PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY

BIDDING DOCUMENT

FOR

CONSTRUCTION OF AUTOMATIC BACKWASH STRAINER & BOOSTER PUMP HOUSE, WATER SUPPLY AND FILTRATION UNIT HOUSE AT PHEP-I, WANGDUE, BHUTAN

(NIT No. PHPA-I/CE(C&P)/146-03/2023)

Contracts Wing PHPA-I, Bjimthang

JUNE, 2023

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SECTION I

NOTICE INVITING TENDER

PUNATSANGCHHU-I HYDROELECTRIC PROJECT AUTHORITY (PHPA-I)
NIT No. PHPA-I/CE(C&P)/146-03/2023

Sealed item rate bids are hereby invited for and on behalf of PHPA-I from experienced and financially sound bidders from Bhutan (***Medium Class-W3***) and India (**Special/A *Class***) fulfilling the eligibility criteria specified in the Bidding Document for the work "***Construction of Automatic backwash strainer & Booster pump house, Water supply & Filtration unit house at PHEP-I, Wangdue, Bhutan***"

Eligibility Criteria

The participating Bidders shall fulfil the following criteria:

1. Have an average turnover of Nu./Rs. **15 million or more** of any 3 years of the last 5 years preceding the last date of bid submission.
2. Have a valid trade license and registered with CDB as ***Medium Class (W3)*** and **Special/A-Class** for Bhutanese and Indian Bidders respectively.
3. Have the latest income tax/corporate tax clearance certificates. If such a clearance certificate is not being issued by the concerned authority, an authenticated photocopy of the latest income tax return shall be submitted by the Bidders.
4. Bidders should have experience in having completed at least one building work, including piping for water supply & sewage etc. during the last 5 years of value Nu./Rs. **15 million or more**, and submit at least one Completion certificate issued by the previous client(s). Such certificate shall indicate the value, date, and site of works, and shall specify whether they were successfully completed.
5. Bidders shall submit evidence of access to or availability of a credit line of at least Nu./Rs. **6 *million*** issued by the Banks or Financial Institutions in Bhutan/India.

The prospective Bidders may purchase the Bidding Document from the office of the Chief Engineer (C&P), Bjimthangkha, Wangdue w.e.f **5/06/2023 to 4/07/2023** on payment of a non-refundable fee of Nu./Rs. **2,000** (two thousand) only in the form of a Cash Warrant/Bank Draft drawn in favor of PHPA-I, payable at the Bank of Bhutan (Bajo & Thimphu). The bidder can also download the Bidding Document from the PHPA-I website: www.phpa1.gov.bt at free of cost.

Any corrigendum/addendum/errata in respect of this tender shall be made available only at the mentioned website.

PHPA-I reserves the right to reject any or all the bids without assigning any reason thereof.

-sd-
Chief Engineer (C&P)

Contracts Wing PHPA-I, Bjimthangkha

SECTION II

INSTRUCTIONS TO BIDDERS

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GENERAL

1 Introduction

Sealed item rate Bids are invited for and on behalf of the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) from experienced & financially sound Bidders from Bhutan (**Medium Class-W3**) and India (**Special/A Class**) for the Work as described in Bid Data Sheet (BDS).

2 Scope of Work

The scope of works shall be as specified in **Section VI-General Technical Specifications.**

3 Eligible Bidders

3.1 The participating Bidders shall fulfil the following criteria:

3.1.1 Have average turnover of Nu./Rs. ***15 million or more*** of any 3 years of last 5 years preceding the last date of submission of Bid.

3.1.2 Have valid trade license and registered with CDB as Medium ***Class (W3)*** and **Special/A Class** for Bhutanese and Indian Bidders respectively.

3.1.3 Have latest income tax clearance Certificates. If such Clearance Certificate is not being issued by the concerned Authority, an authenticated photocopy of the latest income tax return shall be submitted by the Bidder.

3.1.4 Bidders should have experience in having completed at least one building work, including piping for water supply & sewage etc. during the last 5 years of value Nu./Rs. ***15 million or more***, and submit at least one Completion Certificate issued by previous client(s). Such Certificate shall indicate the value, date and the site of works, and shall specify whether they were satisfactorily completed.

3.1.5 Bidders shall submit evidence of having access to or availability of credit line of at least for **Nu./Rs. 6 *million*** *issued* from the Banks or Financial Institutions in Bhutan/India.

3.2 A Bidder shall not have more than 4 Works in-hand at the time of opening of Bids. ***Bidders shall declare about the "work in-hand" along with the Bid.***

3.3 A Bidder shall not have a conflict of interest. Any 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:

3.3.1 they have at least one controlling partner in common; or

3.3.2 they receive or have received any direct or indirect subsidy from either party; or

3.3.3 they have the same authorized legal representative for purposes of this Bid; or

3.3.4 they have a relationship with each other, directly or through common 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

3.3.5 A Bidder participating in more than one Bid in this Bidding process shall result in the disqualification of all Bids; or

3.3.6 A Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Project Manager for the Contract implementation; or

3.3.7 A Bidder or any of its affiliates employs or otherwise engages a close relative of a civil servant who either is employed by the Employer or has an authority over the Bidder or its affiliates or over the Bid. For the purposes of this Sub-Clause a close relative is defined as immediate family which includes father, mother, brother, sister, spouse and own children.

3.4 Government-owned enterprises shall be eligible only if they can establish that they:

3.4.1 are legally and financially autonomous,

3.4.2 operate under commercial law, and

3.4.3 are not a dependent agency of the Employer.

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

3.6 A Bidder shall be excluded if:

3.6.1 as a matter of law or official regulation, Bhutan prohibits commercial relations with the country in which the firm is constituted, incorporated or registered; or by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, Bhutan prohibits any import of goods or contracting of Works or services from that country in which the firm is constituted, incorporated or registered or any payments to persons or entities in that country.

3.6.2 he is insolvent or is in receivership or is a bankrupt or is in the process of being wound up, or has entered into an arrangement with his creditors; or

3.6.3 his affairs are being administered by a court, judicial officer or appointed liquidator; or

3.6.4 he has suspended business or is in any analogous situation arising from similar procedures under the laws and regulations of his country of establishment; or

3.6.5 he has been found guilty of professional misconduct by a recognized tribunal or professional body; or

3.6.6 he has not fulfilled his obligations with regard to the payment of taxes, social security or other payments due in accordance with the laws of the country in which he is established or of the Kingdom of Bhutan; or

3.6.7 he is or has been guilty of serious misrepresentation in supplying information required for any prior registration with the Employer or the Construction Development Board of Bhutan; or

3.6.8 he has been convicted of fraud and/or corruption by a Competent Authority; or

3.6.9 he has not fulfilled his Contractual obligations with the Employer in the past; or

3.6.10 he has been debarred from participation in public procurement by any Competent Authority as per law.

4 Number of Bid per Bidder

Each Bidder shall submit only one Bid. A Bidder who submits or participates in more than one Bid (other than as a Sub Contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

5 Signatory Authority for Submission of Bid

5.1 Signatory Authority of the submission of Bids shall be as follows:

5.1.1 In case of proprietary firm, the Bid shall be signed by the Proprietor.

5.1.2 In case of a limited Company or Corporation, the Bid shall be signed by an authorized person holding the Power of Attorney for signing the Bid. **A Power of Attorney (in original) shall accompany the Bid**.

5.1.3 Bid documents is not transferable.

6 Cost of Bidding

Bidders shall bear all costs associated with the preparation and submission of their Bids and the PHPA-I will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

7 Site Visit

7.1 Bidder is advised to visit the site to verify, examine and obtain all information that may be necessary for preparing the Bid. The costs of visiting the Site shall be at the Bidder's own expense.

7.2 A Bidder or his representative will be granted permission to enter the site of work only upon the condition that the Employer or his personnel or agent will not be responsible for death or personal injury or loss or damage to property and other loss, damage, cost or expenses incurred as a result of inspection/visit.

8 Procurement of Explosives

In case Explosive materials are required for the work, PHPA-I will assist the Contractor to procure at the Contractor's cost from the Authorized Agency in Bhutan. Arrangement for storage of explosive at site, if required, would be the Contractor's responsibility. The Contractor shall observe all rules & regulations regarding the storage and handling of such materials.

BIDDING DOCUMENT

9 Contents of Bidding Document

9.1 The Bidding document is as stated below and should be read in conjunction with any corrigendum/modification issued to this document:

9.1.1 Notice Inviting Tender (NIT)

9.1.2 Instructions to Bidders (ITB)

9.1.3 Bidding Data Sheet (BDS)

9.1.4 General Conditions of the Contract (GCC)

9.1.5 Special Conditions to Contract (SCC)

9.1.6 General Technical Specifications (GTS)

9.1.7 Forms

9.1.8 Bill of Quantities

9.1.9 Drawings

9.1.10 Any other document as forming part of the Contract.

9.2 Bidders are expected to examine carefully the contents of all the above documents.

Failure to comply with the requirement of Bid submission will be at Bidder's own risk. Bids which are not substantially responsive to the requirement of the Bidding document will be rejected. Prior to last date of submission of Bid, the Employer may, for any reason whatsoever, modify the Bid by issuing corrigendum, which will become a part of Bidding document. No modification of Bid shall be permissible after last date of submission, whatsoever may be the reason.

PHPA-I may at its discretion extend as necessary the deadline for submission of Bid, if considered necessary.

10 Clarification of Bidding Document

10.1 Any prospective Bidder requiring any clarifications of the Bidding Document ***may notify PHPA-I in writing to the address mentioned in BDS, not later than 15 days prior to date of bid submission***. If required, PHPA-I will issue clarification in writing not later than 15 days prior to deadline for submission of Bid. All such clarification shall form part of the Bidding Document and shall accompany Bidder's Bid. Written copies of the PHPA-I's response (including a description of the enquiry but without identifying its source) shall be uploaded on PHPA-I's website (www.phpa1.gov.bt).

10.2 Bidders or their official representatives may attend a pre-Bid meeting, if any, which will take place at the time and place stated in BDS.

11 Amendment of Bidding Document

11.1 At any time but not later than 15 days prior to the deadline for submission of Bids, the PHPA-I may, for any reason, whether at its own initiative or in response to a clarification requested by prospective Bidders, modify the Bidding Document by the issuance of a Corrigendum/Addendum through PHPA-I's website. ***The Bidders may take note and ensure to check regularly for any upload in PHPA-I's website***.

PREPARATION OF BID

12 Language of Bid

Bid prepared by the Bidder and all correspondence and documents relating to the Bid exchanged by the Bidder and the PHPA-I shall be written in the English language only.

13 Documents Comprising the Bid

13.1 Bid to be prepared and submitted by the Bidder for consideration shall comprise the following: -

13.1.1 Complete Bidding document, forms, schedules used thereto duly filled in and signed wherever required without altering the formats;

13.1.2 Bid Security in accordance with clause 17 of ITB. The Bids which do not contain the required Bid Security will be summarily rejected.

13.1.3 Valid Trade license and latest Tax Clearance Certificate & Pre-Contract Integrity Pact Statement;

13.1.4 Abstract programme for completing various works in MS Excel or MS Project ;

13.1.5 List of Machinery, Equipment and Manpower proposed to be deployed;

13.1.6 Site organization proposed for this work;

13.1.7 Methodology proposed to be adopted for this work;

13.1.8 Any other relevant material/information.

13.2 For Bid submissions, the bidders may refer to the **eligibility criteria and other mandatory data prior to submission of bids**.

14 Bid Price

14.1 Unless stated otherwise in the Bidding Document, the Contract shall be for the whole work as described in Clause 2 of ITB, based on the schedule of unit rates and prices submitted by the Bidder.

14.2 In accordance to the BDS, the rates quoted by the Bidder may be subjected to the adjustment during the performance of the Contract as per the provisions of Clause-65 of GCC.

15 Currencies of Bid and Payment

The unit rate shall be Nu/Rs and the payment shall be made in currencies of Bid.

16 Bid Validity Period

16.1 Bids shall remain valid for acceptance for a period specified in the BDS.

16.2 In exceptional circumstances, prior to expiry of the original Bid validity period, the PHPA-I may request the Bidder for a specified extension in the period of validity along with validity of Bid Security. The request and the responses thereto shall be made in writing. A Bidder may refuse the request without forfeiting his Bid Security. A Bidder agreeing to the request will not be required/ nor permitted to modify his Bid, but will be required to extend the validity of his Bid security correspondingly. The provision of ITB Clause 17.4, regarding discharge and forfeiture of Bid security shall continue to apply during the extended period of Bid validity.

17 Bid Security

17.1 Bidders shall furnish as part of its Bid, a Bid Security in original, denominated in the currency and in amount specified in BDS in a separate sealed envelope. Any Bid not accompanied by Bid Security of specific value and validity shall be rejected by PHPA-I as non-responsive.

The Bid Securities of the unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder furnishing the Performance Security and signing the Contract Agreement, in any event, not later than 30 days after the expiry of the validity of the Bid.

17.2 Bid Security shall be in any of the following forms:

17.2.1 account payee/cash warrant;

17.2.2 Demand Draft;

17.2.3 Unconditional Bank Guarantee (BG)

17.3 Bid Security shall be issued by any Financial Institution of Bhutan/India and drawn in favor of Punatsangchhu-I Hydroelectric Project Authority payable at Bank of Bhutan (Bajo & Thimphu).

17.4 Bid Security is liable to be forfeited if:

17.4.1 Bid is withdrawn during the period of its validity, after opening of Bids.

17.4.2 Correction of Bid price is not accepted by the Bidder pursuant to ITB Clause 30.

17.4.3 Successful Bidder fails to sign contract agreement and furnish Performance Security within the specified time limit.

18 Bidding Condition

Bidders shall submit their Bids complying with the requirement of the Bidding Document. Any deviation from the Bidding document shall be liable for rejection.

19 Format for Submittal

Format for submittal of related information for Bid shall be as per the Section-VII -Forms, and shall be strictly adhered to.

20 Signing of Bid

20.1 Bidders shall prepare one original of the documents comprising the Bid as described in ITB Clause 13, bound with the volume containing the Forms of Bid. The Bid, typed or written in indelible ink and shall be signed by a person duly authorized. ***Proof of authorization shall be furnished in the form of a written Power of Attorney (in original) along with the Bid.***

All pages of the Bid and entries where amendments have been made shall be initialed by the person signing the Bid.

20.2 The complete Bid shall be without alternations or erasures, except those to accord with instructions issued by the PHPA-I, or as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person signing the Bid.

SUBMISSION OF BID

21 Sealing and Marking of Bid.

21.1 The documents comprising the Bid as defined in Sub-Clause 9 shall be submitted in separate covers as stated in this Clause. The Bids shall be submitted in one original and copy marked as 'Original' and 'Copy' as appropriate. The Bid shall be submitted in separately sealed envelopes duly marked Envelope I, Envelope II, and Envelope III and each envelope shall contain documents as stated below:

Envelope I

The Envelope I will be named, marked and sealed as "Bid Security".

Envelope II

The Envelope-II will be named, marked and sealed as "Techno-Commercial Unpriced Bid". This Envelope shall contain documents listed in ITB Sub- Clause 9 except Bill of Quantities. This envelope shall contain no information giving any indication about the prices.

Envelope III

The Envelope III will be named, marked and sealed as "Price Bid" and shall comprise of duly filled Bill of Quantities.

21.2 The bids shall be submitted in three parts in separate sealed envelopes and shall be enclosed together in a larger outer envelope. The larger outer envelope, marked as "Confidential" shall be addressed to:

21.2.1 Chief Engineer (Contracts & Procurement), PHPA-I, Wangdue, Bhutan.

21.2.2 bear the following identification:

21.2.2.1 Bid for ***NIT No. PHPA-I/CE(C&P)/146-03/2023 "Construction of Automatic backwash strainer & Booster pump house, Water supply & Filtration unit house at PHEP-I, Wangdue, Bhutan"***.

21.2.2.2 "DO NOT OPEN BEFORE" the date as specified in Bidding Data Sheet.

21.2.3 If the outer envelope is not sealed and marked as above, PHPA-I shall assume no responsibility for the misplacement or premature opening of the Bid.

22 Deadline for Submission of Bids.

22.1 The Bids must be submitted within the time and date specified in BDS.

22.2 PHPA-I may, at its discretion, extend the deadline for submission of Bids by issuing an amendment, in which case all rights and obligations of the PHPA-I and the Bidders previously subject to the original deadline shall thereafter be subject to the new deadline as extended.

23 Late Submission of Bid

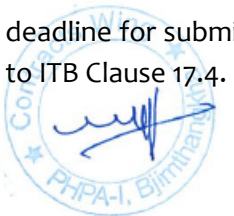
Any Bid received by the PHPA-I after the deadline for submission of Bids prescribed by the PHPA-I in ITB Clause-22 shall be returned unopened (outer envelope shall be opened to know the Bidder's address).

24 Modification and Withdrawal of Bid

24.1 Bidders may modify or withdraw their Bids prior to deadline for submission of Bid by giving modification or withdrawal notice in writing to PHPA-I.

24.2 Bidder's modifications or notice of withdrawal shall be prepared, sealed and clearly marked as "Modification" or "Withdrawal" as appropriate and delivered/submitted prior to deadline for submission of Bid in accordance with ITB Clause 22.

24.3 No Bid will be modified after the deadline for submission of the Bid. Withdrawal of Bid between deadline for submission and expiry of Bid validity will result in forfeiture of Bid Security pursuant to ITB Clause 17.4.



25 Bidding Document

Entire set of Bidding Document shall be submitted after filling it wherever required & signing each page as a token of acceptance of all terms & conditions of the Bidding Document. No portion of the Bidding Document shall be retained by the Bidder.

BID OPENING AND EVALUATION

26 Bid Opening

26.1 The PHPA-I shall open the Bids, including modifications made pursuant to ITB Clause 24, in the presence of the Bidder's authorized representatives who may choose to attend at time & the place mentioned in the BDS.

26.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to ITB Clause 24, shall not be opened.

26.3 The Bidder's name, Bid prices, modifications, withdrawals, presence or absence of Bid Security and other such details as considered appropriate will be announced at the time of opening Bids. The record of the Bid opening including information disclosed will be preserved for office record.

26.4 The "**Price Bid**" of only those bidders whose Techno-Commercial bids have been ascertained to be responsive will be opened at a later date to be notified separately.

27 Confidentiality of Bid

27.1 After the public opening of Bids, information relating to the examination, clarification, evaluation and comparison of Bids and recommendations concerning the Award of Contract shall not be disclosed to Bidders or other persons not officially concerned with such process.

27.2 Any effort by a Bidder to influence the PHPA-I in the process of examination, clarification, evaluation and comparison of Bids, and in decisions concerning Award of Contract, may result in the rejection of his Bid.

28 Clarification of Bid

To assist in the examination, comparison and evaluation of Bid, the PHPA-I may ask Bidders for clarification of the Bids, including breakdown of unit rate. But no change in price or substances of Bid will be sought, agreed or permitted except as required to confirm the correction of arithmetic errors discovered by PHPA-I in the evaluation of Bids. The request for clarification and its response shall invariably be in writing.

29 Determination of Responsiveness

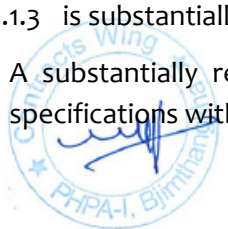
29.1 Prior to detailed evaluation of Bid, it will be determined whether each Bid:

29.1.1 has been properly signed;

29.1.2 is accompanied by required bid security;

29.1.3 is substantially responsive to the requirements of Bidding Document;

29.2 A substantially responsive document is one which conforms to all the terms, conditions & specifications without material deviation or reservation which:



29.2.1 affects in any substantial way the quality or scope of the Work;

29.2.2 limits in any substantial way the scope of Work;

29.2.3 is inconsistent with the Bidding Document;

29.2.4 affects unfairly the competitive position of other Bidders.

29.3 Bids not found substantially responsive are liable to be rejected. Conditions if added by the Bidder, which have adverse bearing on the cost and scope of tendered work shall make the Bid liable to disqualification.

30 Corrections of Errors in Bid

30.1 The price bids shall be checked by the Employer for any arithmetic errors in computation and summation. Errors will be corrected by the Employer as follows:

30.1.1 where there is a discrepancy between the rate in figures and in words, the rate in words will govern; and

30.1.2 where there is a discrepancy between the unit rate and the total amount derived from the multiplication of the unit rate and the quantity, the unit rate as quoted will govern and the total amount shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit rate in which case the total amount as quoted shall govern and the unit rate shall be corrected.

30.1.3 if there is an error in a total corresponding to the addition or subtraction of sub-totals, the sub-totals shall prevail and the total shall be corrected.

30.1.4 If the Bidder does not quote for any item, it is presumed that he will execute the quantity mentioned in the BoQ free of cost and he has covered the price of this item in rate of other items quoted by him.

30.2 If the Bidder does not accept the corrected amount of Bid, his Bid will be rejected and the Bid security will be forfeited.

31 Evaluation and Comparison of Bid

31.1 PHPA-I will only evaluate and compare the Bids determined to be substantially responsive.

31.2 In evaluating Bids, PHPA-I will determine, for each Bid, the Evaluated Bid Price by adjusting the Bid Price as follows:

31.2.1 making any correction for errors;

31.2.2 making an appropriate adjustment for any discount and;

31.2.3 making an appropriate adjustment for acceptable quantifiable variations or deviations.

31.3 If the Bid price of the lowest evaluated Bid appears abnormally low or seriously unbalanced (below 20% of the estimated value), PHPA-I may ask the Bidder to produce written explanations of, justifications and 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. Abnormally low Bid may or may not be accepted. However, if PHPA-I decides to accept the abnormally low or the Bid with serious unbalanced rates after considering the above, the Bidder

shall increase the Performance Security from 10% up to maximum of 30% of the initial Contract Price; or

Alternatively, the PHPA-I may require the successful Bidder to deposit the difference between the PHPA-I's estimate and Contract Price in the form of cash warrant/BG in addition to 10% Performance Security.

31.4 If the prices of all Bids are abnormally high (above 20% of the estimated value), PHPA-I may seek justification from the Bidders for the high rates and if necessary, negotiate with the lowest evaluated Bidder or may reject the Bid if considered to be abnormally higher than the estimated cost.

31.5 PHPA-I reserves the right to accept or reject any variation, deviation or alternative offers. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Bidding Document or otherwise result in the accrual of unsolicited benefits to PHPA-I shall not be taken into account in Bid evaluation.

31.6 PHPA-I will carry out a detailed technical evaluation of the Bids in order to determine whether the technical aspects are in accordance with the requirements. In order to reach to such determination, PHPA-I will examine and compare the technical aspects of the Bids on the basis of the information provided by the Bidders.

31.7 Supplied overall completeness and compliance with the Technical Specifications and Drawings as specified in Section VI-Technical Specification; suitability of the Works/ Services offered in relation to the environmental and climatic conditions prevailing at the Site. The Bid that does not meet minimum acceptable standards of completeness, consistency and detail will be rejected as non-responsive.

31.8 All other considerations being equal, preference shall be given to Bhutanese bidder in allocation of the work.

32 Qualification of the Bidder

32.1 PHPA-I shall determine to its satisfaction whether the Bidder selected is having the lowest evaluated responsive Bid, meet the terms of the qualification requirements stipulated in the BDS and have capacity and capability to perform the Contract.

32.2 The determination shall be based upon an examination of the documentary evidence, including its authenticity of the Bidder's qualifications and capacity & capability submitted by the Bidder.

AWARD OF CONTRACT

33 Award Criteria

PHPA-I will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding Document and has evaluated as the lowest Bid.

34 PHPA-I's Right to accept any Bid and or to reject any or all Bids

PHPA-I 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 PHPA-I's action.

35 Notification of Award

35.1 Prior to the expiry of the Bid validity period prescribed or any extension thereof, PHPA-I will notify the successful Bidder in writing that his Bid has been accepted.

35.2 This notification letter shall be issued to the successful Bidder by the PHPA-I in Form (hereinafter and in the Conditions of Contract called the "Letter of Award") in duplicate and will state the sum that PHPA-I will pay to the successful Bidder in consideration of the execution, and completion of the Works by the successful Bidder as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

36 Performance Security

36.1 Within 15 days of the issue of letter of award by PHPA-I, but not later than the date of the signing of the Agreement, the successful Bidder shall furnish to the PHPA-I, a Performance Security in the form of a Bank Guarantee for an amount equal to **10%** of the Contract Price.

36.2 Performance Security provided by the successful Bidder in the form of a Bank Guarantee, shall be in favour of PHPA-I issued by any Financial Institutions in Bhutan/ India. Bank Guarantee shall be on the Proforma.

37 Signing of the Contract

37.1 Upon submission of the Performance Security as per ITB Clause 36, and within 30 days of issue of the Letter of Award, the successful Bidder or his authorized representative shall attend the office of the ***Chief Engineer (C&P), PHPA-I, Bjimthangkha, Bhutan*** for signing of the Contract Agreement on a date and time mutually agreed upon, or as specified in the Letter of Award.

37.2 In case the successful Bidder fails to sign the Contract Agreement within the deadline specified above, it shall lead to cancellation of the award and forfeiture of Bid Security.

SECTION III

BID DATA SHEET

BID DATA SHEET

The following Bid Data for the Work to be procured shall amend and/or supplement the Clauses in the Instruction to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB.

ITB Clause Reference	Data
General	
1. Name of work	Construction of Automatic backwash strainer & Booster pump house, Water supply and Filtration unit house at PHEP-I, Wangdue, Bhutan (NIT No. PHPA-I/CE(C&P)/146-03/2023).
3.6 A Bidder shall be excluded if	If the Contract has been terminated by the PHPA-I due to fundamental breach of Contract by the Contractor in last **2 *years*** prior to submission of the Bid.
Bidding Document	
10.1 Clarification on Bidding Document	Employer's address for clarification *in writing:* *Chief Engineer (C&P),* *Punatsangchhu-I Hydroelectric Project Authority (PHPA-I),* *Bjimthangkha, Wangdue* *Email:* ***secphpa@gmail.com***
10.2 Pre-bid Meeting	Not applicable
Preparation of Bids	
14 Bid Price	Price quoted by Bidder shall remain firm & not subject to adjustment during the performance of Contract.
15 Currency of Bid and Payment	Currencies of Bid shall be *Ngultrum (Nu.)/ Rupee (Rs.)*
16 Bid Validity Period	The bid shall remain valid up to **90 days** from the deadline for submission of a bid.
17 Bid Security	Bid Security amount is Nu./Rs. **390,000/-** and shall remain valid for **30 days beyond the validity period of the Bids**, as extended, if applicable, in accordance with ITB Sub-Clause 16.2
Submission of Bids	
21 Sealing and Marking of Bids	The Employer's address for the purpose of Bid submission is: *Chief Engineer (C&P), PHPA-I, Bjimthangkha, Wangdue, Bhutan.*
22 Deadline for bid submission	The deadline for submission of bids shall be on **4/07/2023 at 1300 Hrs. (BST)**
Bid opening and Evaluation	
26 Bid opening	The bid opening shall take place on **4/07/2023 at 1500 Hrs. (BST)** in

	the O/o Chief Engineer (C&P), PHPA-I, Bjimthangkha, Wangdue
31 Evaluation and Comparison of Bids & 32 Qualification of the Bidder	The following qualification requirement has to be met by the Bidder: **Financial** 1. Average turnover for any 3 years of last 5 years preceding the last date of bid submission shall be equal to Nu./Rs **15 million or more.** 2. The Bidder must have credit line facilities in the relevant form issued by any Banks or Financial Institutions in Bhutan/India for at least Nu./Rs. **6 million or more.** **Technical** 1. Experience in having completed at least one building work, including piping for water supply & sewage etc. during the last five years of value Nu./Rs. **15 million or more**, and submit at least one Completion Certificate issued by the pervious client(s). Such Certificate shall indicate the value, date, and site of works, and shall specify whether they were successfully completed. 2. The essential construction equipment to be made available for the Contract by the Bidder shall be: a. Concrete mixer- 1 No b. Truck – 1 No c. Survey equipment – 1 No d. Vibrator - 1 No. Bidder is required to furnish the document to prove the ownership of the equipment. In case of hire, the agreement/consent letter along with the proof of ownership with the leaser shall be submitted. 3. The skilled and experienced manpower required for the timely and quality execution of the work to be made available for the Contract by the Bidder shall be: a. One Site Engineer (Civil) with a minimum of 3 years work experience in a similar field. b. One Site Supervisor with minimum 3 years of experience in similar work. CV of the personnel shall be submitted.

