works or has assigned his assets for the benefit of his creditors.
- (e) The Contractor has violated certain important provisions to the Contract, such as Sub-Contracting of the works without the approval of the Employer in writing, failure to comply technical specifications, poor workmanship, unreasonable delay, etc., and has failed to take compensatory measures.

### **30. Corrupt or Fraudulent Practices:**

If the employer determines that the contractor has engaged in corrupt, fraudulent, collusive, coercive or obstructive practices in competing for or in executing the contract, then the Employer may, after giving 14 days' notice to the contractor terminate the Contractor's employment under the contract and expel him from the site, and the contractor shall stop the work immediately, make the site safe and secure, and leave the site as soon as reasonably possible.

For the purpose of this Clause:

- (a) "Corrupt practice" is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
- (b) "fraudulent practice" is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit to avoid an obligation;
- (c) "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;
- (d) "coercive practice" is impairing or harming, or threatening to impair to harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- (e) "Obstructive practice is
  - (i) Deliberately destroying, falsifying, altering or concealing of evidence material to the investigation of making false statements to investigators in order to materially impede any investigation into allegations of corrupt, fraudulent, coercive or collusion practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or pursuing the investigation; or

(ii) Acts intended to materially impede the exercise of the inspection and audit rights of the Employer or organization or person appointed by the Employer and/or relevant RGoB agency.

### **31. Payment upon Termination**

If the Contract is terminated because of a fundamental breach of Contract by the Contractor and/or due to violation of any of the provisions under the Integrity Pact by the Contractor, the Project Manager shall issue a certificate for the value of work done and materials ordered less advance payments received up to the date of the issue of the certificate and less the value of work not completed.

### **32. Take Over of the Works by the Employer**

In case of termination under Clause 29 above, the Employer will take possession of the works, materials, tools, equipment and other properties of the Contractor which have been provided in connection with the Works, and may continue and complete the works by whatever manner or method it deems best including the employment of another contractor. The cost of completing the same shall be deducted from whatever monies are due to the Contractor had the Contract not been terminated. If the amount due to the Contractor is less than the residual cost of completion, the Contractor shall pay the difference; if the residual cost is less, the Contractor shall have no claim to the excess, except for payment for rentals for the use of the Contractor's cost of protecting and securing the Works, and less all payments received by the Contractor up to the date of the Certificate.

### **33. Termination of Contract by Contractor**

The Contractor may terminate the Contract upon thirty (30) days notice to the Employer where;

(a) The works have been suspended by the Employer for sixty (60) days and no permission to resume work has been granted, and

(b) The Employer has failed to pay any substantial sums due to the Contractor under the terms of the Contract within the time specified for payment.

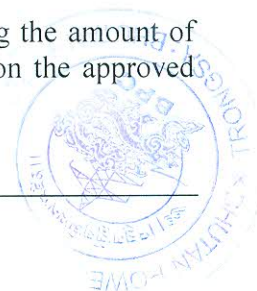
### **34. Termination without Prejudice to Other Rights**

The right of either the Employer or the Contractor to terminate the Contract in accordance with the foregoing provision is without prejudice to any actions, or remedies which either party may take under the provisions of the Contract.

## **ARTICLE IV PAYMENT PROVISIONS**

### **1. Cash Flow Estimates**

The Contractor shall submit a quarterly cash flow estimate indicating the amount of quarterly payments expected to be made under the Contract based on the approved Work Program.



## **2. Advance Payment**

The Contractor shall be eligible for advance payment of ten percent (10%) of the Contract Price excluding provisional sum and contingency, which can only be used to pay for equipment and other mobilization expenses required to start the works. The advance payment will be made only upon submission to the Employer of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amount equal to the advance payment. Such guarantee shall remain effective until the advance payment has been repaid fully.

The advance payment shall be repaid by the Contractor through percentage deduction from the interim progress payments and that the advance payment shall be fully repaid prior to the time when eighty percent (80%) of the Contract Price has been certified for interim progress payment. The amount of the bank guarantee may proportionately be reduced with every repayment made by the Contractor.

## **3. Retention Money**

From each amount due for payment, the Employer will deduct ten percent (10%) thereof as Retention Money. Such deductions will be made until the completion of the Works and shall serve as a guarantee that any defects discovered during the Defects Liability Period will be corrected. Upon the expiration of the Defects Liability Period, the remaining balance to the retention money will be returned to the Contractor.

The Employer and the Contractor may agree that after the completion of the Works but during the warranty period, the Retention Money or part thereof will be returned to the Contractor and in lieu thereof, a bank guarantee may be put up by the Contractor.

## **4. Material at Site**

The contractor shall maintain proper storage.

## **5. Additional Claims**

Should the Contractor have any additional claims for payment pursuant to any provision of the Contract, he shall advise the Employer about such claims, and submit to the Employer full details thereof including the basis of the claims. The Contractor shall permit the Employer to examine all records relevant to the claims.

Within thirty (30) days after receipt of the claims, the Employer shall establish the veracity and propriety of the claim and shall communicate to the Contractor his decision. The Employer may decide to pay the full amount claimed, or may opt to pay just part thereof, to the extent of what has been substantiated by the evidence submitted by the Contractor. In case of disagreement, an arbitrator(s) may be appointed by the parties to resolve any difference between them.

## **6. Price Adjustment**

The rates and prices in the Bill of Quantity are fixed for the duration of the contract. Hence, no price adjustment shall be applicable under the contract.

## **7. Terms of Payments**

The Contractor shall submit monthly bills/invoices for completed works. The bills/invoices must be supported by joint measurement duly signed by the Engineer of the Employer. Based on these measurements, the Employer shall then review and verify the bills/invoices submitted by the Contractor and determine how much is actually payable to the Contractor after necessary deductions. The Employer may make any correction or modification in any previous payments which has been approved by him.

The Final Payment by the Employer to the Contractor in respect of the whole Works under the Contract shall be made as per Clause 2, Article V. Payment shall be made by the Employer within sixty (60) days from receipt of statement, unless delay is encountered in the submission of supporting documents if required by the Employer.

## **ARTICLE V COMPLETION OF THE WORKS**

### **1. Taking – Over Certificate**

When whole of the works have been substantially completed and satisfactorily pass any tests on completion prescribed by the Contract, the Contractor may give a notice to this effect to the Employer, accompanied by a written undertaking to finish with due expedition any minor outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Employer to issue a Taking-Over Certificate in respect of the work. The Employer shall either issue a Taking-Over Certificate, stating the date on which the works were completed in accordance with the Contract, or give instructions in writing to the Contractor specifying all the work, including any defects in the Works affecting completion, which is required to be done before the issue of such certificate. The contractor shall be entitled to receive such TakingOver Certificate within 21 days of satisfactory completion of the works so specified and remedying any defects so notified.

### **2.Statement of Completion**

After the issue of the Taking-Over Certificate in respect of the whole works and when the minor outstanding works have been completed including the final cleanup of the Site has been performed, the Contractor shall submit the Employer a Statement of Completion which shall show in detail:

- (a) The final value of the work done in accordance with the Contract, including variations.
- (b) Any further sums that are due to the Contractor and remain unpaid.



Upon receipt of such statement, the Employer shall conduct a final inspection of the Works, measure the works and within Forty five (45) days from receipt of the statement of Completion prepare a final estimate and present the same to the Contractor for his concurrence. This statement, if approved by both parties, is the Final statement and the total amount of the Final Statement represent full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract.

### 3. Contractor's Liability

Neither the final inspection nor the preparation of the Final Statement by the Employer, nor the issuance of the Taking-Over Certificate to the Contractor, nor the payment of the amount due, nor the possession by the Employer of the Work, shall operate as a waiver of the provision of the Contract, and the Contractor shall remain liable for a period of Twelve (12) months from the date of completion, stated in the Taking-Over Certificate, for any defect or damage arising from any violation or lack of compliance with the covenants and conditions of the Contract.

Any work of reconstruction and correcting of defects must be done within thirty (30) days from receipt of advice of the existence of such defects by the Contractor. The cost of such works shall be for the account of the Contractor if the defect(s) were due to:

- (i) The use of materials, plant or workmanship not in accordance with the Contract;
- (ii) Fault in design for which the Contractor was responsible; and
- (iii) Failure on the part of the contractor to comply with any obligation under the contract.

Neither shall the Contractor be released of any unfulfilled obligations including, but not limited to, the payment of taxes due to him, and for unpaid claims for labour, materials and equipment used in the works.





## Section IV

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## Section IV

### 1. General

All the works should be carried out strictly as per the Drawings, Specifications, etc. and as per the Contract document. Any modification/changes pertaining to the work should not be carried out without the prior written approval from the Employer. Any modification/changes done without the prior approval will be asked to be dismantled/demolished at the cost of the Contractor and the Employer will not be responsible for any cost whatsoever associated with the modification of works. All approval shall be in writing and no verbal approval will be entertained.

Prior to start of work, the Contractor is obliged to study the route and possible location of various poles, double pole, angle pole, transformers, etc. Any change in the route or modification should be at the approval of the Employer. The Scope of Works to be carried out under the Contract covers all the works associated with the:

- a) Construction, testing and commissioning of 33 kV (Three phase and Two Phase), 11kV (Three Phase and Two Phase) and LT lines (Three Phase and Single Phase) including line route finalization, transportation of materials from designated stores to the Work site, erection of poles, fixing of insulators, line stringing, clamping, earthing, erection of anti-climbing devices, danger plates, painting of poles, etc.
- b) Erection, testing and commissioning of distribution transformers including transportation of materials from designated Stores to sites, mounting of the transformers, distribution pillars, associated pole-top equipment like isolators, drop-out fuses, earthing work, etc.
- c) Clearing jungles/bushes, trees and removal of branches and disposal; felling of trees including cutting of trunks and branches, and removal;
- d) Materials required for the execution of the Contract shall be collected from the designated stores as specified under Article III, Clause 6 of Conditions of Contract.

**The Bidder shall note that supply of sand, stone chips, cement, bricks, HT tiles, PVC tape, Ampere Tape, Welding rods, Hack saw blades, marking cloth, nuts & bolt and Aluminium lugs, paints, thinner, charcoal and salt for earthing, GI pipes & HDPE pipes (as specified in BoQ), and other miscellaneous material required for the construction work is in the Bidder's Scope. Bidder shall also note that any excess materials procured by the Bidder for the construction works will not be taken by the Employer.**

The Bidder may contact the persons mentioned in Clause 3.3 of Section II- Instructions to Bidders, for detailed list of miscellaneous items required.

The work shall be carried out with full diligence and in accordance with the general guidelines listed herein. It is imperative/mandatory that the workers and the Supervisors

wear safety helmet, safety belts and other kits for their own safety.



The survey work shall be carried out in close coordination with the Employer's Engineer and the line route and the pole locations, angle points, etc. finalized and approved by the Employer's Engineer. All the works associated with the erection shall be carried out under the general supervision of the Employer's Engineer/Supervisor.

## **2. Construction of Overhead 33 kV, 11 kV and low voltage lines**

### **2.1 General**

This section covers the procedures to be adopted during the construction of 33kV lines, 11kV lines, low voltage lines etc. Before start of construction works, the persons in charge shall familiarize with the line route and acquaint themselves with the Local Rules, so that necessary provisions there-of may be adopted.

### **2.2 Distribution line voltages, locations and clearances**

#### **2.2.1 Standard voltage for distribution system:**

##### **Proposed Medium Voltage (MV) construction:**

- 33 kV Line (Three Phase, 3 wire & Two Phase, two wire)
- 11 kV Line (Three Phase, 3 wire & Two Phase, two wire)
- 6.6 kV Line (Three Phase, 3 Wire & Two Phase, two wire)

##### **Proposed Low Voltage (LV) construction**

- LV Line (Three phase, 4 wire, 415 Volts)
- LV Line (Single phase, 2 wire, 240 Volts)

#### **2.2.2 Choice of route**

The route selected for the proposed overhead line should be the one that will give the lowest cost over the life of the line. Route selection therefore involves consideration of a number of factors, including the cost of landowner compensation, the cost of transporting materials to the site, construction cost and the cost of ongoing maintenance requirements including vegetation control. As a general rule, following parameters should be kept in mind:

The shortest route practicable:

As close as possible to the road for easy maintenance and approach during construction.

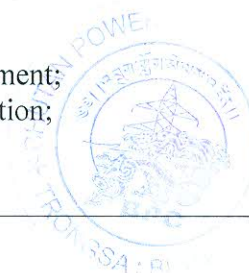
Route in direction of possible future load.

Angle point should be less.

Where possible, line routes should avoid steep hills or valleys, swamps, lakes, thick forests, rivers or other locations where access is difficult or long spans are required. When building along a road, pole positions should not cause a traffic hazard or be in locations where there is a higher probability of vehicle impact.

The following should be avoided wherever possible:

- a) Areas likely to be used for future urban development;
- b) Routes incorporating sharp changes in line direction;



- c) Routes close to aerodromes;
- d) Religious monuments;
- e) Special trees of religious significance;
- f) School playgrounds;
- g) Cemeteries;
- h) Buildings containing explosives;
- i) Taking lines through individual/private plots/community forest; and
- j) Not considering the aesthetic of the land use.

No lines should be within 50ft distance from a National Highway.

### 2.2.3 Approval of Line Routes

Prior to the erection of lines along public roads, the authority responsible for the road should be contacted and approval obtained for the location of all poles, road crossings, tree cutting or trimming and guying locations. Where overhead distribution lines are to be constructed in urban areas, it will also be necessary to contact the local Town Planning Authority for approval. Where appropriate, approval should also be obtained from authorities such as the National Environment Commission, Department of Forestry, etc.

Once the line route is finalised, a detailed line survey should be undertaken and the pole locations finalized and marked. Poles should be located well clear of water and other areas of potential land subsidence. Poles for lines that cross-agricultural fields should, wherever possible, be located at bunds.

### 2.2.5 Tree clearances

The width for tree clearance will depend upon the voltage and the importance of the line concerned. No rigid limitations can be laid down. However, the following clearances may be adhered to, as far as possible.

Voltage	Comment
33 kV lines (Bare ACSR, 3 phase & 2 Phase)	The route should be cleared of all growth within 6 m on either side starting from the centre of the line and, in addition, of trees that could fall and contact the line.
11 kV lines (Bare ACSR, 3 phase & 2 Phase)	The route should be cleared of all growth within 4.5 m on either side starting from the centre of the line and, in addition, of trees that could fall and contact the line.
33 kV Lines (Covered Conductor, 3 Phase & 2 Phase)	The route should be cleared of all growth within 4 m on either side starting from the centre of the line and, in addition, of trees that could fall and contact the line.
11 kV Lines (Covered Conductor, 3 Phase & 2 Phase)	The route should be cleared of all growth within 3 m on either side starting from the centre of the line and, in addition, of trees that could fall and contact the line.
All ABC	Left to the discretion of the Supervisor. Aerial bundled conductor is insulated so contact with vegetation should not cause a fault. However, the route should be cleared so the risk of trees falling across the line is minimized.

### 2.2.6 Overhead Line Clearances



**2.2.7 The following minimum clearances should be maintained.**

Particulars	33 kV	11 kV	6.6 kV	LV (bare conductor)	LV (ABC)
<b>Ground clearance</b>					
• Across street	6.1 m	6.1 m	6.1 m	5.8 m	5.5 m
• Elsewhere	5.8 m	5.8 m	5.8 m	5.5 m	4.5 m
<b>Separation between phases</b>					
• Horizontal	0.9 m	0.7 m	0.7 m	#	#
• Vertical	1.0 m	0.6 m	0.6 m	0.3 m	#
<b>Clearance from buildings</b>					
• Horizontal	1.8 m	1.2 m	1.2 m	1.2 m	#
• Vertical	3.7 m	3.7 m	3.7 m	2.5 m	#
<b>Sectional clearance</b>	2.8 m	2.6 m	2.6 m	#	#
<b>Safe working clearance (minimum)</b>	0.6 m	0.3 m	0.3 m	0.15 m	#

Notes: #: Not Applicable

The following minimum vertical separation of conductors should be maintained.

Particulars	Minimum Clearance
33 kV and 11 kV	1.2 m
33 kV and LV	1.5 m
11 kV and LV	1.2 m
33 kV or 11 kV and telephone line	1.8 m
LV and telephone line	0.6 m

**2.2.8 Road Crossings**

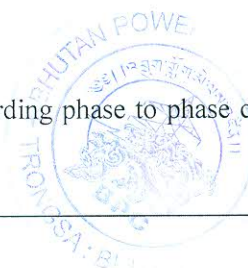
The road crossings should be as minimum as possible

**2.3 Construction, Testing and Commissioning**

The construction of overhead lines may be divided into the following parts:

- (i) Erection of supports.
- (ii) Providing guys to supports.
- (iii) Mounting cross-arms, pins and strain insulators.
- (iv) Stringing of line conductors.
- (v) Jointing of conductors.
- (vi) Sagging or tensioning of conductors.
- (vii) Earthing.
- (viii) Testing and commissioning.

The drawings/sketches may be referred, which give the details regarding phase to phase clearances, positioning of cross arms, pole top brackets, earth wire clamps, etc.



### **2.3.1 Alignment of the line**

A detailed route survey for the line has to be made and approval of the alignment of the line should be obtained by the Engineer before excavation of the pits. To the extent possible, alignment of lines shall be located along or close to existing roads and tracks. During alignment, the pole locations may be marked with pegs conspicuously and shall be located with adequate distance from water bodies. Also, the poles that pass through agricultural field, to the extent possible shall be located at the bunds.

### **2.3.2 Erection of supports**

After the final survey of the line and after marking of the pole locations with peg and approved by the Employer, excavation work has to be commenced. The pits for the supports are excavated in the direction of the line as this will facilitate the erection of support, in addition to giving greater lateral stability. The depth of the foundation to be excavated for poles shall be 1400 mm for 7.5 metre poles (LV), 1600 mm 9.0 metre (11 kV) poles and 1900mm for 10 metre (33kV) poles, while the area of the foundation will be 600x700mm.

Before the pole is put into the pit, a stone base of 100 mm thick shall be placed at the bottom of the pit. In lieu of 100 mm PCC base, base plate is being used. When the pole is erected inside the pit, wooden dead men may be utilized to facilitate lifting of the pole. Once planted into the pit, the pole should be kept in a vertical position with the help of ropes, using them as a temporary anchor.

As the poles are being erected, say from an anchor point to the next angle point, the alignment of the poles is to be checked and set right by visual check. The verticality of the poles are to be checked with a spirit level on both transverse and longitudinal directions. In case of LV lines, the holes for fixing hook bolts are also to be checked for facing proper direction. Once the verticality and alignment are satisfactory, the pit shall be backfilled and compacted to a distance of 450 mm below ground level. A 500 x 500 mm concrete foundation shall then be constructed around the pole and extending to 300 mm above the ground level as shown in the relevant drawings. The concrete shall be a mixture of cement, granite chips of 20/30 mm mesh and sand in the ratio of 1:2:4. The top of the foundation shall be tapered to allow water to run away from the pole.

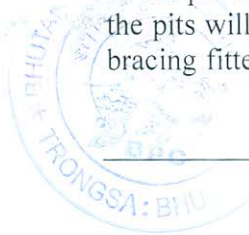
Concrete foundations are not required for poles that are hot dip galvanised. In this case the foundation should be backfilled with excavated soil. The backfill should be progressively compacted as the foundation is filled. Do not simply refill the foundation and compact at the surface.

After the poles have been set and the excavated pit backfilled and compacted, the temporary anchors may be removed

### **2.3.3 Erection of DP Structures for angle locations**

Generally, for angles of deviation more than 10 degrees, double pole structure shall be erected. The pits are to be excavated along the bisection of the angle of deviation.

Before the pole is put into the pit, a stone base of 100 mm thick shall be placed at the bottom of the pit. In lieu of 100 mm PCC base, base plate is being used. After erection of the poles the pits will need to be temporarily backfilled so the poles can be climbed and the horizontal bracing fitted. The structure should then be set for verticality and alignment and the supports



held in position with the help of temporary rope guys.

The temporary backfilling should be removed and permanent foundations constructed by backfilling, compacting and, if necessary, concreting each pit as described in Section 2.3.2. Concrete foundations are not required if the poles are hot dipped galvanized.

Stays along the bisection of the angle of deviation as required depending on the conductor size and angle of deviation, are to be provided.

#### **2.3.4 Special Foundation in Unstable Soil**

Special care has to be taken where foundation in unstable soil is encountered.

In such locations, mass concrete foundations, extending up to the ground level, are to be adopted to avoid collapse of foundation in the unstable soil. The concrete is to be a mixture of cement, granite chips of 20/30 mesh and sand in the ratio of 1:2:4.