SECTION IV

GENERAL CONDITIONS OF CONTRACT

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Contracts Wing
PHPA-I, Bjmthanakha

DEFINITIONS AND INTERPRETATIONS

1 Definitions

1.1 In the Contract, as hereinafter defined, the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires:

1.1.1 'PHPA-I'/ 'Project Authority' means the Punatsangchhu-I Hydroelectric Project Authority and the legal successor in title to the PHPA-I who will employ the Contractor.

1.1.2 "RGoB" means the Royal Government of Bhutan.

1.1.3 "BDS" means Bid Data Sheet.

1.1.4 "Tender/Bid, tenderer/bidders" means synonymous throughout this Contract document.

1.1.5 'Contractor'/ 'Supplier' means the person or persons, firm or company, group of firms or Joint Venture, whose bid has been accepted by the PHPA-I and includes the Contractor's personal representatives, successors and permitted assigns.

1.1.6 Employer/Department/Authority shall mean Punatsangchhu-I Hydroelectric Project Authority and include duly authorized representative or any other person empowered or any other person empowered on behalf of PHPA-I to discharge all or any of its function.

1.1.7 Accepting Authority shall mean the Managing Director of Punatsangchhu-I Hydroelectric Project Authority or his authorized nominee.

1.1.8 "Engineer-in-Charge" (EIC) means the Engineer-in-Charge appointed from time to time by the PHPA-I and notified in writing to the Contractor to act as the Engineer-in-Charge for the purposes of the Contract.

1.1.9 "Engineer-in-Charge's Representative" means any Engineer or assistant of the Engineer-in-Charge appointed from time to time by the PHPA-I or the Engineer-in-Charge to perform the duties set forth in Clause-2, hereof, whose authority shall be notified in writing to the Contractor by the Engineer-in-Charge.

1.1.10 "Works" shall include both Permanent Works and Temporary Works.

1.1.11 "Temporary works" means all temporary works of every kind required in or about the execution or maintenance of Works.

1.1.12 "Permanent Works" means the permanent works to be executed and maintained in accordance with the Contract.

1.1.13 "Contract" means the Conditions Governing the Contract, Technical Specifications, Drawings, priced Bill of Quantities, Letter of Award and the Contract Agreement.

1.1.14 "Contract Price" means the aggregate price payable to the Contractor as specified in the Contract at the time of award, subject to such additions and adjustments thereto or deductions therefrom as may be made pursuant to the provisions of the Contract till the completion of the Contract, the price so adjusted shall be termed as Executed Price.

1.1.15 "Constructional Plant", "Plant and Equipment" or "Machinery" means and include plant, equipment, machinery, tools, appliances, other implements of all description or things of whatsoever nature required in or about the execution, or maintenance of the Works but does not include materials or other things intended to form or forming part of the Permanent Works.

1.1.16 "Specifications" means the Technical Specifications and other Specifications referred to in the Bidding Documents and any modification thereof or addition thereto or deletion therefrom as may, from time to time, be furnished/ decided by PHPA-I and/or submitted by the Contractor and approved in writing by the Engineer-in-Charge.

1.1.17 "SBRW" shall mean the latest 'Specifications for Building and Road Works' of MoWHS, RGoB, Thimphu.

1.1.18 "Drawings" means the drawings referred to in the Specifications and any modification of such drawings approved in writing by the Engineer-in-Charge and such drawings, as may, from time to time, be furnished by PHPA-I and/or submitted by the Contractor and approved in writing by the Engineer-in-Charge.

1.1.19 Special conditions to Contract referred to in these conditions shall mean relevant schedule(s) annexed to these tender documents or the standard schedule mentioned in Section V with amendments thereto, if any.

1.1.20 "Site" means the land and other places on, under, in or through which the Permanent Works or Temporary Works, designed by the Engineer-in-Charge are to be executed and any other lands and places provided by the PHPA-I for the purposes of working space or any other purpose as may be specifically designated in the Contract or subsequently approved as forming part of site.

1.1.21 "Approved" means approved in writing, including subsequent written confirmation of previous verbal approval and "approval" means approval in writing, including as aforesaid.

1.1.22 "Director (Technical)" means the Chief of Engineering of the Works or his successor and to whom the Engineer-in-Charge reports.

1.1.23 "Managing Director" means the Technical and Administrative head of the Project.

1.1.24 "GoI" means Government of India.

1.1.25 "Sub-Contractor" means the party or parties having direct Contract with the Contractor and to whom any part of the Contract has been sublet by the Contractor with the consent, in writing, of the Engineer-in-Charge.

1.1.26 "Manufacturer" means the party proposing to design and/or manufacture the equipment and materials as specified complete or in part.

1.1.27 "Letter of Award" means the letter from the PHPA-I conveying acceptance of the bid subject to such reservations as may have been stated therein.

1.1.28 Metric system shall be followed in all interpretation and execution of Works under this Contract. Any conversion found necessary shall be in accordance with the figures given in 'Indian Standard', IS 786-1967 and subsequent revision(s) of this Standard.

1.1.29 "Day" means a day from midnight to midnight.

1.1.30 "Month" means from the beginning of a given date of a calendar month to the end of the preceding date of the next calendar month.

1.1.31 "Week" means seven consecutive days.

1.1.32 "Quarter" means a period of three consecutive months starting from January, April, July and October i.e., January to March, April to June, July to September and October to December.

1.1.33 "Ngultrum" means Bhutanese Currency.

1.1.34 "Rupee" means Indian Currency

1.1.35 Words in singular number shall include the plural number and vice-versa where the context so requires. "He" shall include "She" and vice-versa.

1.1.36 "Cost" means all expenditure properly incurred or to be incurred whether on or off the site including overhead and other charges allocable thereto but does not include any allowance for profit.

1.1.37 The "Goods" means all the equipment/machinery's accessories and/or other materials, etc. which the Contractor is required to supply to PHPA-I under the scope of Contract for execution of all works in totality.

1.1.38 "Services" means services ancillary to the supply of Goods such as transportation and insurance and any other incidental services such as installation, performance of on-site erection, testing, painting, commissioning for the supplied goods, training and other such obligations of the Contractor covered under the Contract.

1.1.39 Retention money & security deposit are synonymous.

1.1.40 Defects Liability Period means the period of validity of warranties given by the Contractor commencing at the completion of the Works or a part thereof, if separate completion of the Works for such part has been provided in the Contract, during which the Contractor is responsible for defects with respect to the Works

ENGINEER-IN-CHARGE AND ENGINEER-IN-CHARGE'S REPRESENTATIVE(S)

2 Duties and Powers of Engineer-in-Charge and Engineer-in-Charge's Representative(s)

2.1 The Engineer-in-Charge shall carry out such duties in issuing decisions, Certificates and orders as are specified in the Contract.

2.2 The Engineer-in-Charge's representative(s) shall be responsible to the Engineer-in-Charge, and his duties are to watch and supervise the works and to test and examine any materials to be used or workmen employed in connection with the Works. He shall have no authority to relieve the Contractor of any of his duties or obligations under the Contract nor, except as expressly provided hereunder or elsewhere in the Contract, to order any Work involving delay or any extra payment by the Engineer-in-Charge, nor to make any variation of or in the Works.

2.3 The Engineer-in-Charge may, from time to time in writing, delegate to the Engineer-in-Charge's Representative(s) any of the powers and authorities vested in the Engineer-in-Charge and shall furnish to the Contractor a copy of all such written Delegation of Power and Authorities. Any written instructions or approval given by the Engineer-in-Charge's Representative(s) to the Contractor within the terms of such delegation, but not otherwise, shall bind the Contractor as though it had been given by the Engineer-in-Charge. Provided always as follows:

Failure of the Engineer-in-Charge's Representative(s) to disapprove any Work or materials shall not prejudice the powers of the Engineer-in-Charge thereafter to disapprove such Work or materials and to order the pulling down, removal or breaking up thereof.

2.4 If the Contractor is dissatisfied by reason of any decision of the Engineer-in-Charge's Representative(s), he shall be entitled to refer the matter to the Engineer-in-Charge, who shall thereupon confirm, reverse or vary such decision.

3 Assignment

The Contractor shall not assign the Contract or any part thereof, or any benefit or interest therein or thereunder, otherwise than by a charge in favor of the Contractor's bankers of any money due or to become due under this Contract, without the prior written consent of the PHPA-I.

4 Sub-letting

The Contractor shall not sub-let the whole of the Works. Except where otherwise provided by the Contract, the Contractor shall not sub-let any part of the Works without the prior written consent of the Engineer-in-Charge, which shall not be unreasonably withheld, and such consent, if given, shall not relieve the Contractor from any liability or obligation under the Contract and

he shall be responsible for the acts, defaults and neglects of any sub-Contractor, his agents, Employees or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents, employee or workmen. Provided always that the provision of labour on a piece work basis shall not be deemed to be a sub-letting under this Clause.

CONTRACT DOCUMENTS

5 Language and Law

5.1 The Contract documents shall be drawn up in English. All correspondence and documents relating to the bid, exchanged by the bidder and the PHPA-I, shall be submitted in the prescribed form in English. All supporting documents and printed literature in connection with the bid shall be preferably in English.

The law to which the Contract is to be subject and according to which the Contract is to be construed shall be the law for the time being in force in Bhutan and within the jurisdiction of Thimphu courts.

5.2 *Documents Mutually Explanatory*

Several documents forming the Contract are to be taken as mutually explanatory of one another, but in case of ambiguities or discrepancies, the documents shall take precedence in the order in which they are set out in the Proforma of Agreement (Forms).

6 Drawings

6.1 *Custody of Drawings*

The drawings shall remain in the sole custody of the Engineer-in-Charge, but 2 copies thereof shall be furnished to the Contractor free of charge. The Contractor shall make and provide at his own expense, any further copies required by him.

6.2 *One copy of drawings to be kept on site*

One copy of the drawings, furnished to the Contractor as aforesaid, shall be kept by the Contractor on the Site and the same shall, at all reasonable times, be available for inspection and use by the Engineer-in-Charge and the Engineer-in-Charge's Representative and by any other person authorized by the Engineer-in-Charge in writing.

7 Further Drawings and Instructions

The Engineer-in-Charge shall have full power and authority to supply to the Contractor from time to time, during the progress of the Works, such further drawings and instructions as shall be necessary for the purpose of the proper and adequate execution and maintenance of the Works. The Contractor shall carry out and be bound by the same.

GENERAL OBLIGATIONS

8 Contractor's General Responsibilities

8.1 The Contractor shall, subject to the provisions of the Contract, and with due care and diligence, execute and maintain the Works and provide all labour, including the supervision thereof, materials, constructional plant and all other things, whether of a temporary or permanent nature, required in and for such execution and maintenance, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

8.2 The Contractor shall take full responsibility for the adequacy, stability and safety of all site operations and methods of construction, provided that the Contractor shall not be responsible, except as may be expressly provided in the Contract, for the design or specification of the Permanent Works, or for the design or specification of any Temporary Works prepared by the Engineer-in-Charge.

8.3 The Contractor shall promptly inform the Engineer-in-Charge of any error, omission, fault and other defects in the design of or specifications for the Works which are discovered when reviewing the Bidding Document or in the process of execution of the Works.

8.4 Where no specifications have been laid down, the materials used and the Work done shall conform to the relevant Specifications for Building and Road Works-2022 or I.S. Code or as directed by the Engineer-in-Charge.

8.5 All instructions and orders given by the Engineer-in-Charge at Site are to be maintained in the Site Instruction Book and shall be taken to have been conveyed to the Contractor for his compliance.

8.6 The Contractor must have a site office to receive normal correspondence between 9 AM and 5.30 PM on working days and urgent correspondence at any time on all days.

9 Contract Agreement

The Contractor shall, when called upon so to do, enter into and execute a Contract Agreement, to be prepared and completed at the cost of the PHPA-I in the Proforma annexed, with such modification as may be necessary.

10 Performance Security

10.1 For the due performance of the Contract, the Contractor shall furnish to the PHPA-I a Performance Security in the form of bank guarantee. The amount of the bank guarantee shall be **10% *of the Contract Price***. The bank guarantee shall be issued by any Financial Institutions in Bhutan/India. The cost of complying with the requirements of this Clause shall be borne by the Contractor unless the Contract otherwise provides.

10.2 The proceeds of the Performance Security shall be payable to PHPA-I as compensation for any loss, resulting from Contractor's failure to complete his obligation under the Contract.

10.3 The Performance Security shall be valid until 30 days after the issue of **Completion Certificate**.

10.4 Should the Contract period, for whatever reasons be extended, the Contractor, on receipt of written request from the Engineer-in-Charge, shall at his own cost get the validity period of Bank Guarantee in respect of Performance Security furnished by him extended and shall furnish the extended/revised Bank Guarantee to the Engineer-in-Charge before the expiry date of the Bank Guarantee originally furnished.

10.5 Performance Security shall not be refunded till the Contractor produces NOC from all concerned including the Labour and Environmental officers. As soon as the work is virtually complete, the Contractor shall apply for the Clearance Certificate to the Labour/Environmental Officer under intimation to the Engineer-in-Charge. On receipt of the said communication, the Engineer-in-Charge shall write to the Labour/Environmental Office to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending on record after completion of the work and/or no communication received from the Labour/Environmental Officer to this effect till 6 months after the date of completion, it will be deemed to have received the Clearance Certificate and the security deposit will be released if otherwise due.

11 Inspection of Site

The Contractor must inspect and examine the Site and its surroundings and information available in connection therewith and to have satisfied himself, so far as is practicable, before submitting his Bid, as to the form and nature thereof, including the subsurface conditions, the Hydrological and climatic conditions, the extent and nature of work, and materials necessary for the completion of the Works, means of access to the Site and the accommodation he may require and, in general, shall be deemed to have obtained all necessary information, subject as above mentioned, as to risks, contingencies and all other circumstances which may influence or affect his Bid. The costs of visiting the site shall be at the bidder's own expense.

12 Sufficiency of Bid

The Contractor shall be deemed to have satisfied himself before bidding as to the correctness and sufficiency of his Bid for the Works and of the rates stated in the priced Bill of Quantities and the Schedule of Rates, if any, which Bid rates shall, except in-so far as it is otherwise provided in the Contract, cover all his obligations under the Contract, and all matters and things necessary for the proper execution/completion and maintenance of all the permanent works.

13 Works to be to the Satisfaction of Engineer-in-Charge

Save in-so-far as it is legally or physically impossible the Contractor shall execute and maintain the Works in strict accordance with the Contract to the satisfaction of the Engineer-in-Charge and shall comply with and adhere strictly to the Engineer-in-Charge's instructions and directions on any matter whether mentioned in the Contract or not, touching or concerning the Works. The Contractor shall take instructions and directions only from the Engineer-in-Charge, or, subject to the limitations referred to in Clause-2 hereof, from the Engineer-in-Charge's Representative.

14 Programme to be furnished

14.1 Within a period of 15 days, the Contractor shall, after the acceptance of his Bid by PHPA-I, submit to the Engineer-in-Charge for his approval, 2 copies of the detailed **Construction Programme in MS Excel or MS Project** showing the order of sequence and procedure in which he proposes to carry out the Works. The Contractor's programme shall conform to the total time period and completion of the work specified in Clause-41 hereof. The Contractor shall thereafter revise the programme on monthly basis (if required) and submit to the Engineer-in-Charge by first week of following month.

14.2 The detailed construction programme submitted by the Contractor for orderly completion of the Works, shall show planned sequence of operations and the dates for commencement and completion of all salient feature of the Works.

14.3 The programme shall cover activities on the Site and procurement and delivery activities.

14.4 The programme shall be orderly and realistic to meet this requirement and should include a chart of the principal quantities of Work forecast for monthly execution, and a schedule of payments expected to be made to the Contractor by the PHPA-I.

14.5 The Contractor shall promptly advise the Engineer-in-Charge of any occurrence requiring substantial revision of the programme, giving a detailed explanation of the cause of the revision, and shall furnish a revised programme within 15 days of such occurrence.

14.6 If at any time it should appear to the Engineer-in-Charge that the actual progress of the Works does not conform to the approved programme, the Contractor shall produce, at the request of the Engineer-in-Charge, a revised programme showing the modifications to the approved programme necessary to ensure completion of the Works within the time for completion as defined in Clause-41 hereof.

14.7 The submission to and approval by the Engineer-in-Charge or Engineer-in-Charge's Representative of such program or the furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the Contract.

14.8 The Contractor shall, whenever required by the Engineer-in-Charge or Engineer-in-Charge's Representative also provide in writing, for his information a general description of the arrangements such as deployment of modern and efficient machinery, skilled and unskilled labour and methods, which the Contractor proposes to adopt for the execution of Works.

14.9 The Contractor shall have to obtain prior approval of the Engineer-in-Charge for the sequence of construction which he proposes to adopt.

15 Contractor's Superintendence

15.1 The Contractor shall provide all necessary superintendence during execution of the work and as long thereafter as may be necessary for proper fulfilling of the obligations under the Contract.

15.2 The Contractor shall immediately after receiving letter of award, intimate in writing to the Engineer-in-Charge the name, qualification, experience, age, address and other particulars along with Certificates of the Site Engineer to be the In-Charge of the work.

15.3 The Engineer-in-Charge shall within 15 days of receipt of such communication intimate in writing his approval or otherwise of Site Engineer of the Contractor.

15.4 Any such approval may at any time be withdrawn and in case of such withdrawal the Contractor shall appoint another such Site Engineer according to the provisions of this Clause. Decision of the EIC shall be final and binding on the Contractor in this respect.

15.5 Such Site Engineer shall be appointed by the Contractor soon after receipt of the approval from Engineer-in-Charge and shall be available at site within 15 days of start of work.

15.6 The Site Engineer shall on receiving reasonable notice from the Engineer-in-Charge present himself to the Engineer-in-Charge and/or at the site of work, as required, to take instructions. Instructions given to the Site Engineer shall be deemed to have the same force as if these have been given to the Contractor. The Site Engineer representative and/or the Contractor or his responsible authorized agent shall be available at site as well as during recording of measurement of works and whenever so required by the Engineer-in-Charge by a notice as aforesaid and shall also note down instructions conveyed by the Engineer-in-Charge or his designated representative in the site order book and shall affix his signature in token of noting down the instructions and in token of acceptance of measurement.

15.7 If the Engineer-in-Charge, is convinced that no such Site Engineer or agent is effectively appointed or is effectively attending or fulfilling the provision of this Clause, then the decision of the Engineer-in-Charge as recorded in the site order book and measurement recorded in Measurement Books shall be final and binding on the Contractor.

15.8 In case the Site Engineer of the Contractor does not discharge his duties satisfactorily, the Engineer-in-Charge shall have full powers to suspend the work and Contractor shall be held responsible for the delay so caused to the work.

16 Contractor's Employees

16.1 The Contractor shall provide its employees on the Site in connection with the execution and maintenance of the Works:

16.1.1 only such technical assistants as are skilled and experienced in their respective trades and such sub-agents competent to give proper supervision to the work they are required to supervise, and

16.1.2 such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution and maintenance of the Works.

16.1.3 experienced Safety Officer to maintain and supervise safety requirements at the site of Works. Safety standards shall be followed as provided in these documents.

16.2 The Engineer-in-Charge shall be at liberty to object to and require the Contractor to remove forthwith from the Works any person employed by the Contractor in or about the execution or maintenance of the Works who, in the opinion of the Engineer-in-Charge, misconducts himself, or is incompetent or negligent in the proper performance of his duties, or whose employment is otherwise considered by the Engineer-in-Charge to be undesirable and such persons shall not be again employed upon the Works without the written permission of the Engineer-in-Charge. Any person so removed from the Works shall be replaced as soon as possible by a competent substitute approved by the Engineer-in-Charge.

17 Setting out

17.1 The Contractor shall be responsible for true and proper setting out of the works in relation to original points, lines and levels of reference given by the Engineer-in-Charge in writing.

17.2 The Contractor shall ensure the correctness thereof and shall carefully protect and preserve all bench marks, pegs and other things used in setting out the Works.

18 Watching and Lighting

18.1 The Contractor shall, in connection with the Works, provide and maintain at his own cost, all lights, guards, fencing and watching when and where necessary or required by the Engineer-in-Charge or the Engineer-in-Charge's Representative, or by any duly constituted authority, for the protection of the Works, or for the safety and convenience of the public or others.

18.2 The Contractor shall also be responsible for temporary roadways, footways, guards, fences, caution notices etc. as far as the same may be rendered necessary by reason of the Work for the pedestrians or other traffic and owners/occupiers of the adjacent property and of the public and shall remain responsible for any accidents that may occur on account of his failure to take proper and timely precautions.

19 Care of Works

19.1 The Contractor shall take full responsibility for the care of the Works from the date of Commencement of Works until the date of issue of the Completion Certificate for the whole of the Works.

19.2 In the event of any loss or damage to the Works or any part thereof, during the period for which the Contractor is responsible for the care thereof, from any cause whatsoever, other than the risks defined in Clauses 19.5 & 19.6 of this Clause, the Contractor, at his own cost, shall rectify such loss or damage so that the permanent works conform in every respect within provision of the Contract to the satisfaction of Engineer-in-charge. The Contractor shall also be liable for any loss or damage to the Works occasioned by him in the course of any operation carried out by him for the purpose of complying with his obligations under Clause-47.

19.3 In the event of any loss or damage to the Permanent Works which may occur or arise out of any of the Risks defined in Clause 19.5, the same shall be made good/rectified by the Contractor, if

and to the extent required by the Engineer-in-Charge, at the cost of the PHPA-I which sum shall be determined by the Engineer-in-Charge in accordance with Clause 48 and Clause 49.

19.4 In the event of any loss or damage which may occur or arise out of any of the risks defined in Clause 19.6, neither party to the Contract shall be liable to the other for any such loss or damage. However, in the event of any loss or damage to the Permanent Works arising as a consequence of the risk(s) defined in Clause 19.6 the same shall be made good/rectified by the Contractor at the cost of the PHPA-I which sum shall be determined by the Engineer-in-Charge under the provisions of the Contract.

19.5 *The PHPA-I's risks are as under:*

19.5.1 Loss or damage due to the use or occupation by the PHPA-I of any section or part of the Permanent Works except as may be provided for in the Contract.

19.5.2 loss or damage to the extent that it is due to the design of the Works other than any part of the design provided by the Contractor.

19.6 Force Majeure/Excepted risks are as under:

19.6.1 war, hostilities (whether war be declared or not), invasion, act of foreign enemies, act of public enemies.

19.6.2 riot, commotion, disorder, any epidemic/pandemic, strike or lockout by persons other than the Contractor's personnel.

19.6.3 Ionizing, radiations or contamination by radio activity from any nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly.

19.6.4 Pressure waves caused by aerial devices travelling at supersonic speeds.

19.6.5 any operation of the forces of nature against which an experienced Contractor could not reasonably have been expected to take precautions.

20 Insurance of Plant & Equipment

The Contractor shall take insurance cover to the replacement value for the Constructional Plant, equipment and other things brought to the site by him or acquired by him against the advance payment released by PHPA-I for such Constructional Plant, equipment and other things naming PHPA-I as the beneficiary.

21 Damage to Persons and Property

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the PHPA-I against all losses and claims in respect of injuries or damage to any persons or material or physical damage to any property whatsoever which may arise out of or in consequence of the execution and maintenance of the Works and against all claims, proceedings, damages, costs, charges and expenses whatsoever in respect of or in relation thereto except any compensation

or damages for or with respect to injuries or damage to persons or property resulting from any act or neglect of the PHPA-I, his agent, Employees or other Contractors, not being employed by the Contractor, or for or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or where the injury or damage was contributed to by the Contractor, his Employees or agents, such part of the compensation as may be just and equitable having regard to the extent of the responsibility of the PHPA-I, its Employees or agents or other Contractors for the damage or injury.

22 Third Party Insurance

22.1 Before commencing the execution of the Works, the Contractor, but without limiting his obligations and responsibilities under Clause-21 hereof, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property, including that of the PHPA-I, or to any person, including any employee of the PHPA-I, by or arising out of the execution of the Works or in the carrying out of the Contract, otherwise, than due to the matters referred to in the provision to Clause- 21 hereof.

23 Accidents or Injury to Workmen

23.1 The PHPA-I shall not be liable for or in respect of any damages or compensation payable according to law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub -Contractor, save and except an accident or injury resulting from any act or default of the PHPA-I, its agents or Employees. The Contractor shall indemnify and keep indemnified the PHPA-I against all such damages and compensation, save and except as aforesaid, and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

23.2 On the occurrence of accident arising out of the Works which result in death, or which is so serious as to be likely to result in death, the Contractor shall, within 24 hours of such accident, report in writing to the Engineer-in-Charge and other statutory bodies of the Government the facts stating clearly and in sufficient details the circumstances of such accident and the subsequent action. All other accidents on the Works involving injuries to persons or damage to property other than that of the Contractor shall be promptly reported to the Engineer-in-Charge and other statutory bodies of the Government stating clearly and in sufficient details of the facts and circumstances of the accidents and the action taken. In all cases, the Contractor shall indemnify the PHPA-I against all loss or damage resulting directly or indirectly from the Contractor's failure to report in the manner aforesaid. This includes penalties or fines, if any, payable by the PHPA-I as a consequence of failure to give notice or failure to conform to the provisions of any Act in regard to such accidents.

23.3 Insurance against Accident, etc. to Workmen

The Contractor shall insure against such liability with an insurer approved by the PHPA-I, which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any persons are employed by him on the Works and shall, when required, produce to the Engineer-in-Charge or the Engineer-in-Charge's Representative such policy of

insurance and the receipt for payment of the current premium. Provided always that, in respect of any persons employed by any sub-Contractor, the Contractor's obligation to insure as aforesaid under this sub-Clause shall be satisfied if the sub-Contractor shall have insured against the liability in respect of such persons in such manner that the PHPA-I is indemnified under the policy, but the Contractor shall require such sub-Contractor to produce to the Engineer-in-Charge or the Engineer-in-Charge's Representative, when required, such policy of insurance and the receipt for the payment of the current premium.

24 Giving of Notices, Payment of Fees and Compliance with Statutes and Regulations etc.

24.1 Giving of Notices and Payment of Fees

The Contractor shall give all notices and pay all fees required to be given or paid by any Statute, Ordinance, or other Law, or any regulation, or by-law of any local or other duly constituted authority in relation to the execution of Works and by the rules and regulations of all public bodies and companies whose property or rights are affected or may be affected in any way by the Works.