#### **2.3.5 Anchoring and providing guys for supports**

One or more guys will have to be provided for all supports where there is an unbalanced strain action on the support, which may result in tilting/uprooting or breaking of the support. To avoid such situation arising, guys are provided to take care of the unbalanced forces. Normally, these guys are provided to the supports at the following places: (i) Angle locations (ii) Dead end locations (iii) Tee-Off points (iv) Termination Points (v) Unstable locations and (vi) Steep gradient locations to avoid uplift on the poles.

Guy wires shall be angled at 45° from the vertical for MV lines and 30° from the vertical for low voltage lines.

Single guys shall be provided for single poles with line deviations from 5° to 10° and also for double poles with line deviations not exceeding 30°. Where the angle of deviation exceeds 30°, two guys along the resultant angle of line deviation or one guy in each direction of the line shall be provided. When two or more stays are fixed to the same support, each stay should be attached separately to the pole.

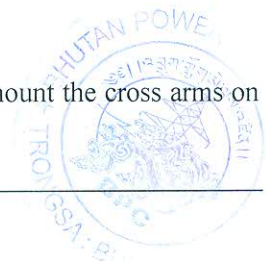
The installation of guy will involve the following works:

- (i) Excavation of pit and fixing guy rod;
- (ii) Backfilling and compacting the guy foundation;
- (iii) Fastening guy wire to the support; and
- (iv) Tightening guy wire and fastening to the anchor.

When installing the guy wire, the turnbuckle shall be mounted at the pole end of the stay and guy wire so fixed that the turn buckle is half way in the working position; thus giving the maximum movement for tightening or loosening. Where the existence of guy wire may be hazardous, it should be protected with a suitable PVC pipe, filled with concrete of about 2-metre length above the ground level, duly painted with white and black stripes. No guy insulator shall be located less than 3 metres from the ground.

#### **2.3.6 Fixing of cross arms and insulators**

After the erection of supports and providing guys, the next step would be to mount the cross arms on



the support. The practice of fixing the cross arm before the pole is erected is followed sometimes but only after the pole painting. In case, the cross arm is mounted after the support is erected, the line-man should climb the support having requisite tools with him. The cross arm is then tied to a hand line and pulled up by the ground man, through a pulley till the cross arm reaches the line-man. The ground man should station himself well to one side so that if any material drops from the top of the pole it may not strike him. All the materials required should be lifted or lowered by means of the hand line. In no case, the materials or the tools should be dropped or thrown from the pole top. Horizontal cross arms and pole top brackets (hamper assemblies) for 33 kV and 11 kV lines as per construction drawings/sketches are standardized. They shall be fitted as shown on the drawings.

The pins for insulators are fixed in the holes provided in the cross arms and the pole top brackets. The insulators are mounted in their places over the pins and tightened. In the case of strain or angle supports, where strain fittings are provided for this purpose, the straps of the strain fittings are placed over the cross arm before placing the bolt in the hole of the cross arm. The nut of the straps is so tightened that the strap can move freely in horizontal direction, as this is necessary to fix the strain insulator.

### **2.3.7 Laying of AAAC/HV ABC/LV ABC/ACSR Conductor**

During running out, the conductor drum should be securely supported on drum jacks with an axle, so that the conductor is pulled from the top of the drum. The drum jacks should be on a firm foundation and the axle of the drum jack should be leveled horizontally.

Sufficient employees shall be engaged at site to ensure that the conductors are not damaged by contact with the ground or pole hardware during running out. Stringing pulleys shall be used while stringing conductors. Care should be taken to avoid kinking, twisting or abrading the conductor in any manner. The conductor should not be trampled on, run over by vehicles or dragged over the ground. Vehicles should not be used to run out conductors.

Extreme care must be taken to avoid contact with the conductors of any other live line in the vicinity when running out or stringing conductors, and if necessary neighboring lines should be de-energized during the stringing operation.

Stays shall be installed and kept in position before conductors are strung to avoid over straining of poles. Stringing pulleys shall be used while stringing conductors.

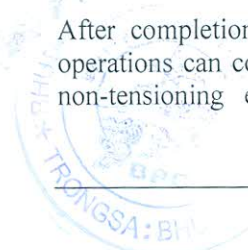
In installing LV aerial bundled cable, the cable must be pulled from the top of the drum and should not be dragged along the ground. A suitable 'drum brake' mechanism shall be used to prevent conductor overrun. Stringing pulleys compatible with bundled conductor shall be installed on every pole. During running out, the cable should be pulled out by hand or by using a nylon-pulling grip designed for bundled cables. Insulated conductor grips designed to prevent damage to the insulation of the conductor shall be used for tensioning. Every care must be taken to avoid damage to the conductor insulation.

### **2.3.8 Mid span jointing of conductors**

Mid-span jointing of conductors shall use compression joints, appropriately sized for the conductor and made with a proprietary compression tool using appropriate sized dies.

### **2.3.9 Sagging and Tensioning of conductors**

After completion of conductor stringing and making any mid-span joints, conductor tensioning operations can commence. The conductors are first attached to the insulator string assembly at the non-tensioning end of the section, using preformed dead-ends. Further, before tensioning





commences, temporary guys should be provided as necessary for the anchoring supports at each end of the line section to be tensioned to avoid over-stressing the strain poles due to unbalanced loads.

The centre conductor should be tensioned first followed by the outer two conductors. At the tensioning end, the conductor being tensioned is pulled manually up to a certain point and then a come-along clamp is fixed to it. The grip to the come-along clamp is attached to a double sheave pulley block or a pull-tight machine and the conductor is gradually tensioned. The conductor should then be sagged in accordance with the sag-temperature chart for the particular conductor and span. These are given in Section 2.3.10 below. The correct sag should be measured in the middle span of the section.

The stretch of the conductor has to be taken out before sagging in order to avoid the gradual increase in sag, due to the setting down of the individual wires. There are two ways of accomplishing this:

**(i) Pre-stressing**

Using the pre-stressing method, the conductor is pulled unto a tension considerably above the correct figure, but never exceeding 50% of breaking load for a period of about twenty minutes. As this method requires more time and involves the use of stronger tackle to secure the higher tension, it is not commonly used.

**(ii) Over tensioning**

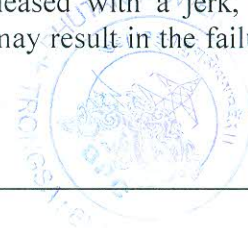
The over tensioning method consists of pulling up the conductor to a tension of 5%-8% above the theoretical tension for the prevailing temperature and fixing the conductor at that tension with correspondingly reduced sag. Over time, the conductor will settle down to the correct sag and tension.

Conductors can be sagged correctly only when the tension is the same in each span throughout the entire length of the section. Use of snatch blocks during sagging reduces the friction and chances of inequality of tension in various spans.

Measurement of conductor sag can be accomplished by several different methods but most commonly used method is 'sighting'. Targets are placed on the supports below the cross arms. The targets may be light strips of wood, which are clamped to the pole at each end of the sagging span at a distance below the conductor when the conductor is placed in snatch blocks that is equal to the required sag. A lineman sights the sag from the next pole and the tension of the conductor is reduced or increased, until the lowest part of the conductor in the span coincides with the lineman's line of sight.

When sagging is completed, the preformed dead end should be fixed to the tension end. The dead-end and socket thimble can be fitted to the conductor without releasing the tension. A mark is made on the conductor at a distance from the cross arms equal to the length of the complete strain insulator to indicate where the dead-end should be installed.

After the dead-end has been installed and the insulator string attached to the top hamper or cross-arm, the conductor is pulled in sufficiently using the come-along clamp, to allow the insulator assembly to be fitted to the socket thimble. After the conductor is attached, the conductor tension may be released gradually. If the tension is released with a jerk, an abnormal stress may be transferred to conductor and support, which may result in the failure of the cross arms, stay or pole.



After the stringing is completed, all poles, cross-arms, insulators, fittings, etc. should be checked to ensure that there have been no deformities, etc.

The conductor is then placed on the pin insulator on each pole ready for tying and to remove the snatch blocks. On straight line poles the conductor should be tied to the top groove of the insulator and on angle poles the conductor should be tied to the side groove. The conductor is then fastened to the insulator using aluminum helities or binding wire.

In fastening the conductor to pin insulators, the following points should be observed:

- (i) The correct size of binding wire, which can be readily handled, and with adequate strength should be used.
- (ii) The length of tie wire should be sufficiently long for making the complete tie including end allowance for gripping each end.
- (iii) A good tie should provide a secure binding between the line conductor and insulator, and should reinforce the conductor on either side of the insulator.
- (iv) The use of cutting pliers for binding the tie wire should be avoided.
- (v) A helities or binding wire that has been used previously should not be reused.
- (vi) Before tying the conductor to the insulator, it shall be ensured that only the portion of helities wrapped with chloroprene pad (where applicable) touches the insulator.
- (vii) At section poles correctly sized parallel groove (PG) clamps must be used to connect the two conductor tails.

### 2.3.10 Conductors Sag and Tension

The following sag-span tables are provided for the guidance of field staff when stringing conductors.

#### 2.3.10.1 ACSR Conductors

##### Sag-Span Chart - 33kV, Wolf

Conductor : Wolf  
Voltage : 33 kV  
Design Tension : 3.42 kN at 15°C, no wind (approx 5% MBL)

Temp	10°C	15°C	25°C	30°C	75°C
<b>Span (m)</b>	<b>Sag (m)</b>				
40	0.37	0.42	0.51	0.55	0.70
50	0.60	0.65	0.75	0.80	0.97
60	0.88	0.94	1.04	1.09	1.28
80	1.61	1.67	1.78	1.84	2.04

<b>100</b>	2.55	2.62	2.73	2.79	3.27
<b>150</b>	5.82	6.00	6.00	6.07	6.60

**Sag-Span Chart – 33 kV, DOG**

Conductor : Bare ACSR DOG  
 Voltage : 33 kV  
 Design Tension : 1.95 kN kg at 15°C, no wind (approx 5% of MBL)

Temp	10°C	15°C	25°C	30°C	50°C
<b>Span (m)</b>					
40	0.34	0.40	0.50	0.55	0.88
50	0.56	0.62	0.73	0.79	1.17
60	0.83	0.89	1.01	1.07	1.49
80	1.52	1.59	1.72	1.78	2.26
100	2.38	2.45	2.59	2.65	3.19
150	5.44	5.52	5.66	5.73	6.33

**Sag-Span Chart – 33 kV, RABBIT**

Conductor : Bare ACSR RABBIT  
 Voltage : 33 kV  
 Design Tension : 1.04 kN kg at 15°C, no wind (approx 5% of MBL)

Temp	10°C	15°C	25°C	30°C	50°C
<b>Span (m)</b>					
25	0.125	0.157	0.231	0.266	0.389
30	0.187	0.227	0.310	0.350	0.488
35	0.262	0.308	0.400	0.443	0.595
40	0.352	0.403	0.501	0.547	0.712
60	0.845	0.907	1.023	1.078	1.280

**Sag-Span Chart – 11 kV, DOG**

Conductor : DOG  
 Voltage : Bare ACSR 11 kV  
 Design Tension : 5.71 kN kg at 15°C, no wind (approx 17% of MBL)

Temp	10°C	15°C	25°C	30°C	50°C
<b>Span (m)</b>					
40	0.12	0.14	0.18	0.22	0.65
50	0.19	0.21	0.28	0.33	0.84
65	0.27	0.31	0.40	0.45	1.03
80	0.49	0.54	0.68	0.75	1.46
100	0.76	0.84	1.01	1.11	1.93
150	1.76	1.88	2.14	2.26	3.33
200	3.20	3.35	3.65	3.80	5.05
250	5.06	5.23	5.57	5.74	7.13
300	7.35	7.54	7.90	8.07	9.57

**Sag-Span Chart – 11 kV, RABBIT**

Conductor : Bare ACSR RABBIT  
 Voltage : 11 kV  
 Design Tension : 3.02 kN kg at 15°C, no wind (approx 17% of MBL)



Temp	10°C	15°C	25°C	30°C	50°C
Span (m)					
25	0.047	0.054	0.076	0.093	0.220
30	0.068	0.078	0.108	0.131	0.280
35	0.093	0.106	0.146	0.174	0.344
40	0.122	0.139	0.188	0.222	0.412
60	0.278	0.313	0.404	0.460	0.720

### 2.3.10.2 Covered AAAC/HV ABC Conductors

Conductors shall be tensioned by evenly tensioning each conductor. The sag and tension tables and recommendations of conductor manufacturer should be utilized.

### 2.3.10.3 Low Voltage Aerial Bundled Conductors (ABC)

#### Sag-Span Chart for Low Voltage ABC Conductors

Conductor Size	50mm <sup>2</sup>		95mm <sup>2</sup>	
	Design Tension at 15 <sup>0</sup> C (kN)		Design Tension at 15 <sup>0</sup> C (kN)	
	2.52	5.04	4.79	9.58
Span (m)	Sag (m)			
30	0.15			
40	0.26			
50	0.41			
60	0.59			
70	0.80			
80	1.04			
90	1.32			
100	1.63			
110	1.97			
120	2.35			
130	2.75			

#### Maximum Spans for Aerial Bundled Cable

Pole Length (m)	Maximum Span (m)	
	Across Street	Elsewhere
7.5	50	80 (4 core) 100 (2 core)

Dead-end (termination) fittings shall be fitted to the conductor after tensioning at each termination point. Intermediate fittings shall then be fitted at major angles and then at smaller angles. After all fittings are in place the sagging should be checked at two places and corrected if necessary.

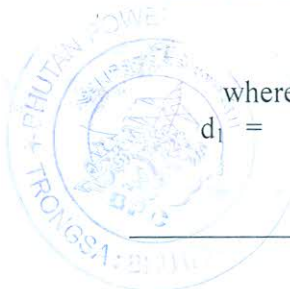
### 2.3.11 Supports at Different Elevation

Where the supports at each end of a span are at different elevations the following formula can be used for sagging the conductor.

$$d_1 = d(1-h/4d)^2$$

where:

$d_1$  = vertical distance between the conductor at the lower support and the lowest



- mid-span point.
- d = sag for a level span equal to the slope distance between the poles. The slope distance is the distance that would be measured by a tape stretched between the two poles. Once this is known the value of d can be taken from Sag-Span chart above.
- h = difference in height between the conductor at each end of the span.

The above formula can be used to determine the value of  $d_1$ . A sighting board can then be attached to the lower support pole and the conductor sagged by sighting horizontally through it. One way to do this would be to attach a second sighting board to the next pole. Check that the two sighting boards are level using a taut line and spirit level. The sag can then be sighted using the two sighting boards.

### 2.3.12 Good Conductor Stringing Work Practices

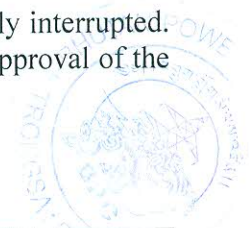
#### DO:

- Use proper equipment for handling aluminum conductors at all times.
- Use skids, or similar method for lowering reels or coils from transport to ground.
- Examine the reel before unreeling for presence of nails or any other object, which might damage the conductor.
- Rotate the reel or coil while unwinding the conductor.
- Unwind the conductor in the direction of the arrow on the side of the drum
- Grip all strands when pulling out the conductor.
- Control the unreeling speed with a suitable braking arrangement.
- Use wooden guards of suitable type to protect the conductor when pulling it over barbed wire fences, sharp rock edges or similar obstructions.
- Use long straight, parallel jaw grips with suitable liners when pulling the conductor in order to avoid nicking or kicking of the conductors.
- Use free-running sheaves or blocks with adequate grooves for drawing/paying conductors.
- Measure temperatures accurately with an accurate thermometer.
- Use proper sag charts.
- Mark conductors with crayons or adhesive tape or such other material which will not damage the strand.
- Make all splicing with the proper tools.

#### DO NOT

- Do not handle conductors without proper tools at any stage.
- Do not pull conductors without first ensuring that there are no obstructions on the ground.
- Do not pull out a greater quantity of conductor than is required.
- Do not make jumper connections on dirty or weathered conductor. Instead, clean the conductor with sandpaper. Alternatively apply a chromate or graphite conducting oxide-inhibiting grease to the point of connection and then clean the conductor with a wire brush.
- Do not handle aluminum conductor in a rough fashion but handle it with care it deserves.

At road crossings, a flagman should be in attendance to that traffic is not unduly interrupted. The running of conductor across roads should only be carried out in with the approval of the Authority responsible for the road.



Conductor drums should be transported to the tension point without injuring the conductor. If, it is necessary to roll the drum on the ground for a small distance, it should be slowly rolled in the direction of the arrow marked on the drum.

When running out conductor the drum should be so supported that it can be rotated freely. For this purpose, the drum should either be mounted on the cable drum supports or jacks or hung by means of chain pulley of suitable capacity, suspended from a tripod. If it is not possible to raise the conductor drum by any of the above methods, a trench of suitable depth slightly bigger than the conductor drum may be dug, so as to facilitate free rotation of the drum when it is suspended above the trench using a steel shaft. While running out the conductor, care should be taken to ensure that the conductor does not rub against any metallic fitting of the pole or on the uneven or rocky ground. Wooden trusses may be used for this purpose to support the conductor when running out.

Should the length the conductor be less than the length of the section, the conductors should be run out from both ends and joined where they meet with a mid-span full tension joint.

On no account, should any part of the conductor shall be left overnight at a height of less than 5 meters above the ground. The work should be so arranged that before the end of the day, the conductor is raised to a minimum height of 5 meters above the ground by rough sagging.

### **2.3.13 Earthing of Distribution Lines**

All MV line steel poles should be separately earthed. The earth pin is a 2.5 m galvanized steel rod, which must be driven into undisturbed ground clear of the pit excavation. It is not acceptable to insert the earth rod in the pit excavation as the backfill used often does not provide a good earth connection.

The earth pin is connected to the pole using No 8 SWG galvanized steel wire/GI Strip as shown in the drawings. Lugs and bolts must be used for both the connection to the pole and to the earth pin. Wire wrapped connections are not acceptable as a good electrical connection cannot be assured.

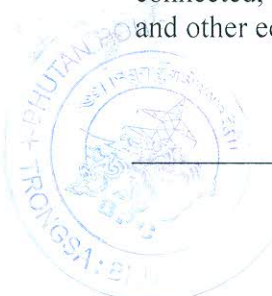
The earth resistance of the pole and earth pin connected together should be as low as possible and ideally should not exceed 10 ohms. Additional earth pins, spaced at least 1 meter apart, should be used in difficult locations, to reduce the resistance.

The earthing stake for pole earths is also used for earthing LV distribution pillars.

The earth resistance of the earth stake and pole connected together should be measured and recorded every tenth pole. The earth resistance of a greater percentage of poles should be measured if earth resistances are high or if there is high soil variability.

### **2.3.14 Final Completion and Commissioning**

Before commissioning a line into service, the line shall be visually checked over its full length to ensure that all structures are correctly installed, all pole earths are installed and connected, all conductors are correctly bound and terminated on all structures and all tools and other equipment have been removed.



The line shall be energized with all distribution substations isolated and unloaded on the low voltage side. Where the line is directly connected to a zone substation supply bus, rather than to an upstream line, the protective relay settings should be reduced. Once the line has been successfully energised, the correct protection relay settings should be applied and the distribution substations connected to the load one at a time.

In energizing distribution transformers for the first time, the MV drop out fuse should first be closed to liven the transformer on no load. The transformer can then be loaded by closing the incoming MCCB in the LV feeder cubicle.

### **3. Underground Cable Installation**

#### **3.1 General Scope**

This specification covers the requirements of Cabling System installation work. The installation, testing and commissioning of the complete cabling system shall be carried out as stipulated in this specification. This shall cover the requirements of supply of cabling accessories such as lugs, glands, jointing and terminating boxes/kits, junction/ marshalling boxes, cable trays, conduits and pipes to complete the work in all respects. These notes in general cover cables up to and including 33 kV rating.

#### **3.2 Codes and Standards**

**3.2.1** The cabling system installation work shall comply the latest applicable standards, regulations and safety codes of the locality where the installation is carried out. Nothing in this specification shall be construed to relieve the Contractor of this responsibility.

**3.2.2** The installation work shall conform to the latest applicable codes of practices, Electricity rules, Fire Insurance Regulations and standards.