24.2 Compliance with Statutes, Regulations etc.

The Contractor shall conform in all respects with the provisions of any such Statute, Ordinance or Law as aforesaid and the regulations or by-laws of any local or other duly constituted authority which may be applicable to the Works and with such rules and regulations of public bodies and companies as aforesaid and shall keep the PHPA-I indemnified against all penalties and liability of every kind for breach of any such Statute, Ordinance or Law, regulation or by-law.

24.3 The Contractor shall be fully responsible for compliance to any notices, payment of any fees etc. of under this Clause.

25 Fossils etc.

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site of the Works shall, as between the PHPA-I and the Contractor, be deemed to be the absolute property of the PHPA-I/RGoB. The Contractor should protect such findings from any damage/theft & notify immediately to the Engineer-in-Charge &/or his authorized representative.

26 Compliance with Tax laws

26.1 The Royal Government of Bhutan shall exempt taxes, levies/duties for plant, construction materials & equipment, machineries and services imported for direct use in the construction of the Project. Any procurement made under tax exemption basis shall be liable for tax payment as per the Tax Act of the Kingdom of Bhutan if disposed off in Bhutan.

26.2 Any Contractor, sub-Contractor or consultants recruited in connection with the Project will be liable for tax in Bhutan as per the Income Tax Act of the Kingdom of Bhutan, 2001. Further, such

recruiting agency shall be responsible for deducting and remitting Tax Deducted at Source (TDS) as per the provision of the said Income Tax Act.

26.3 With effect from 1st July 2017, all exports (including ones to Bhutan) are 'zero rated items' under the GST regime in the GoI. Therefore, no reimbursement or costs on account of any tax implications will be admissible. However, in the situation, if the categorization is changed for exports from 'zero rated' to any other slab, the same will be applicable.

26.4 The Royal Government of Bhutan shall receive royalty from the Contractor for the timber, boulders, aggregates and other construction materials required from Bhutan for the work.

26.5 The Contractor shall obtain necessary permits and deposit royalty with local authorities for supply of such materials required for the work.

27 Interference with Traffic and Adjoining Properties

All operations necessary for the execution of the Works shall, in so far as compliance with the requirements of the Contract permits, be carried on so as not to interfere unnecessarily or improperly with the convenience of the public, or the access to, use and occupation of public or private roads and footpaths to or of properties whether in the possession of the PHPA-I or of any other person. The Contractor shall save harmless and indemnify the PHPA-I in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters in-so-far as the Contractor is responsible there for.

28 Extraordinary Traffic

28.1 Protection of Highways and Bridges

The Contractor shall use every reasonable means to prevent any of the highways or bridges communicating with or on the routes to the Site from being damaged or injured by any traffic of the Contractor or any of his sub-Contractors and, in particular, shall select routes, choose and use vehicles and restrict and distribute loads so that any increase in traffic frequency as will inevitably arise from the moving of plant and material from and to the Site, shall be limited, as far as reasonably possible to arise any unnecessary traffic congestion damage or injury which may be occasioned to such highways & bridges.

28.2 Settlement of Extraordinary Traffic Claims

If during the execution of the Works or at any time thereafter, the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges, he shall immediately report the same to the Engineer-in-Charge and thereafter the PHPA-I shall negotiate the settlement of and pay all sums due in respect of such claim and shall indemnify the Contractor in respect thereof and in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto. Provided always that if and so far as any such claims or part thereof shall, in the opinion of the Engineer-in-Charge, be due to any failure on the part of the Contractor to observe and perform his obligations under Clause 28.1, then the

amount certified by the Engineer-in-Charge to be due to such failure shall be paid by the Contractor to the PHPA-I.

29 Opportunities for other Contractors

The Contractor shall, in accordance with the requirements of the Engineer-in-Charge, afford all reasonable opportunities for carrying out their works to any other Contractors employed by the PHPA-I and their workmen and to the workmen of the PHPA-I and of any other duly constituted authorities who may be employed in the execution on or near the Site of any work not included in the Contract or of any Contract which the PHPA-I may enter into in connection with or ancillary to the Works.

30 Upkeep of Site

30.1 During the progress of the Works, the Contractor shall keep the site reasonably free from all unnecessary obstructions and shall store or dispose of any Constructional plant and surplus materials and clear away and remove from the site any wreckage, rubbish or Temporary Works no longer required.

30.2 In case the Contractor does not keep the area clean and if found necessary to get the area cleaned, the Engineer-in-Charge shall issue a notice of 48 hours, and in the event of non-compliance by the Contractor, get the area cleaned by some other agency at the cost of the Contractor. In case of rubbish accumulating due to deposition by more than one Contractor, the share of charges to be borne by the Contractors as indicated by the Engineer-in-Charge.

31 Clearance of Site on Completion

On the completion of the Works, the Contractor shall clear away and remove from the Site all Constructional Plant, surplus materials, rubbish and Temporary Works of every kind, and leave the whole of the site and Works clean and in a workman like condition to the satisfaction of the Engineer-in-Charge.

LABOUR

32 Labour

32.1 Engagement of Labour

The Contractor shall make his own arrangements for the engagement of all labour, local or otherwise, and save in-so-far as the Contract otherwise provides, for the transport housing, feeding and payment thereof. The Contractor shall not employ in connection with the Works any person who has not completed 18 years of age. No female labour shall be employed in night shifts. The Contractor shall have to arrange permits for the labour/staff for their entry into Bhutan, at his own cost. The Contractor shall recruit local manpower (skilled and unskilled) and use local resources to the extent possible.

32.2 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site, to the satisfaction of the Engineer-in-Charge or his Representative, an adequate supply of drinking and other water for the use of the Contractor's staff and workmen.

32.3 Alcoholic Liquor & Drugs

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

32.4 Disorderly Conduct, etc.

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

32.5 Contractor to Follow Labour Laws and Chathrim

The Contractor shall, in respect of labour employed by him, comply with the provision of the various labour laws, Minimum Wages as per Chathrim issued by Ministry of Home & Culture Affairs, RGoB and shall indemnify the PHPA-I in respect of all claims that may be made against the PHPA-I for non-compliance thereof by the Contractor.

Notwithstanding anything contained herein, the Engineer-in-Charge may take such actions as may be necessary for compliance of the various labour laws and recover the costs thereof from the Contractor.

32.6 Observance by Sub-Contractors

The Contractor shall be responsible for observance by his Sub-Contractors of the foregoing provisions.

33 Returns of Labour etc.

The Contractor shall, deliver to the Engineer-in-Charge or his Representative, a return in detail in such form and at such intervals as the Engineer-in-Charge may prescribe showing the supervisory staff and the number of the several classes of labour from time to time employed by the Contractor on the site.

MATERIALS AND WORKMANSHIP

34 Materials and Workmanship

34.1 Materials and Workmanship

34.1.1 The Contractor shall be responsible for arranging all the materials required for the construction of the Works from the source(s) acceptable to the PHPA-I. He shall also be

responsible for proper transportation and storage of these materials to the satisfaction of the Engineer-in-Charge and shall bear all related costs.

34.1.2 The Engineer-in-Charge shall be entitled at any reasonable time, to inspect or examine all such materials. The Contractor shall provide reasonable assistance for such inspection or examination as may be required.

34.1.3 The Contractor shall initiate timely action to procure the materials well in advance so as to ensure that the progress of Works does not suffer for want of the materials on the site at least 30 days before these are intended to be used on Works. Any setback to the progress of the Works and consequent delay in completion of the Works on account of non-availability of materials on Site shall be the sole responsibility of the Contractor.

34.1.4 Any assistance that the Engineer-in-Charge can give to the Contractor for arranging the materials shall be provided on a "no responsibility basis".

34.2 Quality of materials, Workmanship and Tests

34.2.1 The Contractor shall, provide the materials of the quality, kind and specifications as provided in the Contract. The Contractor shall produce to the Engineer-in-Charge, certified quality test reports in respect of the materials procured by him.

34.2.2 In case the materials procured by the Contractor are not to the satisfaction of the Engineer-in-Charge and do not conform to the specifications laid in the Contract, such materials shall be rejected by the Engineer-in-Charge and the cost incurred on such procurement shall be responsibility of the Contractor.

34.2.3 The workmanship shall be of the kind described in the Contract and in accordance with the Engineer-in-Charge's instructions.

34.2.4 All the materials and the workmanship shall be subjected, from time to time, to such tests as the Engineer-in-Charge may require. The Contractor shall provide such assistance, instruments, machines, labour and materials as are required for examining, measuring and testing any material and shall supply samples of materials, before incorporation in the Works, for testing, as may be selected and required by the Engineer-in-Charge.

34.3 Cost of Samples

All samples shall be supplied by the Contractor at his own cost.

34.4 Cost of Tests

Cost for any test intended by or provided for in the Contract shall be borne by the Contractor.

35 Inspections of Operations

The Engineer-in-Charge or any person authorized by him shall, at all times, have access to the Works and to all places where the materials, manufactured articles or machinery are being obtained for the Works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

36 Examination of Work Before covering up

36.1 No Work shall be covered up or put out of view without the approval of the Engineer-in- Charge or his Representative and the Contractor shall afford full opportunity for the Engineer-in-Charge or the Engineer-in-Charge's Representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereof. The Contractor shall give due notice whenever any such work or foundations is or are ready or about to be ready for examination and the Engineer-in-Charge or the Engineer-in-Charge's Representative shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

36.2 Uncovering and making Openings

The Contractor shall uncover any part or parts of the Works or make openings in or through the same as the Engineer-in-Charge or Engineer-in-Charge's Representative may, from time to time, direct and shall reinstate and make good such part or parts to the satisfaction of the Engineer-in-Charge and all such costs shall be borne by the Contractor.

37 Removals of Improper Work and Materials

37.1 The Engineer-in-Charge shall have power to issue instructions from time to time for:

37.1.1 the removal from the Site, within such time as may be specified in the instructions, of any materials which, in the opinion of the Engineer-in-Charge, are not in accordance with the Contract,

37.1.2 the substitution of proper and suitable materials, and

37.1.3 the removal and proper re-execution, notwithstanding any previous test thereof or interim payment therefor, of any work which in respect of materials or workmanship is not, in the opinion of the Engineer-in-Charge, in accordance with the Contract.

37.2 Default of Contractor in Compliance

In case of default on the part of the Contractor in carrying out such instruction, as specified in Clause 37.1, the Engineer-in-Charge shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Engineer-in-Charge or may be deducted from any money due or which may become due to the Contractor.

38 Suspension of Work

38.1 The Contractor shall on the order/instructions of the Engineer-in-Charge suspend the progress of the Works or any part thereof for such time or times and in such manner as the Engineer-in-Charge may consider necessary and the Contractor shall during such suspension properly protect and secure the Works as is necessary in the opinion of the Engineer-in-Charge. If such suspension is:

38.1.1 provided for in the Contract, or

38.1.2 necessary for the proper execution of the Works or by reason of weather conditions or on account of any default on the part of the Contractor, or

38.1.3 necessary for the safety of the Works or any part thereof,

then, the Contractor shall not be entitled to payment of extra costs (if any) incurred by him during the period of suspension of the Works. Provided however that in the event of any suspension being ordered by the Engineer-in-Charge for reasons other than aforementioned and if each such period of suspension exceeds a continuous period of 14 days, the Contractor shall be entitled to such extension of Time for Completion of the Works as the Engineer-in-Charge may deem proper having regard to the period or periods of such suspensions and shall also be entitled to such compensation as the Engineer-in-Charge may consider to be reasonable cost incurred by the Contractor during the periods of such suspension.

38.2 If the progress of Works or any part thereof is suspended on the order of the Engineer-in-Charge for a continuous period of not less than 90 days at a time for reasons other than those referred to in sub-Clause 38.1.1, 38.1.2 or 38.1.3 of Clause 38.1 above, the Contractor may serve a written notice to the Engineer-in-Charge requiring permission within 15 days from the receipt thereof to proceed with the Works or that part thereof in regard to which progress is suspended and if such permission is not granted within the said 15 days period, the Contractor may by a further written notice served on the PHPA-I elect to treat the suspension where it affects part only of the Works as an omission of such part and where it affects the whole of the Works as an abandonment of the Contract by the Employer.

COMMENCEMENT AND DELAYS

39 Commencements of Works

The Contractor shall commence the Works on Site within a period of ***30 days*** from the date of issue of the Letter of Award.

40 Possession of Site

40.1 Save in so far as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time, the Engineer-in-Charge in turn will issue written order to commence the Works, give to the Contractor possession of so much of the Site

as may be required to enable the Contractor to commence and proceed with the execution of the Works in accordance with the programme referred to in Clause-14 hereof.

The Contractor shall not be allowed, without any prior consent of the Engineer-in-Charge, to occupy other Government and/or PHPA-I land for temporary use.

40.2 ***Rights of Way and Facilities***

The Contractor shall bear all costs and charges for special or temporary rights of way required by him in connection with access to the Site. The Contractor shall also provide, at his own cost, any additional facilities outside the Site required by him for the purpose of the Works.

40.3 The Contractor shall not be entitled for any additional payment against any delay of handing over of site up to the extent of 30 days from the date of issuance of Letter of Award.

41 Time for Completion

41.1 The period of completion of the whole of the Work shall be specified in SCC or such extended time as may be allowed under Clause-42 hereof. The period of completion shall be reckoned from 30 days of issue of the Letter of Award to the Contractor by the PHPA-I. The programme submitted by the Contractor in accordance with Clause-14 should match with the total time of completion as specified in this Clause.

41.2 The time for completion of the works shall be extended in the event of any deviations resulting in additional cost over the Contract Price. If requested by the Contractor, same shall be worked out in proportion to additional cost of the altered, additional or substituted work against original Contract Price.

42 Extension of Time for Completion

42.1 Should the amount of extra or additional work of any kind or any cause of delay referred to in these Conditions, or exceptional adverse climatic conditions which results in stoppage of work and such stoppage of work is duly recorded in the hindrance register maintained by Contractor and verified by PHPA-I. The Contractor shall, within 28 days of such circumstances, or as soon thereafter as is practicable, submit to the Engineer-in-Charge, full and detailed particulars of any extension of time to which he may consider himself entitled to. The Engineer-in-Charge shall determine the period of such hindrance and accordingly notify the Contractor for time extension. The Contractor shall not be entitled to any payment for the time related costs incurred by him, if any, except those provided under the Contract, during the extended period for completion of Works.

42.2 The Contractor shall maintain record of hindrances in the ***Hindrance Register*** (Form No-11) which shall be endorsed by the Engineer-in-Charge or Engineer-in-Charge's representative on monthly basis. Only such hindrances approved by Engineer-in-Charge will be taken into consideration for granting of any time extension.

42.3 ***Site Order Book*** shall be maintained at site systemically and securely by the Engineer-in-Charge or Engineer-in-Charge's Representative.

43 Shift Works

43.1 To achieve the required progress, the Work may be carried out round the clock. The period of completion and number of working days shall not be affected by the number of shifts. No extra amount on account of any shift work is payable to the Contractor.

44 Rate of Progress

44.1 To ensure proper progress during the execution of the Works, the Contractor shall complete 1/8th of the Works before 1/4th of the whole time allowed in the Contract has elapsed, 3/8th of the Works before one half of such time has elapsed and 3/4th of Works before 3/4th of such time has elapsed.

44.2 If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the Works of any section at any time is not commensurate with the rate of progress stipulated in this Clause and in the opinion of the Engineer-in-Charge does not ensure completion by the prescribed time or extended time for completion, the Engineer-in-Charge shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer-in-Charge may approve to expedite progress so as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps.

45 Liquidated Damages for Delay

45.1 If the Contractor fails to achieve completion of the Works within the time prescribed by Clause-41 hereof, then the Contractor shall pay to the PHPA-I, the sum stated in SCC as liquidated damages. The PHPA-I may without prejudice to any other method of recovery, deduct the amount of such damages from any money in its hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the Contractor from his obligation to complete the Works, or from any other of his obligations and liabilities under the Contract.

45.2 The Liquidated Damages penalty will be charged for all delays due to the fault of the Contractor at **1.0 % per week** subject to maximum of 10% of the **Executed Price**.

45.3 In the event of termination of the Contract in accordance to Clause-60 of GCC, referred hereof, PHPA-I shall be entitled to recover Liquidated Damages up to 10% of the Contract price. The Performance Security shall be adjusted towards Liquidated Damages. The balance work (if any) under the Contract shall be executed in any other manner by PHPA-I by recovering the value equivalent to ***20% of balance works up to a maximum of 10% of the Contract Price*** from Contractor.

46 Certification of Completion of Works

When the whole of the Works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the EIC, the Contractor may give a notice to that effect to the Engineer-in-Charge or to the Engineer-in-Charge's representatives accompanied by an undertaking to finish any outstanding work within a mutually agreed period. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer-in-Charge to issue a Certificate of Completion in respect of the Works. The Engineer-in-Charge shall, within 21 days of the date of delivery of such notice either issue to the Contractor, a Certificate of Completion stating the date on which, in his opinion, the Works are substantially completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the Works which, in the Engineer-in-Charge's opinion, are required to be done by the Contractor before the issue of such Certificate. The Engineer-in-Charge shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the Works specified therein. The Contractor shall be entitled to receive such Certificate of Completion within 21 days of completion to the satisfaction of the Engineer-in-Charge.

MAINTENANCE AND DEFECTS

47 Maintenance and Defects

47.1 Defects Liability Period

In these Conditions, the expression "Defects Liability Period" shall be as specified in SCC, calculated from the date of completion of the Works, certified by the Engineer-in-Charge in accordance with Clause -46 hereof.

47.2 Execution of Work of Repair, etc.

To the intent that the Works shall, at or as soon as practicable after the expiration of the Defects Liability Period be delivered to the PHPA-I in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer-in-Charge, the Contractor shall complete the work, if any, outstanding on the date of completion, as certified under Clause-46 hereof, as soon as practicable after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer-in-Charge during the Defects Liability Period or within 14 days after its expiration, as a result of an inspection made by or on behalf of the Engineer-in-Charge prior to its expiration.

47.3 Cost of Execution of Works of Repair, etc.

All repair works shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer-in-Charge, be due to the use of materials or workmanship not in accordance with the Contract, or due to neglect or failure on the part of the Contractor to comply with any obligation, expressed or implied, on the Contractor's part under the

Contract. If, in the opinion of the Engineer-in-Charge such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

47.4 Remedy on Contractor's Failure to carry out Work Required

If the Contractor fail to do any such work as aforesaid required by the Engineer-in-Charge, the PHPA-I shall be entitled to employ and pay other persons to carry out the same and if such work is the work which in the opinion of the Engineer-in-Charge, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent there on or incidental thereto shall be recoverable from the Contractor by the Engineer-in-Charge from any money due or which may become due to the Contractor.

ALTERNATIONS, ADDITIONS, OMISSIONS AND EXTRA ITEMS

48 Variations

48.1 The Engineer-in-Charge shall make any variation in the form, quality or quantity of the Works or any part thereof or substitution for original specifications, design, drawings and instructions that may, in his opinion be necessary and for that purpose, or if for any other reason it shall, in his opinion be appropriate, he shall have power to order the Contractor to do and the Contractor shall do any or all of the following:

48.1.1 increase or decrease the quantity of any work included in the Contract;

48.1.2 omit or substitute any such work;

48.1.3 change the character or quality or kind of any such work;

48.1.4 change the levels, lines, positions and dimensions of any part of the work;

48.1.5 execute, additional work of any kind necessary for the completion of the works, and

48.1.6 change any specified sequence, or timing of construction of any part of the work.

No such variations shall in any way vitiate or invalidate the Contract, but the effect if any, of all such variations shall be valued in accordance with Clause-49 hereof.

Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of Contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor. Any altered, additional and substituted work which the Contractor may be directed to do in the manner above specified as part of the Works, shall be carried out by the Contractor on the same conditions in all respects on which he agreed to do the main Works.

49 Determination of Price Variation

49.1 Upon certified completion of the whole Works, if reduction or increase in the total value of the work is found to be within 20% of initial Contract Price, then there shall be no change in the

Contract rates for individual items of work specified in the bill of quantities irrespective of the quantum of variation in individual items.

49.2 However, if reduction or increase is found to be more than 20% of initial Contract price, the increase in payment for minus variation or decrease in payment for plus variation shall be specified based on slabs of variation in the Contract value as specified below:

Variation in Value of Works	**Increase in Payment for minus variation**	**Decrease in Payment for plus variation**
Up to 20%	Nil	Nil
Above 20% and up to 35 %	6.00%	3.00%
Above 35% and up to 60%	8.00%	4.00%
Above 60 % and up to 100%	10.00%	5.00%
Above 100%	-	5.00%

While working out the value of Works for the purpose of variation, the extra items for which new rates have been paid and payment towards price adjustment; and the adjustment towards statutory variations shall not be considered.

While working out the value of Works for the purpose of variation, the extra items for which new rates have been paid and payment towards price adjustment; and the adjustment towards statutory variations shall not be considered.

Illustration

a) In case of variation in value of Works by (plus) + 60 percent, the payment for (60-20) percent i.e., 40 percent of Contract value of Works shall be decreased by 4 % (four percent.). The reduction in Contract rates shall commence as soon as the value of Works executed reaches 120% of Contract Price.

b) In case of variation in value of Works by (minus) – 55 percent, the payment for (55-20) percent i.e., 35 percent of Contract value of Works shall be increased by 8% (eight percent).

49.3 No variation limit for any individual BOQ item has been specified in these GCC except for the payment due to the Contractor as detailed above. No claim for revision of rate(s) for any individual BOQ item shall be admissible irrespective of the extent to which the ordered quantity may get revised (+) or (-) during the actual execution of the Works.

49.4 Within 14 days of the date of instruction for executing varied Works and before the commencement of such Works, notice shall be given either:

a) by the Contractor to the Employer of his intention to claim extra payment or a varied rate or price, or

b) by the Engineer-in-Charge to the Contractor of the intention to vary a rate or price.

49.5 The Contractor within 14 days from the receipt of an order to execute any extra item shall submit rate analysis to the Engineer-in-Charge supported by documentary evidence of basic rates adopted therein; having regard to the cost of materials, actual wages of labour, and other operational costs. The analysis so provided by the Contractor shall form the basis for determination of rates for such extra items. Extra items of work/supply which are not provided in the Bill of Quantities shall be paid on the basis of Bhutan Schedule of Rates (BSR) after adjusting such rates for the place of Works and cost index prevailing at the time of award. If rates for such extra items are not available in BSR, the rates for such items shall be determined based on the actual expenditure relating to that item including cost of materials, fabrication/machinery handling and erection at Site plus twenty percent (20%) towards overheads including profits. The price of varied items determined by the Engineer-in-Charge shall be final and binding on the Contractor. No payment shall be made for the items of Works ordered to be omitted.

49.6 If there is delay in the agreement between Employer and the Contractor on the rate of varied Works, provisional rates @ 75% of the rates as determined by the Engineer-in-Charge shall be payable as a provisional payment till such time as the rates are finalized.

49.7 Under no circumstances, the Contractor shall at any stage suspend work on account of non-settlement of rates of such item(s).

PLANT, TEMPORARY WORKS AND MATERIALS

50 Plants, Temporary Works and Materials

50.1 Contractor to Provide Plant

The Contractor shall provide at his own expense all Constructional Plant, Temporary Work and materials including Equipment, Materials and Camps required for the execution of the Works. He shall furnish along with the bid a list of items of all Constructional Plant and machinery which he shall be deploying on the particular job. He shall also make necessary arrangements for supplementing them at his own expense, if required to do so by the Engineer-in-Charge at the time of award of the Contract, or later on as the Work progresses.

50.2 Plant etc., Exclusive Use for the Works.

All Constructional Plant, Temporary Works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Work and the Contractor shall not remove the same or any part thereof, except for the purpose of moving it from one part of the Site to another, without the consent, in writing of the Engineer-in-Charge.

50.3 Removal of Plant etc.

Upon completion of the Works, the Contractor shall remove from the Site all the said Constructional Plant and Temporary works remaining thereon and any unused materials provided by the Contractor after obtaining written permission from the Engineer-in-Charge.

50.4 ***PHPA-I not Liable for Damage to Plant etc.***

PHPA-I shall not at any time be liable for the loss of or damage to any of the said Constructional Plant, Temporary Works or materials save as mentioned in Clause-19 and Clause-61 hereof.

51 Approval of Materials etc. not implied

The operation of Clause-50 hereof shall not be deemed to imply any approval by the Engineer-in-Charge of the materials or other matters referred to therein nor shall it prevent the rejection of any such materials at any time by the Engineer-in-Charge.

MEASUREMENT

52 Quantities

The quantities set out in the Bill of Quantities are the approximate estimated quantities of the Work, and they are not to be taken as the actual quantities of the Works to be executed by the Contractor in fulfillment of his obligations under the Contract.

53 Works to be measured

53.1 Engineer-in-Charge shall, except as otherwise provided, ascertain and determine the measurement value in accordance with the Contract of work done.

53.2 All measurement of all items having financial value shall be entered in Measurement Book and/or level in the field book so that a complete record is obtained of all works performed under the Contract.

53.3 All measurements and levels shall be taken jointly by the Engineer-in-Charge or his authorized representative and by the Contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer-in-Charge and the Contractor or his representative as token of his acceptance. If the Contractor objects to any of the measurement recorded, a note shall be made to that effect with reasons and signed by both the parities.

53.4 If for any reason, the Contractor or his authorized representative is not available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge shall not entertain any claim from Contractor for any loss or damages on this account. If the Contractor or his authorized representative does not remain present at the time of such measurements after the Contractor or his authorized representative has been given a notice in writing 3 days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-Charge or his representative shall be deemed to be accepted by the Contractor.

53.5 The Contractor shall, without extra charge, provide all appliances, instruments, labour and other items necessary for survey, measurement and recording of levels etc.

53.6 In the case of items which are not covered by specifications, measurements issued by the Ministry of Works and Human Settlement, RGoB and if for any item no such standard is available, then a mutually agreed method shall be followed.

54 Method of Measurement

The Works shall be measured net, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. However, the guidelines given in relevant part of Specifications of Building & Road Works-2022 published by the erstwhile Ministry of Works and Human Settlement, RGoB, will prevail in case of any confusion that may arise during measurement.

55 Security Rules

The Work shall be a protected area. The Contractor, his employees and labourers shall have to follow the Security Rules as may be imposed from time to time by the Engineer-in-Charge or by the Royal Government of Bhutan. If the Contractor, his employees or labourers are found to be reluctant to follow the Rules, the Engineer-in-Charge will have the right to prohibit such persons from entering into the Work area. If required, the Engineer-in-Charge shall have the authority to take the help of local District Administration and or local police, if it is considered absolutely necessary.

56 Foreign Personnel

56.1 The Contractor shall submit to the PHPA-I, the details and bio-data of all personnel he proposes to bring into Bhutan for the performance of the Works under the Contract. Such data for each person shall, besides the proof of his citizenship (either passport or voter identity card only will be acceptable), contain the name, his present address, his assignment and responsibility in connection with the Works, and a short resume of his qualifications, experience etc. in relation to the Works to be performed by him.