#### **3.3 Installation Work Scope**

##### **3.3.1 Scope**

- a) The installation work shall include unloading, storing, laying, fixing, jointing/ termination, testing, commissioning and any other work items necessary completing the job.
- b) The Contractor shall furnish all supervision, labour, tools, welding equipment, tackles and testing equipment as required for installation work. All incidental hardware and miscellaneous items such as saddles, spacers, nuts/bolts/washers, anchor fasteners, cable route and joint markers and protective covers for buried cables, cable identification tags and ferrules, nylon cord/G.I. wire, earthing as required for the cabling installation shall be deemed to be included by the Contractor as part of installation work.
- c) Civil works for constructions of built-up cable trenches/tunnels/duct banks, cable carrier supports on main pipe rack structure, provision of embedded conduits/pipes in RCC masonry structures and across roads are included in Contractor's scope.
- d) The Manufacturer's drawings, cable schedules, instructions and recommendations shall be correctly followed by the Contractor in handling, laying, testing and commissioning of the cabling system. In case of any doubt/misunderstanding as to correct interpretation of drawings/instructions, necessary clarifications shall be obtained by the Contractor from the Employer.



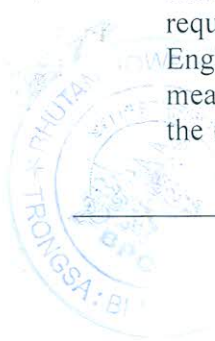
- e) Any changes in routes of cables which are required to be made to suit site conditions shall be carried out by the Contractor in consultation with the Engineer and after his approval. All such changes shall be marked by the Contractor on relevant drawings/in cable and conduit schedule.
- f) All thefts and damage of cables or equipment to which cables are to be connected, till the installations is handed over to the Employer, shall be made good by the Contractor.
- g) It will be responsibility of the Contractor to clean the trenches/tunnels, remove cable drums, surplus/waste materials and all other similar items after the installation work is completed.

### 3.3.2 Cable Laying

- a) The Contractor shall install, test and commission all power and control cables. The quantities, sizes and types of cables shall be indicated in Bill of Quantities.
- b) The cable shall be laid in built-up trenches, directly buried in ground, cable ducts, on cable trays vertical raceways, clamped on structures/walls/ceiling, pulled through pipes and conduits etc., as per the relevant cable installation practice notes and drawings.
- c) The Scope of cable laying shall include laying, pulling cable as above, proper dressing of cables on cable trays, racks, vertical raceways and supply and installations of cable fixing saddles, spacers and nylon cord for tying as required. The installation of trefoil/wooden clamps for clamping the cables shall be included in the installation cost of relevant cables including excavation, backfilling, etc. However, during layout of cable do not drag the cable on surface of ground, roads, etc. including pulling with excessive force especially with help of vehicle.
- d) Where cables are to be installed at temperatures below 3 ° C, they shall be heated to about 10 ° C for not less than 24 hours (in a heated building or in a tent with hot air heater) to facilitate laying (otherwise the bending would damage the insulation and protective coverings of cables). The cable laying must be carried out swiftly so as not to allow the cable to cool down too much.
- e) Control cables and small power cables in trenches and tunnels shall be run in ladder type cable trays (maximum tray width 600 mm) supported on trench/tunnel carrier arms. Control and power cables shall be clamped separately. It will be the responsibility of the Contractor to check the neatness of such cable runs and to see that horizontal/vertical runs of cables are parallel to fixed axes in respective plans. The cables shall be laid to tray rungs by means of 3mm dia. nylon cord at an interval of 5000 mm and also at bends.
- f) For good sealing arrangement at entry points, suitable pipe sleeves, adequate in number and of adequate sizes shall be provided in building walls/slabs for passage of cables into a building from cable trays/racks/cable trenches located outside the buildings.

### 3.3.3 Cabling

- a) Standard cable grips and reels shall be utilized for cable pulling. Care shall be taken to avoid damage to the cable and seal, which shall be made up and maintained during cable installation. If unduly difficult pulling occurs, the Contractor shall check pull required and suspend further pulling until further procedure has been approved by the Engineer. Maximum pull tension shall not exceed recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering and does not set up undesirable conditions of electrostatic stress





or electrostatic charge may be used in pulling insulated cables in conduits and ducts. In particular soap shall not be used as lubricant. For cables over 2,000 volts and having non-metallic jackets without adequate static shielding, the lubricant should not include graphic or hygroscopic greases that will leave a conducting film on the surface of the cable. It is not considered likely that all cable to be pulled from any pulling location can be pulled consecutively without moving and later backtracking, and it may be required that cables reels and equipment be moved from pulling locations when no actual pulling is in progress to allow performance of collateral work, and when so requested by the Engineer, such reels and equipment shall be removed. When pulling cable from any pulling location, reels shall be laid out from locations, which will permit performance of collateral work without obstruction.

- b) After pulling cable, the Contractor shall record cable identification and date pulled, neatly with water-proof ink on linen tags at all cable ends. This is in addition to the cable identification tags to be tied by GI wire at each end of the cable.
- c) Cable take-off from drums shall be so planned as to avoid using joints and splices in the run of the cable. Cable splices will be made only after obtaining permission of the Engineer. Splices where permitted, shall be made in a neat workmanlike and approved manner by man specialized in this class of work, particular attention being paid to higher voltage splices and splices involving armour or lead sheath constructions. Splices shall be made by the Contractor for each type of wire or cable in accordance with the instructions issued by the cable Manufacturer and the Engineer. Before splicing, insulated cables shall have conductor insulated stepped and bound or penciled for recommended distance back from splices to provide along leakage path. After splicing, insulation equal to that of the spliced conductors shall be applied a teach splice. In baring conductors for splices, care shall be taken to avoid nicking of strands.
- d) Cables shall be protected at all times from mechanical injury and from absorption of moisture at unprotected ends. Damaged cables shall be replaced at the Contractor's expense.
- e) Sharp bending and kinking of cables shall be avoided. The bending radii for various types of cables shall not be less than those specified below, unless specified in cable installation notes.

DESCRIPTION	SINGLE CORE	MULTICOURED ARM OURED	MULTICOURED UNARM URED
PVC insulated cable upto 11 kV	20 D	12 D	15 D

Where D = Overall diameter of cable.

(For XLPE insulated cables, recommendations of manufacturers to be followed).

If shorter radius appears necessary, no bend shall be made until clearance and instructions are obtained from the Engineer.

The above values may be reduced to 70% when making only one bend such as in case of installing an end



termination.

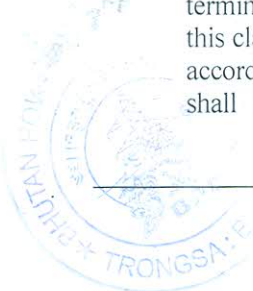
- f) When power cables are laid in the proximity of communication cables, minimum separation between power and communication cables shall be not less than 460 mm for single-core cables and 300 mm for multi-core cables. Power and communication cable shall, as far as possible, cross at right angles to each other.
- g) The end portions of directly buried cables shall be protected as indicated in the relevant enclosed typical drawing by bringing out the cables from earth at the entry/exit points in conduits/pipes.
- h) Unarmoured cables shall be protected in conduits up to 2.5 meters from floor level.
- i) The Contractor shall make connections to small electrically operated devices on equipment installed as accessories to, or assemble with other equipment and requiring two-wire or three-wire connections. Connections to recording instruments float switches, limit switches pressure switches, thermocouples, thermostats and other miscellaneous equipment shall be done as per the Manufacturer's drawings and schedules.
- j) The Contractor shall be responsible for correct phasing of the motor power connections and shall interchange connections at the motor terminal box, if necessary, after each motor is test run.

#### 3.3.4 Cable Termination

- a) All cables that will be laid by the Contractor shall be connected at both ends to switchgear, panels, equipment, local push buttons, instruments or junction/marshalling boxes terminals as the case may be.
- b) The scope of termination at each end shall include dressing and connection of all the cores of the cables. The following shall be included in this scope of work:

Making the requisite holes in the bottom/gland plate of the switchgear for cable boxes/glands, fixing the cable boxes/glands, terminating the cables in the cable boxes/glands, earthing the cable armour, crimping the cable lugs on each core neatly, clamping the cables inside switchgear/panels cable alleys, wiring troughs and connecting to correct terminals as per the Manufacturer's wiring diagrams and cable schedules. The cable and core identifying lugs and ferrules respectively shall be supplied and installed by the Contractor as part of cable termination work.

- c) All cable terminations shall be solder less crimping type. Proper crimping tools shall be used by the Contractor. The crimping tools used shall be subject to the Engineer's approval.
- d) Spare cores of control cables shall be connected to spare terminal blocks, where available, with appropriate ferrules. If there are no spare terminal blocks, the spare core shall be bunched together and shall be neatly kept inside the panel.
- e) At cable terminal points where the conductor and cable installation will be terminated, terminations shall be made in a neat, workmanlike and approved manner by men specialised in this class of work. Terminations shall be made by the Contractor for each type of wire or cable in accordance with instructions issued by cables Manufacturer and the Engineer. The Contractor shall have on hand at the job site the Manufacturer's drawings on high voltage cable

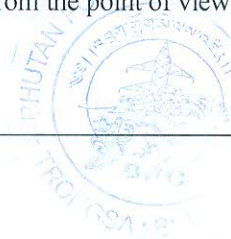


terminations. Terminations shall be made using compression type lugs. Main runs of power and control cables will consist of PVC/XLPE insulated armoured or unarmoured cables. Terminations of such cables will generally occur in terminal boxes where splices may be required, using a special compressing or clamp type termination, beyond which PVC insulated conductor, will continue to the terminals of the control device. Terminal boxes in which splices occur will require filling with compound after completion of splices.

- f) Where terminal boxes have wiping sleeves, the lead sheath of cable shall be belled in an approved manner to fit, and a standard wiped joint made, using steering flux and lead heated to proper temperature. Where conduits continues with cable to terminal box and mechanical clamping of lead sheath of cable is required, sheath shall be belle, trimmed and clamped in a good and approved manner. Before any cable terminal connections are made, conductors shall be rung out and identifying tags shall be installed as required by the Engineer. Connections shall be made according to wiring diagrams. Polarity of phasing shall be checked before connections are made, and correction of polarity, phasing or rotation shall be made by the Contractor without additional cost.
- g) Control cable terminations shall be made in accordance with wiring diagrams/cable interconnection diagram and cable schedules. It is the intend that the Contractor shall terminate the cables which he installs. Additional work of testing and reconnection where leads have been brought by the Contractor to terminal boards and connected, but where on further testing, reversal or other rearrangement of load turns out to be necessary, additional work of testing and reconnecting shall be performed by the Contractor at no extra cost to the Employer.
- h) When control cable cores are to be fanned out and cabled together with core, the Contractor shall make connections to terminal blocks, and test equipment for proper operation before cables are corded together. If there is any doubt as to proper connection, the Contractor shall make temporary connection with sufficient length of cable so that cable can be switched to another terminal without splicing cable. Splices will not be accepted, and any cable cut out short shall be replaced and installed, at the Contractor's expense. After correct connections are established through operating equipment, cables shall be cut to correct lengths connected to terminals in the specified manner and corded together where necessary to hold cables in place in a workman-like manner.

### **3.3.5 Associated Work for Direct Burial of Cables, Conduits and Pipes**

- a) The Contractor's scope of work for the cable trenches required for directly buried cables shall include excavation, preparation of riddled soil bedding, supply and installation of protective covers i.e. tiles for HT cable and bricks for LT cables, back-filling, ramming and installation of route markers and joint markers. The details of construction work and provision of protective covers and markers shall be as indicated in the enclosed drawings of installation practice for directly buried cables. The sizes of these trenches shall be as indicated in the Drawing.
- b) The Contractor's scope of construction work for directly buried pipes/conduits shall be excavation and back filling as per varying depths/widths required in drawings.
- c) In each cable run greater than 50 meter, some extra cable length shall be kept at a suitable point to enable a straight through joint to be made should the cable develop fault at a later date.
- d) Where cables cross roads, water or sewage pipes, the cable shall be laid in hume or steel pipes. For road crossings the pipe for the cable shall be buried at not less than 600 mm unless otherwise noted in the drawings. Hume pipes shall be preferred to that of steel pipes from the point of view of corrosion.

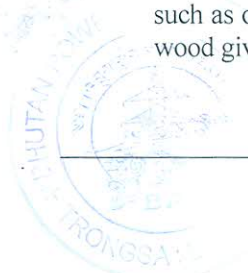


### 3.3.6 Cable Joints

- a) Cables to each circuit shall be laid in one continuous length. Cable jointing and splicing shall be done after obtaining Site Engineer's permission. The work shall be carried out as per the cable and jointing kit Manufacturer's instructions furnished to the Contractor.
- b) The scope of jointing of various sizes and types of power cables indicated in Bill of Quantities shall include all necessary special tools and incidental accessories for testing of the joints and as per specification.
- c) Directly buried cables shall be laid as per the drawings and cable route markers shall be provided. At least one marker shall be provided if the length of the buried cable is less than 15 metres. Buried cables in trefoil formation shall be bound by plastic tapes or 3mm dia. nylon core every 750 mm.
- d) Jointing of cables shall be carried out in accordance with relevant Standard Codes of Practice and the Manufacturer's special instructions. Hardware like clips and clamps and tools required for cable jointing work shall be supplied by the Contractor. Cables shall be firmly clamped on either sides of a straight through joint at not more than 300 mm away from the joints. Identification tags shall be provided at each joint and at all cable terminations. Single core cable joint shall be marked so that phase identity at each can be determined easily. The joints shall be located at the most suitable places. There shall be sufficient overlap of cables to allow for the removal of cable ends which may have been damaged.
- e) Joint pits shall be of sufficient dimensions to allow the jointers to work with as much freedom as possible. When two or more cables are laid together, joints shall be arranged to be staggered by about three metres.
- f) Cable seal shall be examined to ascertain if they are intact and also that cable ends are not damaged. If the seals are found to be broken or lead sheath punctured, the cable ends shall not be jointed until after due examination and testing by the Engineer. Before jointing is commenced, insulation resistance of both sections of cables to be jointed shall be checked by megger and insulation values recorded.

### 3.3.7 Junction/ Marshalling Boxes/ Button Station Installation

- a) The Contractor shall install the junction/marshalling boxes wherever necessary.
- b) The scope of installation of junction/marshalling boxes and push-button stations shall be mounted on wall, columns, and structures, including necessary bolts, nuts, screws and welding work as necessary.
- c) Cable entry to motors, push button stations and other electrical devices shall be from the bottom as far as possible or from the sides. Top entry shall be avoided particularly for outdoor equipment.
- d) Identification tags made from aluminium sheet shall be attached to each end of each cable by means of GI binding wire as shown in drawing. Tags shall be additionally put at an interval of 30 meters on long runs of cables and in pull boxes.
- e) Wooden cleats when required for vertically supporting on or more single core cables per phase, such as on vertical framework near transformer cable boxes, shall be made out of well-seasoned wood given two coats of fire retarding paint of approved quality.



### **3.4 Earthing of Cables**

- a) Metallic sheaths, screens and armour of all multicore cables shall be earthed at both equipment and switchgear end.
- b) Sheath and armour of single core power cables shall be earthed at switchgear end only. If specifically indicated in drawings, for long lengths of cables multiple earthing may have to be adopted to safeguard against the presence of standing voltage under normal as well as fault conditions.
- c) Earthing of CT and PT neutral lead shall be at one end only.
- d) Metal sheath and armour of the cable shall be bonded to the earthing system of the station. Bond shall be of at least 70 sq.mm copper conductor unless otherwise specified.

### **3.5 Testing of Cables**

- a) All new cables shall be megger tested before jointing. After jointing is completed all L.V. cables shall be megger-tested and H.V. cables (3.3 kV and above) pressure tested before commissioning. The test voltage for pressure testing shall be as per the relevant cable standards. 1100/650 Volt grade cables shall be tested by 1000 volt Megger.
- b) The Contractor shall furnish all testing kit and instruments required for field testing.
- c) All cables of 1.1 kV grade 400 sq.mm and above and all HV cables shall be subjected to DC or AC high voltage test after jointing and terminating but before commissioning as per the relevant standards. Testing with DC voltages should be preferred as test equipment required is compact, easily portable and requires low power. The cable cores must be discharged on completion of DC high voltage test and cable shall be kept earthed until it is put into service.
- d) DC test voltage for old cables is 1.5 times rated voltage or less depending upon the age of cables, repair work or nature of jointing work carried out.
- e) In each test, the metallic sheath/screen/armour should be connected to earth.
- f) Continuity of all the cores, correctness of all connections as per wiring diagrams, correctness of polarity and phasing of power cables and proper earth connection of cable gland, cable boxes, armour and metallic sheath shall be checked.

## **4. *Installation of Distribution Transformer Substations***

### **4.1 Selection of Site**

The location of distribution transformer substations should ideally be:

- as close as possible to the centre of the load, in order to reduce the voltage drop in the low voltage circuits;
- in a location that is clear of obstructions and that provides satisfactory access for the incoming medium voltage overhead distribution line;
- readily accessible for transportation of the distribution transformer to site;
- above a road rather than below it where this is practical; and
- in a location likely to provide a low resistance to earth.



## 4.2 Substation Structure and Earthing

Distribution substations shall be constructed in accordance with BPC's arrangement drawings.

Particular care should be given to the construction of the earthing system as proper earthing of distribution transformer substations is necessary to ensure safe operation of the supply system. The earth pits should be located as shown in Drawing BPC-DCS-018 and the earth connections to the substation structure are shown in Drawing BPC-DCS-20.

BPC's standard earthing conductor for transformer substation is 25xg mm galvanized iron flat. Three electrodes forming an equilateral triangle with minimum distance of 6500mm, so that adequate earth buffer is available. Each electrode shall be GI pipe of 4 mm thick, 40mm outer dia and 2500mm long and buried vertically so as to leave about 4 inch pipe length above ground level to fix a 250x250mm G.I plate. The three earth electrodes should be connected together by an equi potential earthing ring embedded at least 100 mm below ground level. These are connected as follows:

- 1) One earth electrode is connected to earth lighting arrestor and the transformer tank. It is important that the earthing conductor is kept as short as possible.
- 2) The second earth electrode is connected to the transformer LV neutral bushing, the transformer tank and the cross arms supporting the drop-out fuses.
- 3) The third earth electrode is also connected to the transformer tank and LV neutral and also to the earth in the low voltage distribution cabinet.

Earth resistance tests of the three earth electrodes connected together should be undertaken on installation and subsequently at intervals of no greater than 10 years. The maximum permissible earth resistance is 5 ohms. Bentonite soil and salt can be used inside the earthing pipes to reduce the earth resistance. In extreme situations additional earth electrodes should be installed.

## 4.3 Transportation and Handling of Transformers

Distribution transformers should be stored in such a way that 'first in first out' becomes a normal procedure. Care must be taken to place the transformers in store in such a fashion that no damage occurs to tank, bushings, etc. due to movement of personnel and materials.

Transformers should be loaded and unloaded with care. Prior to loading a transformer for dispatch to site, the transformer condition (bushings, fittings, tank, oil level, etc.) should be checked. If any damage is noticed, the in-charge should be notified immediately, and transformer should be loaded only after the written approval of the person in charge. The BDV value of the transformer oil should be checked and transformer should be loaded only after written approval of the In-Charge.

Every transformer dispatched to site should be entered individually in store register. This register should have the following:

- (i) Serial Number
- (ii) Date of receipt
- (iii) Transformer capacity (kVA)
- (iv) Manufacturer's name
- (v) Date of Dispatch to site



- (vi) Name of site
- (vii) Technical test reports

Transformers should be lifted using the lifting lugs provided on the transformer tank and the lifting arrangement should not cause unbalance of the transformer. Before lifting the complete transformer, it should be ensured that all cover bolts are tightened. The slings, lifting tackle, etc. to be used in hoisting of transformers should have adequate strength to handle the weight.

During transport of transformers, they should be rigidly secured to the transport vehicle and packing materials put on either side of the base of the transformer to prevent skidding. A responsible official shall supervise the loading. Rollers, if provided, should be removed.

Care should be taken in transporting transformers to site to prevent the transformers moving when going up and down hills and around corners.

Transformer should be brought just adjacent to the mounting structure for installation. Lifting tackle should be used for hoisting transformer on structure.

In case, it is not possible to bring the vehicle carrying transformer near the mounting structure, it should be unloaded at a nearest safe place and carried to the mounting structure manually with great care and under proper supervision or shifted on platforms fitted with rollers.

While installing transformers on the Transformer Platform, safety precautions by way of fixing additional clamps and bolts should be taken.

Readymade slings to suit the capacity of transformer should be available.

#### 4.4 Protection of distribution transformers

The pole mounted distribution substation arrangement has been standardized to the extent possible with the structure and the high voltage connections being identical for all transformer sizes. Dropout fuses are provided on H.V side of the transformer for isolating and protection. The size of fuse link used in these drop out fuses will vary with transformer rating. Acceptable fuse link sizes for BPC's existing transformer capacities are given below.