56.2 Any person unsuitable and unacceptable to the PHPA-I shall not be brought to Bhutan. Any person, if found unsuitable or unacceptable to the PHPA-I on a later date, shall within a reasonable time, be repatriated by the Contractor, who shall make alternative arrangements for providing a suitable replacement.

56.3 No person brought to Bhutan for the purposes of the Works shall be repatriated without the consent of the PHPA-I in writing, which shall be based on a written request from the Contractor for such repatriation giving reasons for such an action to the Engineer-in-Charge. The PHPA-I may give permission for such repatriation provided it is satisfied that the progress of Works shall not suffer due to such repatriation/replacement.

56.4 The Contractor and his expatriate personnel shall observe/respect all Bhutanese Acts, Laws, Rules and Regulations and shall not in any way interfere with Bhutanese political and religious affairs and shall meticulously follow any other Rules and Regulations which the RGoB, the PHPA-I and the Engineer-in-Charge may impose on them from time to time. The Contractor's expatriate personnel shall work and live-in close co-operation with their co-workers and the

community and shall not engage themselves in any other employment either part time nor shall they take part in any local politics.

56.5 PHPA-I will assist the Contractor, to the extent possible, in obtaining necessary permits to travel to Bhutan and back by issuing necessary Certificates and other information required by the RGoB and other agencies.

CERTIFICATE AND PAYMENT

57 Certificate and Payment

57.1 Interim Payment Certificate

The Contractor shall submit an application for interim payment, in duplicate to the Engineer-in-Charge at the end of each month in a Proforma approved by the Engineer-in-Charge. The application shall include the following items, as applicable, which shall be taken into account in the sequence listed.

57.1.1 the estimated Contract Price of the Permanent Works executed up to the end of the month in question, obtained by applying the base unit rates and prices in the Bill of Quantities to the quantities measured by the Engineer-in-Charge pursuant to Clause-53,

57.1.2 the estimated Contract value of the Permanent Works obtained as in 57.1.1, executed up to the end of the previous month.

57.1.3 the estimated Contract value at base unit rates and prices, of the Permanent Works for the month in question obtained by deducting 57.1.2 from 57.1.1.

57.1.4 an amount reflecting any changes pursuant to Clause-64 hereof.

57.1.5 any amount to be deducted on account of the repayment of Advances under the provisions set forth in Clause 57.2 and

57.1.6 any other sum to which the Contractor may be entitled under the Contract.

It may be noted that all interim payment would be treated as provisional payment.

Within 28 days of receipt of the said applications for interim payment, it shall be approved or amended such that, in the Engineer-in-Charge's opinion, the Certificate reflects the amount due to the Contractor in accordance with the Contract. In case of differences in opinion as to the value of any item, the Engineer-in-charge's view shall prevail. When the Engineer-in-Charge has determined the amount due to the Contractor, he shall issue to the Contractor a Certificate hereinafter called "Interim Payment Certificate" certifying the amount due to the Contractor, and

No Interim Payment Certificate shall be issued for a sum less than 1% of the Contract Price.

The Engineer In-Charge may make any correction or modification in any previous interim Payment Certificate which was issued by him. The Engineer In-Charge shall have authority to omit or reduce the value of such work in any Interim Payment Certificate if any work is not carried out to his satisfaction.

57.2 *Retention Money*

57.2.1 Deduction of Retention Money amounting to **10** % (ten percent) of the amount included in any monthly Interim Payment Certificate pursuant to Clause 57.1 due to the Contractor on account of Permanent Works executed shall be made by the Engineer-in-Charge.

57.2.2 The Retention Money shall be certified due for payment after the expiration of the **Defects Liability Period**, notwithstanding that at such time there may be outstanding claims by the Contractor against the PHPA-I. Provided always that, if at such time there shall remain to be executed by the Contractor any Works ordered during such period pursuant to Clause-47 hereof, the PHPA-I shall be entitled to withhold payment until the completion of such Works or so much of the Retention Money as shall, in the opinion of the Engineer-in-Charge represent the cost of the Works so remaining to be executed, and

57.2.3 On completion of the whole of the works, the Retention Money may be substituted by a Bank Guarantee issued by any Financial Institution in Bhutan/India acceptable to PHPA-I. The Bank Guarantee on the proforma of PHPA-I form shall be valid until the issue of the Defects Liability Certificate by PHPA-I.

57.2.4 Retention Money shall not be refunded till the contractor produces a NOC from all concerned including the labour officers. As soon as the work is virtually complete the Contractor shall apply for the clearance certificate to the Labour Officer under intimation to the Engineer-in-Charge. On receipt of the said communication, the Engineer-in-Charge shall write to the Labour Office to intimate if any complaint is pending against the Contractor in respect of the work. If no complaint is pending on record till after three months after completion of the work and/or no communication received from the Labour Officer to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the security deposit will be released if otherwise due.

57.3 *Advances*

Advances for execution of the Works, if required by the Contractor, will be granted in the following cases provided that the advances spent only for the Work under the Contract.

57.3.1 *Mobilization Advance*

i. Advance to the extent of **10%** of the Contract Price can be granted for mobilization of labour, stores and workshops including camps, labour sheds, and Construction Plant, etc. for preliminary and enabling Works. The Contractor is to use the advance payment only to pay for equipment, Plant, Materials and Mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that

advance has been used in this way by supplying copies of invoices or other documents to the project manager.

ii. The release of this advance shall be regulated and governed by the following conditions:

a. The advance shall be interest free.

b. The advance will be released, if request by the Contractor in writing within one month of the order to commence the work.

c. The advance will be disbursed on production of the irrevocable Bank Guarantee (on the Proforma in Forms) from any Financial Institution of Bhutan/India for an amount equal to the required advance payment and the BG shall be valid till the advance is fully recovered.

The advance is recoverable and the deduction of the advance shall be made on pro-rata percentage basis from the interim payments certified by the Engineer-in-Charge under the Contract. The deduction shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached 10% of the Contract Price until such time as the advance has been fully repaid, provided always that the entire amount of advance shall be completely deducted by the time the total of all payments to the Contractor has reached 80% of the Contract Price.

57.3.2 *Secured Advance*

The Contractor shall be entitled to Secured Advance during the execution of the work up to **75%** of the assessed value of any materials which in the opinion of the Engineer-in-Charge are non-perishable, non-fragile and non-combustible and are in accordance with the Contract and which have been brought to site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the Works. When materials on account of which an advance have been made under this sub-Clause are incorporated in the work, such advance shall be recovered/deducted from the next payment of the Contractor. Such Secured Advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Engineer-in-Charge and provided that the Contractor take comprehensive insurance cover for the full cost of such materials. The decision of the Engineer-in-Charge shall be final and binding on the Contractor in this matter. No Secured Advance, shall however, be paid on high-risk materials such as glass, petrol, diesel etc.

57.3.3 *Corrections*

Since all the interim payment Certificates are issued provisionally, the Engineer-in-Charge may, by any Interim Payment Certificate, make any correction or modification in any previous Certificate (other than one purporting to be Final Payment Certificate) which shall have been

issued by him and shall have power to modify or withhold any Interim Certificate if the Works or any part thereof, are not being carried out to his satisfaction.

57.4 *Final Account*

57.4.1 Not later than 2 months after the date of issue of the Certificate of Completion of Works in pursuance of Clause-46 hereof, the Contractor shall submit a draft statement of Final Account and supporting documentation to the Engineer-in-Charge showing in detail the value of the work done in accordance with Contract, together with all further sums which the Contractor considers to be due to him under the Contract up to the date of Defects Liability Certificate (Hereinafter called the "Contractor's Draft Final Account").

57.4.2 Within 4 months after receipt of the Contractor's Draft Final Account and of all information reasonably required for its verification, the Engineer-in-Charge shall determine the value of all matters to which the Contractor is entitled under the Contract. The Engineer-in-Charge shall then issue to the Contractor a statement (hereinafter called the "Engineer-in-Charge's Draft Final Account") showing the final amount to which the Contractor is entitled under the Contract. The Contractor shall sign the Engineer-in-Charge's Draft Final Account as an acknowledgement of the full and final value of the work performed under the Contract and shall promptly submit a signed copy (hereinafter called the "Final Account") to the Engineer-in-Charge within 30 days, failing which the Engineer-in-Charge shall consider it as accepted by the Contractor.

57.5 *Final Certificate*

On receipt of the Final Account, the Engineer-in-Charge shall promptly prepare and issue to the Contractor a Final Payment Certificate certifying any further money due to the Contractor in respect of the Contract. Payment to the Contractor of the amount due under Final Payment Certificate shall be made by the PHPA-I within 60 days of such Certificate being issued. In the event of non-payment/ failing to collect by Contractor within the said period, no interest shall accrue to the Contractor.

58 Approval only by Maintenance Certificate

No Certificate other than the Maintenance/Defects Liability Certificate referred to in Clause-59 hereof shall be deemed to constitute approval of the Works.

59 Maintenance Certificate

59.1 The Contract shall not be considered as completed until a Maintenance/Defects Liability Certificate shall have been signed by the Engineer-in-Charge stating that the Works in all respect have been completed and maintained to his satisfaction. This Certificate shall be issued by the Engineer-in-Charge within **28** days after the expiry of the Defects Liability Period or if different periods become applicable to different sections or parts of the Works, the expiry of the latest such period, or as soon thereafter as any work ordered during such period, pursuant to Clause-47 hereof, shall have been completed to the satisfaction of the Engineer-in-Charge and full effect

shall be given to this Clause, notwithstanding any previous entry on the Works or the taking possession, using thereof or any part thereof by the PHPA-I.

59.2 Cessation of PHPA-I's Liability

The PHPA-I shall not be liable to the Contractor for any matter or thing arising out of or in connection with Contract or execution of the Works unless the Contractor shall have made a claim in writing in respect thereof before the issuing the Maintenance/Defects Liability Certificate.

REMEDIES AND POWERS

60 Remedies and Powers

60.1 Default of Contractor

If the Contractor shall become bankrupt, or have a receiving order made against him, or shall present his petition in bankruptcy, or shall make an arrangement with or assignment in favors of his creditors, or shall agree to carry out the Contract under a committee of inspection of his creditors or, being a corporation, shall go into liquidation (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), or if the Contractor shall assign the Contract, without the consent in writing of the PHPA-I first obtained, or shall have an execution levied on his goods, or if the Engineer-in-Charge shall certify in writing that, in his opinion, the Contractor:

60.1.1 has abandoned the Contract, or

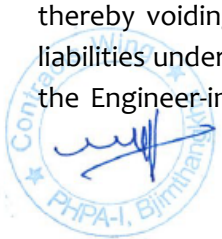
60.1.2 without reasonable excuse has failed to commence the Works or has suspended the progress of the Works for 28 days after receiving written notice from the Engineer-in-Charge to proceed, or

60.1.3 has failed to remove materials from the site or to pull down and replace work for 28 days after receiving from the Engineer-in-Charge's written notice that the said materials or work had been condemned and rejected by the Engineer-in-Charge under these conditions, or

60.1.4 despite previous warnings by the Engineer-in-Charge's in writing, is not executing the Works in accordance with the Contract, or is persistently or flagrantly neglecting to carry out his obligations under the Contract, or

60.1.5 has, to the detriment of good workmanship, or defiance of the Engineer-in-Charge's instruction to the contrary, sub-let any part of the Contract;

then the Engineer-in-Charge may, after giving 14 days' notice in writing to the Contractor, enter upon the Site and expel the Contractor, from the entire Works or part thereof, without thereby voiding the Contract, or releasing the Contractor from any of his obligations or liabilities under the Contract, or affecting the rights and powers conferred on the PHPA-I or the Engineer-in-Charge by the Contract, and may itself complete the entire Work or part



thereof as the case may be or may employ any other Contractor to complete the Works at the risk and cost of the Contractor in accordance with Clause 45.3.

60.1.6 PHPA-I or such other Contractor may use for such completion so much of the Constructional Plant, Temporary works and materials, which have been deemed to be reserved exclusively for the execution of the works, under the provisions of the Contract, as he or they may think proper, and the PHPA-I may, at any time, sell any of the said Constructional Plant, Temporary works and unused materials and apply the proceeds of sales in or towards the satisfaction of any sums due or which may become due to the Contractor under the Contract.

60.2 Valuation at Date of Forfeiture

The Engineer-in-Charge shall, as soon as may be practicable after any such entry and expulsion by the PHPA-I, fix and determine ex-party, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work actually done by him under the Contract and the value of any of the said unused or partially used materials, any Constructional Plant and any Temporary Works.

60.3 Payment after Forfeiture

60.3.1 If the PHPA-I shall enter and expel the Contractor under this Clause, it shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Defects Liability Period and thereafter until the costs of execution and maintenance, damages for delay in completion, if any, and all other expenses incurred by the PHPA-I have been ascertained and the amount thereof certified by the Engineer-in-Charge. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Engineer-in-Charge may certify would have been payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the PHPA-I the amount of such excess and it shall be deemed a debt due by the Contractor to the PHPA-I and shall be recoverable accordingly.

60.3.2 In the event of the above course being adopted by the Engineer-in-Charge, the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any Constructional Plant, material or entered into any agreements or made any advances on account or with a view to the execution of the Works or the performance of the Contract.

SPECIAL RISKS/TERMINATION

61 Special Risks/Termination of Contract

61.1 Special Risks

The special risks are war, hostilities (whether war be declared or not), invasion, act of foreign enemies, and all other risks described in Clause-19.6 hereof.

61.2 Termination of the Contract

If, during the currency of the Contract, any of the Special Risks mentioned hereinabove which, whether financially or otherwise, materially affects the execution of the Works, the Contractor shall unless and until the Contract is terminated under the provisions of this Clause continue to use his best endeavors to complete the execution of the Works. Provided always that the PHPA-I shall be entitled at any time after occurrence of such Special Risks to terminate the Contract by giving written notice to the Contractor and upon such notice being given, this Contract shall, except as to the right of the parties under this Clause and to the operation of Clause-69 hereof, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

61.3 Removal of Plant on Termination

If the Contract shall be terminated under the provisions of the last preceding sub-Clause, the Contractor shall, with all reasonable dispatch, remove from the Site all Constructional Plant and shall give similar facilities to his sub-Contractors to do so.

61.4 Payment if Contract is Terminated

If the Contract is terminated as aforesaid, the Engineer-in-Charge shall issue a Certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting & securing the Works less advance payments received in respect of Constructional Plant and materials and any other sums which at the date of termination were recoverable by the PHPA-I from the Contractor under the terms of the Contract. `

NOTICES

62 Notices

62.1 Service of Notices to Contractor

All Certificates, notices or written orders to be given by the Engineer-in-Charge to the Contractor under the terms of the Contract shall be served either through post or hand delivery to the Contractor's office on Site or his principal place of business, or such other address as the Contractor shall nominate for this purpose.

62.2 Service of Notice to PHPA-I or its Engineer-in-Charge

All notices to be given to the PHPA-I or to its Engineer-in-Charge under the terms of the Contract shall be served to the Engineer-in-Charge, PHPA-I, Bjimthangkha, Wangdue.

62.3 Change of Address

Either party may change these addresses through prior written notice.

DEFAULT OF PHPA-I

63 Default of PHPA-I

63.1 In the event of the PHPA-I failing to pay to the Contractor the amount due under any Certificate of the Engineer-in-Charge within 90 days after the same shall have become due under the terms of the Contract, subject to any deduction that the PHPA-I is entitled to make under the Contract, the Contractor shall be entitled to issue a notice to the Engineer-in-Charge stating that he shall be terminating his Works after 30 days from the issue of such notice, for the reasons stated therein. However, if within the said period of 30 days, the Engineer-in-Charge notifies the Contractor that the reasons stated in the notice of the Contractor are not valid or that the alleged event of default of the PHPA-I has been remedied or no longer exists, then the Contractor shall not be entitled to terminate the Contract.

63.2 If the Contractor becomes entitled to terminate the Contract in terms of Clause 63.1, after expiry of the notice of 30 days, he may, notwithstanding the provisions of Clause 50.2 hereof, remove from the Site all Constructional Plant brought by him.

63.3 In the event of such termination, the PHPA-I shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions in Clause-61 hereof.

CHANGES IN COSTS AND LEGISLATION

64 Increases or Decrease of Costs

64.1 If the prices of materials and/or wages of labour required for execution of the work increase/decrease, the Contractor's payment shall be adjusted for such variation as per provisions detailed below and the amount of the Contract shall accordingly be varied, subject to the condition that such variation in prices shall be available only for the work done during the stipulated period of the Contract as per Clause 41 including such period for which the Contract validity is extended under the provisions of Clause 42 of the Contract without any action under the Clause 45. Such variation in the prices of materials and labour, when due, shall be worked out based on the following provisions:

64.1.1 No price adjustment shall be allowed for the work within first 12 months of Contract. The base date for working out such variation for the Contract period exceeding 12 months shall be the last stipulated date of Bid submission including extension, if any.

64.1.2 The cost of work on which variation will be payable shall be reckoned as 80% of the cost of work as per the bills, running or final, excluding any work for which payment is made at prevailing market rates. From this amount the value of materials supplied under Clause 57.2 of this Contract and proposed to be recovered in the particular bill, shall be deducted before the amount of compensation for price variation is worked out. In the case of materials brought to site for which any secured advance is included in the bill, the full value of such

materials as assessed by the Engineer-in-Charge (and not the reduced amount for which secured advance has been paid) shall be added to the cost of work shown in the bill for operation of this Clause.

Similarly, when such materials are incorporated in the work and the Secured Advance is deducted from the bill, the full assessed value of the materials originally considered for operation of this Clause should be deducted from the cost of the work shown in the bill, running or final.

64.1.3 The compensation for escalation for material shall be worked out as per the formula given below:

Vm = 0.80 W x 0.75 x (MI-MIo)/ MIo

Where,

Vm: Variation in material cost i.e., increase or decrease in the amount in BTN to be paid or recovered.

W: Cost of work as indicated in Clause 64.1.2.

MI & MIo: Material Index (Index Number published by National Statistical Bureau) for the period under consideration and that valid on the last stipulated date of Bid submission including extension, if any (Clause 64.1.6).

64.1.4 The following principles shall be followed while working out the indices mentioned in Clause 64.1.2.

i. The compensation for price variation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the 3 calendar months of the said quarter. The first such payment shall be made after first 12 month of the Contract excluding the month in which the tender was accepted and thereafter at three months interval. At the time of completion of the work, the last period for payment might become less than 3 months, depending on the actual date of completion.

ii. The index (MI) relevant to any quarter/period for which such compensation is paid shall be the arithmetical average of the indices relevant to the 3-calendar month. If the period up to date of completion after the quarter covered by the last such installment of payment, is less than 3 months, the index MI shall be the average of the indices for the months falling within that period.

64.1.5 The compensation for escalation for labour shall be worked out as per the formula given below:

Vl = 0.80 W x (25/100) x (LI-LIo)/LIo

Where:

Vl: Variation in labour cost i.e., amount of increase or decrease in BTN to be paid or recovered.

W: Cost of work as indicated in Clause 64.1.2.

LIo: Minimum daily wage in BTN. of an unskilled adult male mazdoor, fixed by the Royal Govt. of Bhutan on the last stipulated date of Bid submission including extension, if any.

LI: Minimum wage in BTN of an unskilled adult male mazdoor, fixed by the Royal Govt. of Bhutan on the last date of the quarter previous to the one under consideration.

64.1.6 The following principles will be followed while working out the compensation as per Clause 64.1.4.

i. The price variation for labour also shall be paid at the same quarterly intervals as applicable to materials under this Clause. If such revision of minimum wages takes place during any such quarterly intervals, the compensation shall be applicable at revised rates only for work done in subsequent quarters.

ii. Irrespective of variation in minimum wages of any category of labour, for the purpose of this Clause, the variation in the rates for an unskilled adult male mazdoor alone shall form the basis for working out the compensation payable on the labour component.

iii. Subsequent Legislation

If, after the date 30 days prior to the latest date of submission of Bid for the Works, there occur in Bhutan changes to any Statute, Ordinance, Decree or other Law or any regulation or by-law of any local or other duly constituted authority, or the introduction of any such Statute, Ordinance, Decree, Law, Regulation or bye-law which causes additional or reduced amount to the Contractor, other than above Clause (64.1.3 & 64.1.5) in the execution of the Works, such additional or reduced amount shall be certified by the Engineer-in-Charge after examining the record provided by the Contractor and shall be paid by or credited to the PHPA-I. Notwithstanding the foregoing, such additional or reduced amount shall not be separately paid or credited if the same shall already have been taken into account in the indexing of any input to the price adjustment formulae in accordance with sub-Clause 64.1.3 & 64.1.5 of this Clause.

ADDITIONAL CLAUSES

65 Bribery and Collusion

65.1 The PHPA-I shall be entitled to terminate the Contract and recover from the Contractor the amount of any loss resulting from such termination if the Contractor shall have offered or given to any person any consideration of any kind as an inducement or reward for doing, forbearing to do, any action in relation to obtaining, or in the execution of the Contract or any other

Contract with the PHPA-I, or for showing favour to any person in relation to the Contract or any other Contract with the PHPA-I, or if any of the like acts shall have been done by any person employed by the Contractor or acting on his behalf (whether with or without the knowledge of the Contractor), or if the Contractor shall have come to any agreement with another Contractor or number of Contractors whereby an agreed quotation or estimate shall be offered as a bid to the PHPA-I by one or more Contractor(s).

65.2 ***In the event of such termination, the Contractor shall:***

65.2.1 proceed as provided in Clause-61.3 hereof;

65.2.2 be paid by the PHPA-I as provided in Clause-61.4 hereof, provided that any loss referred to in Clause-66.1 shall first be deducted.

66 Termination of Contract for PHPA-I's Convenience

66.1 The PHPA-I shall be entitled to terminate this Contract at any time for the PHPA-I's convenience after giving 60 days prior notice to the Contractor.

66.2 In the event of such termination, the Contractor shall:

66.2.1 Proceed as provided in the sub-Clause-61.3 hereof, and;

66.2.2 be paid by the PHPA-I as provided in sub-Clause-61.4 hereof.

67 Environment, Pollution and Noise

67.1 Subject to and without prejudice to any other provision of the Contract and the law of the land and its obligations as applicable, the Contractor shall take all reasonable precautions in connection with streams, watering, drains, water courses, underground water resources including percolating water and will prevent:

67.1.1 Silting

67.1.2 Erosion of the beds or banks

67.1.3 Pollution of the water so as to affect adversely the quality or appearances thereof or cause injury or death to animals and plants.

67.1.4 Any interference with the supply to or obstruction from such sources

67.1.5 Pollution of the water so as to affect adversely the quality thereof.

67.2 All works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify and keep the PHPA-I indemnified from & against any responsibility for damages or in carrying out the work and against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability. All RGoB environment protection laws will be duly implemented. The vegetation and land shall be protected from

damage during the course of execution except to the barest minimum essentially required not to cause or permit any one to cause any nuisance, disturbance or pollution or inconvenience to public, employer or neighborhood of site.

68 Occupational Health and Safety

The Contractor shall comply with the Labour and Employment Act of Bhutan-2007, Regulations on Occupational Health and Safety (OHS) and Welfare-2012 or any revisions thereof. Payment towards Personal Protective Equipment (PPE) and Common Protection Measures (CPMs) as listed in BSR-2022 for worker's OHS measures at construction sites shall be released upon certification by the Engineer-in-Charge.

68.1 Non- compliance

If during the performance of works under the Contract, the PHPA-I informs the Contractor that it is the opinion of the Engineer-in-Charge that the Contractor is:

68.1.1 Not conducting the work in compliance with the Contractor's Health and Safety Coordination Plan, relevant Safe Working Method Statements, relevant legislation or Health and Safety procedures provided by the RGoB from time to time, or

68.1.2 Conducting the work in such a way as to endanger the Health and Safety of Contractors employees or its Contractors' and sub-Contractors' employees, and the public.

68.1.3 Conducting the work in such a way as to risk property, plant, equipment or materials.

The Contractor shall remedy that breach of Health and safety promptly.

68.2 Consequences to its non-compliance

68.2.1 The Engineer-in-Charge shall reject the Contractor’s claim on worker’s Occupational Health and Safety measures.

68.2.2 The Engineer-in-Charge may direct the Contractor to suspend the work until such time as the Contractor satisfies the Engineer-in-Charge that the work will be resumed in conformity with applicable health and safety provisions.

68.2.3 During periods of suspension referred to above, the PHPA-I shall not be required to make any payment whatsoever to the Contractor.

68.2.4 If the Contractor fails to rectify any breach of health and safety for which the work has been suspended, or if the Contractors performance has involved recurring breaches of health and safety, the PHPA-I may as its option terminate the work forthwith, without further obligation to the Contractor. In this event, the PHPA-I's liability shall be limited to payment for the work performed and costs incurred by the Contractor up to the time of termination or an earlier suspension of works.

SETTLEMENT OF DISPUTES

69 Arbitration

69.1 Except where otherwise provided in the Contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the Contract, designs, drawings, specifications, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the cancellation, termination completion or abandonment thereof shall be dealt with as mentioned hereinafter.

69.2 If the Contractor considered any work demanded of him to be outside the requirements of the Contract, or disputes any drawings, record or decision given in writing by the Engineer-in-Charge on any matter in connection with or arising out of the Contract or carrying out of the work, to be unacceptable, he shall promptly within 15 days request the Engineer-in-Charge in writing for written instruction or decision. There upon, the Engineer-in-Charge shall give his written instructions or decision within a period of 1 month from the receipt of the Contractor's letter.

If the Engineer-in-Charge fails to give his instructions or decision in writing within the aforesaid period or if the Contractor is dissatisfied with the instructions or decision of the Engineer-in-charge, the Contractor may, within 15 days of the receipt of Engineer-in-charge's decision, appeal to the Director (Technical), PHPA-I, who shall afford an opportunity to the Contractor to be heard, if the latter so desires, and to offer evidence in support of his appeal. The Director (Technical), PHPA-I shall give his decision within 30 days of receipt of Contractor's appeal. If the Contractor is dissatisfied with his decision, the Contractor shall within a period of 30 days from receipt of his decision, give notice to Director (Technical), PHPA-I for resolution of disputes or differences through arbitration in accordance with the rules and procedure prescribed in the SCC, failing which the said decision shall be final, binding and conclusive and not referable to adjudication by the Contractor.

SECTION V

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF THE CONTRACT

The following Special Conditions of Contract (SCC) shall supplement and/or amend the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

Sl#	Clause Reference to GCC	Data
1	10 Performance Security	The Performance Security shall be **10%** of the Contract Price in the form of a Bank Guarantee (on the proforma form of PHPA-I) issued by any Financial Institution in Bhutan/India and valid until **30 days** after the date of issue of the **Completion Certificate**.
2	22.2.1 Minimum amount of third-party insurance	As permissible under the policy.
3	41 Time for Completion	The work shall be completed within **12 months**. The period of completion shall be reckoned from the 30th day of issue of the Letter of Award.
4	45.2 Liquidated Damage	1.0% per week of delays subject to a maximum of 10% of the ***Executed Price***.
5	47.1 Defects Liability Period	Defects Liability Period shall be for **12 months**.
6	64. Increase or decrease of cost	The prices shall remain firm during the performance of this contract.
7	69. Arbitration	Except where a decision has become final and conclusive, all disputes arising in connection with this Contract shall be referred to arbitration at the Bhutan Alternative Dispute Resolution Centre (BADRC). The parties shall follow the procedure as contained in the Alternatives Resolution Act of Bhutan 2013 and Alternative Dispute Resolution Rules & Regulations 2019.

SECTION VI

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GENERAL TECHNICAL SPECIFICATIONS

1. GENERAL

The General Technical Specifications (hereinafter called GTS) shall give general information about execution of various items of works under the Contract and cover the specified stipulations for measurements and payment therefore included in the Bill of Quantities.

These specifications shall be the part of the requirements for various items of works, which shall be executed according to the stipulations of the Contract. Hence, the instructions given herein form an integral part of and are applicable to the bidding documents issued for the works. Addenda to these specifications may be issued, as required during bidding and construction phases.

These specifications shall be read in conjunction with Bill of Quantities (BOQ), drawings and the Conditions of Contract. While quoting the price, the Contractor shall comply with all provisions contained within the bidding documents with an objective to complete each items of work without any addition of cost thereof. In case Specifications, BoQ and Condition of Contract do not corroborate each other for completion of any particular item of work, the same as well as the assumptions made in quoting of price for such item(s) of Works shall be brought out clearly in the bid.

It is the intent of these specifications to establish acceptable standards of quality as specified in the technical specifications. Minor deviations in details due to manufacture's standard shop process for bought out items will be considered for acceptance provided that, in the opinion of the Engineer-in-Charge, the proposed substitutions are equal in quality to those specified.

The Contractor shall be required to use locally manufactured Bhutan Standard Bureau (BSB) certified Domestic construction materials especially Concrete Blocks/Bricks, Interlocking cement earth blocks, HDPE pipes, Reinforcement & Steel section, etc. in the Buildings and Road construction works. The material shall conform to latest BSB standards or in the absence of these standards, to the equivalent IS Codes. These materials must be cost effective as compared to the imported materials of certified quality standards.

All works shall comply with the quality requirements defined in the relevant sections of these specifications and other section of the bidding documents. Where no specifications have been laid down, the materials used and the Work done shall conform to the relevant Specifications for Building and Road Works: Royal Govt. of Bhutan, 2022/I.S. Code or as directed by the Engineer-in-Charge. The Contractor shall endeavor to provide all such necessary efforts in order to comply with the intent of these specifications to the satisfaction of the Engineer-in-Charge.

1.1 Scope of Work

The broad scope of works in general, shall be "Construction of Automatic backwash strainer & Booster pump house, Water supply and Filtration unit house at PHEP-I, Wangdue, Bhutan". For detailed scope refer Section II – Instruction to Bidders and Section III - BDS

The work needs to be completed to meet functional requirements as per the approved design drawings, Specifications, Bill of Quantities and/or as directed by the Engineer-in-Charge.

2. WORKING FACILITIES

2.1 Scope of Work

The scope of works under this clause to design, provide, erect, operate and maintain all the working facilities as would be necessary for execution of the works within the specified time schedule, but not necessarily limited to the following:

- Camp and Facilities
- Plant and Equipment
- Electric Power Supply System
- Water Supply System
- Sewage & Waste Water and Garbage Disposal System
- Temporary Access and Construction Roads

Working Facilities shall be subject to the Engineer-in-Charge's approval. The Contractor shall comply with all applicable laws, regulations, and ordinances relating to the construction and operation of the working facilities in Bhutan.

2.2 Submissions

The Contractor shall submit basic plans of Working Facilities along with his bid. He shall attach to his bid documents drawings and operating descriptions for his proposed working facilities. At least **15 days** prior to commencing the work, the Contractor **shall submit** to the Engineer-in-Charge for approval the drawings of layout and details of Working Facilities.

Should the Engineer-in-Charge determine that the details of working facilities furnished does not meet all requirements, the deficiencies shall be made good by the Contractor before commencement of the work. Any cost incurred therefor or replacement shall be borne by the Contractor.

2.3 Camp and Facilities

The Camp and Facilities shall include but are not limited to

- Office for the Contractor / Engineer-in-Charge's Site office
- Accommodation for Staff and Workmen
- Miscellaneous Working Facilities like:
- Stores, Warehouses and sheds for the Contractor
- Portable Explosive Magazines

Office for the Contractor shall be of sufficient size and fully furnished and equipped. All working facilities shall be equipped with proper light arrangement, water supply, telephone, sewage and waste water disposal system. Contractor shall make his own arrangement for all working facilities.

The Contractor shall acquaint himself with all applicable laws and regulations as applicable in Bhutan for handling and use of explosives. All such laws, regulations and rules etc., as are amended from time to time shall be binding on the Contractor. The Contractor shall also arrange mobile / portable explosive magazines of suitable capacity and explosive van. The Contractor shall arrange the security system for the Contractor's own mobile / portable magazine house.

2.4 Plant and Equipment

2.4.1 General

The Contractor shall provide all construction plants and equipment necessary for the efficient execution of the work described in the Specifications and details supplied by the Contractor in the construction plant and equipment schedule. The Contractor shall also deploy additional equipment, if needed, at his own cost for timely completion of the Works.

The capacity and number of equipment shall conform to the specific minimum requirements for the works and the climatic conditions prevailing at the site. The Contractor shall maintain all his equipment, tools and plants with sufficient spare parts, special tools for repair work and complete standby units of vital parts to guarantee a continuous operation without untimely delays. The Contractor shall remain fully responsible for any delays due to disregard of said necessity.

2.4.2 Transportation and Storage Facilities for Cement

Transportation of cement shall be accomplished in adequately weather-tight trucks or other means which will protect the cement completely from exposure to moisture. Storage of cement at the Site shall be done in weather-tight and properly ventilated structures with adequate provisions for the prevention of absorption of moisture. Said structures shall be complete with all equipment for loading, unloading and weighing of cement. The cement storage structure on the site shall be at least **for 20-day capacity**, to be determined by the Contractor in consideration of supply capability.

2.5 Electric Power Supply System

i. PHPA-I will supply electricity at one point to the Contractor. The Contractor shall make all arrangement for distribution within his working area. The electric energy consumed by the Contractor shall be measured by a suitable Energy meter installed at the supply point and the cost thereof shall be paid by the Contractor at the prevailing rates.
ii. The power supply to the construction sites, camps and the entire project area shall be designed for continuous operation, 24 hours a day, with sufficient capacity to satisfy peak and emergency demands.

The Contractor shall also furnish, install and maintain the electrical distribution system to the Engineer-in-Charge's site office.

2.6 Water Supply System

The Contractor shall be fully responsible for the arrangement of necessary facilities for water supply. The Contractor shall design, construct, equip, operate and maintain two separate water installations at the Site necessary for the adequate supply of:

Raw water: for general construction use, treated to the extent necessary to meet specified requirements (e.g. for concrete),

Potable water: for supply to all camps, site offices and plants requiring high quality water meeting relevant requirements for drinking water.

The Contractor shall furnish, install, operate and maintain all pumps, piping, fittings, valves, storage tanks for the water supply and distribution systems, adequate in quantity and pressure. Raw water shall be used for construction purposes only if of adequate quality. There shall be no cross connections of any kind between the raw and potable water supply systems. Only potable water shall be piped for drinking purposes.

2.7 Sewage, Waste Water and Garbage Disposal System

The Contractor shall design, construct, equip, operate and maintain all the installation necessary to properly collect, treat and dispose of sewage from the camp office and other

construction facilities. The Contractor shall not, under any circumstances, discharge sewage or contaminated water into natural streams or any open areas. Treatment and disposal of sewage shall be performed in accordance with the current related standards and laws in force in Bhutan and always subject to the Engineer-in-Charge's approval. The drainage systems shall be designed taking into account the rainfall /snowfall rate in the area and the disposal of rainwater/snow shall be accomplished in such a way that no erosion problems are caused which may alter the stability of the soil.

The Contractor shall provide necessary arrangements for disposal of waste and garbage disposal. The areas surrounding camps, offices, job facilities and the work sites shall be kept clean and free of refuse at all times. No waste shall be dumped in areas other than those approved by the Engineer-in-Charge for waste disposal. No waste of any kind shall be deposited in any watercourses. The Contractor shall observe the norms prescribed by the Government of Bhutan for keeping all areas clean.

2.8 Testing and Quality control

The Contractor shall collect the samples as specified or as directed by the Engineer-in-Charge, carryout the relevant test as approved by the Engineer-in-Charge and submit the test reports to the Engineer-in-Charge in time. All tests will be made according to the approved standards.

2.9 Medical Care Facilities

In the event of illness of an epidemic nature breaking out, the Contractor shall carry out and comply with all orders, arrangements or regulations, which may be issued by the Government or local authorities. Basic Medical facilities are available at Wangdue. The Contractor shall provide and maintain minimum one first aid facilities at the work site.

2.10 Environmental Obligations

The Contractor shall, during the whole period of the Works comply fully with all applicable laws and regulations relating to environmental protection, mitigating measures for reducing environmental impacts and remedial works on completion of the Works. This obligation shall extend to the construction sites themselves, all the Contractor's site installations, and all quarries, borrow areas and tips.

2.11 Final Clean-up

Upon the Completion of Works, or when any plant has completed its functions, the Contractor shall dismantle and demobilize all temporary facilities and remove all refuse, debris, objectionable material, and fill, grade and dress all excavated areas in a clean and proper condition acceptable to the Engineer-in-Charge. All such areas, as far as possible, shall conform to the natural appearance of the landscape.

2.12 Measurement and Payment

No separate payment for establishing the working facilities shall be made. Cost of all such working facilities shall be included in the unit price of works. No separate payment shall be made for complying with any environmental obligations required by applicable laws and regulations, and all such costs incurred by the Contractor to this end shall be considered as being included in the Contractor's Unit Prices.

3. PREPARATION OF SITE/CLEARING & GRUBBING

3.1 Scope of Works

During clearing and grubbing the trees and shrubs, pole lines, fences, monuments, pipe lines etc. within or adjacent to the work site which are not be disturbed shall be protected properly at his own cost, from injury or damage by the Contractor. In case of Archaeological monuments within or adjacent to the area, the Contractor shall provide necessary fencing all around as per the direction of the Engineer-in-Charge and protect the same properly during execution.

Methods, tools and equipment to be adopted for the work shall be such which will not affect the property to be preserved. Only such methods, tools and equipment as approved by the Engineer-in-Charge shall be adopted in the work.

3.2 Submittals

At least ten (10) days before beginning of the works, the Contractor shall submit to the Engineer-in-Charge for his approval:

a. Program of works indicating schedule of the time and the area to be covered
b. The arrangements the Contractor intends to adopt to carry out the work

3.3 Execution

3.3.1 General

Operation for Site preparation shall be strictly limited to the area to be occupied by the indispensable works unless otherwise directed by the Engineer-in- Charge. Cleaning shall be extended to approximately three (3) meters beyond the limit of the works for permanent structures. For temporary works, such extension shall be as minimum as required.

During clearing and grubbing the trees and shrubs, pole lines, fences, monuments, pipe lines etc. within or adjacent to the work site which are not be disturbed shall be protected

properly at his own cost, form injury or damage by the Contractor. In case of Archaeological monuments within or adjacent to the area, the Contractor shall provide necessary fencing all around as per the direction of the Engineer-in- Charge and protect the same properly during execution.

Methods, tools and equipment to be adopted for the work shall be such which will not affect the property to be preserved. Only such methods, tools and equipment as approved by the Engineer-in- Charge shall be adopted in the work.

3.3.2 Jungle Clearance

Jungle clearance shall comprise of cutting, removing and disposing of all materials such as vegetation, grass, brushwood, shrubs, stumps and trees and sapling of girth up to 300 mm or more measured at height of 1 m above ground level which in the opinion of Engineer-in-Charge is unsuitable for incorporation in the works, rubbish and other objectionable matters.

The roots of trees and saplings shall be removed to a depth of 600mm below ground level or 140mm below sub-grade level, whichever is lower. Trees and shrubs, etc. within or adjacent to the areas which are not required to be disturbed during jungle clearance shall be properly protected by the Contractor at his own cost.

No trees shall be cut from outside areas designated unless absolutely warranted and approved by the Engineer-in-Charge and all trees designated outside the areas shall be protected carefully from any damage and cleared areas shall be maintained free of vegetable growth during the progress of the works.

3.3.3 Cutting /Felling of Trees

After clearance of the grass, vegetation, shrubs and bushes, etc., trees having girth of (i) 300mm to 600mm and (ii) above 600mm, measured at the height of one meter about ground level) shall be grouped separately and shall be numbered suitable at the site. These trees shall be cut after approval of the Engineer-in-Charge. Filling trees shall include taking out roots out to 600mm below ground level or 140mm below sub-grade level whichever is low.

The trunks and branch of trees shall be cleared of limps and tops and cut to suitable place as direct by the Engineer-in-Charge. Woods, branch, twits of trees and other useful materials shall be the property PHPA. The serviceable materials shall be stacked in the manner as directed by Engineer-in-Charge.

As unserviceable materials shall be disposed of as per the direction of the Engineer-in-Charge. All excavation below ground level arising out of removal trees, stumps, etc., shall be filled with suitable materials in 400cm layer and compacted thoroughly so that the surface at these points conform to the surrounding area.

3.3.4 Protection of Other Areas

The contractor shall ensure that trees and other vegetation outside the areas of the permanent works and the minimal areas required for temporary works including access are protected and the preserved from damage.

Any clearing required by the Contractor for Construction of temporary works, or for any other purpose shall be at the Contractor's expense and shall not be carried out without the approval of the Engineer-in-Charge unless otherwise specified.

The Engineer-in-Charge reserved the right to reinstate any damage to vegetation and the surface of the ground beyond the areas of the works (including temporary works) at the expense of the Contractor.

3.3.5 Disposal of Stripped Materials

All useful materials obtained from clearing operation shall be stacked in the manner as direct by the Engineer-in-Charge. Trunks and branch of trees shall be cleared of limbs and tops stacked neatly at place indicated by the Engineer-in-Charge. The materials shall be the property of the Engineer-in-Charge. All unserviceable materials which in the opinion of the Engineer-in-Charge cannot be used or auctioned shall be removed from and disposed off as per the direction of the Engineer-in-Charge. Care shall be taken to see that unserviceable materials are disposed of in such manner that there is no like lihood of getting mixed up with the materials meant for construction. When materials are to be buried, they shall be disposed of in horizontal layers alternatively with earth layer and shall be compacted to the maximum extend practicable by routine the haulage traffic over area. The maximum height of these spoil materials will be 3m with slope less than 4:1 (4 horizontal to 1 vertical) in adequate conditionals in regard of safety for the stability of the deposit. Vegetal matter shall be covered with 1 m of earth material.

Disposal of waste materials by burning will be permitted only at times and conditions are considered favorable for burning and at location approved by the Engineer-in-Charge. Materials to be burnt shall be piled neatly in such a manner and in such location as to cause the least fire risk. Burning shall be thorough so that the burnt materials reduced ashes. No logs, branches are churched pieces shall be permitted to be remin. The Contractor shall at all times take special precaution to prevent fire from spreading to areas beyond the limits of the cleared areas and shall have available at the times suitable equipment and supplied for use preventing and suppressing fires. Care shall be taken to see that the burning of such materials doesn't destroy or damage public of private property adjacent vegetation and the Contractor shall be fully responsible for destruction, damage, or nuisance, if any.

3.3.6 Auxiliary Works

The Auxiliary works comprise, but are not necessary limit to, the following:

- Removing and storing of boundary or stones, protections of surveying points; benchmarks, etc. and protection of all secondary survey points, etc.
- Difficulties to be overcome where excavation may have to be carried out on steps in slopes.
- Difficulties in transport due to exiting access condition.
- Sorting of excavated material which, if necessary, is to be use for special purposes.
- Conveying and damping equipment that might be required.

3.4 Measurement & Payment

3.4.1 Measurement

Only the area over which the grass and rubbish has been removed shall be measured. The length and breadth shall be measured and the area shall be calculated correct to two places of decimals.

3.4.2 Payment

The rate shall cover the cost of carrying out all the required operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work. Where necessary, the rate shall also include handling; salvaging, piling and disposing of the cleared materials with all lift and lead up to 150m.

4. EARTH WORKS

4.1 Scope of Work

The scope of works under this clause covers excavation and filling in and around foundation trenches, pits, drains, and similar works including all activities for proper setting out works, stripping / storing of top soil wherever necessary. It also covers filling areas and plinths with selected materials, conveyance and disposal of surplus soils and /or stacking them properly as directed by the Engineer-in-Charge.

The Scope of works shall also cover to provide and maintain all equipment and machinery, skilled and auxiliary personnel and materials as may be necessary for various tasks and requirements associated with all types of excavation / filling along with installation of all temporary and / or permanent supports as necessary or as directed by the Engineer-in-Charge to protect excavated surface from collapse, damage or any mishap.

The Scope of works shall also cover for protection from damage of the existing trees, shrubs and any other plants, pole lines, fences, signs, monuments, buildings, pipelines, drains, sewers, or other surface or sub-surface systems / drains / facilities within or adjacent to the works being carried out. The Contractor shall provide and install suitable safeguards approved by the Engineer-in-Charge for this purpose and carry out all works within the intent of this specification even if not explicitly mentioned herein.

4.2 General Requirements

The Contractor shall make his own arrangements for locating the co-ordinates and positions of all work and establishing the reduced levels (RLs) at these locations based on two reference grid lines and one Bench Mark, before earth work is taken up in hand. The Contractor shall also provide at site all required instruments, materials and man-power, to carry out the work accurately and according to the Specifications and Drawings.

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-in-Charge during all types of excavation / filling at his own cost and responsibility. However, approval given by the Engineer-in-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of excavations, or of liability for injuries to, or death of persons, or any obligations under this Contract.

All excavation shall be carried out in the dry. The Contractor shall take all necessary precautions including supplying and operation all necessary pumping plant to remove all water from any source whatsoever which may enter the excavations whether these are in progress or completed.

If excavations are carried out within 5m of building or other constructions, the Contractor shall execute the work in a way that will minimize damage and disturbance. In general vertically sided excavation will be required in such places and all necessary timbering or other support shall be provided. Undercutting of excavations sides will not be permitted.

In the case where, in the opinion of the EIC, the works are likely to cause interference to the public, the Contractor shall organize his operations in such a way as to reduce to a minimum the interval between opening up and back-filling the excavations. No further work shall commence until the EIC has inspected and approved the completed excavation.

All excavation operation shall include excavation and "getting out" the excavated material. "Getting out" shall include throwing the excavated material; as directed by the Engineer-in-Charge.

The excavation shall conform to the lines, grades, side slopes and levels shown on the drawing or as directed by the Engineer-in-Charge. The contractor shall not excavate outside the limits of excavation. Subject to the permitted tolerances, any excess depth/ width excavated beyond the specified levels/dimensions on the drawings shall be made good at the cost of the contractor with suitable material of characteristics similar to the removed and compacted to the requirements.

All debris and loose material on the slopes of cutting shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulder or soft materials are encountered in cut slopes, these shall be excavated to approved depth on instructions of the Engineer-in-Charge and the resulting cavities filled with suitable material and thoroughly compacted in an approved manner.

After excavation the sides of excavated area shall be trimmed and the area contoured to minimize erosion and ponding, allowing for natural drainage to take place. If trees were removed, new trees shall be planted, as directed by the Engineer-in-Charge. The cost of planting new trees shall be deemed to be incidental to the work.

All materials obtained from excavation shall remain Owner's property. All salvaged materials of archaeological importance or of value in the opinion of the Engineer-in-Charge shall be segregated from the excavated materials and stacked separately in a regular manner at locations as directed by the Engineer-in-Charge. Within **fifteen (15) days** of taking over of the site, the Contractor shall submit to the Engineer-in-Charge for approval, his proposal for excavation together with pertinent data for each stage of excavation in each work area. The Contractor shall furnish the following details in his proposal:

a. Details of the proposed setting-out methods before commencing the work.
b. Descriptions of working methods and sequences of excavation.
c. Proposals for controlling ground water and details of associated plant and equipment proposed to be deployed, where dewatering is felt necessary.
d. Preliminary design and procedures for blasting and blast monitoring if proposed to be necessary, including name and qualifications of Blasters [**copies of valid Blaster's Certificates for Blasting Supervisor and Blasters to be attached**], commercial description and technical information for the blasting products (explosive, detonator, fuses, etc.) proposed, capacity of explosives and detonator magazines, elements of drilling, charging, delay patterns and weight of explosive to be detonated per day, etc.

4.3 Specifications and Standards

The methods and practices for all types of excavation shall conform to the Specifications for Building and Road Works, 2021: Royal Govt. of Bhutan and / or latest editions of the Indian Standards, subject to the approval of the Engineer-in-Charge.

A. EXCAVATION

4.4 Classification of Excavation

Excavation shall be classified depending upon the type of soil encountered during excavation from ground surface or below the finished stripped level and also for purpose of payment. The type of soil in excavation shall be classified as follows:

a. Excavation in Soil
b. Excavation in Rock

4.4.1 Excavation in Soil

Excavation in soil includes excavation in all kinds of soil such as vegetable or organic soil, turf gravel, sand, silt loam, clay, peat, gravel; cobble stone, boulders upto one man size etc, which requires close application of picks or jumpers or scarifies to loosen.

Excavation in soil also includes excavation in soft rock like lime stone, sand stone, hard laterite, hard conglomerate and un-reinforced cement concrete below ground level, which can be excavated by splitting with crow bars or picks and does not require blasting, wedging or similar means of excavation.

4.4.2 Excavation in Rock

Rock when encountered in excavation shall be removed upto the formation level or as otherwise indicated on the drawings. Where, however, unstable shales or other unsuitable material are encountered at the formation level, these shall be excavated to the extent of 500mm below the formation level or as otherwise specified. In all cases, the excavation operation shall be so carried out that at no point on cut formation the rock protrudes above the specified levels. Rock and large boulder which are likely to cause differential settlement and also local drainage problems should be removed to the extent of 500 mm below the formation level in full formation width including drains and cut through the side drains.

Where excavation is done to levels lower than those specified, the excess excavation shall be made good to the satisfaction of the Engineer-in-Charge.

Slopes in rock cutting shall be finished to uniform lines corresponding to slope line shown on the drawing or as directed by the Engineer-in-Charge. Notwithstanding the foregoing, all loose pieces of rock on excavated slope surface shall be removed.

When blasting is to be resorted to the same shall be carried out to clause 4.5 and all precautions indicated therein observed.

4.5 Blasting

Where hard rock is met with and blasting operations are considered necessary, the Contractor shall obtain the approval of the Engineer-in-Charge. For an ordinary rock, in general, blasting operation shall not be carried out unless permitted by the Engineer-in-Charge. All blasting operations including the depth and size of holes and the size and characteristics of charges shall be subject to the approval of the Engineer-in-Charge. The Contractor shall submit all such information to the Engineer-in-Charge for approval **at least 14 days** prior to starting blasting operation.

The Contractor shall obtain a license from the competent authority for obtaining and storing the explosives. The Contractor shall procure the explosives, fuses, detonators, etc from the Government of Bhutan (RGoB) or as per the provision in terms and conditions of

the Contract. The Engineer-in-Charge or his authorized Representatives shall have the right to check the Contractor's store and accounts of explosives. The Contractor shall provide all facilities for this. The Contractor shall also comply strictly with the regulations as required by the concerned authorities of RGoB, regarding purchase, storage, issue and use of explosives and detonators and transport of same to and from site.

Blasting shall be carried out at specified times to be agreed upon between the Contractor and the Engineer-in-Charge. Contractor shall take all precautions as per rules for blasting operations as per latest RGoB blasting manuals and shall be responsible for any damage done to the Work or any damage arising out of accident to the workmen, public or property due to storage, transportation and use of explosives during blasting.

4.6 Disposal and Stockpiling of Materials from Excavation

All the excavated material shall be the property of the employer. The material obtained from the excavation of benches & foundations of buildings, roadway, shoulders, verges, drains, cross-drainage works etc., shall be used for filling up of (i) roadway embankment, (ii) the existing pits in the right-of-way and (iii) for landscaping of the road as directed by the Engineer-in-Charge, including leveling and spreading and disposal of surplus soil at the designated dumping area or as directed by the Engineer-in-Charge and no extra payment shall be made for the same.

4.7 Excavation Tolerances

The following tolerances shall apply for all excavations

Description	Excavation Tolerance (cm)
a. bed or formation levels for construction	+0, -10
b. side slope (perpendicular to slope)	+4, -10
c. top elevation	+10, -0

The Engineer-in-Charge may require that the Contractor repair or remove at his own expense, any material that exceeds the limits above specified.

4.8 Dewatering

The contractor shall construct, operate and maintain drainage systems, including drainage trenches pumps, pump, sumps, pipe lines etc., to sufficiently dewatering for appearing water, service water and underground water encountered during excavation, in order to allow for the workman like execution of all excavation works. All cost for dewatering systems including drainage trenches pumps sumps, pumps, pipe line, etc., shall be included in the unit price in the schedule of quantities excavation and construction of foundation specified in sub- clause- 4.11.2.3.

4.9 Slides

If slips, slides, over-breaks or subsidence occur in cutting during the process of construction, they shall be removed at the cost of the contractor as ordered by the Engineer-in-Charge. Adequate precautions shall be taken to ensure that during construction, the slopes are not rendered unstable or given rise to recurrent slides after construction. If finished slopes slide into the roadway subsequently, such slides shall be removed and paid for at the contract rate, provided the slides are not due to any negligence on the part of the contractor.

4.10 Slopes Support and Protection

The Contractor is responsible for all necessary safety measures. From the commencement of work until certificate of completion, the Contractor shall strictly follow the safety regulations in order to prevent accidents. Proper strutting, including rearrangements of the struts when necessary, protection of slopes, methods of excavation to reduce risk of slides, etc. shall be deemed to be included in the unit prices. In the event of soil slides occurring during earth and rockwork, all damage will be to the Contractor's account. All additional work from such damage will not be paid for. Where the nature of the soil gives reason to fear of any movement, initial excavation operations shall be carried out with special care. All planking, strutting and supports necessary to retain the sides of the excavations shall be provided, erected and maintained in a safe condition by the Contractor.

Excavation shall not be carried out below foundations of any structure without prior approval of the Engineer-in-Charge, until underpinning and shoring etc. to be performed by the Contractor, have been completed. All existing structures, pipes and foundations, if any, which are to be incorporated into the final work, shall be adequately protected or replaced by the Contractor.

4.11 Measurement and Payment

4.11.1 Measurement

Measurement for excavation will be made according to the volume of solid mass, actually excavated in its natural state by measuring the length, breadth and depth of cutting corrected upto 4mm. The volume computations shall be based on surveys of the original ground surface and / or rock surface after completion of final excavation. Excavation in soil and rock shall be measured separately.

Excavation work for Working Facilities, e.g. access and temporary service roads, camps, etc., will not be measured. The Contractor shall include the costs of such works in the respective pay-items.

4.11.2 Payment

4.11.2.1 General

Payment for excavation in soil or rock shall be made at the unit prices tendered in the Bill of Quantities. The Unit prices shall include the all costs required for carrying out all operations including labour, materials, equipment , tools and plants, drilling and blasting, protection, drainage and dewatering, and cleaning of excavation surface, stockpiling, transportation and disposing the excavated materials and incidentals necessary to complete the work.

Damages or alterations caused by wrong blasting or due to any other incorrect operation by the Contractor shall be repaired at his expense in a manner acceptable to the Engineer-in-Charge.