Acceptable Transformer Medium Voltage Fuse Link Ratings

MV Rating (kV)	Phases	Capacity(kVA)	Rated Current(A)	Fuse Link(A)
33	3	63	1.1	2 to 4
33	3	125	2.2	4 to 7
33	3	250	4.4	9 to 16
33	3	500	8.7	16 to 32
33	1	10	0.3	1 to 2
33	1	16	0.5	1 to 2
33	1	25	0.8	2 to 3
11	3	16	0.8	2 to 3
11	3	25	1.3	2 to 4
11	3	63	3.3	7 to 9
11	3	125	6.6	16 to 25



11	3	250	13.1	32 to 40
11	3	500	26.2	50 to 100
11	3	1250	65.6	150 to 300
11	1	10	0.9	2 to 3
11	1	16	1.5	3 to 7
6.6	3	20	1.7	3 to 7
6.6	3	30	2.6	4 to 9
6.6	3	50	4.4	9 to 16
6.6	3	75	6.6	16 to 25
6.6	3	125	10.9	25 to 40
6.6	1	10	1.5	3 to 7
6.6	1	16	2.4	4 to 7
6.6	1	25	3.8	9 to 16

LV cable specification for connection from Transformer LV side to DP

Phases	Transformer Rating (kVA)	Maximum LV Current (A)	Cable Size(mm <sup>2</sup> )
3	10	14	4Cx35
3	16	23	4Cx35
3	25	36	4Cx35
3	63	91	4Cx70
3	125	180	4Cx150
3	250	361	4cx300
3	500	722	2Rx4cx300
3	1250	1804	2Rx4cx630
1	10	43	2Cx35
1	16	70	2Cx35
1	25	109	2Cx35

On the low voltage side of the transformer the supply cable is run into a 4-way feeder cubicle mounted on the transformer structure. The cubicle's incoming cable is terminated into a circuit breaker which can be used to offload the transformer. Three pole moulded case circuit breakers (MCCB's) shall be used for transformer sizes up to and including 500kVA. Air circuit breakers may be used for larger transformers.

#### 4.5 Installation of Distribution Pillars

Distribution pillars are used to connect LV ABC Cable to the feeder poles. LV UG Cables are used to





connect Transformer LV side to Distribution pillars. Distribution pillars must be effectively earthed. An earthing stake should be installed at the pillar location and this should be connected to an earthing terminal on each side of the pillar using 25x6 galvanized iron strips. Drawing No. BPC-DCS-019 may be referred for connections.

#### 4.6 Connection of Supply to Consumer's Premises

Supply to consumer premises through a 2 or 4 core overhead cable in situations where consumers are fed from the overhead system and a 2 or 4 core underground cable when fed from an urban underground system.

The connection arrangement for a single phase consumer shall be as per the relevant drawings. The residual current circuit breaker (RCCB) shown in the drawing is optional but the remainder of the circuit is mandatory. All components except the energy meter shall be provided by the consumer. The energy meter will be provided by BPC.

A new connection should not be livened unless;

- The consumer has installed an MCB as a point of isolation;
- The consumer has installed a stake earth, which is connected to a main earth terminal on the consumer's distribution board;
- Each and every power point is properly earthed;
- There is a link between the earth terminal and the incoming neutral. As shown in the drawing, the configuration of this connection will depend on whether or not the customer chooses to connect an RCCB.

#### 4.7 Consumer Metering

The choice of meter to install in consumer installation will depend on the expected load. Three types of meter are available:

- Direct connected, where the meter is directly connected to the incoming low voltage supply;
- CT metering, where the meter is indirectly connected to the low voltage supply through a current transformer; and
- High voltage metering, where the consumer is supplied at high voltage and the meter is indirectly connected to the high voltage supply through a high voltage metering unit.

#### 4.8 Direct Connected Metering

Direct connected metering should be used when the consumer load is not expected to exceed 60 A. Standard direct connected meters used by BPC are given in table below:

BPC Standard Direct Connected Meters.

1	Static 1P energy meter	10/60	2
3	Static 3P energy meter	5/30	2
3	Static 3P energy meter	10/80	2



The class of meter indicates its accuracy and the meter capacity indicate the current range over which the accuracy can be assured. Hence a class 2 10/60 A meter can be expected to have a metering accuracy of 2 % over a current range of between 10 and 60 amps.

#### **4.9 CT Metering**

Where the consumer is supplied at low voltage and the expected maximum three phase load is greater than 60 A, current transformer (CT) metering should be used. All current transformers have a 5 A output and feed into a standard 5 A, class 1 electromechanical meter. The load shown on the meter needs to be multiplied by the CT ratio to give the actual consumption.

CTs currently used by BPC have a ratio of 100/5, 200/5, 300/5, 400/5, and 500/5 and have an accuracy of class 1 and a burden of 15 VA.

Care must be taken to ensure the correct multiplier is used when measuring consumption using CT metering.

#### **4.10 High Voltage Metering**

Consumers supplied at high voltage must provide a high voltage metering unit acceptable to BPC. The high voltage metering unit shall incorporate potential and current transformers. The current transformer shall be class 0.5, have a maximum burden of 15 VA and have either a 1 A or 5 A output. The voltage transformer shall be class 0.5, have a maximum burden of 15 VA and have a 110 V output.

BPC will connect its own class 0.5 trivector electronic meters meeting the requirements of IEC 60687 to the consumer's high voltage metering unit. The meter shall incorporate a data logging facility and be capable of recording a range of different power system parameters at the point of connectio

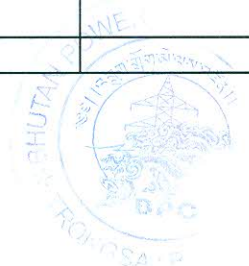


## Section V

# Price Schedules



<b>1. O&amp;M Works: Improvement and upgradation of lines and substations - 2021</b>					
SI No	Description of Work	Unit	Quantity	Rate	Amount
<b>A. Right of Way (ROW) Cutting and Clearing</b>					
1	Cutting and Clearing of Right of Way (ROW) along the MV line, for 33 kV line - 12 m width, for 11 kV - 9 m width. Need to carry out cutting of trees & trunks, debranching, including through cleaning of bushes, creepers, bomboos along the line and all underneath growth. The measurement will be done as per the actual work done, point by point at ground zero by GPS equipment and the line length will be not be considered.				
1.1	Yurmoo - Kewathang (Incomer) feeder	Km	0.233		
1.2	Kewathang - Taktse feeder	Km	19.396		
1.3	Kewathang - Bumthang (Yotula) feeder	Km	9.15		
1.4	Kewathang - Sembji feeder	Km	22.677		
1.5	Yurmoo - Langthel Feeder	Km	19.705		
1.6	Korphu feeder from Wangdigang till Nabji	Km	10.288		
2	Dismatling of ASCR Dog/ Rabbit / AAAC conductor and accessories at Sherabling and other area	Km	1.755		
3	Re-stringign of ASCR Dog/Rabbit/ AAAC conductor	Km	1.544		
	<b>Total (A)</b>				
<b>B. Painting of MV and LV Poles.</b>					
2	Painting of Poles (10/9/7.5 m), fittings and accessories with aluminium and black paints for MV/LV poles in identified locations, including transportation both vehicular and head loading from Regional/ESD stores to sites and other related works.				
2.1	Langthel feeder both MV pole till Thresa and LV pole at Indocholing, Upper/Lower Baling, Namther, Gangphey, Wengkhang, Dandung & Thresa.	No	656		
2.2	Taktse feeder MV pole from Kewathang till Banglapokto	No	880		
2.3	Sembji feeder MV till view point via Yangkhil, Sembji, Bjeezam and Bjee villages and LV pole at Tshangkha, School & Park office, Lower/Mid Tashiling	No	534		
	<b>Total (B)</b>				
<b>C Improvement of Distribution Substation Earthing at Tashidingkha, Bubja, Kuengarabten, Chakerzor, Eusa, Above Taktse School, Taktse top, Taktse town, CLCS Academic, Taktse school, samcholing.</b>					
1	Earthwork in foundation trenches or drains not exceeding 1.5m in width or 10 sq.m in area on plan including dressing & ramming, disposal of surplus soil within all lead and lifts in ordinary soil.	Cum	80.44		
2	Spreading of soft soil, Laying of GEE slab and earth connection back fill with black soil, including transportation both vehicular & head loading, testing and commissioning of earthing.	No	165.00		
3	Filling of trenches, sides of foundations etc. in layers <200mm using selected excavated earth, ramming etc. within lead 50 m & lift 1.5m	Cum	54.48		
	<b>Total (C)</b>				



SI No	Description of Work	Unit	Quantity	Rate	Amount
<b>D</b>	<b>Improvement of ground clearance for MV and LV lines</b>				
1	Degging of holes for 10 m poles.	Nos	18.00		
2	Erection of 10 m poles, pole base casting including transportation from ESD store to site	Nos	18.00		
3	Digging of holes for stay set assembly	Nos	12.00		
4	Erection of stay set assembly including transportation from ESD store to site.	Set	12.00		
5	Erection of Single pole cross arm assembly complete with M & U clamps, nuts, bolts and its accessories including painting. Including transportation from ESD store to site.	Set	6.00		
6	Erection of Top Hamper assembly complete with M & U clamps, nuts, bolts and its accessories including painting. Including transportation from ESD store to site.	Set	6.00		
7	Erection of Cross arm assembly H-frame O with complete clamps and its accessories including painting. Including transportation from ESD store to site.	Set	7.00		
8	Erection of Cross brace assembly for H-frame with complete clamps and its accessories including painting.		7.00		
9	Erection of 33/11 kV Pin insulator assembly with transportation from ESD store to site.	Set	18.00		
10	Erection of 33/11 kV Disc insulator assembly (1 set= 3 Nos) with transportation from ESD store to site.	Set	42.00		
11	Erection of spike earthing set including transportation from ESD store to site	Set	18.00		
12	Erection of anti-climbing device including transportation from ESD store to site.	Nos	18.00		
13	Degging of holes for 7.5 m poles.	Nos	5.00		
14	Erection of 7.5 m poles, pole base casting including transportation from ESD store to site	Nos	5.00		
15	Digging of holes for stay set assembly	Nos	4.00		
16	Erection of stay set assembly including transportation from ESD store to site.	Set	4.00		
17	Laying and Stringing of LV ABC conductor including LV ABC fittings, jumperring and joints lines wherever necessart to complete work. Including transportation from ESD store to site.				
18	4 x 50 sq mm	Km	0.50		
19	Dismantling of poles and fittings of Sherabling Micro hydro 6.6 kV line and transportation from site to ESD store.	Nos	9		
20	Dismantling of 6.6/0.415 kV transformer of micro hydro plant sherabling and accessories, transportation from site to ESD stores	Set	2		
	<b>Total (D)</b>				
	<b>Total - 1 (A+B+C+D)</b>				



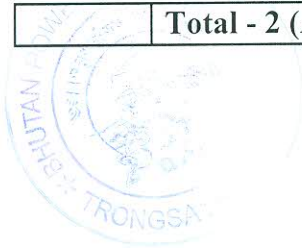
## 2. Plan Works Lines and Distribution System - 2021

SI No	Description of Work	Unit	Quantity	Rate	Amount
<b>A</b>	<b>Installation of LBS at Jangbi, Karshong, Kaba and Drenshing</b>				
1	Digging of holes	Nos	8.00		
2	Erection of poles, 10 m including transportation for ESD store to site	Nos	8.00		
3	Erection of Substation cross arm assembly complete with M & U clamps, nuts, bolts and its accessories including painting. Including transportation from ESD store to site.	Set	4.00		
4	Digging of holes for stay sets	Nos	8.00		
5	Erection of stay sets, including transportation from ESD store to site	Set	8.00		
6	Erection of 33 kV Disc insulator assembly (1 set= 3 Nos) with transportation from ESD store to site.	Set	48.00		
7	Erection of 33 Pin insulator assembly with transportation from ESD store to site.	Nos	24.00		
8	Erection of anticlimbing device, including transportation from ESD store to site	Nos	8.00		
9	Erection of danger plate, including transportation from ESD store to site.	Nos	8.00		
10	Painting of pole and fittings complete.	Nos	8.00		
11	Erection /installation of LBS with complete accessories with fittings 33kV, including transportation from ESD store to site	Set	4.00		
12	<b>Total (A)</b>				
<b>B</b>	<b>Re - conductoring of ACSR rabbit with LV ABC 4x50 sq mm</b>				
1	Dismantling of ACSR Squirrel conductor and accessories, rolling and transportation from site to ESD store.	Km	0.6		
2	Laying and Stringing of LV ABC conductor including LV ABC fittings, jumperring and joints lines wherever necessart to complete work. Including transportation from ESD store to site.				
	4 x 50 sq mm	Km	0.6		
3	Digging of holes for stay sets	Nos	4		
4	Erection of stay sets, including transportation from ESD store to site	Set	4		
	<b>Total (B)</b>				



SI No	Description of Work	Unit	Quantity	Rate	Amount
<b>C</b>	<b>Upgradation of Single phase LV ABC to Three phase LV ABC 4x 50 sq mm, Bhutan Telecom, Koshala.</b>				
1	Degging of holes for 7.5 m poles.	Nos	12		
2	Erection of 7.5 m poles, pole base casting including transportation from ESD store to site	Nos	12		
3	Digging of holes for stay set assembly	Nos	6		
4	Erection of stay set assembly, clamps and accessories, including transportation from ESD store to site.	Set	6		
5	Laying and Stringing of LV ABC conductor including LV ABC fittings, jumperring and joints lines wherever necessart to complete work. Including transportation from ESD store to site.				
	4 x 50 sq mm	Km	0.965		
6	Erection of suspension clamp 4x 50 sqmm, including transportation form ESD store to site.	Set	6		
7	Erection of strain dead clamp 4x 50 sqmm, including transportation form ESD store to site.	Set	10		
9	Erection of hook bolt assembly, including transportation form ESD store to site.	Set	16		
10	Dismantling of LVA ABC conductor and fittings and transportation back to ESD store from site	Km	0.965		
	<b>Total C</b>				

	<b>Total - 2 (A+B+C)</b>				-
--	--------------------------	--	--	--	---



**3. O&M 33/11 kV substation: Covering of existing cable trench cover with MS Plates**

SI No	Description of Work	UoM	Quantity	Rate	Amount
	<b>P l a t e s</b>				
1	Providing, making and fixing M.S. straps, flats, sole plates etc. (flats 6mm thk)				
	(840*500*6)mm	Kg	4,470.28		
	(840*830*6mm)		459.76		
	(1270*300*6mm)		17.95		
2	Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for MS Flates work including cutting, bending, binding and placing in	Kg	298.84		
	<b>CONCRETE WORK</b>				
3	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level. 1:2:4 (1 cement : 2 sand : 4 graded crushed rock 20 mm nominal size)				
	Cable trench repairing works	cu.m	0.3		
	<b>Formwork</b>				
4	Providing & fixing centering and shuttering (form work)including strutting, propping etc. and removal of form work.	sq.m	6		
	<b>Providing &amp; applying one coat of primers</b>				
5	Providing & applying one coat of primers- Metal work - synthetic red oxide primer	Sqm	210.12		
	<b>Providing and applying finishing coats</b>				
6	Providing and applying finishing coats with - Black corrugal, ready mixed, two	Sqm	210.12		
	<b>Total -3</b>				

	<b>Grand Total (1+2+3)</b>			<b>Nu.</b>	
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**In Words:**





## Section-VI

### BID FORM

To:  
Sr. Divisional Manager,  
Electricity Services Division,  
Bhutan Power Corporation Limited,  
Trongsa: Bhutan

Gentlemen:

1. We have examined and have no reservation to the Bidding Document including the addenda No :
2. We offer to execute in conformity with the Bidding Document and in accordance with the completion schedule specified in the Bidding Document.
3. The Total Price of our Bid, excluding any discounts offered in item (4) below is:  
.....
4. The discounts offered and the methodology for their application are:  
.....
5. We undertake, if our Bid is accepted, to complete the Works within (*Number*) days, calculated from the date of site handing over.
6. If our Bid is accepted, we will provide the performance security in the sum of (Amount), equal to (\_\_\_\_\_) per cent of the Contract price, for the due performance of the Contract.
7. Our bid shall be valid for a period of .....days from the date fixed for the bid submission deadline in accordance with Bidding Document, and it shall remain binding upon us and may be accepted at any time before expiration of that period.
8. We are not participating, as bidders, in more than one Bid in this bidding process, other than alternative offers in accordance with the Bidding Document.
9. We understand that this Bid, together with your written acceptance thereof in your Notification of Award, shall constitute a binding contract between us, until a formal contract is executed.
10. We understand that you are not bound to accept the lowest-priced of any Bid that you may receive.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 2015.

\_\_\_\_\_ (Signature)

\_\_\_\_\_ (in the Capacity of)

Duly authorized to sign Bid for and on behalf of \_\_\_\_\_

\_\_\_\_\_ (Signature of Witness)

Witness \_\_\_\_\_



## SECTION – VII

1. Bid Security Form
2. Contract Form
3. Performance Security Form
4. Advance Payment Security Form
5. Form of Information for Establishment of Bidder's Eligibility
6. Form of Information for Establishment of Bidder's Qualification.
7. Average Performance Scoring Form



## 1. Bid Security Form

WHEREAS \_\_\_\_\_ (Hereinafter called "the Bidder") has submitted its bid dated \_\_\_\_\_ for the construction of \_\_\_\_\_  
(Name of the package) (hereinafter called "the Bid").

**KNOW ALL MEN by these presents that WE \_\_\_\_\_ of \_\_\_\_\_ having our** registered office at \_\_\_\_\_ (hereinafter called "the Bank") and bound unto Bhutan Power Corporation Limited (hereinafter called the Employer) in the sum of \_\_\_\_\_ (Amount of the Guarantee in Words and Figures) \_\_\_\_\_, for which payment well and truly to be made to the said Employer, the Bank binds itself, its successor and assigns, by these present. Sealed with the Common Seal of the Bank this \_\_\_\_\_ day of \_\_\_\_\_, 2015.

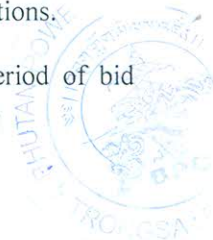
THE CONDITIONS of this obligation are:

1. if the Bidder withdraws its Bid during the period of bid validity specified by the Bidder on the Bid form; or
2. if the Bidder, having been notified of the acceptance of its Bid by the Employer during the period of bid validity:
  - (a) fails or refuses to execute the Contract Form, when requested; 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, according to, and upon receipt of, its first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer will note that the amount claimed by it is due to it owing to the occurrence of one or both of the two above-stated conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including \_\_\_\_\_ days after the period of bid validity, and any demand in respect thereof should reach the Bank not later than such date.

[NAME OF BANK]  
by  
(Title)  
Authorized representative



## 2.Contract Form

This Agreement made this \_\_\_\_\_ day of \_\_\_\_\_, 2015, between Bhutan Power Corporation Limited (hereinafter "the Employer") of the one part and \_\_\_\_\_ (hereinafter "the Contractor") of 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 remedying of any defects therein. (hereinafter "the Contract Price").

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. The following documents shall be deemed to form and read and construed as part of this Agreement, viz:
  - (a) Letter of Acceptance;
  - (b) The said Bid;
  - (c) Condition of Contract;
  - (d) The Specifications;
  - (e) The drawings;
  - (f) The Price Schedules; and
  - (g) The Schedules of Supplementary Information.

This Contract sets forth the entire contract and agreement between the parties pertaining to the Works described herein and supersedes any and all earlier verbal or written agreements pertaining to the Contract.

This Contract shall prevail over all other Contract documents. In the event of any discrepancy or inconsistency within the Contract documents, then the documents shall prevail in the order listed above.

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 herein 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.
5. Any notice under this Contract shall be in the form of letter or facsimile. Notices to either party shall be given at such address or addresses as such party shall specify from time to time by written notice to the other. In the absence of such notice to the contrary, notice to the Employer shall be properly addressed to :

[Employer's address and electronic transmission address]

\_\_\_\_\_

and notice to the Contractor shall be properly addressed to :

[Contractor's address and electronic transmission address]

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A notice shall be effective when delivered or on the notice's effective date, whichever is later.

IN WITNESS WHEREOF, the parties hereto have caused this Contract to be executed in accordance with their respective laws the day and year first above written.