4.11.2.2 Payment for Over-Excavation

1) Over - excavation due to Geological Conditions

The cost incurred in connection with cave-ins and rock falls due to geological conditions will be reimbursed to the Contractor, subject to the approval of the Engineer-in-Charge, at the reduced rate only in case of unexpected and unavoidable occurrences, which could not be avoided by proper excavation and support methods.

2) Over-excavation due to Contractor's Fault

Where over-excavation is caused by inappropriate working methods or negligent work (e.g. wrong location of drill holes, careless blasting operations, excessive pulls, etc.), no payment will be made either for the over-excavation / over-break beyond the pay line or for the additional concrete required for filling. The Contractor shall be responsible for all cave-ins, erosion and over-break due to the Contractor's fault. He shall take all necessary measures at his own cost, to control the excavation and make all the repairs ordered by the Engineer-in-Charge.

3) Extra Excavation Required for Operational Reasons

Extra excavation not described in the Bill of Quantities or not shown on the Drawings, but considered necessary by the Contractor for his operations in excavation or for supply facilities and the like may be made only if approved by the Engineer-in-Charge. The cost of such excavation including supporting work and of the concrete required to fill them shall be included in the unit prices of excavation in the Bill of Quantities and shall not be paid separately even though their construction has been approved by the Engineer-in-Charge.

4.11.2.3 Payment for Dewatering

No measurement and payment for dewatering shall be made extra. All cost of dewatering during excavation and construction of foundation of any structure shall be included in the Unit Rates in the respective Bill of Quantities.

4.12 Geotechnical Investigation

The safe bearing capacity of foundation strata of buildings is taken as 15 T/m^2 based on bouldary soil strata expected to be encountered. After completion of excavation, the soil conditions need to be evaluated by client geologist and Engineer-in-charge before proceeding construction. Based on observations, bearing capacity test may be recommended by the Engineer-in-Charge. The investigation should be carried out prior to taking up of construction of the respective buildings. The test results are required to be submitted to the Engineer-in- Charge for approval of taking up construction of buildings.

The bearing capacity strata less than 15 T/m^2 may necessitate revision in design /drawings, if found necessary.

B. FILLING

4.13 Definition of Fill

The expression 'fill' shall be taken to mean backfill as well as fill in trenches and is deemed to include excavation from trenches / borrow area or stockpile, loading/ unloading, transport up to 2 km radius, spreading / placing, compaction and trimming to final profile and any moisture control measures required to bring the fill to within specified moisture content whether drying or wetting measures.

4.14 Fill Material

Materials to be used for filling purposes shall be obtained in general, from the excavated earth. The fill materials shall be clean and free from shingle, organic matters, roots and excessive amount of sand, lumps, concrete or any other foreign substances which could harm or impair the strength of the sub-structure in any manner. Fines less than 74microns shall not be more than 20%. In any case, materials to be used for filling shall have the prior written approval of the Engineer-in-Charge.

Filling in trenches, retaining wall foundation and planters shall be done using selected excavated earth or otherwise as directed by the Engineer-in-Charge. Materials required for filling / banking in the Works, if not available from the required excavation shall be obtained from the Designated Borrow Area. Some degree of selection may be required by the Engineer-in-Charge within the Designated Borrow Area. Where access to suitable material within the borrow area is not possible, the borrow area's site shall be cleared and/ or grubbed at the Contractor's expense.

4.15 Execution of Filling

After completion of foundation for trenches, retaining walls, and other construction below the elevation of the final grades and prior to filling, all temporary shoring, timber, etc shall be sequentially removed and the excavation cleaned of all trash, debris and perishable materials. If antitermite treatment is required to be done, the same should be done as directed by the EIC. Filling shall begin only with the written approval of the Engineer-in-Charge. Also, area identified for filling shall be cleared of all soft pockets, vegetation, bushes, slush, etc. In case of foundation and similar filling, the ground shall be dressed and consolidated by ramming and light rolling by portable mechanical compacter.

Filling for paver block foundation shall be with clean sand and free from dust, organic and foreign matter and its grading shall be as approved by the Engineer-in-Charge. Sand filling in the pavement shall be in a manner similar to earth filling as specified above except that consolidation shall be done by flooding with water. The surface of the consolidated sand filling shall be dressed to the required level or slope and shall not be covered till inspected and approved by the Engineer-in-Charge.

Fill adjacent to pipes shall be free of stones, concrete, etc and shall be hand placed and compacted uniformly on both sides of the pipes and where practicable up to a minimum depth of 400mm over the top of pipes . While tamping around the pipes, care should be taken to avoid unequal pressure.

Filling shall be accurately finished to the line, slope, cross section and grade as shown on the Drawings. Finished surface shall be free of irregularities and depressions and shall be within 20mm of the specified level.

4.16 Measurement and Payment

4.16.1 Measurement

For filling sides of the foundations, the cubical contents of bed concrete leveling course and masonry / concrete in foundations upto the ground level shall be worked out and the same shall be deducted from the cubical contents of earth work in excavation for foundations already measured under the respective item of earth work to arrive at the quantity of filling the sides of foundations.

Filling in plinth and under floors shall be measured by cubical contents of the filling after consolidation.

4.16.2 Payment

Payment for filling either from excavated earth or borrowed earth or sand shall be made as per the Unit Rates tendered in the Bill of Quantities. The unit rates shall cover the cost of all the required filling operations including cost of labour , materials, equipment, tools

and plants, watering, consolidation, etc and incidentals necessary to complete the work. No additional payment will be made for preparation of the borrow area.

4.17 Trenches Excavation

4.17.1 Excavation

All excavation operation shall include excavation and getting out the excavated matter. Getting out shall include throwing the excavated earth at least one metre or half the depth of excavation whichever is more, clear off the edge of excavation. The subsequent disposal of the excavated material shall either be as directed by the Engineer under a separate item or as included in this item disposal up to 50 metres lead. Excavation shall be dug out to the exact dimensions as shown in the drawing or as directed by the Engineer.

Care shall be taken to cut the sides and bottom exactly to the required shape, slope and gradient, while carrying out excavation for drains work. The surface shall be dressed properly. If the excavation is done to a depth greater than that shown in the drawings or greater than that required by the Engineer, the excess depth shall be made good at the cost of the contractor with stiff clay puddle at places where the drains are required to be pitched and with ordinary earth, properly watered and rammed, where the drains are not required to be pitched. In case the drain is required to be pitched, the back filling with clay puddle shall be done side by side as the pitching work proceeds. The brick pitched storm water drains shall be avoided as far as possible in filled up areas.

Excavation in ordinary rock shall be carried out by crowbars, pickaxes or pneumatic drills. Blasting operations are generally not required in this case. If the contractor wishes to resort to blasting, he can do so with the permission of Engineer, but nothing extra will be paid to him on this account.

Excavation in hard rock shall be done by chiselling where blasting operation is prohibited or is not applicable. In trenches or drains where blasting is not otherwise prohibited, the excavation in hard rock shall be carried out by blasting in the first instance and finally by chiselling so as to obtain the correct section of the trench as per drawing. The blasting operation shall be strictly as per latest RGOB blasting manuals

Where water is met within excavation due to stream flow, seepage, springs or other reasons, the contractor shall take adequate measures such as bailing, pumping, construction of diversion channels, drainage channels, bunds, coffer dam and other necessary works to keep the foundation trench dry when necessary and to protect the green concrete/masonry against damage by erosion, or sudden rising of water level. The steady water level in the trial pits prior to the start of pumping operations shall be considered to be the subsoil water level in that area.

4.17.2 Measurements

The length, breadth and depth shall be measured correct to 10mm. The cubical contents shall be worked out to the nearest two places of decimal in cubic metres.

4.17.3 Rates

The rates shall cover the cost for carrying out all the required excavation and banking operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work. In case of rock, the rate shall also include the cost of all operations of blasting with explosive and accessories as mentioned above.

Protection and supporting of existing services i.e. pipes, water mains, cables met within the course of excavation. Care shall be taken not to disturb electric and communication cables, and, if necessary for removal it shall be arranged by the Engineer.

4.18 Filling of Trenches

4.18.1 Filling

Earth used for filling shall be free from stone, shingle or boulder larger than 75 mm in any direction and salts, organic or other foreign matter. Normally excavated earth from the same area shall be used for filling. However if such earth contains deleterious material, it shall not be used. All clods of earth shall be broken or removed. Filling in trenches for pipes and drains shall be commenced as soon as the joints of the pipes and drains have been tested and passed.

The spaces around the foundations pipes and drains in trenches shall be cleared of all debris, brick bats etc. The filling shall be done in layers, not exceeding 200mm in each layer. Each layer shall be watered, rammed and consolidated before the succeeding one is laid. Earth shall be rammed with iron rammers where feasible and with the butt-ends of crowbars where rammer cannot be used. Special care shall be taken that no damage is caused to the pipes, drains and masonry or concrete in the trenches, under floor, etc.

4.18.2 Measurement

The cubical contents of foundation concrete and masonry in foundation up to ground level shall be worked out and the same deducted from the cubical contents of earthwork in excavation for foundations to arrive at the quantity for filling sides of foundation. For filling in plinths and under floors, depth shall be the consolidated depth.

4.18.3 Rates

The rates shall cover the cost for carrying out all the required filling operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work.

4.19 Sand

Sand filling shall be done similar to earth filling in plinth as specified above except that the consolidation shall be done by flooding with water. The surface of the consolidated sand shall be dressed to required level or slope. Concreting of floor shall not be started until the sand filling is inspected and approved by the engineer.

4.19.1 Measurements

Volume of consolidated filling shall be measured. The dimensions shall be measured correct to 10mm and cubical contents worked out in cubic metre correct to two places of decimal.

4.19.2 Rates

The rates shall cover the cost for carrying out all the required filling operations including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work.

5. MASONRY WORKS

5.1 Scope of Works

The Scope of Works covered under this clause shall comprise of stone masonry works including supply of all construction materials, equipment, tools and plants, labour (skilled or un-skilled) , etc. as would be required for construction of all types of masonry as shown in the Drawings and as specified herein and / or as directed by the Engineer-in-Charge.

The Scope of Works shall also include to provide all structural parts, scaffolding, transportation, loading, unloading, inspection, test and quality control , preparation of foundation surfaces, adjustment of surfaces adjacent to the walls, linings, pavements, including curing and protection, etc. and all other incidentals and operations required to complete the masonry works in all respects.

5.2 General Requirements

All materials and structural parts incorporated in the permanent work shall be new and unused. Quality and dimensions of materials as well as works shall comply with these Specifications and approved Standards.

All masonry shall be carried out in a workman like manner at the highest standards and all works shall be coordinated with the other works carried out at the site to allow the performance of all works simultaneously without causing any hindrance to other works.

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-in-Charge during all masonry works at his own cost and responsibility. However, approval given by the Engineer-in-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of masonry, or liability for injuries to, or death of persons, or any obligations under this Contract.

5.3 Submission

At least **fifteen (15)** days prior to commencement of the masonry work, the Contractor shall submit the details of schedule of works to the Engineer-in-Charge for approval. Submission shall also include details of source of supply of Stones, Cement and Sand for mortar, indicating the estimated quantity to be obtained from each source and all other requisite materials.

Approval of plant and equipment or their operation or of any construction procedure will not waive or modify any provisions or requirements contained in this Specification governing the quality of the materials or the finished work.

5.4 Classification of Masonry

The masonry works shall be classified as mentioned in **Table -5.1.** The required works shall be **executed** as per drawing, specifications and / or as directed by the Engineer-in-Charge

Table -5.1
Classification of Masonry

Type of masonry	Classification	Cement-mortar Mix
Random Rubble Masonry	RRM	1 (Cement) :6 (Sand)
Coursed Rubble Masonry	CRM	1 (Cement) : 4 (Sand)
Brick Masonry/AAC	BM/AAC	1 (Cement) : 5 (Sand

5.5 Execution

5.5.1 General

The mortar for all masonry works shall consist of cement, sand as specified above and water with or without admixtures as approved by the Engineer-In-Charge, each complying with its specifications. The quantity of water shall be as necessary to obtain a satisfactory workability regarding the use of the mortar. Quality of mortar shall in general, meet the requirements specified in IS: 2250 (Code of Practice and Use of Masonry mortar).

5.5.2 Mixing, Transporting and Placing

The unit of measurement for cement shall be a bag of cement weighing 50kg and this shall be taken as 0.035 cubic metre. Sand in specified proportion shall be measured in boxes of size: 35 x 25 x 40 cm. It shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulking.

Mortar for masonry shall invariably be produced in a mechanical mixture by volume batching. The mortar shall be mixed in small batches such that the quantity of mortar so prepared at a time could be completely used up in masonry **within 30 minutes of mixing**. Mortar that has remained longer than this period or that has become stiff or set on account of delay in consumption or otherwise shall be rejected at the Contractor's cost.

Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least two minutes. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of a stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time. The drum shall be totally emptied before a new batching cycle is started. The drum shall be kept free from hardened mortar and shall be thoroughly cleaned prior to change of mix or on cessation of mixing.

Hand-mixing for small batches may be approved by the Engineer-in-Charge. However, the mortar shall be mixed up to the degree obtained with a mechanically operated mixer. Prior to adding water to the mix, sand, cement and admixture (if required) shall be mixed dry thoroughly in a leveled platform until the mixture has a uniform colour. The quantity of dry mix, which can be used within 30 minutes, shall then be mixed in masonry trough with just sufficient quantity of water to bring the mortar to the consistency of a stiff paste.

The equipment and tools used for transporting and placing of mortar shall ensure that contamination or loss of ingredients do not take place. Mortar shall be stirred or worked at frequent intervals to prevent separation. In case, the mortar has stiffened because of evaporation of water from the mortar, it may be re-tampered by adding water frequently as needed to restore the requirements of consistency but this re-tampering shall be permitted only upto 2 hours from the time of original addition of water. Mortar unused for more than two hours shall be rejected and removed from the site of work.

5.6 Brick Masonry

5.6.1 General

Bricks shall conform to the requirements of IS 1077. Bricks required for brick work in cement mortar shall be adequately soaked in stacks, before use, by profusely spraying with clean water at regular intervals for a period of not less than six hours so as to keep them wet to the satisfaction of the Engineer. Bricks required for masonry with mud mortar need not be soaked.

Brickwork shall be laid in English bond unless otherwise specified. For brick work in half brick wall, bricks shall be laid in stretcher bond. Half or cut bricks shall not be used; except where necessary to complete the bond. Closures, in such cases, shall be cut to the required size and used near the ends of the walls.

In exposed brickwork, selected bricks shall be used for the face work. A layer of mortar shall be spread on full width over a suitable length of the lower course. Each brick shall be properly bedded and set home (in position) by gently tapping with handle of trowel or wooden mallet. Its inside faces shall be buttered with mortar before the next brick is laid and pressed against it. On the completion of course, all vertical joints shall be fully filled from the top with mortar. The walls shall be taken up truly plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate courses shall come directly one over the other.

Thickness of brick courses shall be kept uniform and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. The height of windowsills, bottom of lintels and other such important points in the height of the wall shall be marked on the graduated straight edge.

Both the faces of walls of thickness more than one brick length shall be kept in proper plane. All connected brickwork shall be carried up simultaneously and no portion of work shall be left more than one metre below the rest of the work. Where this is not possible, in the opinion of the Engineer, the work shall be raked back according to bond (and not toothed) at an angle not steeper than 45 degree. The work done per day should not be more than one metre height.

All iron fixtures, pipes, outlets of water, hold fasts of doors and windows, which are required to be built into the walls shall be embedded in mortar or cement concrete as specified in their correct position, as directed by the Engineer, as the work proceeds. The flue of the chimney shall be plastered with mud and cow dung mortar (3 mud: 1 cow dung) as the work proceeds. Nothing extra shall be paid for this 'pargeting'.

5.6.2 Physical Requirement of Bricks

Crushing strengths of bricks varies from 30 kg/sq.cm. to 150kg/sq.cm for handmade burnt bricks, while heavy duty bricks machine pressed (Also called engineering bricks) may have

compressive strength as high as 450 kg/sq.cm and even 500 kg/sq.cm. The minimum crushing strength (or compressive) of bricks should be as follows.

Sl. No.	Type of Bricks	Crushing(compressive) strength
1.	Common building bricks	35 kg/sq.cm
2.	Second class bricks	70 kg/sq. cm
3.	First class bricks	105 kg/sq cm
4.	A-4 class bricks	Not less than 140 kg/sq. cm --

The bricks/AAC blocks shall be true shape. The actual common size of bricks is 250 mm x 125 mm x 75mm/ 600x200x100. A tolerance allowance shall be 1.5mm for breadth and height and 3 mm for length.

5.6.3 Laying of bricks

The bricks should be laid by breaking joints in successive layer. Half or cut bricks should not be used except where necessary for breaking the joints in successive layers. Close in such a cases should be cut to the required size and used near the ends of walls. A layer of mortar mix specified in the item shall be spread on full width of suitable length of lower course keeping the mortar dropping to the minimum possible. Each brick shall be properly bedded and set home by gentle tapping with handle of shovel or wooden mallet. The side face shall be buttered with mortar before the next brick is laid and pressed against it. On completion of a course, the vertical joints shall be fully filled from the top with mortar.

The wall shall be truly plumb. All courses should be laid truly horizontal and all vertical joints should be truly vertical. The vertical joints in alternate layer shall come directly one over other. A set of tools comprising of wooden straight edges, mason's sprit level, square half meter rule line and pins string and plumb shall be kept on the site of work.

All the connected bricks works shall be carried up nearly at one level and no portion of the work shall be left more than one meter below the rest of the work. All item fixtures, pipes, out lets of water, hold fasts of door and windows etc. which are required to be built in wall shall be embedded in cement mortar or cement concrete as specified in their correct position as the work proceeds.

5.6.4 Joints

Brick shall be so laid that all joints are full of mortar. The thickness of joints shall not exceed 10mm. All face joints shall be raked to a minimum depth of 15mm by raking tool during the progress of work when the mortar is still green so as to provide proper key for the plaster

or pointing to be done. Where, plastering or pointing is not required to be done the joints shall be struck flush and finished at the time of laying.

The face of brickwork shall be cleaned on the same day on which brickwork is laid and all mortar dropping removed promptly.

5.6.5 Curing

Brickwork shall be protected from rain by suitable covering when the mortar is green. Masonry work in cement mortar shall be kept constantly moist on all faces for a minimum period of seven days. Brickwork carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

5.6.6 Scaffolding

For all exposed brickwork, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other brickwork in buildings, single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width, or immediately near the skewbacks of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Note: In case of special type of brickwork, scaffolding shall be got approved from Engineer in advance. Brickwork shall be protected from rain by suitable covering when the mortar is green.

Masonry work in cement mortar shall be kept constantly moist on all faces for a minimum period of seven days. Brickwork carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

5.6.7 Measurement

Unless otherwise specified, all work shall be measured net as fixed in its proper position. Any extra work done by the contractor over the specified dimensions shall be ignored. Dimensions shall be measured correct to 10mm. Areas shall be worked out in sq.m correct to two places of decimal. Cubic contents shall be worked out in cu.m correct to two places of decimal.

Neither any deduction made nor any extra payment shall be made for the following:

a) Ends of dissimilar materials (i.e. joists, beams, posts, girders, rafters, purlins, trusses, steps etc.) each 500 sq.cm in section.

b) Opening each up to 0.1 sq.m. In calculating the area of the openings any separate lintels or sills shall be included along with the size of the openings but the end portions of the lintels shall be excluded and the extra width of the rebated reveals, if any, shall also be excluded.
c) Wall plates and bed plates, bearing of slabs, chajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the walls.
d) Drainage holes, and recesses for cement concrete blocks to embed holdfasts for doors,
e) windows etc.
f) Necessary holes etc. for iron fixtures, pipes up to 300 mm dia.
g) Forming chases in masonry each up to section of 350 sq.cm.

The work shall be measured separately under the following categories:

i. From foundation to floor 1 level (plinth level);
ii. From floor 1 level to floor 2 level;
iii. From floor 2 level to floor 3 level and so on;
iv. Brickwork in parapet walls shall be measured along with the corresponding masonry in the walls of the storey just below it.

Corbels, string courses, projecting pilasters, aprons, sills, cornices, over-sailing courses and other projections etc. or splayed bull nosed or any other type of projection with made or cut bricks shall be fully described and measured separately in running metres stating dimensions of each projections.

Walls of half brick thickness or less shall each be measured separately and shall be given in square metres stating the wall thickness.

Brick wall beyond half brick up to and including three bricks in thickness shall be measured in multiples of half brick, which shall be deemed to be inclusive of mortar joints.

Where fractions of half bricks occur due to architectural or other reasons, the work shall be measured as follows:

a. If, as per drawings, the use of fraction of half bricks is required, the measurements shall be made for half brick.
b. If the thickness of the wall is required to be increased up to 20 mm beyond the structural thickness of half brick multiples the same shall be made up in mortar and paid for the specified thickness.

For walls beyond three brick thickness, actual thickness shall be measured.

Brick work in backing to stone or other type of facing shall be measured separately. The description shall include all cutting and wastage for bonding.

Masonry (excluding fire brick work) in chimney breasts, chimney stacks, smoke or air flues up to 0.25 sq.m sectional area, shall be measured as solid and no extra payment shall be made for pargeting and coring such flues. Where flues exceed 0.25 sq.m in sectional area, deduction shall be made for the same and pargeting and coring flues paid for separately.

Apertures for fireplaces shall not be deducted and extra labour shall not be measured for paying of jambs, throating and making arch to support the openings. Square or Rectangular Pillars shall be measured as walls but extra payment shall be allowed for brick work in square or rectangular pillars over the rate for brick work in walls.

Circular Pillars shall be measured net as per actual dimensions, but extra payment shall be allowed for brickwork in circular pillars over the rate for brickwork in walls. Diameter as well as height shall be measured correct to 10 mm.

Tapered Walls shall be measured net as per actual dimensions, but extra payment shall be allowed for making tapered surface of brick masonry walls. The width as well as length and height shall be measured correct to 10mm.

Brickwork curved on plan to a mean radius exceeding 6 m shall be measured net and included with general brickwork. Brickwork circular on plan to a mean radius not exceeding 6 m shall be measured separately and shall include all cutting and waste and template. It shall be measured as the mean length of the wall.

5.6.8 Rate

The rate shall include the cost of materials and labour required for all the operations described above

5.7 AAC Blocks

5.7.1 General

Autoclaved Aerated Concrete Blocks (AAC): concrete shall be made in sizes and shapes to fit different construction needs conforming to IS: 2185 (part 3)-1984. They include stretcher, corner, double corner or pier, jamb, header, bull nose, and partition block, and concrete floor units.

All units shall be sound and free of cracks or other defects which interfere with the proper placing of unit or impair the strength or performance of the construction. Minor chipping resulting from customary methods of handling during delivery, shall not be deemed grounds for rejection. Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall be free of chips, cracks, or other imperfections; except that, if not more than 5 percent of the consignment contains slight cracks or small chipping not larger than 25 mm, this shall not be deemed grounds for rejection. Concrete blocks shall be referred to by its nominal dimensions. The term 'nominal' means that the dimension includes the thickness of the mortar joint. Actual dimensions shall be 10 mm

short of the nominal dimensions (or 6 mm short in special cases where finer jointing is specified). The nominal dimensions of the concrete block shall be as follows:

Length 400, 500 or 600 mm

Height 200, 250 or 300 mm

Width 100, 150, 200 or 250mm

In addition, block shall be manufactured in half lengths of 200, 250 or 300 mm to correspond to full lengths. The maximum variation in the length of the units shall not be more than ± 5mm and maximum variation in the height and width of the unit, not more than ± 3 mm (*see* Fig 3.1 for mode of measurement). Subject to the tolerances specified, the masonry units shall be flat and rectangular, opposite faces shall be parallel, and arises shall be square. The bedding surfaces shall be all at right angle to the faces of the blocks.

Blocks of sizes other than those specified may also be used if so specified. In the case of special concrete masonry units such as jallie or screen wall blocks and ornamental block, the specified sizes may not necessarily apply.

The autoclaved aerated (cellular) concrete blocks shall be classified in two grades according to their compressive strengths as indicated in table below:

Physical Properties of Autoclaved Aerated (Cellular) Concrete Blocks:

Sl. No	Density in Oven dry condition (Kg/m^3)	Compressive strength(Min) N/mm^2		Thermal Conductivity in air dry condition W3/m.k
		Grade -1	Grade -II	
i	451 to 550	2.0	1.50	0.21
ii	551 to 650	4.0	3.0	0.24
iii	651 to 750	5.0	4.0	0.30
iv	751 to 850	6.0	5.0	0.37
v	851 to 1000	7.0	6.0	0.42

The minimum compressive strength; being the average of twelve units, the block density shall conform to the requirement specified in table 3.4 when tested as per testing procedure specified in IS: 2185 (part 3)-1984.

5.7.2 Laying of AAC blocks

The laying of AAC block should be in accordance with IS 6041 (1985). For mortar either conventional mortar or dry mix mortar can be used.

Do not soak the blocks during laying. All surfaces of the blocks are to be moistered using wet brush or sponge, to prevent absorption of water from mortar. Best way is to dip and remove the blocks

The AAC blocks should be laid by breaking joints in successive layer. Half or cut bricks should not be used except where necessary for breaking the joints in successive layers. Close in such a cases should be cut to the required size and used near the ends of walls. A layer of mortar mix specified in the item shall be spread on full width of suitable length of lower course keeping the mortar dropping to the minimum possible. Each brick shall be properly bedded and set home by gentle tapping with handle of shovel or wooden mallet. The side face shall be buttered with mortar before the next brick is laid and pressed against it. On completion of a course, the vertical joints shall be fully filled from the top with mortar.

The wall shall be truly plumb. All courses should be laid truly horizontal and all vertical joints should be truly vertical. The vertical joints in alternate layer shall come directly one over other. A set of tools comprising of wooden straight edges, mason's sprit level, square half meter rule line and pins string and plumb shall be kept on the site of work.

All the connected bricks works shall be carried up nearly at one level and no portion of the work shall be left more than one meter below the rest of the work. All item fixtures, pipes, out lets of water, hold fasts of door and windows etc. which are required to be built in wall shall be embedded in cement mortar or cement concrete as specified in their correct position as the work proceeds.

For cutting of AAC blocks a handsaw or a cutting wheel should be preferred.

5.7.3 RCC bands

The nominal reinforced concrete bond beam/ rcc band shall be spaced 1200-1500 apart vertically and reinforcement rods of it shall be inserted the into surrounding columns. This information should be followed if no details are given in drawing.

5.7.4 Joints.

Both horizontal and vertical joints shall be 10 mm thick if traditional 1:6 mortar is used required. Cement mortar is used. If dry mix then only 3-5 mm thick mortar is required

The minimum grade of concrete used shall not be less than m15.

When the mortar is still green so as to provide proper key for plaster or pointing to be done. Where plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying.

The face of brick work shall be cleaned the very day that brick work is laid daily and all mortar dropping removed.

5.7.5 Curing

Green work shall be protected from rain by suitable covering. Masonry with AAC blocks requires no curing but bricks works shall be kept constantly moist on all the faces for a minimum period of seven days.

For AAC blocks curing is required only for cement mortar joint and is not required for ready made mortar jointing.

5.7.6 Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The support shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry, such holes; however, left in masonry work for supporting the scaffolding shall be filled and made good before plastering.

5.7.7 Precautions to be taken for laying of AAC masonry:

i. Do not store the blocks on un leveled surface.
ii. Do not use wet blocks for masonry construction.
iii. Do not make the holes on block masonry for scaffolding supports.
iv. Do not soak the blocks before use.
v. Do not hammer the block masonry for service lines, chases etc.
vi. Do not completely wet the block masonry before plastering works

5.7.8 Measurement

The length, width and height shall be measured correct to a mm and volume calculated correct to 0.1 Cu.m. For rest of details refer 'Measurement' section of brickwork.

5.7.9 Rate

Rate shall include all materials and labour described above including scaffolding where necessary. For rest of details refer 'Rate' section of brickwork.

5.8 Random Rubble Masonry

5.8.1 Dressing

Stones shall be hammer dressed, on the face, the sides and the beds, to enable it to come into close proximity with the neighboring stone. The bushing in the face shall not project more than 4 cm in an exposed face, and one cm on a face to be plastered. The hammer

dressed stone shall have a rough tooling for a minimum width of 2.5 cm along the four edges of the face of stone.

5.8.2 Laying

Every stone shall be carefully fitted to the adjacent stones, so as to form neat and close joints. Stones may be brought to level courses at plinth, windowsills and roof level. Leveling up at plinth level, window sills and roof level shall be done with concrete comprising of one part of the mortar as used for the masonry and two parts of graded stone aggregate of 20mm nominal size and shall be-included in the items. The bond shall be obtained by fitting in closely, the adjacent stones and by using bond-stones. Face stones shall extend and bond well into the backing. These shall be arranged to-break joints as much as possible, and to avoid long vertical lines of joints. The hearting or interior filling of the wall shall consist of rubble stones, which may be of any-shape but shall not pass through a circular ring of 15 cm inner diameter; thickness of these stones in any direction shall not be less than 10 cm. These shall be carefully laid, hammered down with a wooden mallet into position and solidly bedded in mortar, chips and spalls of stone being used wherever necessary to avoid thick mortar beds or joints and at the same time ensuring that no hollow spaces are left anywhere in the masonry. The hearting will be laid nearly level with facing and backing, except that at about one meter intervals, vertical 'Plumb' projecting about 15 cm to 20 cm shall be firmly embedded to form a bond between successive courses.

5.8.3 Bond Stones

Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60 cm thick and in case of walls above 60 cm thickness, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided in a line from face to back. At least one bond stone or a set of bond stones shall be provided for every 0.5 sq.m of the wall surface. All bond stones in stone masonry shall be marked suitably as directed by the Engineer-in-charge.

5.8.4 Quoins or corner stone

The quoins shall be of selected stones neatly dressed with the hammer and / or chisel to form the required angle, and laid header and stretcher alternately. The length of these stones shall be 45cm or more and at least 25% of the stones shall be 50cm or more in length.

5.8.5 Jambs

Stones used in jambs shall be similar to those in quoin, excepting the length of the stem, which shall be 45cm, or thickness of the wall whichever is less.

5.8.6 Joints

Stones shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be thicker than 20 mm.

When plastering or pointing is not required to be done, the joints shall be struck flush and finished at the time of laying. Otherwise, the joints shall be raked to a minimum depth of 20 mm by raking tool during the progress of work, when the mortar is still green.

5.8.7 Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all face for a minimum period of seven days. In case of masonry with fat-lime mortar, curing shall commence two days after laying of masonry and shall continue for at least seven days thereafter.

5.8.8 Protection

Green work shall be protected from rain by suitable covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

5.8.9 Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars less than one metre in width or immediately near the skew back of arches.

The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 stone aggregate 20mm nominal size).

5.8.10 Measurements

The length, height and thickness shall be measured correct to 1 cm. The thickness of wall shall be measured at joints, excluding the bushings. Only specified dimensions shall be allowed anything extra shall be ignored. The quality shall be calculated in cubic metre nearest to two places of decimal.

5.8.11 Rate

The rate shall include the cost of materials, labour and all lead and lift required for all the operations described above.

5.9 Coursed Rubble Masonry

5.9.1 General

The stones shall be hard, sound and durable of approved quarry, approved by the Engineer-in-Charge before used in the works. Face stone shall be hammer dressed on all beds and joints so as to give them approximately rectangular block shape. They shall be squared on all joints and beds. Mortar shall be as specified and material of mortar shall be as per standard specifications. The bed joint shall be dressed for at least 8 cm back from the face and side joints for at least 4 cm such that no portion of the dressed surface is more than 10 mm from a straight edge placed on it. The hammer dressed stone shall also have a rough tooling for a minimum width of 2.5 cm along the four edges of the face of the stone.

5.9.2 Curing, scaffolding, measurements and rate

Curing, scaffolding, measurements and rate shall be as specified for RRM

5.10 Water Proofing Materials in Cement Mortar

5.10.1 General

The water proofing compound shall be mixed in the proportion and in the ways as recommended by the manufactures.

5.10.2 Measurements

Cubical contents shall be worked out in cu.m corrected to two places decimal only for the volume where cement mortar is mixed with water proofing compound.

5.10.3 Rate

The rate shall be included the cost of water proofing compound and labour involved in mixing the compound with cement mortar

5.10.4 Hand-Packed Stone Filling or Soling with Stone

5.10.4.1 General

Stones as obtained from the quarry shall be packed with their broader surface as base. The packing shall be as dense as possible and the interstice shall be filled with small stones. The height of stones shall be as per the thickness of soling required. The stones shall be arranged neatly and the joints shall be as thin as possible.

5.10.4.2 Measurement

The length, breadth and height shall be measured correct to 10mm and the volume calculated correct to 0.01 cu.m

5.10.4.3 Rate

The rate shall include the materials and labour involved in all operation described above.

6. CONCRETE WORKS

6.1 Scope of Work

The Scope of works under this clause covers plain cement concrete works (PCC) which shall consist of:

- Supply of all concrete constituents including, cement, sand, aggregate, labour, equipment, tools and plants, joint materials etc.
- Manufacturing, cooling, transporting, placing, consolidating, protecting and curing of concrete
- Constructing, erecting and dismantling of form work
- Placing materials for expansion and construction joints

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-in-Charge in execution of concrete works at his own cost and responsibility. However, approval given by the Engineer-in-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of concreting, or of liability for injuries to, or death of persons, or any obligations under this Contract.

6.2 Definitions

a. Fine aggregate (Sand)

Fine aggregate is defined as the part of aggregate having a maximum dimension of 4.8 mm.

b. Coarse aggregate

Coarse aggregate is defined as the part of aggregate having a minimum dimension of 4.8 mm and maximum of 40 mm.

c. Construction Joint

Concrete surfaces, upon or against which concrete is to be placed or where new concrete is to be adhered, that have become so rigid that the new concrete cannot be incorporated integrally with that previously placed are defined as construction joints.

d. Expansion or Contraction joint

All joints allowing relative movement of concrete structures with respect to an adjacent one, due to expansion, shrinkage, settlement of foundations etc. are to be considered expansion or contraction joints.

6.3 Submission

The Contractor shall perform the concrete works in accordance with the Specifications, the Drawings and the instructions of the Engineer-in-Charge. At **least seven (7) days** prior to commencement of the concrete work, the Contractor shall submit the details of materials of concrete and schedule of concreting to the Engineer-in-Charge for approval.

The approval given by the Engineer-in-Charge to the Contractor's plants and equipment or their operation or any construction method shall not relieve the Contractor of his full responsibility for the proper and safe execution of concrete work or any obligations under the Contract.

6.4 Materials

All materials like cement, aggregates, water, admixture, etc as would be required for production of concrete shall conform to the Specifications for Building & Road works, 2021, RGoB / IS Codes

6.5 Execution of Concrete Works

6.5.1 General Requirement

The works should be carried out in accordance with IS: 456 (latest edition). The concrete to be produced and placed according to the Specifications shall be of highest quality and uniformity. In all phases of operations, the Contractor shall be subject to strict inspection and tests to assure concrete of the best quality. Special emphasis shall be made on the uniformity of the concrete aggregates, water-cement ratio, consistency, air content and the temperature control of the concrete at the time of placement in the formwork, as well as the density and finishing when placed.

The Contractor shall be fully responsible for producing and maintaining the quality of concrete with especially compressive strength not inferior to the specified one, except if different instructions are given by the Engineer-in-Charge.

The Engineer-in-Charge shall have the right to reject concrete in any of the following events:

When mixing operations have not been started within thirty (30) minutes after the cement is added to the aggregates or,

when more than fifteen (15) minutes have elapsed between the discharging of the mixer and the actual placing of the concrete, without agitating the concrete mix or,

When more than one (1) hour has elapsed between the adding of the cement to the aggregates, and the actual placing of the concrete.

The Engineer-in-Charge reserves the right to specify a lesser time, if hot weather or other conditions cause quick stiffening of the concrete.

None of the concrete rejected by the Engineer-in-Charge shall be utilized in any of the permanent works. The re-tempering of concrete, which has partially hardened, that is, remixing with or without additional cement, aggregate or water shall not be permitted.

6.5.2 Execution of Plain Concrete Works (PCC)

6.5.2.1 Mixing of Concrete

Mixing of concrete shall be done by volume measure in the proportion as specified in the drawing and / or as directed by the Engineer-in-Charge. Boxes of suitable size shall be used for measuring sand and aggregates. The internal dimensions of the boxes shall be generally 35x25x40 cm deep or as otherwise approved by the Engineer-in-Charge. The unit of measurement for cement shall be a bag of 50 kg and this shall be taken as 0.035cum.

While measuring the aggregates, shaking ramming or heaping shall not be done. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowance for bulkage shall be made by adopting the method prescribed under "Mandatory tests".

Mixing shall be done in mechanical mixers. Mixing by hand shall be employed only in special cases with the specific prior permission of the Engineer-in-Charge. Stone aggregate shall be washed with water to remove dirt, dust or any other foreign materials, where necessary before putting into the mixer.

a. Machine Mixing

Before starting mixing in a mixer, the mixer drum shall be flushed clean with water. Measured quantity of dry coarse aggregate shall be placed in the skip followed by measured quantity of fine aggregate and then cement. In case damp sand is used, add half of the quantity of coarse aggregate followed by cement and sand. Finally add balance quantity of the coarse aggregate. The skip shall be raised and dry materials slipped into the drum. The dry materials shall be mixed for at least four turns of the drum, after which the correct quantity of water shall be added gradually while the drum is in motion, to ensure even distribution with the dry material. The total quantity of water for mixing shall be introduced before 25% of mixing time has elapsed and shall be regulated to achieve the

specified water- cement ratio. The materials shall be mixed for a period of not less than 2 minutes and until a uniform colour consistency is obtained. The time shall be counted from the moment at all the materials have been put into the drum.

The complete contents of the mixed concrete shall be emptied before recharging. When the mixer closed down for the day or at any time exceeding 20 minutes, the drum shall be flushed clean.

b. Hand Mixing

Hand mixing shall be done on a smooth, clean and water-right platform of suitable size in the following manner.

i. Measured quantity of sand shall be spread only
ii. The cement shall be dumped on the sand and distributed evenly
iii. The sand and cement shall be mixed intimately with spade, turning the mixture over and over again, until it is of even colour throughout and free from streaks.
iv. The sand cement mixture shall be spread out and measured quantity of coarse aggregate shall be spread on its top. Alternatively the measured quantity of coarse aggregate shall be spread out and the same cement mixture shall be spread on its top.
v. The above materials shall be mixed at least three times by shoveling and turning over by twist from center to side, then back to the centre and again to the sides.
vi. A hollow shall be made in the middle of the mixed pile.
vii. Three quarters of the total quantity of water required shall be added while the material is turned in towards the centre with spades. The remaining water shall be added by water can fitted with rose head, slowly turning the whole mixture over and again until a uniform colour and consistency is obtained throughout the pile.
viii. The mixing platform shall be washed at the end of the day.

6.5.2.2 Consistency and Slump of Concrete

Concrete shall be of a consistency and workability suitable for the conditions on the job. For most concrete a "plastic" mix is required, which will not crumble, but will flow sluggishly when vibrated, without segregation.

The quantity of water to be used for each mix of 50 kg cement , to give the required consistency shall not be more than 34 litres for 1:3:6 mix, 30 litres for 1:2:4 mix, 27 litres for 1:1.5:3 mix and 25 litres for 1:1:2 mix. In the case of vibrated concrete, such limits specified may be suitably reduced to avoid segregation. The quantity of water shall be regulated by carrying out regular slump tests.

Slump tests shall be performed in accordance with the "Standard Method of Slump Test for Consistency of Portland Cement Concrete"- **IS-515**. The Engineer-in-Charge may require to adopt a stiffer consistency than that specified wherever concrete of such consistency can be poured and be compacted easily by vibrators.

Wherever the limits for consistency and/ or slump are exceeded, the concrete shall be rejected and removed at the Contractor's expense. The slumps as given in the Table 6.1 shall be adopted for different kinds of work:

Table -6.1

Limit of Slump for Plain Concrete

Works	Slump in mm	
	Vibrator Used	Vibrator not used
Mass concrete in foundation, etc	10-25	50-75
Thin sections of flooring less than 75 mm thickness	25-40	75-100

6.5.2.3 Strength of concrete

The compressive strength on work tests for different mixes shall be as given in the table 6.2

Table - 6.2

Compressive Strength of Concrete

Grade of concrete	Mix	Compressive strength in N/mm.sq	
		At 7 days	At 28 days
M30	1:1:1.5	20	30
M25	1:1:2	17	25
M20	1:1.5:3	13.5	20
M15	1:2:4	10	15
M10	1:3:6	7	10

6.5.2.4 Placing of concrete

The entire concrete to be used in the work shall be laid gently (not thrown) in layers not exceeding 170 mm and shall be thoroughly vibrated by means of mechanical vibrators till a dense concrete is obtained. The Engineer-in-Charge may however relax the condition specifying use of mechanical vibrators at his discretion for certain items depending upon the thickness of the members and feasibility of vibrating the same and permit hand compaction.

Hand compaction shall be done with the help of tamping rods so that the concrete is thoroughly compacted and completely worked into the corners of the formwork. The layers of concrete shall be so placed that the bottom layer does not finally set before the top layer is placed.

Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to the dry mixture. For items where the vibrators are not to be used, it

shall be the duty of the Contractor to take the permission of the Engineer-in-Charge before the start of work.

During cold weather, concreting shall not be done when the temperature falls below 4.7° C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During hot weather, precaution shall be taken to see that the temperature of wet concrete does not exceed 38° C.

When the placing of concrete is suspended, necessary removal of laitance and roughening the surface for jointing future work shall be done before the concrete sets. When the work is resumed the previous work must be thoroughly cleaned, roughened, watered and a grout of neat cement slurry of the proportion, 1 kg of cement per litres of water applied uniformly.

6.5.3 Execution of Reinforced Concrete Works (RCC)

6.5.3.1 General Requirement

The production of concrete for RCC works shall be as specified under concrete works (plain), vide **para-6.5.2**. Concrete shall be always mixed by mechanical mixer unless otherwise the Engineer-in-Charge permits hand mixing.

6.5.3.2 Fabrication of Reinforcement

a) General

The reinforcement, in general, shall be of Fe 500 grade, unless otherwise specified the Contractor shall fabricate reinforcing steel to the dimensions configuration as shown on the drawings or as approved by the Engineer-in-Charge

6.5.3.3 Consistency of RCC

The concrete, which will flow sluggishly into the forms and around the reinforcements without any segregation of coarse aggregate from the mortar, shall be used. The consistency shall depend on whether the concrete is vibrated or hand tamped. It shall be determined by slump test as prescribed in mandatory test. The slumps of concrete for different types of RCC works shall be given in Table-6.3, unless otherwise specified.

Table-6.3

Limit of Slump for Reinforced Concrete

Sl. No	Work	Slump (in mm) Vibrators	
		Used	Not used
1	Mass concrete in R.C.C. foundation footings, and retaining walls.	10-25	80

2.	Beams, slabs and columns, simply reinforced.	25-40	100-125
3.	Thin R.C.C. section or section with congested steel	40-50	125-150

6.5.4 Form Work

i. Centering and Strutting

Props used for centering shall be steel, timber posts, ballies or any other material approved by Engineer-in-Charge. In no case ballies shall be of diameter less than 100 mm measured at mid length and 80 mm at thin end. Maximum permissible spacing shall be 1.2 m centre to centre. Ballies shall rest squarely on wooden sole plates of 40mm thickness and minimum bearing area of 0.1 sq.m laid either on ground or on 40x40 cm brick masonry pillars in mud mortar of height not exceeding 40 cm. Double wedges shall further be provided between the sole plates and the wooden props so as to facilitate tightening and easing of shuttering without jarring the concrete. In case brick masonry pillar of adequate section are used instead of props, wooden sole plates shall be provided at the top of pillars and double wedges inserted between the sole plate and the bottom of shuttering.

ii. Shuttering

The shuttering shall have smooth and even surface and the joints shall not permit leakage of cement grout. Timber used shall be well seasoned, free from loose knots, projecting nails, splits or other defects that may mar the cement surface of concrete. It shall not be so dry as to absorb water from the concrete and swell and bulge, or so green or wet as to shrink after erection. Species of timber that are not affected appreciable by its contact with water shall be used. The timber shall be accurately sawn and planned on the sides and the surface coming in contact with concrete. For exposed concrete faces, timber for shuttering shall be wrought on all faces in contact with concrete.

Wooden formwork with metal sheet lining of steel plates stiffened by steel angles shall also be permitted. Where metal forms are used, all bolts and nuts shall be countersunk and well ground to provide a smooth plane surface. The chamfers, beveled edges and molding shall be made in the formwork itself. Opening for clamps and other fittings connected with services shall be provided in the shuttering as directed by the Engineer-in-Charge. As for as practicable, clamps shall be used to hold the forms together. Where use of nails is unavoidable minimum number of nails shall be used and these shall be left projecting so that they can be easily withdrawn. Use of double head nails shall be performed.

iii. Surface Treatment for Shuttering

The surfaces of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution, raw linseed oil, form oil of approved manufacturer or any other approved material (such as polythene/polyethylene sheets), to prevent adhesion of concrete to form work. Soap solution, for the purpose shall be prepared by

dissolving yellow soap in water to get the consistency of paint. Inside surface of forms shall be thoroughly cleaned before application or any of the materials mentioned above. Release agents shall be applied strictly in accordance with the manufacturer's instruction and shall not be allowed to come in contact with any reinforcement. Re-use of the shuttering shall be permitted only after the inside surface has been thoroughly cleaned in the manner described above.

Contractor shall give the Engineer-in-Charge due notice before placing any concrete in the forms to permit him to inspect and accept the form work as to its strength alignment and general fitness, but such inspection shall not relieve the Contractor of his responsibility for safety of workman, machinery, materials and for results obtained.

iv. Removal of Form Work

No formwork of any part thereof shall be removed without prior approval of the Engineer-in-Charge. The formwork shall be so removed as not to cause any damage to concrete due to shock or vibration. In a slab and beam construction, sides of beam shall be stripped first, then the under sides of slab and lastly the underside of the beam. Formwork must be so designed that they can be stripped in the order required i.e.

a) Shutters to vertical (non load bearing) faces e.g. column boxes, beam sides, wall forms,
b) Shutters forming soffits to slab, horizontal and inclined which carry only light load, e.g. slab, roofs, floors and canopies etc.
c) Soffit shutters carrying heavy load e.g. beam and girder bottoms.

The whole of the formwork should be planned and a definite scheme of operation worked out. In no circumstances should forms be struck until the concrete reaches strength of at least twice the stress of which the concrete may be subjected at the time of striking. Where possible the formwork should be left longer as it would assist curing. Forms should be eased carefully in order to prevent the load being suddenly transferred to concrete. The period that shall elapse after the concrete has been laid, before easing and removal of centering and shuttering is undertaken shall be as given in **Table -6.4**.

Table -6.4

Minimum period of Removal of Form works

Type of formwork	Minimum period before striking formwork
Vertical formwork to columns, walls and beams	15-24 h
Sofit formwork to slabs (props to be refixed immediately after removal of formwork)	3 days
Sofit formwork to beams (props to be refixed immediately after removal of formwork	7 days
Props to slab spanning upto 4.7m	7 days

Props to slab spanning over 4.7 m	14 days
Props to beam and arches spanning upto 7 m.	14 days
Props to beams and arches spanning over 7 m	21 days

Notes:

1. For rapid hardening cement, 3/7 of the above period will be sufficient in all cases except for vertical sides of slabs, beams and columns which should be retained for at least 24 hours.
2. In case of cantilever slabs and beams, the centering shall remain till structures for counter acting or bearing down have been erected and have attained sufficient strength.
3. Proper precautions should be taken to allow for the decrease in the rate of hardening that occurs with all cements in cold weather.
4. Work damaged through premature or careless removal of forms shall be reconstructed.

6.6 Measurements and Payment

6.6.1 Measurements and Payment for Concrete

6.6.1.1 Measurement

The concrete work under the following categories shall be measured separately:

a) From foundation to plinth level
b) From plinth level to all heights
c) Concrete work at the parapet shall be measured together with the corresponding work in the wall of the storey next below.

The consolidated cubical contents shall be calculated net nearest to 0.01 cu.m. Concrete laid in excess, of the sections shown in the drawing unless directed by the Engineer-in-Charge shall not be measured.

Pre-cast cement concrete solid articles shall be measured separately and shall include use of moulds, finishing the top surfaces even and smooth with wooden trowel, before setting in position in cement mortar (1 cement: 3 coarse sand).

No deduction shall be made for:

a) Ends of dissimilar materials (e.g. joists, beams, posts, girders, rafters, purlins, trusses, corbels, step etc.) upto 500 sq.cm in section.
b) Opening upto 0.1 m^2 or as specified.
c) Volume occupied by pipes, conduits, sheathing etc. not exceeding 100 sq. cm each in cross sectional area.

d) Volume occupied by reinforcements

6.6.1.2 Payment for Concrete

Payment for concrete works shall be made at Unit Rates tendered in the Bill of Quantities. The Unit rate shall include the cost for carrying out all the required operations including the cost of labour, materials equipment, tools and plants, and incidentals, etc, but excluding reinforcement and form work, necessary to complete the work.

6.6.2 Measurement & Payment for Formwork

6.6.2.1 Measurement for Formwork

Form work shall be measure separately (i) Upto foundation and plinth and (ii) above for each of the items as per Bill of Quantities. All measurement shall be taken of the area shuttering in contact with the concrete surface dimension of Form work shall be measure correct to 10mm.

No deduction from shuttering due to the opening /obstruction shall be made in area of such opening/ obstruction does not exceed 0.1 sq.m. Nothing extra shall be paid for forming.

6.6.2.2 Payment for Formwork

Payment for Form work which includes entering shuttering for all heights shall be paid separately Unit Rates tendered for the items specified in Bill of Quantities. Where it is not specially stated in the description of the item that form work shall be paid for separately, the rate of the R.C.C. item shall be deemed to include the cost of form work.

The Unit Rate for form work shall include the cost of labour, materials, tools and plants and all incidentals required for all operation including supporting members until the concrete is cured, set and hardened as required. No separate payment shall be made for items such as from form releasing agent, connections provision for openings and other items required for completion of the works unless specified otherwise.

6.6.3 Measurement & Payment for Reinforcement

6.6.3.1 Measurement for Reinforcement

Measurement for reinforcing bars will be made for actual lengths of reinforcement bars including permissible hooks, bends and splices will be measured. The weight of reinforcing bars will then be calculated for each size of bar from the unit weight as stated on the certified copies of manufacturer's reports, which the Contractor shall submit to the Engineer-in-Charge or otherwise standard weights per metre for each size of bars as provided in the Steel Tables shall be used.

Before starting concreting, the Contractor shall make sure that the measurements of reinforcing bars placed in position have been recorded and that the Engineer-in-Charge has certified the correctness of the reinforcement used.

6.6.3.2 Payment for Reinforcement

Payment for reinforcements shall be made at the unit rate per kg tendered in the Bill of Quantities, which shall includes the entire cost of supply, taxes, handling, storage, cutting, bending, placing, wire clips, ties, separators and any other fastening devices.

No separate payment will be made for the following, which shall be included in the quoted unit price:

1. Wire for tying reinforcement.
2. Any additional reinforcement or splices required when Contractor's casting sequence differ from construction joints shown on the drawings.
3. Any reinforcement steel placed by the Contractor for his own convenience in addition to those shown on the drawings.
4. Devices like steel chairs, hangers, spacers, small spacer concrete blocks, other supports, ties and anchor rods etc. used to maintain reinforcing steel in position.
5. Any reinforcing steel delivered for testing.
6. Carrying out tests for checking butt welds to replace lapping/splicing of reinforcing bars.
7. Carrying out tests to verified quality of steel reinforcement to be used as required and directed by the Engineer-in-Charge.

6.7 Plinth Protection

Plinth protection shall be provided, as specified, to required width. It comprises of 5cm thick cement concrete 1:3:6 over 75mm bed of gravel or shingle or dry brick aggregate 40mm nominal size, grouted with fine sand. The outer edge shall be lined with 2nd class bricks laid on edge and joints laid in cement mortar 1:4 (1 cement: 4 fine sand). Plinth protection shall be laid with a minimum outward slope of 1 in 50.

6.7.1 Preparing Ground

The ground, where plinth protection is to be laid, shall first be prepared to the required slope. The high portions of ground shall be excavated, hollows and depressions filled up to the required level with the excavated earth and watered and rammed to give uniform outward slope. Preparation of any area involving cutting and filling up to a depth of 15cm shall not be paid for separately. Cutting and filling beyond 15 cm shall be paid for

separately. The bed shall be watered adequately and rammed with iron rammers. Surplus earth, if any, obtained shall be disposed of within a lead 50 meters or as directed by the Engineer-in-charge.

6.7.2 Brick Edging

The edging shall be of bricks or of stone. Trenches of required depth and width shall first be made along the edge of the plinth protection to receive the edging. The bed of trenches shall be compacted to a firm and even surface. The bricks or stones shall be laid true to line in cement mortar 1:4 (1 cement: 4 fine sand) with length parallel and abutting the plinth protection. The top face of the brick edging shall be in one level, to conform to the finished level of the plinth protection adjacent to the edging. After the concreting is done, no portion of the edging shall project above the adjacent concrete surface.

6.7.3 Sub-Grade

The sub-grade shall consist of a bed of dry brick aggregate or gravel or shingles of 40 mm nominal size. The aggregate shall be spread evenly over the prepared surface to 75mm depth (unconsolidated) and given a minimum outward slope of 1 in 50. The aggregate shall be carefully laid and packed, bigger size being placed at the bottom. It shall then be consolidated dry with heavy iron rammers. After the aggregate has been consolidated the surface shall be checked with a straight edge and any depressions etc. filled up and consolidated. The aggregate shall then be grouted evenly with fine sand @ 0.60 cubic Meters /10 sq. meter area adequately watered to ensure filling of the voids by sand and again rammed with heavy iron rammers. The finished surface shall give uniform appearance.

6.7.4 Cement Concrete Topping

After the sub-grade has been compacted and prepared as above 50mm thick cement concrete 1:3:6 shall be laid in one operation except that the top shall not be finished with neat cement slurry but shall be finished with only wooden floats. The concrete surface shall not be finished with mortar. The length of each panel shall not be more than 5m. The finished surface shall have a minimum outward slope of 1 in 50.

6.7.5 Curing

Specification for curing shall be same as described under "concrete work".