\_\_\_\_\_  
Signature of Employer

---

Signature of Contractor

Signed, Sealed and Delivered by the said \_\_\_\_\_  
(For the Employer) in the presence of \_\_\_\_\_

Signed, Sealed and Delivered by the said \_\_\_\_\_ (for the Contractor) in  
the  
presence of \_\_\_\_\_



### 3. Performance Security Form

To:  
The Sr. Divisional Manager,  
Electricity Service Division,  
Bhutan Power Corporation Limited,  
Trongsa: Bhutan

WHEREAS (Name of the Contractor) hereinafter called "the Contractor", has undertaken, in pursuance of Contract No. \_\_\_\_\_ dated \_\_\_\_\_ to execute \_\_\_\_\_ (name of the contract) (hereinafter called "bid").

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 the Bidder's performance obligations in accordance with the Contract;

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

NOW THEREFORE we hereby affirm that we are Guarantors and responsible to you, on behalf of the Contractor, up to a total of (Amount of the Guarantee in Words and Figures) and we undertake to pay you, upon your first written demand declaring the Bidder to be in default under the Contract, and without cavil or argument, any sum or sums as specified by you, within the limit of (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or 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 there under or any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

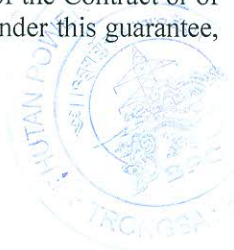
This guarantee is valid until \_\_\_\_\_ day of \_\_\_\_\_ 2015.

[NAME OF GUARANTOR]

By \_\_\_\_\_  
(Title)  
Authorized Representative

Date: \_\_\_\_\_

Address: \_\_\_\_\_



#### 4. Advance Payment Security Form

To: *Sr. Divisional Manager, Electricity Services Division, Bhutan Power Corporation Limited, Trongsa, BHUTAN.*

[Name of Contract] \_\_\_\_\_

Gentlemen:

In accordance with the payment provision included in the Clause 45 of the General Conditions of Contract to provide for advance payment, [name and address of Contractor] (hereinafter called "the Contractor") shall deposit with the Employer a bank guarantee to guarantee its proper and faithful performance under the said Clause of the Contract in an amount of *[amount of guarantee in figures and word]*.

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 the Employer on its first demand without whatsoever right of objection on our part and without its first claim to the Contractor, in the amount not exceeding *[amount of guarantee in figures and words.]*

We further agree that no change or addition to or other modification of the terms of the Contract to be performed thereunder or of any of the Contract documents which may be made between the 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 Bhutan Power Corporation Limited receives full repayment of the said amount from the Contractor.

Yours truly,

Signature and seal of the Guarantor: \_\_\_\_\_

\_\_\_\_\_  
[name of bank or financial institution]

\_\_\_\_\_  
[address]

\_\_\_\_\_  
[date]

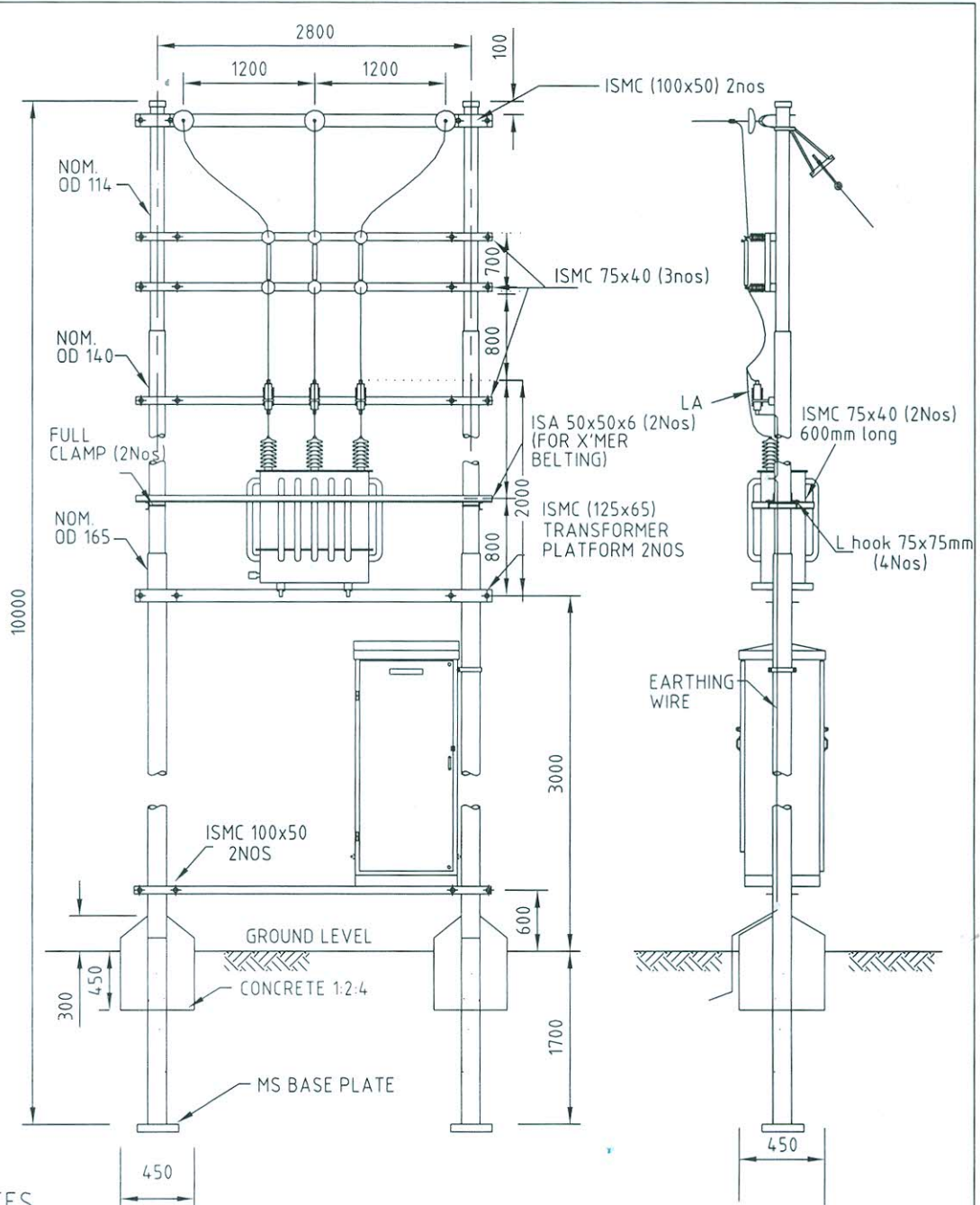
\_\_\_\_\_  
Address



# Reference Drawings




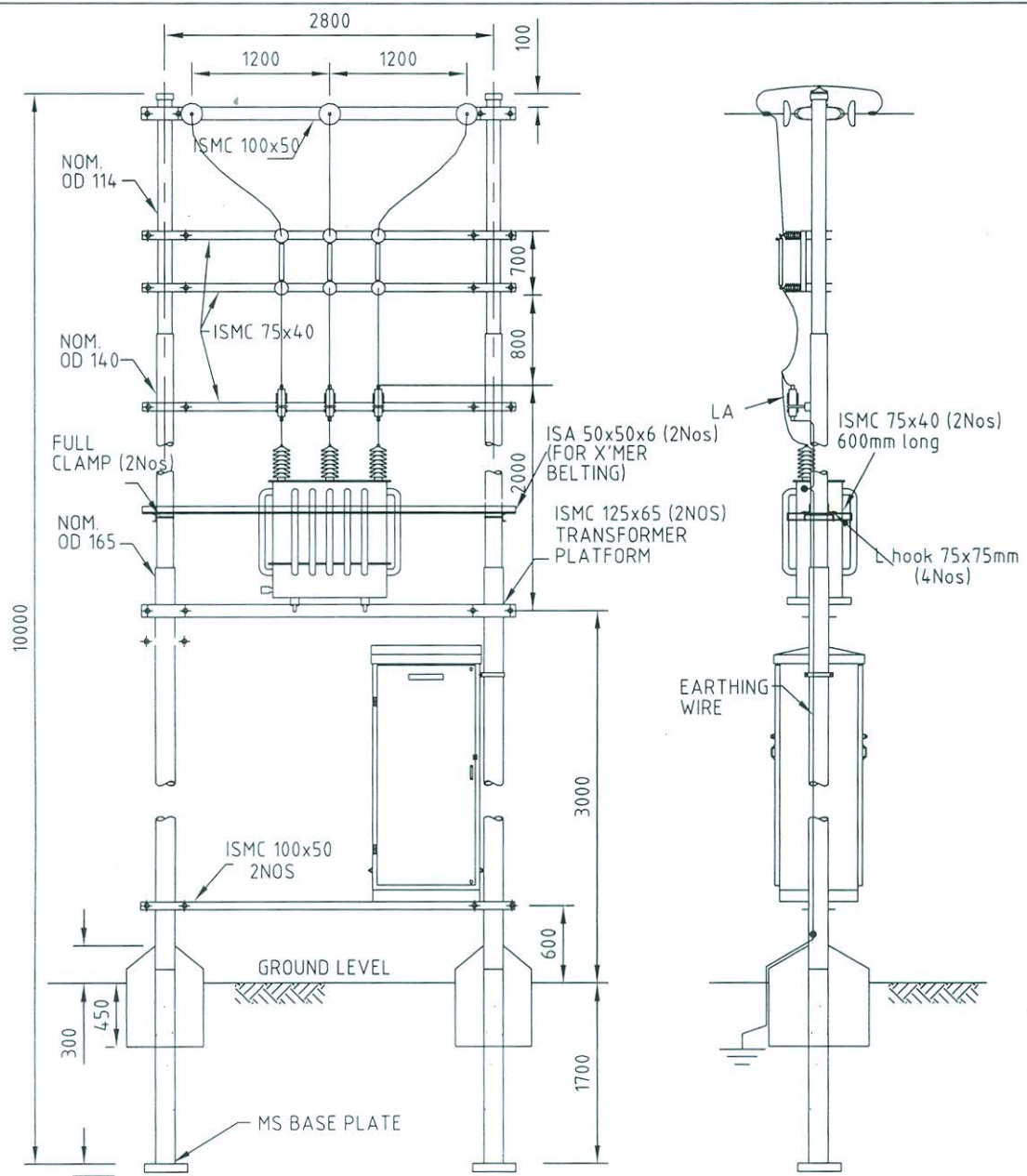




**NOTES**


1. DIMENSIONS AS SHOWN ARE IN mm.
2. DISTRIBUTION PILLAR MOUNTING CHANNEL ONLY REQUIRE FOR 125 kVA TRANSFORMERS
3. MOUNTING HEIGHT OF THE TOP DO-FUSE TO BE ADJUSTED WITHIN 6M FOR USE OF HOT STICK

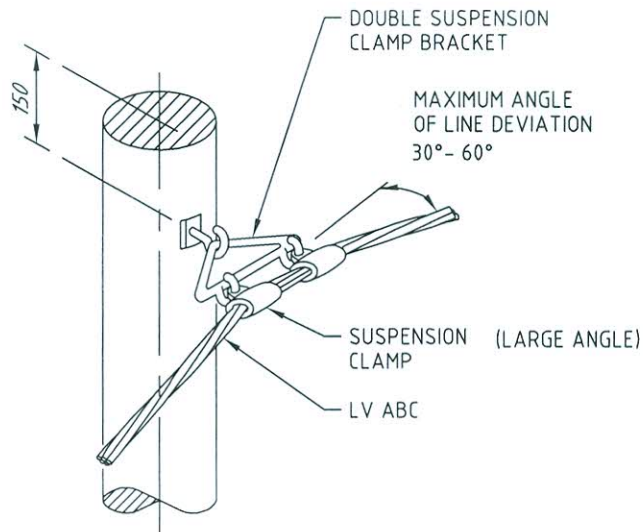
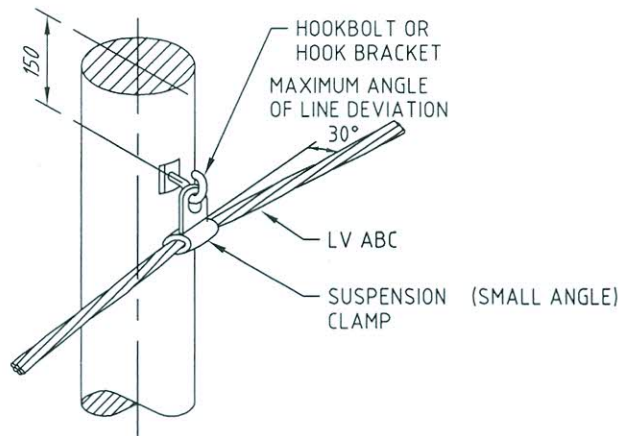
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			<b>DISTRIBUTION DESIGN &amp; CONSTRUCTION STANDARD</b>	
		<b>TERMINATION POLE SUBSTATION TYPE "A" ARRANGEMENT</b>		
DESIGNATION	NAME	DATE		
DRAFTSMAN				
DESIGNER				
DESIGN CHECK				
PROJECT MANAGER				
PROJECT DIRECTOR				
			DRAWING NO. BPC-DDCS-2015-9	<b>REVISION</b> 2015



**NOTES**


1. DIMENSIONS AS SHOWN ARE IN mm.
2. DISTRIBUTION PILLAR MOUNTING CHANNEL ONLY REQUIRE FOR 125 kVA TRANSFORMERS
3. MOUNTING HEIGHT OF THE TOP DO FUSE TO BE ADJUSTED WITHIN 6M FOR USE OF HOT STICK

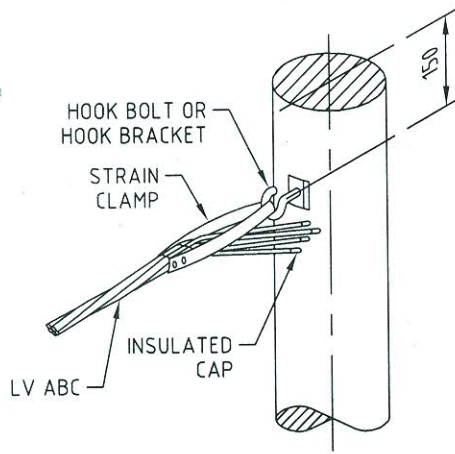
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			<b>DISTRIBUTION DESIGN &amp; CONSTRUCTION STANDARD</b>	
		<b>TENSION POLE SUBSTATION TYPE " C " ARRANGMENT</b>		
DESIGNATION	NAME	DATE		
DRAFTSMAN				
DESIGNER				
DESIGN CHECK				
PROJECT MANAGER				
PROJECT DIRECTOR				
			DRAWING NO. BPC-DDCS-2015-II	REVISION 2015



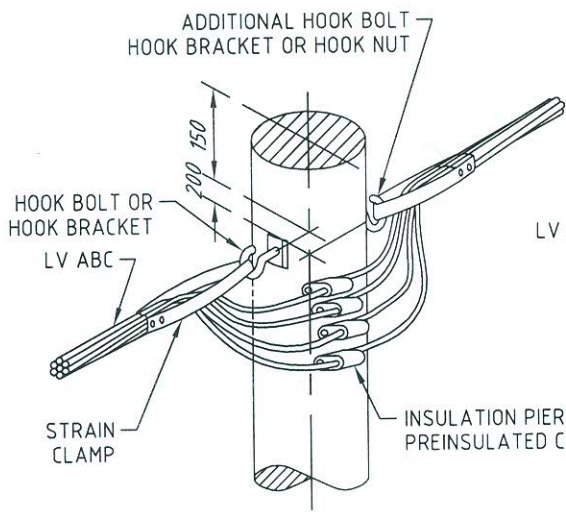
NOTES

1. DIMENSIONS AS SHOWN ARE IN mm.
2. DRAWING IS NOT TO SCALE.

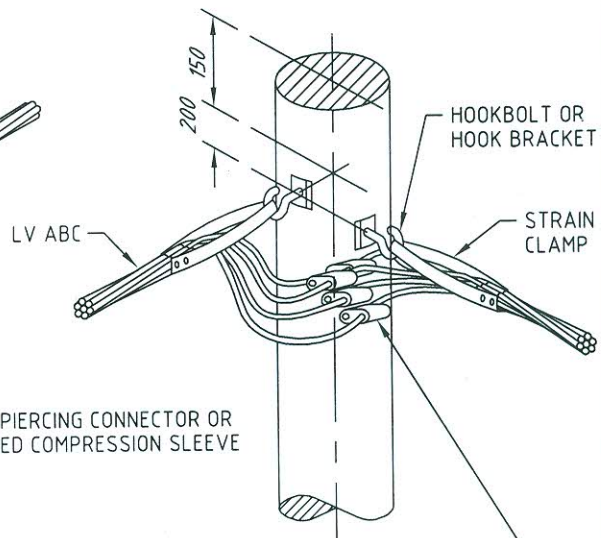
 <p>BHUTAN POWER CORPORATION LIMITED</p>			ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD LV ABC INTERMEDIATE & ANGLE POLES DETAILS	
DESIGNATION	NAME	DATE	DRAWING NO. BPC-DDCS-2015-15	
DRAFTSMAN				
DESIGNER				
DESIGN CHECK				
PROJECT MANAGER				
PROJECT DIRECTOR			REVISION 2015	



ALLOW SUFFICIENT CABLE TAIL  
TO ALLOW FOR FUTURE EXTENSION



FIELD CONDITIONS MAY ALLOW  
CABLE TO BE CONTINUOUS AT POLE



INSULATION PIERCING CONNECTOR OR  
PREINSULATED COMPRESSION SLEEVE

### NOTES

1. DIMENSIONS AS SHOWN ARE IN mm.
2. DRAWING IS NOT TO SCALE.



BHUTAN POWER  
CORPORATION LIMITED

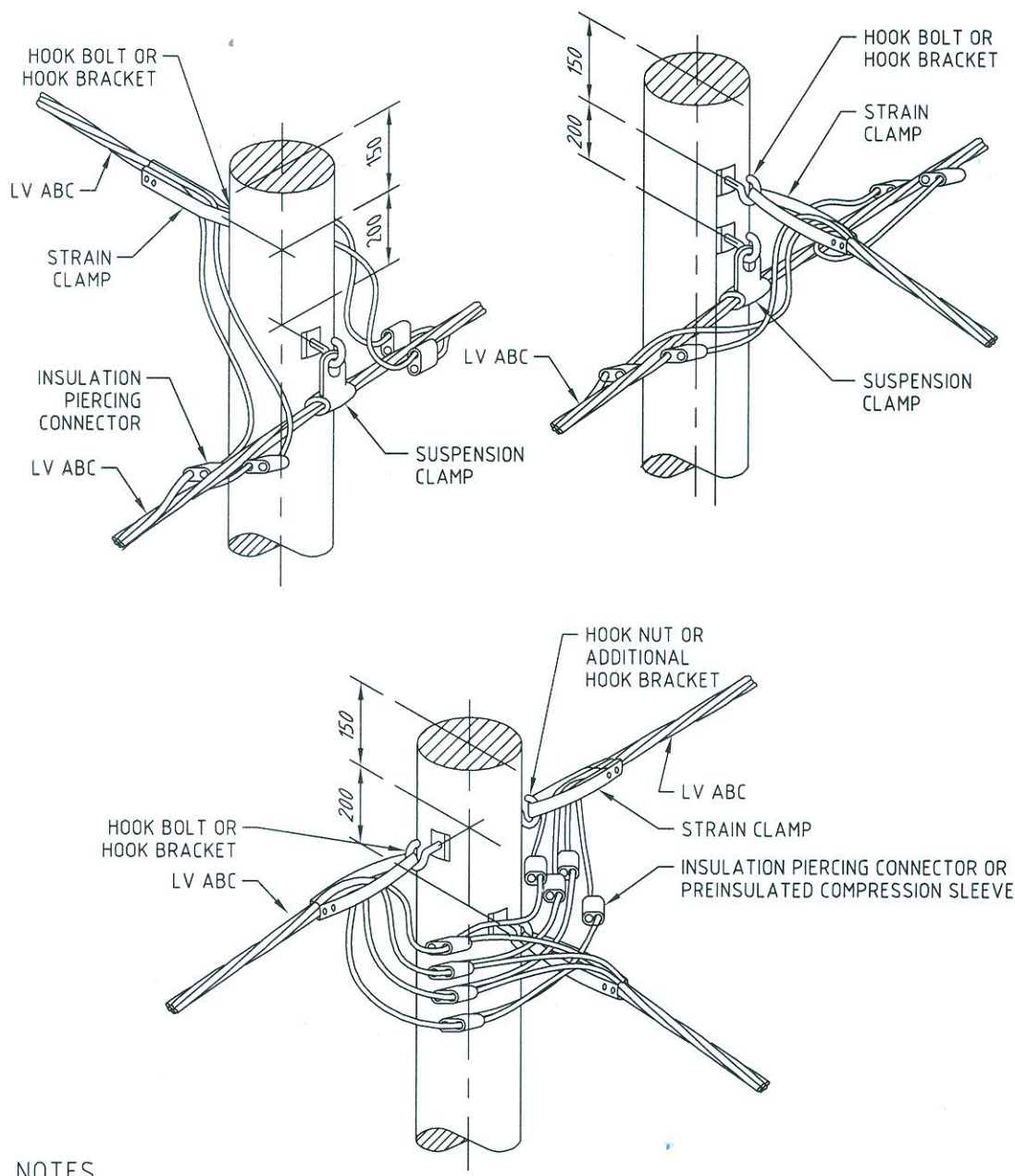
ENGINEERING DESIGN & CONTRACTS DEPARTMENT

TITLE : DISTRIBUTION DESIGN & CONSTRUCTION STANDARD  
LV ABC TERMINATION & ANCHOR POLES DETAILS

DESIGNATION	NAME	DATE
DRAFTSPERSON		
DESIGNER		
PROJECT MANAGER		
HEAD OF DEPARTMENT		

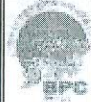
DRAWING NO. BPC - DDCS - 2015-16

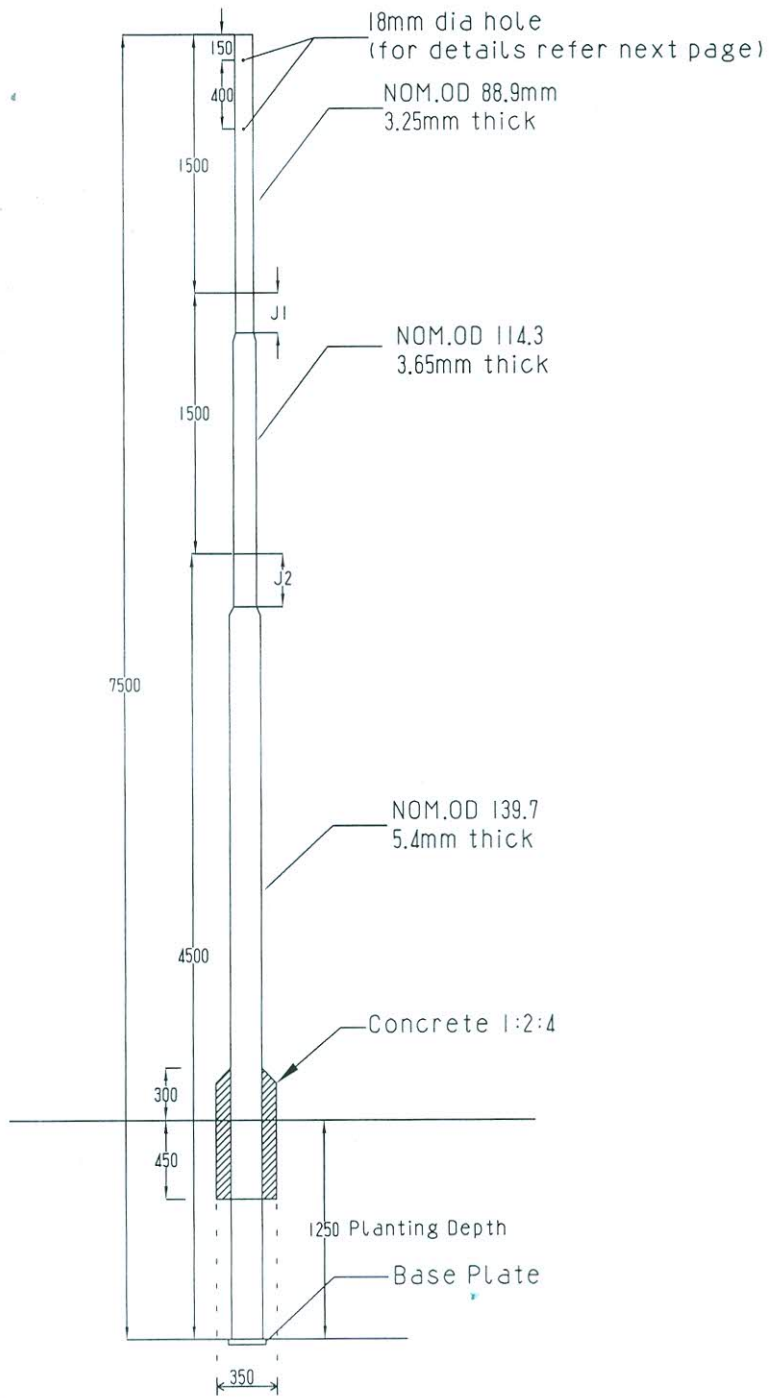
REV  
2015



**NOTES**


- 1. DIMENSIONS AS SHOWN ARE IN mm.
- 2. DRAWING IS NOT TO SCALE.

	<b>BHUTAN POWER CORPORATION LIMITED</b>		<b>ENGINEERING DESIGN &amp; CONTRACTS DEPARTMENT</b>	
	DESIGNATION DRAFTSPERSON DESIGNER PROJECT MANAGER HEAD OF DEPARTMENT	NAME    	DATE    	<b>DISTRIBUTION DESIGN &amp; CONSTRUCTION STANDARD LV ABC TEE POLE DETAILS</b>
			DRAWING NO. BPC - DDCS - 2015-17	REVISION 2015

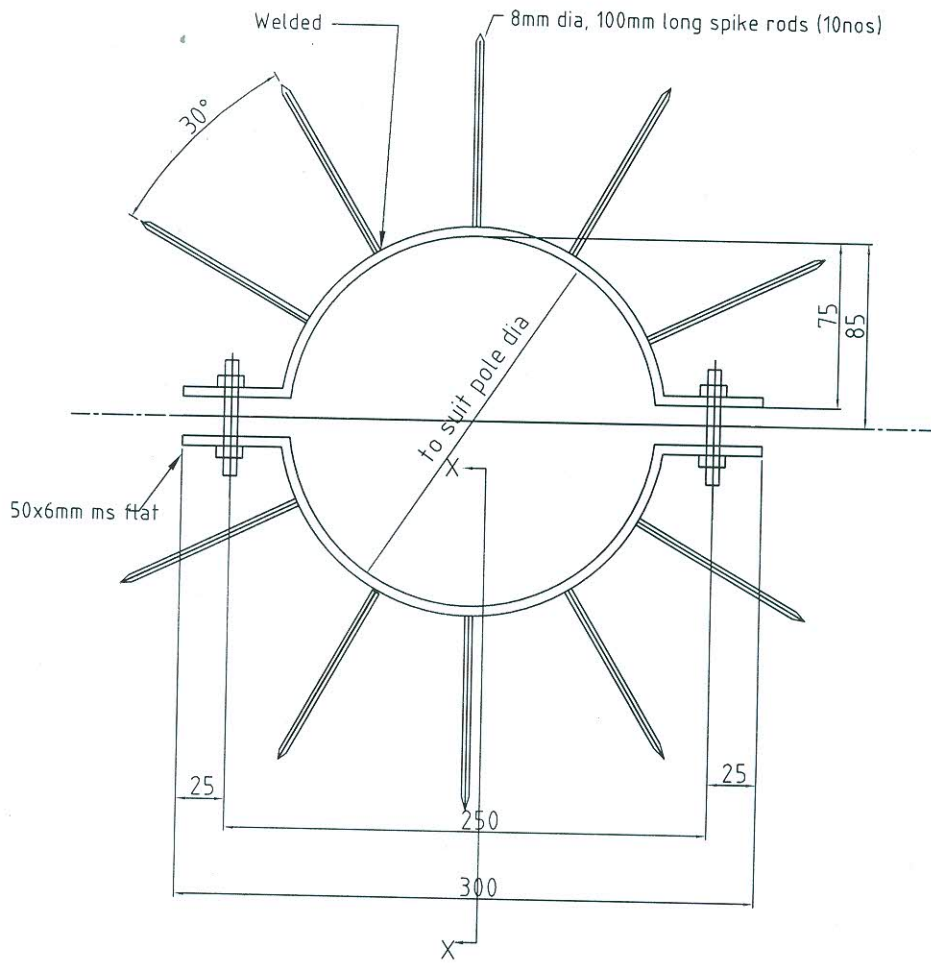


**NOTES**

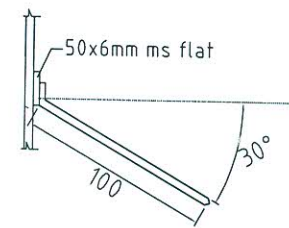
1. DIMENSIONS AS SHOWN ARE IN MM.
2. SPECIFICATIONS AS PER IS:2713 (PART I TO III : 1980)
3. POLE TOP CAP -M.S. PLATE WOULD BE TAG WELDED TO THE POLE

	<b>BHUTAN POWER-CORPORATION LIMITED</b>		ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
		7.5 METERS SWAGED POLE ASSEMBLY		
DESIGNED BY	NAME	DATE	DRAWING NO. BPC-DDCS-2015-18	REVISION 2015
CHECKED BY				
APPROVED BY				






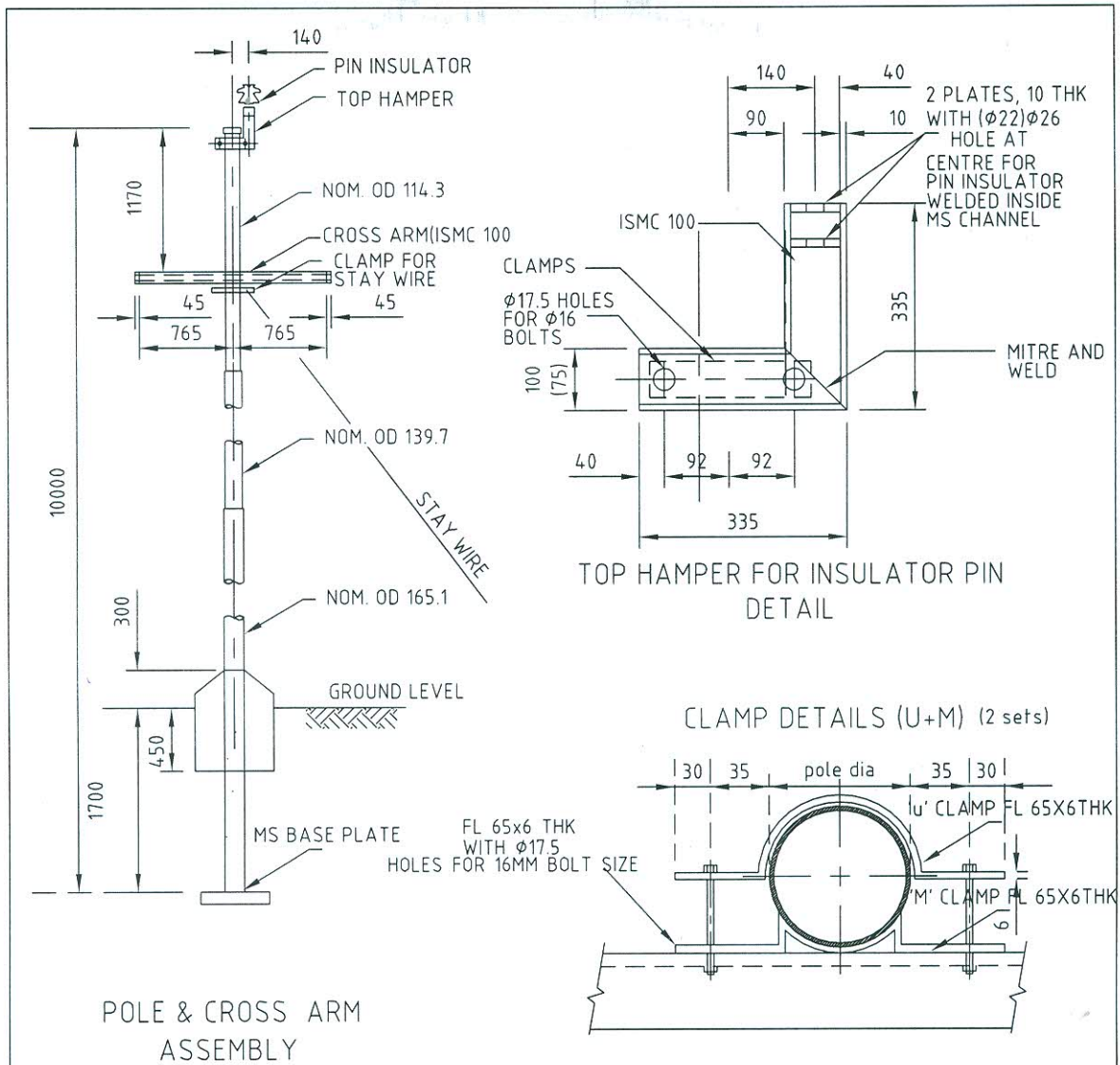
section X-X



NOTES

1. FERROUS PARTS HOT DIP GALVANIZED AS PER BS-729
2. DIMENSIONS AS SHOWN ARE IN mm.
3. TOLERANCE  $\pm 5\%$
4. DRAWING IS NOT TO SCALE.
5. ONE NUMBER PER POLE

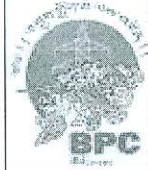
	BHUTAN POWER CORPORATION LIMITED		ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
ANTI-CLIMBING DEVICE			DRAWING NO. BPC-DDCS-2015-27 REVISION 2015	
DESIGNATION	NAME	DATE		
DRAFTSMAN				
DESIGNER				
DESIGN CHECK				
PROJECT MANAGER				
PROJECT DIRECTOR				



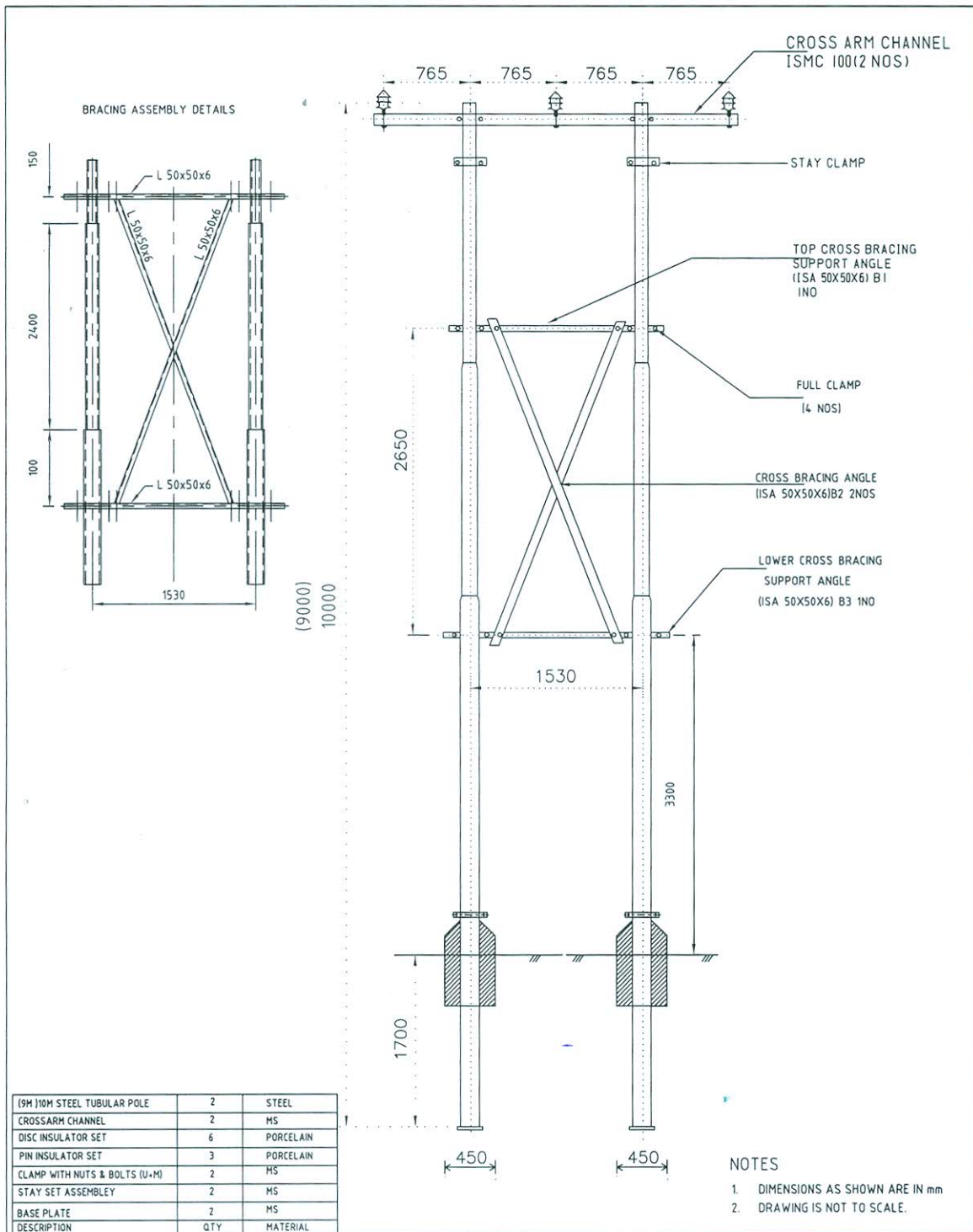
**NOTES**

1. DIMENSIONS AS SHOWN ARE IN mm
2. DRAWING IS NOT TO SCALE.
3. ALL NUTS AND BOLTS TO BE HOT DIPPED GALVANISED

10M STEEL TUBULAR POLE	1	STEEL
CROSSARM CHANNEL	1	MS
TOP HAMPER WELDED IN "L" SHAPE	1	MS
PIN INSULATOR	3	PORCELAIN
CLAMP WITH NUTS & BOLTS (U+M)	2	MS
STAY SET ASSEMBLY	1	MS
BASE PLATE	1	MS
DESCRIPTION	QTY	MATERIAL

 <p><b>BHUTAN POWER CORPORATION LIMITED</b></p>	ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD STEEL TUBULAR-SINGLE POLE STRUCTURE DETAILS 11 & 33 kV	
DESIGNATION	NAME	DATE
DRAFTSMAN		
DESIGNER		
DESIGN CHECK		
PROJECT MANAGER		
PROJECT DIRECTOR		
DRAWING NO. BPC-DDCS-2015-31		REVISION 2015





NOTES  
 1. DIMENSIONS AS SHOWN ARE IN mm  
 2. DRAWING IS NOT TO SCALE.

**BHUTAN POWER CORPORATION LIMITED**

DESIGNATION	NAME	DATE
DRAFTSMAN		
DESIGNER		
DESIGN CHECK		
PROJECT MANAGER		
PROJECT DIRECTOR		

**ENGINEERING DESIGN & CONTRACTS DEPARTMENT**

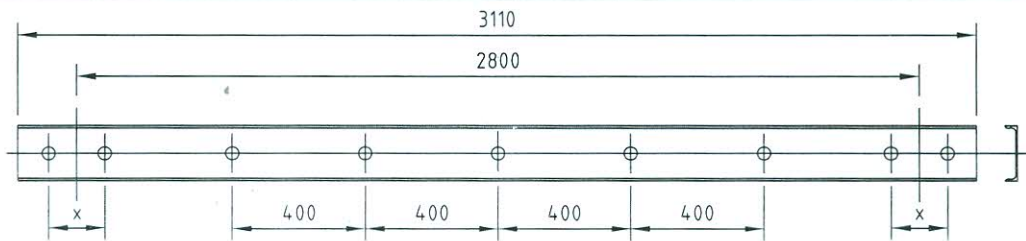
**DISTRIBUTION DESIGN & CONSTRUCTION STANDARD**

**11 & 33 KV H-FRAME**

**DOUBLE POLE ARRANGEMENT (STEEL TUBULAR POLES)**

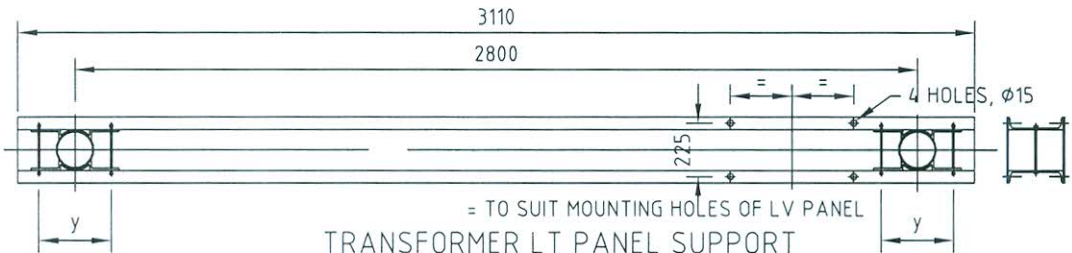
DRAWING NO. BPC-DDCS-2015-32/1

REVISION 2015



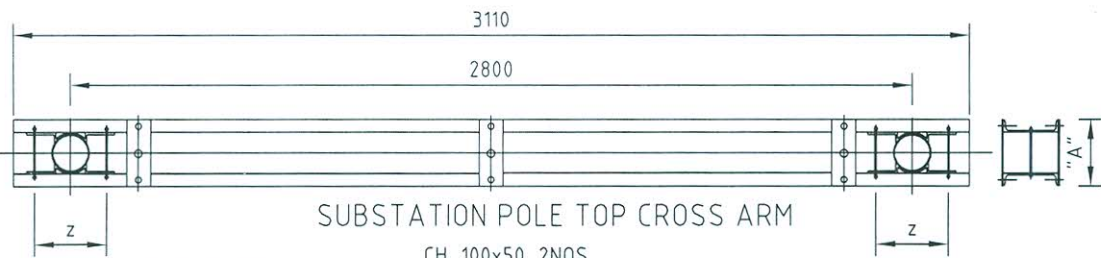
"x" TO SUIT OD OF POLE,

EQUIPMENT SUPPORTS,  
CH 75x40 (3NOS)



"y" TO SUIT NOM 165 OD OF POLE,

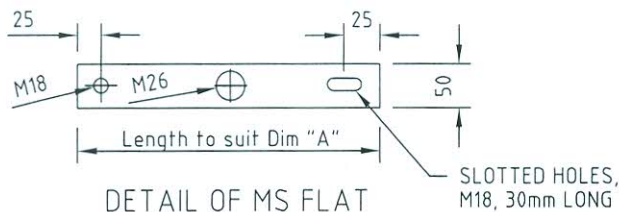
= TO SUIT MOUNTING HOLES OF LV PANEL  
TRANSFORMER LT PANEL SUPPORT  
CH 100x50



"z" TO SUIT OD OF POLE

SUBSTATION POLE TOP CROSS ARM

CH 100x50 2NOS

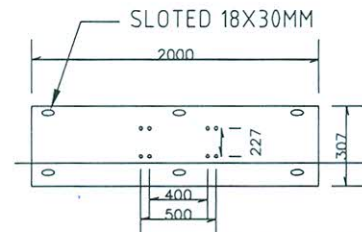


DETAIL OF MS FLAT

FL 50x6 (6 NOS)

GI 16MM DIA NUTS AND BOLTS (6NOS)


SLOTTED HOLES,  
M18, 30mm LONG

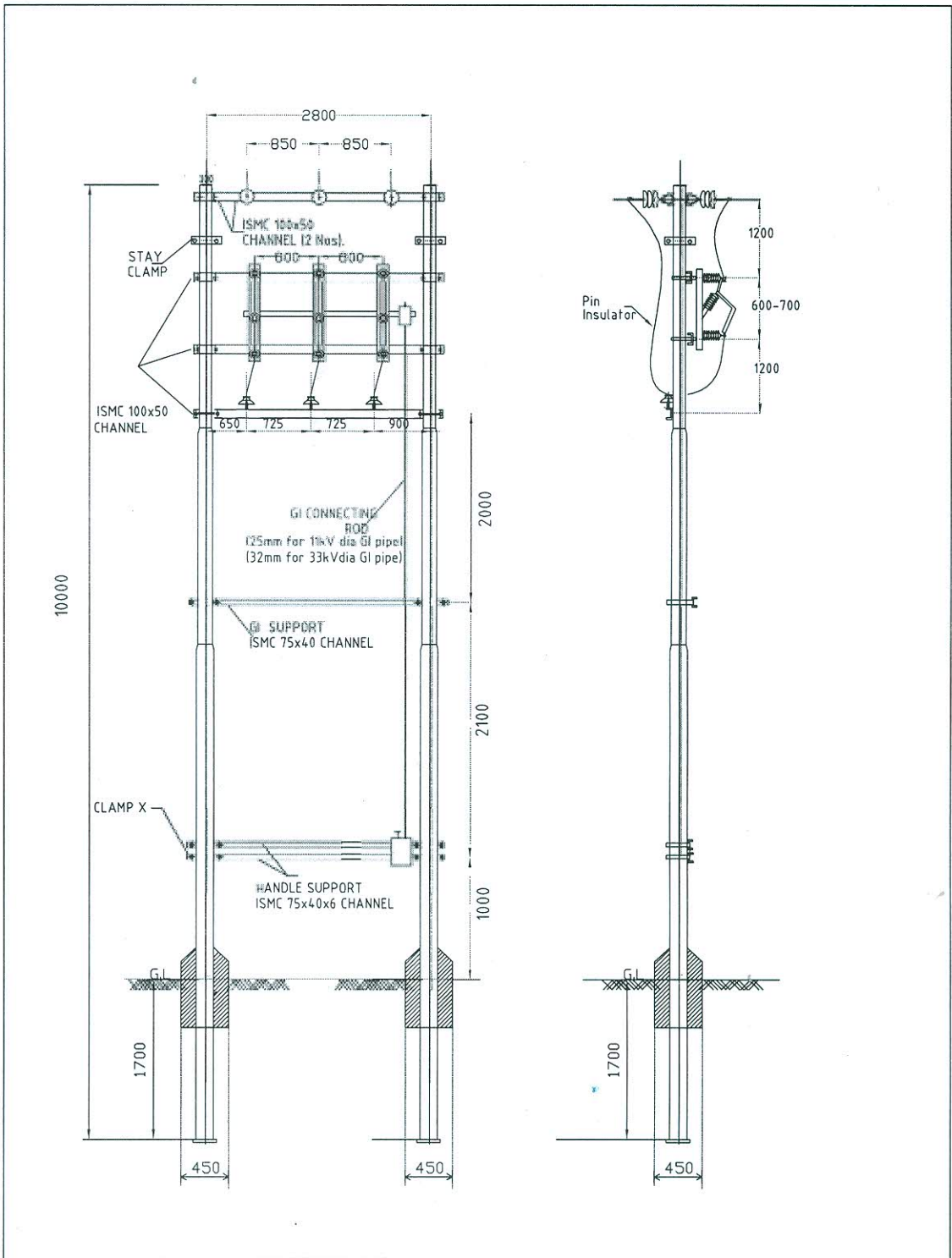



PLATFORM REST PLATE (2000X307X5)

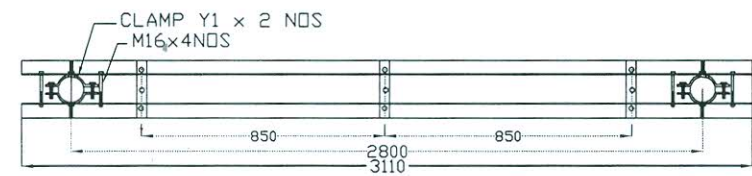
NOTES

1. DIMENSIONS AS SHOWN ARE IN mm.
2. DRAWING IS NOT TO SCALE.
3. TRANSFORMER LT PANEL SUPPORT REQUIRE ONLY FOR 125kVA TRANSFORMERS
4. GENERAL ARRANGEMENT OF SUBSTATION BE REFERRED FROM DRAWING NO. BPC-DDCS-(9 TO 11)

 <p>BHUTAN POWER CORPORATION LIMITED</p>			ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
<p>POLE MOUNTED SUBSTATION STRUCTURE DETAILS FOR STEEL TUBULAR POLE</p>			DRAWING NO. BPC-DDCS-2015-37/1	
DESIGNATION	NAME	DATE	REVISION 2015	
DRAFTSMAN				
DESIGNER				
DESIGN CHECK				
PROJECT MANAGER				
PROJECT DIRECTOR				



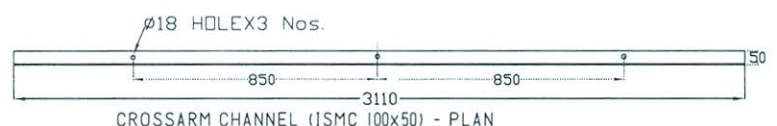
	<b>BHUTAN POWER CORPORATION LIMITED</b>		ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
		11 & 33kV AIRBREAK SWITCH ARRANGEMENT		
		STEEL TUBULAR POLE		
DESIGNED BY	NAME	DATE	DRAWING NO. BPC-DDCS-2015-40/1	
CHECKED BY				
APPROVED BY				
			REVISION	2015



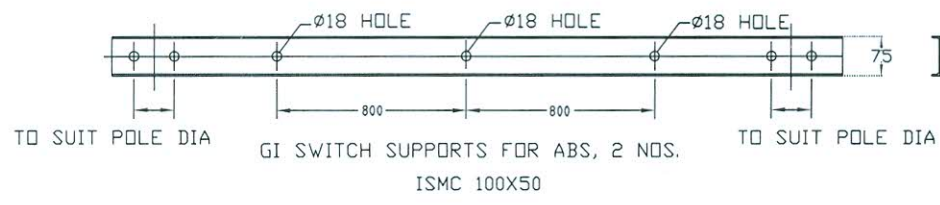
CROSSARM ASSEMBLY



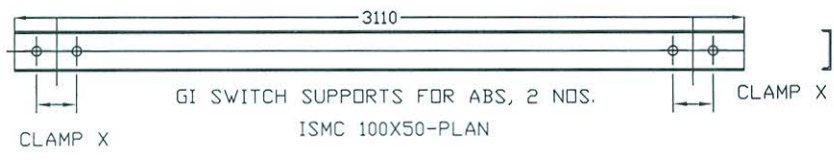
CROSSARM CHANNEL (ISMC 100x50) - ELEVATION



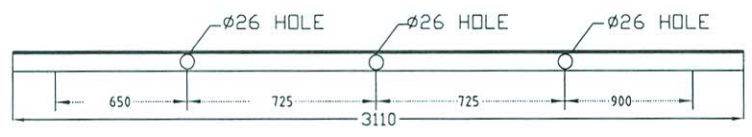
CROSSARM CHANNEL (ISMC 100x50) - PLAN



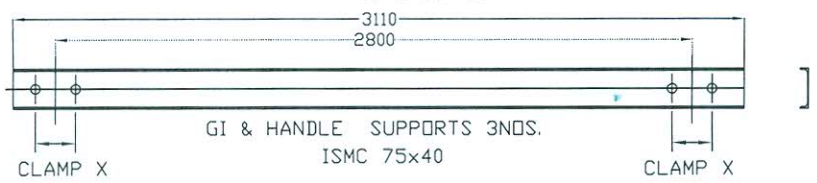
GI SWITCH SUPPORTS FOR ABS, 2 NOS.  
ISMC 100x50



GI SWITCH SUPPORTS FOR ABS, 2 NOS.  
ISMC 100x50-PLAN




PIN INSULATOR SUPPORTS, 1 NO.  
ISMC 100x50

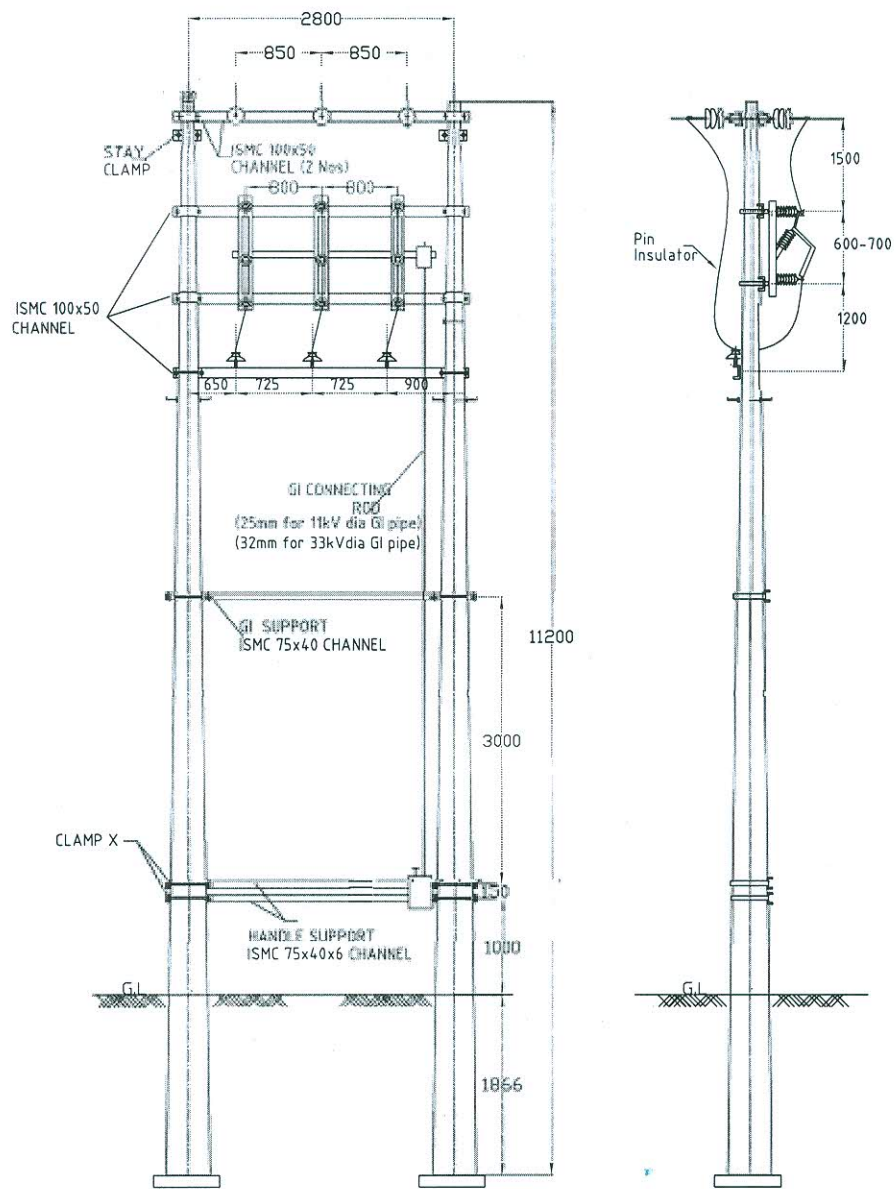



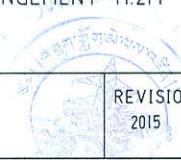
GI & HANDLE SUPPORTS 3NOS.  
ISMC 75x40

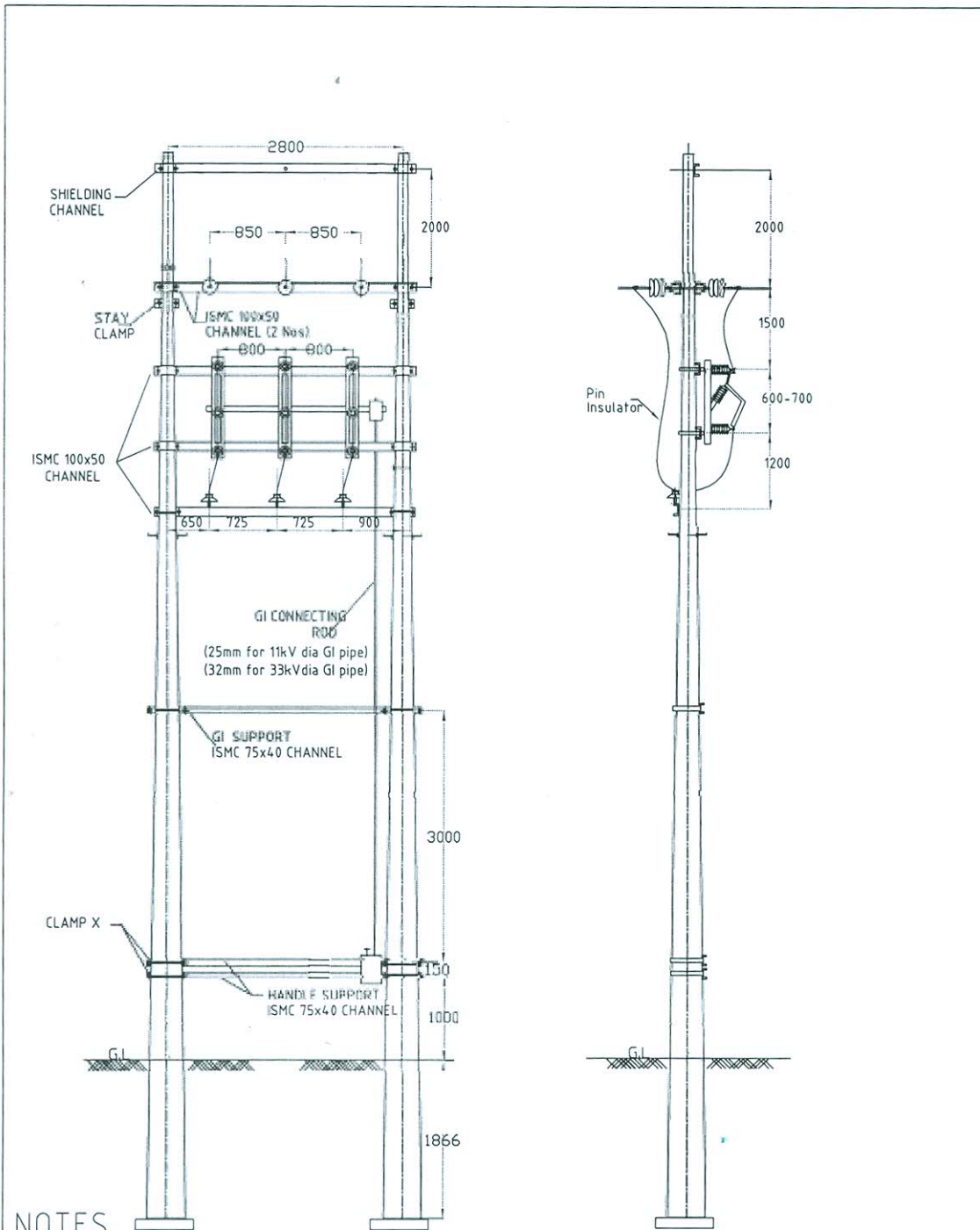
NOTES

1. DIMENSIONS AS SHOWN ARE IN mm.
2. ALL HOLES ARE 18mm AND ALL BOLTS, TO BE 16mm.

 <p>BHUTAN POWER CORPORATION LIMITED</p>	ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
DESIGNED BY	NAME	DATE
CHECKED BY		
APPROVED BY		
AIRBREAK SWITCH CROSS-ARM ASSEMBLY FOR STEEL TUBULAR POLE		DRAWING NO. BPC-DDCS-2015-40/2
		REVISION 2015




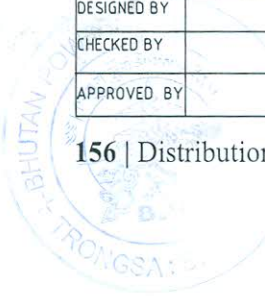
	BHUTAN POWER CORPORATION LIMITED		ENGINEERING DESIGN & CONTRACTS DEPARTMENT
			DISTRIBUTION DESIGN & CONSTRUCTION STANDARD
		11 & 33kV AIRBREAK SWITCH ARRANGEMENT-11.2M TELESCOPIC POLES	
DESIGNED BY	NAME	DATE	DRAWING NO. BPC-DDCS-2015-41/1 
CHECKED BY			
APPROVED BY			
			REVISION 2015

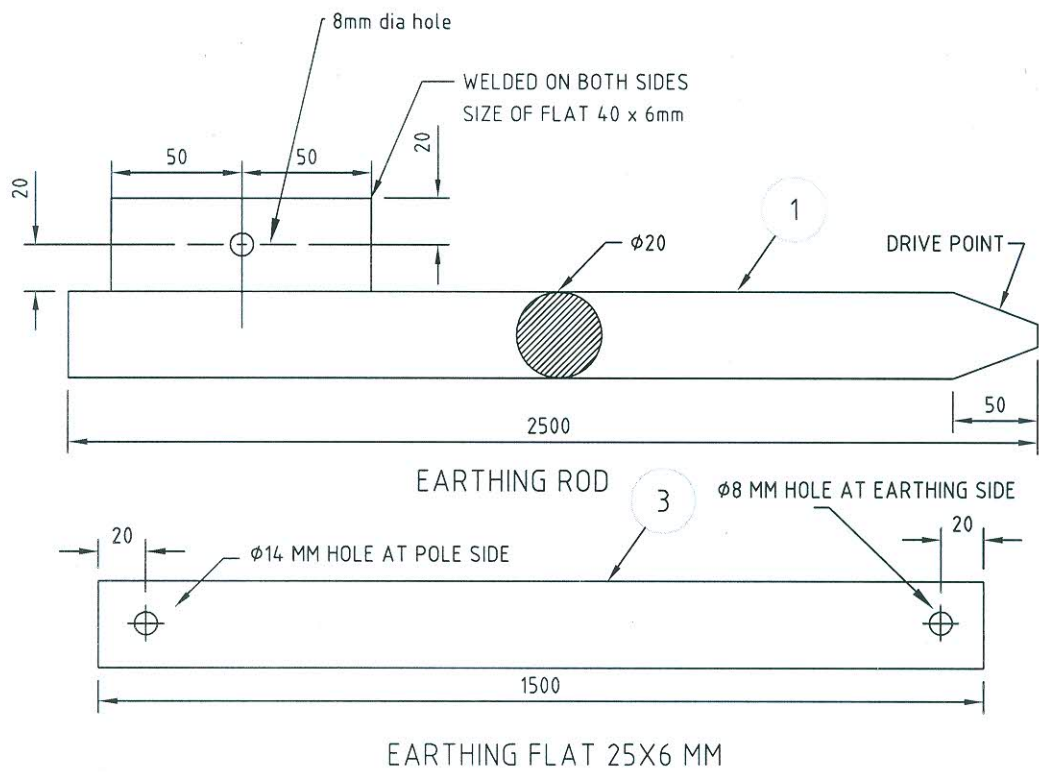


**NOTES**

1. DIMENSIONS AS SHOWN ARE IN mm.
2. ALL HOLES ARE 18mm AND ALL BOLTS TO BE 16mm.


 <p><b>BHUTAN POWER CORPORATION LIMITED</b></p>	ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
33 kV AIRBREAK SWITCH ARRANGEMENT-12M TELESCOPIC POLES		
DESIGNED BY	NAME	DATE
CHECKED BY		
APPROVED BY		
DRAWING NO. BPC-DDCS-2015-41/2		REVISION 2015



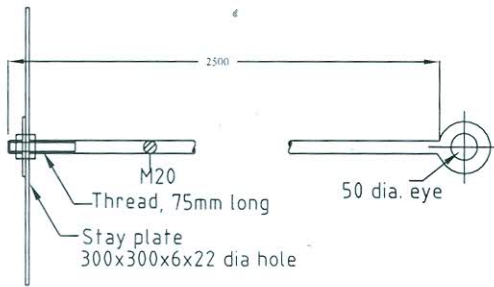


GRADE OF STEEL: BS 4360 GRADE 43A OR EQUIVALENT  
 GALVANISED TO: BS 729 OR EQUIVALENT  
 PACKING: EARTING RODS, NUTS & BOLTS, FLATS  
 TO BE PACKED SEPARATELY

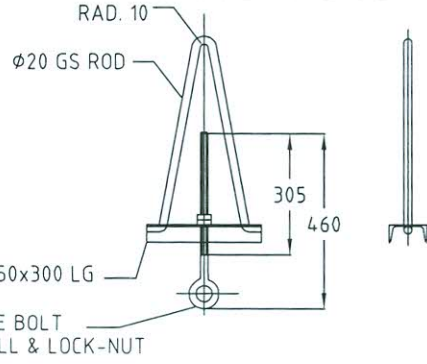
5	WASHER SPRING	4	HDG STEEL	M6
4	NUT HEX	4	HDG STEEL	M6
3	EARTHING FLAT 25X6MM	1	HDG STEEL	1.5Meter
2	BOLT HEX	4	HDG STEEL	M6 x 25 x FT
1	EARTHING ROD	1	HDG STEEL	M20 x 2500
ITEM	NAME OF ITEM	QTY	MATERIAL	SIZE

 <b>BHUTAN POWER CORPORATION LIMITED</b>			<b>ENGINEERING DESIGN &amp; CONTRACTS DEPARTMENT</b>																
<table border="1"> <tr> <th>TITLE</th> <th>NAME</th> <th>DATE</th> </tr> <tr> <td>DRAFTSPERSON</td> <td></td> <td></td> </tr> <tr> <td>DESIGNER</td> <td></td> <td></td> </tr> <tr> <td>PROJECT MANAGER</td> <td></td> <td></td> </tr> <tr> <td>HEAD OF DEPARTMENT</td> <td></td> <td></td> </tr> </table>			TITLE	NAME	DATE	DRAFTSPERSON			DESIGNER			PROJECT MANAGER			HEAD OF DEPARTMENT			<b>DISTRUBUTION DESIGN &amp; CONSTRUCTION STANDARD</b> <b>SPIKE EARTHING SET</b>	
TITLE	NAME	DATE																	
DRAFTSPERSON																			
DESIGNER																			
PROJECT MANAGER																			
HEAD OF DEPARTMENT																			
			DRAWING NO. BPC-DDCS-2015-49	REVISION 2015															

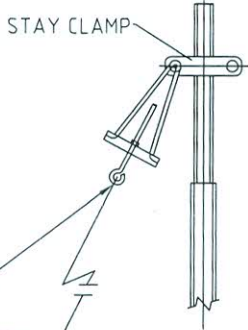
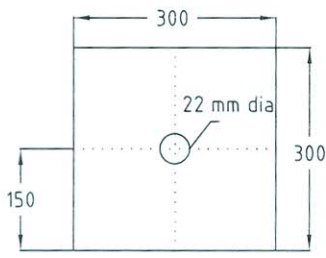
ANCHOR ROD ASSEMBLY



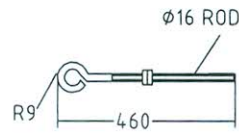
TURN-BUCKLE ASSEMBLY



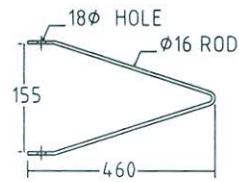
STAY PLATE



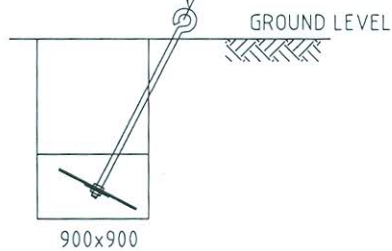
EYE BOLT



V HANGER



Guy preform (4 nos)




STAY WIRE ASSEMBLY

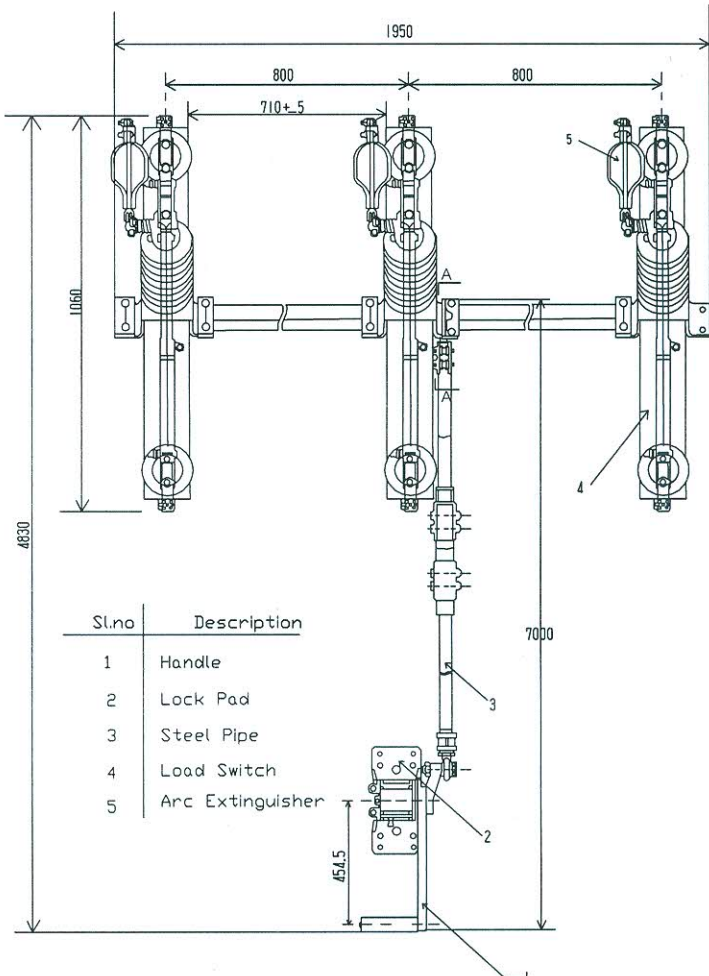
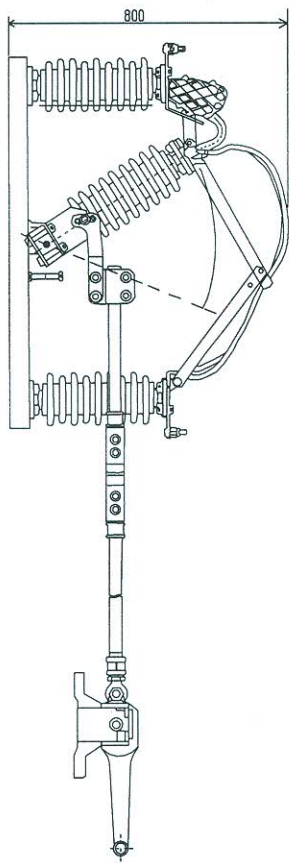
NOTES

- Stay rod and nuts assembled and packed together
- Anchor plates packed separately
- Material :- BS 4360 Grade 43A
- Galvanizing :- BS 729
- Threads :- ISO Metric
- Nut :- BS 4190 Grade 4.0

V-HANGER ONLY FOR TELESCOPIC POLE	1	H.D.G STEEL
STAY WIRE (7/8 SWG) (IN METERS)	IM+POLE HEIGHT	H.D.G STEEL
STAY CLAMP WITH NUTS AND BOLTS	1	H.D.G STEEL
STAY ROD (25 M) WITH THIMBLE	1	H.D.G STEEL
ANCHOR PLATE (300 X 300 X 6MM)	1	H.D.G STEEL
TURN BUCKLE ASSEMBLY WITH THIMBLE	1	H.D.G STEEL
GUY PREFORMED SUITABLE FOR 7/8 SWG	4	GALVANISED STEEL WIRE
STAY INSULATOR	1	PORCELAIN
NAME OF THE ITEM	QTY	MATERIAL

 <p>BHUTAN POWER CORPORATION LIMITED</p>	ENGINEERING DESIGN & CONTRACTS DEPARTMENT	
	DISTRIBUTION DESIGN & CONSTRUCTION STANDARD	
STAY SET ASSEMBLY		
DESIGNATION	NAME	DATE
DRAFTSMAN		
DESIGNER		
DESIGN CHECK		
PROJECT MANAGER		
PROJECT DIRECTOR		
DRAWING NO. BPC-DDCS-2015-51		REVISION 2015





Sl.no	Description
1	Handle
2	Lock Pad
3	Steel Pipe
4	Load Switch
5	Arc Extinguisher

Rated Voltage:  
 Rated short time Withstand current for 1 sec.  
 Current Rating:  
 Diameter and length of the GI operating Pipe  
 Size & length of the channel for mounting  
 Minimum clearances between phases  
 Type of mounting  
 Power frequency withstand Voltage  
 1) Across Isolating Distance  
 2) To earth and between poles  
 Lightning impulse withstand Voltage  
 1) Across Isolating Distance  
 2) To earth and between poles  
 Type of Insulator

11kV 20kA 630A	33kV 16kA 630A
25mm NBx6 mtr. Length 75mmx40mmx660mm Long 800mm vertical	32mmx7 mtr. Length 75mmx40mmx660mm Long 800mm vertical
32kV 28kV	80kV 70kV
85kV 75kV Post Type with alternating shed	195kV 170kV Post type with alternating shed



BHUTAN POWER CORPORATION LIMITED

ENGINEERING DESIGN & CONTRACTS DEPARTMENT

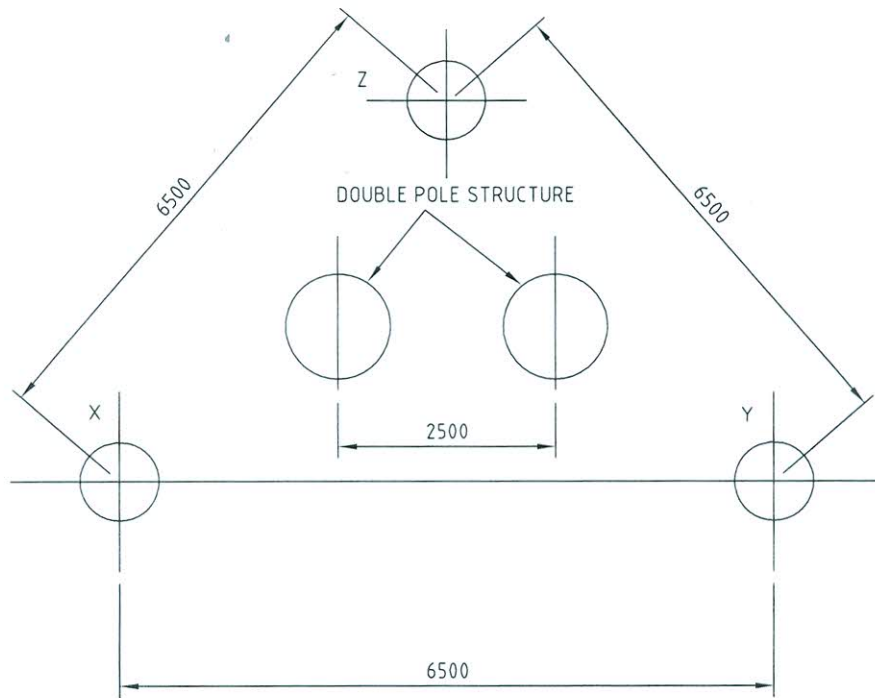
TITLE : DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

Typical Arrangement of 11kV & 33 KV LBS/ABS

DESIGNATION	NAME	DATE
DRAFTSMAN		
DESIGNER		
DESIGN CHECK		
PROJECT MANAGER		
PROJECT DIRECTOR		

DRAWING NO. BPC-DDCS-2015-59

REVISION  
2015



#### NOTES

1. THE CONNECTIONS TO THE THREE EARTH ELECTRODES SHOULD BE AS FOLLOWS:
  - a. TO ONE OF THE EARTH ELECTRODES ON EITHER SIDE OF DOUBLE POLE STRUCTURE ( X-Y )  
ONE DIRECT CONNECTION FROM 33kV OR 11kV NEUTRAL LIGHTNING ARRESTERS AND TRANSFORMER TANK
  - b. TO EACH OF THE REMAINING TWO EARTH-ELECTRODES
    - ( i ) ONE SEPARATE CONNECTION FROM THE NEUTRAL OF THE LOW VOLTAGE SIDE OF THE TRANSFORMER.
    - ( ii ) ONE SEPARATE CONNECTION FROM TERMINAL EARTH OF TRANSFORMER LT PANEL .
    - ( iii ) ONE SEPARATE CONNECTION FROM BODY OF TRANSFORMER LT PANEL .
2. 25 x 6 mm GALVANISED IRON STRAP LEADS.
3. THREE NOS. 40mm x 2500mm PIPE ELECTODES.
4. EARTH ELECTRODES X,Y AND Z TO BE BONDED TOGETHER USING 25x6mm GALVANISED IRON STRAP BURIED 100mm BELOW GROUND LEVEL.
5. REFER DWG BPC-DDCS-2015-66 FOR EARTH POINTS ON TRANSFORMER AND STRUCTURE.



BHUTAN POWER CORPORATION LIMITED

ENGINEERING DESIGN & CONTRACTS DEPARTMENT

TITLE : DISTRIBUTION DESIGN & CONSTRUCTION STANDARD

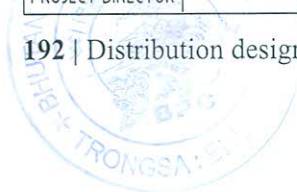
33 kV OR 11 kV / 415 V DISTRIBUTION SUB-STATION  
PIPE EARTHING

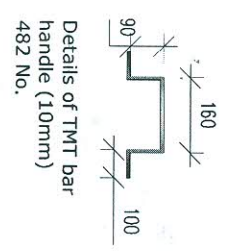
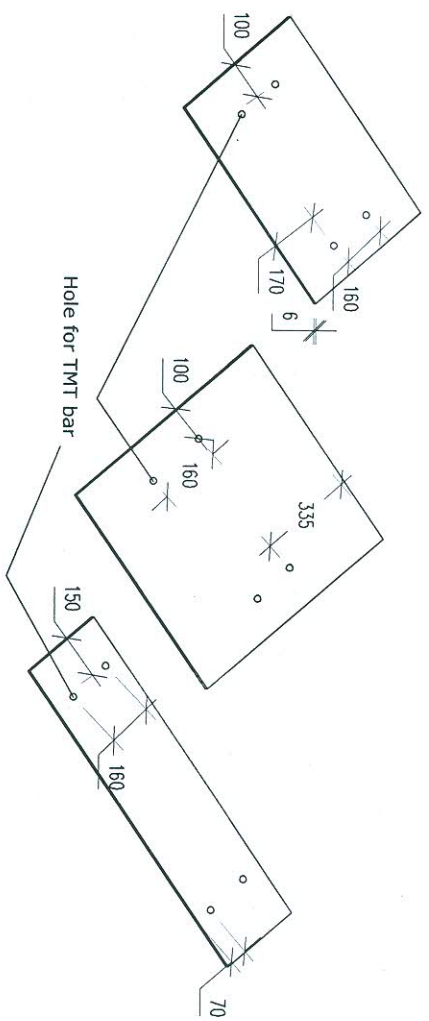
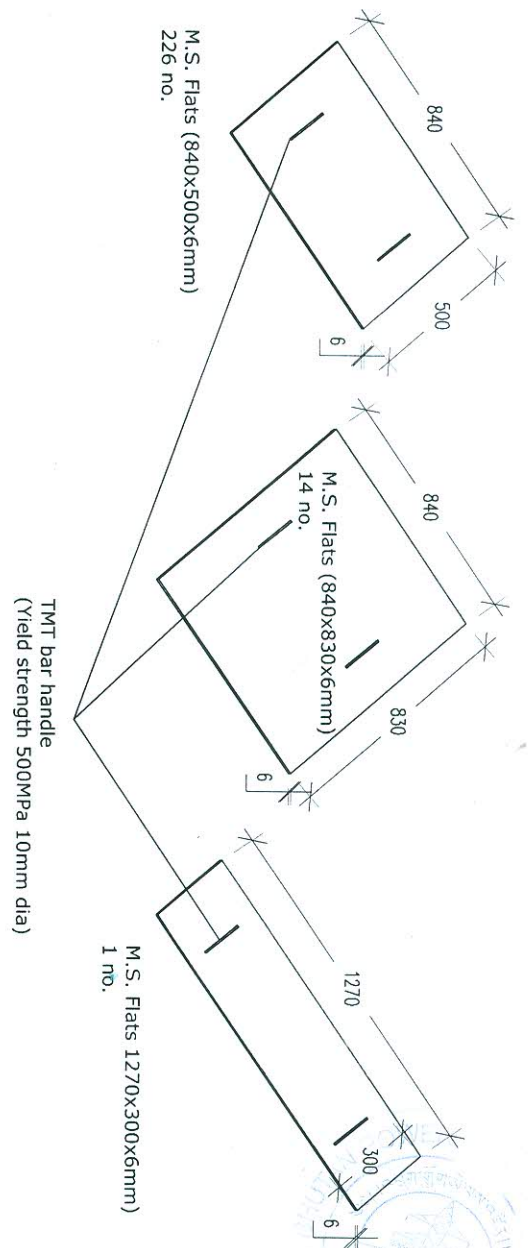
DESIGNATION	NAME	DATE
DRAFTSMAN		
DESIGNER		
DESIGN CHECK		
PROJECT MANAGER		
PROJECT DIRECTOR		

DRAWING NO. BPC-DDCS-2015-64


REVISION

2015





NOTE: All dimensions are in mm unless otherwise specified. Dimensions are to be read not to be measured. Any discrepancies in the drawings shall be notified to the designer for timely rectification.

 DISTRIBUTION & CUSTOMER SERVICES DEPARTMENT BHUTAN POWER CORPORATION LIMITED TRONGSA: BHUTAN	<b>PROJECT TITLE</b> PROPOSED CABLE TRENCH COVER (M.S FLATS) AT KEWATHANG UNDER ESD, BPC, TRONGSA		<b>DRAWING TITLE</b> PLAN DRG. NO. 01	<b>DESIGNED/ DRAWN</b>	<b>CHECKED</b>	<b>APPROVED</b>	<b>DATE</b> 22.03.2021	<b>REVISION</b>	<b>DATE</b>