6.7.6 Measurement

Length and breadth shall be measured correct to a cm and the area calculated in square meter correct to two places of decimal. No deduction shall be made, nor anything extra paid for any openings for pipes etc. up to 0.1 sq.m.

6.7.7 Rate

The rate shall include cost of materials and labour described in all the above operations.

6.8 Open Surface Drain

The open surface drains shall be of the size as specified in the item and laid to such gradients and in such locations as may be shown in the relevant drawing or as directed by the Engineer. The width of the drain at the top shall be as specified measured between the finished walls. The drain shall be given, as far as possible, uniform slope from the starting point to the discharge point.

6.8.1 Measurement

The drain shall be measured in running meters, correct to 10mm.

6.8.2 Rate

The rate shall include the cost of labour and materials, involved in excavation, concreting, masonry, plastering, finishing etc. required for the item. Suitable deduction or extra payments, "per *meter additional depth*" basis shall be made in case there is a variation in average depths from those stated above.

6.9 Traditional Cornices

Bhutan Cornice:

The profile of the cornice shall conform in all respects to the approved design and the work carried out as directed by the Engineer. Care shall be taken to see that cornice at each floor level is as per the design for that level, and to maintain proper line and level.

6.9.1 Measurement

Bhutan cornice shall be measured by length correct to 10mm, along the junction of the cornice and wall.

6.9.2 Rate

The rate includes the cost of materials and labour involved in all the operations described above except for the cost of centering and shuttering unless otherwise mentioned in the item.

7. DOORS & WINDOWS

7.1 Scope of Works

The scope of works under this Section in general, shall comprise of supply, fabrication, erection/installation of **Aluminum frame doors and windows** with paneled/glazed shutters as specified including all hardware, accessories, fittings and fixtures, complete with fixing/fitting in position. The scope of works shall also include all labour, materials and equipment and the performance of all works as shown in the Drawings or as directed by the Engineer and /or as specified herein.

7.2 Submission

The Contractor shall submit, at least thirty (30) days in advance of commencement of fixing doors and windows etc., with complete details. (sections and plans) of all parts, assembles, components, connection and supports etc., scheduling and sequence of execution of such works with details of method of anchoring and any other pertinent details, to the Engineer for his approval.

Before placing orders, the Contractor shall also submit catalogues or samples of hardware, fittings and fixtures, etc., to the Engineer for his approval.

7.3 General Requirement

The Contractor shall make good to the satisfaction of the Engineer all cuttings/damages resulting from his operations during the installation. He shall also dispose of all unserviceable materials at least 50m away from the boundary, unless otherwise directed by the Engineer. All serviceable materials shall be stacked as directed by the Engineer. The Contractor shall remain fully responsible for all normal precautions and vigilance to prevent any damage whatsoever till handing over.

7.4 Standards & Codes

Unless otherwise specified the materials to be used for the works shall conform with regard to quantity, properties and workmanship, to the 'Specification for Building and Road Works, 2009: Royal Govt. of Bhutan' and the relevant Indian Standards.

7.5 Materials for Doors and Windows

7.5.1 General

Timber/ **Anodized Aluminum Sections** for wood/**aluminum** works shall be of first class wood/ **aluminum** of specified variety. It shall be of the best quality, well seasoned and free from sap, knots, warps, cracks and other defects. The scantling shall be sawn in the

direction of the grains and shall be planed smooth and truly finished to the exact dimensions, rebates, rounding and mouldings as shown in the drawings made, before assembling. Patching and plugging of any kind shall not be permitted except as approved by the Engineer In Charge. All joints shall be neat and strong, truly and accurately fitted and coasted with white lead/**gasket** before being fitted together.

All portions of timber/ **Aluminum Sections** build into or in contact of masonry or concrete shall be given two coasts of boiling tar. All exposed surfaces shall be finely polished or varnished as directed by the Engineer –In-Charge, to give a very attractive finish.

7.5.2 Frames for Doors & Windows

(1) General

Frames for doors and windows or otherwise shall be buildup from best quality of mixed Conifer wood/ **Aluminum Sections**. All members of the frames shall be of the same species of timber/ **Aluminum Sections** and shall be straight without any wrap or bow. Frames shall have smooth, well planed surfaces except the surfaces touching the wells, lintels etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15mm and width of the rebates shall be equal to the thickness of the shutters.

(2) Joints

The frames shall have dovetail joints. The jamb posts shall be through renowned into the mortise of the transons to the full thickness of the transons and the thickness of the tenson shall not be less than 2.5cm. The tensons shall closely fit into the mortise without any wedging or filling. The contact surface of tenson and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS-4835 or MR grade of IS 851 and pinned with 10mm dia. hard wood dowels or bamboo pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed into position. Each assembled door frame shall be fitted with a temporary stretcher and temporary diagonal brance on the rebated faces.

(3) Fixing

The frames shall be got approved by the Engineer-In-Charge before painting/treatment and fixing in position. The surface of the frames abutting masonry or concrete and the portion of the frames embedded in floors shall be given in two coats of boiling tar. Frames shall be fixed to the abutting masonry or concrete with three or more hold fast as directed by Engineer on each side of the doors & windows frames with one at the center and other two at 30cm from top and bottom of the frames.

After fixing the jab posts of the frame shall be plugged suitably and finished neat. Vertical members shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedge in order to prevent warping during construction.

7.5.3 Beading for Doors & Windows

Beading to the doors and windows shall be made from Blue Pine moulded wood and shall be true and accurate to the size 50 x20mm. The beading shall have rebate rounding and moulding finished smooth. Fixing of such beading shall be done with screws which shall be sunk into the woodwork and their tops covered with putty. The unexposed surface of beading shall be given a priming coat of paints as directed by the Engineer-in-Charge.

7.5.4 Shutter for Doors & Windows

7.5.4.1 General

Shutter for doors and windows of all rooms except Kitchen and Bath shall have double leaves and shall be fixed as shown in the drawing ort as directed by the Engineer-in-Charge. The shutters shall be 38mm thick for doors and 35mm thick for windows and shall be fabricated from well seasoned best quality champ wood, unless otherwise specified. Shutters shall be free from twist or wrap in its plane and shall be fully paneled in the both faces and shall be finished with decorative look. Each style and rail shall be a single place without any joint. Before taking up work in hand, design of the paneling and its outlook shall be got approved by the Engineer-in-Charge.

Shutters for windows shall be fully glazed.

Shutters for Kitchen doors should be flush, 35mm and shall have a solid core with decorative finish.

Shutters for Bath room shall be of PVC made of approved brand manufacturer.

Shutters for Bath room windows (inside) shall be 35mm thick and shall be fully glazed with best quality frosted glass.

Shutters for cupboards shall be 35mm thick made of best quality champ wood. Shutters shall be fully paneled. Size of rails and styles shall be as mentioned in the Table-7.1.

Each shutter for doors shall be fixed with 4 nos. x100mm brass press butt hinges with necessary hinges.

All shutters shall be provided with all fittings and fixtures, complete in all respects in accordance with the specifications/ drawings and/ BoQ or as directed by the Engineer-In-Charge.

7.5.4.2 Paneled Shutters

a. Gluing of joints

The contact surfaces of tenon and mortise shall be treated, before putting together, with bulk type synthetic resin adhesive conforming to IS: 851 suitable for construction in wood or synthetic resin adhesive (Phenolic and amino plastic) conforming to IS: 848 or polyvinyl acetate dispersion based adhesive conforming to IS: 4835 and pinned with 10mm dia. Hardwood dowels or bamboo pins or star shaped metal pins, after the frames are put together and pressed in position by means of press.

b. Dimensions of Frame work

Stiles and bottom rails shall be made out of one piece of timber only. Intermediate rail; exceeding 200mm in width may be out of one or more pieces of timber. The width of each piece shall not be less than 75mm. Where more piece of timber is tongued and grooved joint glued together and reinforced with metal dowels at regular intervals not exceeding 200mm. Other dimensions shall be as mentioned in the Table -7.1 or as directed by the Engineer-in-Charge.

Table- 7.1 (To be prepared for paneled doors & glazed windows)

Dimensions of the Frame of Paneled Doors/Windows Shutters

Description	Width (mm)	Thickness (mm)
A. For Doors		
Stile, top and freeze rail	100	38
Lock rail	150	38
Bottoms rails	200	38
Muntin	100	38
B. For Windows		
Stile, top and freeze rail	80	35
Bottom rail	80	35
Muntin	60	35
Glazing bar	40	35
C. Cupboards		
Stile, top and freeze rail	75	25
Bottom rail	75	25
Muntin	60	25
Glazing bar	40	25
Runners	25	25
Architraves	25	25
Curtain rod	25 dia.	25

Muntin have where required shall be srrubtenoned to the maximum depth which the size of the member would permit or to a depth of 25mm whichever is less. Unless otherwise specified the finished dimensions of the components of frame work of shutters shall be as given above ± 1mm. The thickness of all components of framework shall be the same as the thickness of the shutter tolerance on overall dimension of the shutter to be ±3mm.

c. Rebating

The shutters shall be single leaf or double leaved as shown in the drawings or as directed by the Engineer-in-Charge. In case of double leaved shutter the meeting of the stiles shall be rebated by one third the thickness of the shutter. The rebating shall be either splayed or square types.

d. Paneling

Timber panels shall be preferably made of timber of large width, the minimum width and thickness of the panel shall be 150mm, and 15mm respectively. When made from more than one piece, the pieces shall be jointed with a continuous tongued and grooved join glued together and reinforced with headless nails at regular intervals not exceeding 100mm. Depth and thickness of such joint shall be equal to one third or thickness of panel. The panels shall be designed such that no single panel exceeds 0.5 square metres in area. The grains of timber panels shall run along the longer dimension of the panels. All panels shall be of the same species of timber.

7.5.4.3 Flush Door Shutters

a. General

Width and height of the shutters shall be as shown in the drawings or as indicated by the Engineer In charge. All four edges of the shutters shall be square. The shutter shall be free from the warp in its plane. The moisture content in timers used in the manufacture of flush door shutters shall be not more than 12 percent when tested according to IS: 1708.

b. Core

The core of the flush door shutters shall be pre-fabricated with block board solid core and ply veneer with a decorative finish. The core shall have wooden strips held in al frame constructed of stiles and rails. Each stile and rail has a single piece without any joint. The width of the stiles and rails shall not be less than… and not more than 100mm. The width of each wooden strip shall not exceed 25mm. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles and rails.

c. Face Panel

The face panel shall be formed by gluing, by the hot-press process on both faces of the core, either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneers and between 0.5 mm and 1.0 mm for decorative veneers. The direction of the veneers adjacent to the core shall be at right angles to the direction of wooden strips. Finished face shall be sanded to smooth even texture.

d. Lipping

Lipping, where specified, shall be provide internally on all edges of the shutters. Lipping shall be done with battens of the first class hardwood or as specified of depth not less than 25 mm. For double leaved shutters, depth of the lipping at meeting of stiles shall be not less than 35 mm. Joints shall not be permitted in the lipping.

e. Rebating

Rebating shall be as specified above.

f. Opening for Glazing

The shutters shall have a opening for glazing of size 25 cm in height and 20 cm in width unless directed otherwise. The bottom of the opening shall not be a height of 140 cm from the bottom of the shutter. Opening for glazing shall be lipped internally with wooden batten of width not less than 25 mm. Opening for glazing shall be provided where specified or shown in the drawing.

g. Tolerance

Tolerance on width and height shall be $\pm$ mm and tolerance on nominal thickness shall be $\pm$ 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

h. Adhesive

Adhesive used for bonding various components of flush door shutters namely, core, core frame lipping, cross-bands, face veneers, plywood etc. and for bonding plywood shall conform to BWP type phenol formaldehyde synthetic resin adhesive conforming to IS:848.

i. Tests

Samples for flush door shutters shall be subjected to the following tests

a) End Immersion Test

b) Knife Test

c) Glue Adhesive Test

One end of each sample shutter shall be tested for End Immersion Test. Two specimen of 150 x 150 mm size shall be cut from the two corners at the other end of each sample shutter for carrying out Glue Adhesive Test. Knife Test shall be done on the remaining portion of each sample shutter.

7.5.4.4 Exterior Shutters

Frames of the exterior shutters shall be 35 mm thick, made of mixed conifer wood with size as specified in Table-7.1. All such shutters shall be fixed with galvanized MS wire-gauge, 0.56 mm dia. Wire and shall be provided with the steel mosquito proof nets of approved mesh size and quality within the frame.

7.6 Glass and Glazing

7.6.1 General

The Contractor shall supply and install all glass and glazing as required for various doors, windows, ventilators and miscellaneous glazing and partitions, unless otherwise stated from approved manufacturer and shall have uniform refractive index and free from flaws specks and bubbles. The glass shall be brought to site in the original packing from the manufacturer and cut to size at site. The cut edges shall be straight and free from hips, sprawls or any other damages.

7.6.2 Materials for Glass and Glazing

Clare reducing (tinted, or heat absorbing glass) shall be of approved quality and special care shall be taken to grind smooth and round off the edges before fixing. Clear glass shall be flat drawn sheet glass and shall be at least 4 mm thick. Sheet glass for doors shall be minimums 5.5 mm thick.

Composite double-glazing shall be made of double-glazing of two 6 mm thick sheet glass either both sheets of tinted glass or one glass tinted and other plain or both sheets of plain sheet glass means of suitable desiccant. The sealing shall be under strict quality control. The composite glazing shall be procured as finished product from reputed manufacturers.

In general, the putty shall be of best quality from approved manufacturer. It shall be brought to site in manufacturer's original packing. Quick setting putty shall be used for windows and sashes except when glare-reducing glass is used where it shall be of non-setting type. Neoprene gaskets with snap-fit glazing shall be fixed as per manufacturer's instructions and shall fit firmly.

7.6.3 Glazing, Setting and Finishing

All glass shall be thoroughly cleaned before setting in position. Each glass pane shall be held in place by special glazing clips of approved type. Four glazing clips shall be provided per glass pane except for large panes where six or more clips shall be used as per the instructions of the Engineer. All holes as necessary for holding the clips, glazing beads and all other attachments shall be drilled.

Glass panes shall be set without springing, and shall be bedded in putty and back putties, except where moulding or gasket are specified. Putty, mastic cement etc. shall be smoothly finished to a true even line. Obscure and figured glass shall be set with smooth side cut.

After completing of glazing work, all dirt, stains, excess putty shall be removed and the glass panes cleaned in perfectly acceptable condition. All broken, racked or damaged glass shall be replaced by new ones at the Contractor's own cost.

7.7 Hardware Materials

The Contractor shall submit catalogues or samples of the hardware to the Engineer for his approval. The hardware shall comply with the following requirement:

Tower Bolts	Brass barrel type, 250 mm, 150 mm and 100 mm size for doors, windows and cupboards respectively.
Sliding Door Bolts	Brass, 250 100 mm size
Knob or Handle	Brass, 150 / 125 / 100 mm size
Door Closer	Die-cast aluminum body, oil and spring activated with 90 degree stop device.
Hook and Eye	Brass, 100 mm
Door Closure	Bright finish brass, Hydraulic
Door Stopper	Bright finish brass
Sash Fastener	Die-cast aluminum

7.8 Acceptance Criteria

7.8.1 Fabricated Items

a) Overall dimensions shall be within $\pm$ 1.5 mm of the size shown on the drawings.

b) Mullions, transoms etc. shall be in one length and permissible deviations from Straightness shall be limited to + 1.5 mm from the axis of the members.

c) Door and window shutters shall operate without jamming. The clearance at head and jamb for door shutters shall not exceed $\pm$ 1.5 mm. For double leaf doors, the gap at the meeting stiles shall not be more than $\pm$ 1.5 mm.

d) Doors leaves shall be undercut where shown on drawings.

e) Doors, windows, frames etc. shall be on a true plane, free from warp or buckle.

f) Provision for hardware and fixtures to be installed at site.

g) Glazing beads shall be cut with mitered corners.

h) Glazing clips, fixing devices etc. shall be supplied in adequate numbers.

7.8.2 Installed Items

a) Installation shall be at correct locations, elevations and in general on a true vertical plane.

b) Fixing details shall be strictly as shown on drawings.

c) Assembly of composite units shall be strictly as per drawings, with mastic caulking at transoms and mullions, gaskets, weather strips etc. complete.

d) All frames on external wall shall be mastic caulked to prevent leakage through joint between frames and masonry.

e) All open able sections shall operate smoothly without jamming.

f) Lock, fasteners etc. shall engage positively. Keys shall be non-interchangeable.

g) Cutting to concrete or masonry shall be made good and all abrasions to shop paint shall be touched up with paint of same quality as shop paint.

It shall be responsibility of the Contractor to see that the material is protected from mortar, paint, plaster, terrazzo framing members to the satisfaction of the Engineer before handing over to the Employer.

7.8.3 Glass and Glazing

a) All installation shall be free from cracked, broken or damaged glass. Edges of large panes of thicker glass and heat absorbing glass shall be inspected carefully for chipped, cracked or underground edges.

b) Glazing shall be carefully done to avoid direct contact with metal frames.

c) All glasses shall be embedded in mastic or fixed by neoprene gaskets to give a leak proof installation.

d) At completion, the panes shall be free from dirt, stains, excess putty etc. to the Complete satisfaction of the Engineer.

7.8.4 Aluminum Doors, Windows and Ventilators

Alloy extruded sections complying with the requirement of IS: 1948. Doors, windows and ventilators shall be designated by symbols denoting their width, type and height in succession in the following manner:

a) Width - It shall be indicated by the number of modules in the width of opening.

b) Type - It shall be indicated by the following letters of alphabet:

C = Centre-hung shutters,

F = Fixed-glass panes,

H = With horizontal glazing bars,

N = Without horizontal glazing bars,

S = Side-hung shutters, and

T=Top-hung shutters.

c) Height - It shall be indicated by the number of modules in the height of opening.

7.8.5 Composite Doors, Windows or Ventilators shall be designated in the following manner:

a) A 12 module wide and 21 module high horizontally glazed side-hung door coupled on its two sides with two side-hung horizontally glazed windows 6 module wide and 12 module high is designated by 6HS 12/12HS21/6HS12.

b) Two 10 module wide and 12 module high horizontally glazed side-hung windows coupled side by side with two fixed glass pane ventilators at top, each 10 module wide and 6 module high, is designated by 10HF6/10HF6 10HS12/10HS12

Glass panes used for doors, windows and ventilators shall weigh at least 7.5 kg/m2 and shall be free from flaws, specks, or bubbles. All panes shall have properly squared corners and straight edges. Frames shall be square and flat, the corners of the frame being fabricated to a true right angle. Both the fixed and opening frames shall be constructed of sections, which have been cut to length, mitered and welded at the corners. Where hollow sections are used with welded joints, argon-arc welding or flash butt welding shall be employed (gas welding or brazing not to be done). Subdividing bars of units shall be tensioned and riveted into the frame.

Aluminum doors, windows and ventilators may be supplied in either matt, scratch-brush or polished finish. They may, additionally, also be anodized, if so required by the purchaser. If colour anodizing is to be done then only approved light-fast shades should be used. A thick layer of clear transparent lacquer based on methacrylates or cellulose butyrate, shall be applied on aluminum doors, windows and ventilators by the suppliers to protect the surface from wet cement during installation. This lacquer coating shall be removed after installation is complete. Glazing shall be provided on the outside of the frames. If required, glazing clips may be provided as extra fittings by mutual arrangement between the purchaser and the supplier. Four glazing clips may be provided per glass pane, except for door type 8HS21 where the glazing clips shall be six per glass pane. In case of doors, windows and ventilators without horizontal glazing bars the glazing clips

shall be spaced according to the slots in the vertical members, otherwise, the spacing shall be 30 cm. All doors, windows and ventilators shall be dispatched with the opening parts suitably secured to preserve alignment when fixing and glazing. Fixing lugs, coupling fittings and all hardware shall be dispatched separately. Composite windows shall be dispatched uncoupled.

7.8.6 Aluminum Door/Windows Fittings

Butt hinges**: -** These shall be manufactured from extruded sections. These shall be well made and free from flaws and defects of all kinds. These shall generally conform to IS 205. They shall be anodized and the size shall be as specified. The hinge pin shall be made of mild steel or brass or stainless steel, in the case of brass hinges. It may also be made of phosphor bronze, if so required by the purchaser. The hinge pin shall be of aluminum alloy or mild steel (galvanized) or stainless steel in case of aluminum alloy hinges. The aluminum alloy hinge pin shall be hard anodized to a minimum thickness of 0.015 mm and sealed with oil, wax or lanolin. The hinge pin shall be firmly riveted or suitably notched and shall be properly finished. The movement of the hinges shall be free, easy and square, and shall not have any play or shake. Washers shall be provided between the knuckles and these shall be of the same diameter as the butt and shall be made of nylon, plastic, stainless steel or other suitable material. Hinges shall be free from all defects. All sharp edges shall be rounded. Brass hinges shall have bright or satin finish and shall be suitably protected against discoloration. Aluminum alloy hinges shall be anodized and the quality of anodized finish shall not be less than Grade AC 10 of IS 1868.

Knuckles: - Number of knuckles in each hinge pin shall not be less than 5. The number of knuckles in case of sizes less than 40 mm shall be three. The sides of the knuckles shall be straight and at right angle to the flap. The movement of the hinge pin shall be free and easy and working shall not have any play or shake.

Screw holes: - The screw holes shall be suitable for counter sunk head wood screws, and of the specified sizes for different types of hinges. The size of the holes shall be such that

when it is counter sunk it shall be able to accommodate the full depth of counter sunk head of wood screw specified.

Aluminum handles: -The handles shall be well made and free from defects. These shall be finished correct to shape and dimensions. All edges and corners shall be finished smooth so as to facilitate easy handling. Cast handles shall be free from casting defects. Where the grip portion of the handle is joined with the piece by mechanical means, the arrangement shall be such that the assembled handle shall have adequate strength comparable to that of integrally cast type handles. These shall be of cast aluminum of specified size, and of shape and pattern as approved by the Engineer. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size, and window handles of 75 mm size unless, otherwise specified. These shall be fixed with 25 mm long wood screws of designation No.6. Aluminum handles, shall be anodized and the anodic coating shall not be less than grade AC-15 as per IS1868.

Aluminum hooks and eyes: - These shall be made of aluminum alloy. It shall be anodized and all edges and corners shall be finished smooth. These shall be well made and free from defects. They shall be finished to the correct shape and dimensions so as to function properly when they are in use. Cast hooks, eyes shall be free from casting and other defects. Sizes of hooks and eyes shall be determined by the length of the hooks measured out to out.

Aluminum kicking plate: - Aluminum kicking plate shall be anodized and the anodic coating shall not be less than grade AC-10 of IS 1868. It shall be made from a plate of thickness 4.0 mm, size and shape of the plate shall be as specified. The edges shall be filed smooth.

Aluminum Sliding Door Bolt: - This shall be made of Aluminum alloy and shall generally conform to IS 2681. It shall be anodized and all edges and corners shall be finished smooth. All screw holes shall be counter sunk to suit the counter sunk head of wood screws of specified sizes. The size shall be as specified.

Aluminum Tower bolts- (barrel type): - Aluminum barrel tower bolts shall be manufactured from extruded section of Aluminum alloy. The knob shall be properly screwed to the bolt and riveted at the back. The bolt and barrel shall be anodized. The anodic film may be either transparent or dyed as specified. The quality of anodized finished shall not be less than grade AC - 10 of IS1868. Size of the bolt shall be as specified.

Aluminum flush bolts: - These shall be of cast aluminum alloy or extruded aluminum alloy as specified. Only one material shall be used in the manufacture of all the components of flush bolts except spring, which shall be of phosphor bronze or steel strip. The length of the bolt shall be such that, when the bolt is pulled down, the top of the bolt shall be flush with the top of the lip face. The top of the bolt shall be given a taper of 45 degree to enable easy push and pull. Aluminum flush bolts shall be anodized and the quality of the anodized finish shall not be less than grade AC 15 of IS 1868.

Aluminum Screws: - They shall be of the slotted counter sunk head type of length as specified. The designation number shall be as required.

Aluminum Door Stopper 150 mm: - Aluminum door stopper shall be anodized and the anodic coating shall not be less than the grade AC-10 of IS 1868. The size and pattern of the door stopper shall be approved by the Engineer-in- charge. The size shall be determined by its length.

7.9 Measurement and Payment

Measurement and payment for wood works and **anodized aluminum** in frames of door, windows and other frames, wrought, framed and fixed in position shall be made for the finished dimension without any allowance for the wastage, at the unit rate per cum/**kg**. Measurement and payment for shutters of doors, windows and cupboards, whether paneled, flush or glazed / PVC/ **anodized aluminum** shall be made at the unit rate per Sq.m/**Kg** on the basis of **relevant standards**/ area of the opening between the frames and shall be inclusive of brass pressed butt hinges and brass screws as required.

Measurement and payment for exterior window shutters shall be made at the unit rate per sq. m/**Kg** on the basis **relevant standard** of area of the opening between the frames.

Measurement and payment for Beads, Railing or Curtain Rods shall be made at the unit rate per meter length.

Unit rates for all of the items covered under this section shall include all materials except specified fittings and fixtures as per BOQ, labour, transport, fabrication and fixing in position, etc. as per specification/directions of the Engineer-In-Charge, complete in all respects.

Measurement and payment for false ceiling with all fittings and fixtures as per specifications/BoQ shall be made for the finished dimension without any allowance for the wastage, at the unit rate per Sqm. The unit rate shall include the cost of materials and labour involved in all operations for fixing in position as per drawing and / or as directed by the Engineer-In-Charge **excluding the cost of aluminum frame/sections**.

8. STEEL WORK

8.1 Scope of Work

This clause shall include all works in connection with structural steel works like steel roof truss. CGI roofing, Doors etc as shown in the Drawings or as specified hereafter and / or as directed by the Engineer-In-Charge. The work shall consist of supply of all materials, transportation, fabrication, erection, storage, painting, inspection and quality control including loading and unloading, protection from damages and all other allied works as required.

8.2 Submission

At least **thirty (30) days** prior to commencing the work, the Contractor shall submit to the Engineer-In-Charge the following documents for his approval:

Complete shop drawings supported by structural computations of all structural steel work showing sizes, type and grade of metals, method of assembly, hardware and anchorage or connection with the main structures.

Mill sheets or certificates of materials which are based on the tests performed in the steel maker or an approved independent laboratory shall be submitted to the Engineer-In-Charge.

Work schedule for shop fabrication, transportation, field fabrication, erection at the site and other necessary items related to the work.

8.3 Material for Steel Work

Except as otherwise specified, all materials in general, for the work under this clause shall be new, free from defects and imperfections and conform to the following standards or equivalent (Table-8.1):

Table-8.1

Relevant Standards for Steel Structural Materials

Material	Standards codes
Angle, steel, channel steel, H-steel	IS 808, 3954
Steel plate	IS 808, 3954, 5986
Steel pipe	IS 3589, 6631
Round steel bar	IS 1786, 432
Steel deck plate	IS 3502
Light gauge steel	IS 979
High strength bolt	IS 3757
Medium finished bolt	BIS 1363
Welding rod	IS 6419
Stud bolt	IS 1862
Ready mixed Redoxide paint	IS 2074

8.4 Fabrication

8.4.1 Straightening, Shaping and Cutting

The steel sections as required shall be straightened and cut as required to correct lengths measured with a steel tape. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of a member. All straightening and shaping to form shall be done by pressure. Bending or cutting shall be carried out in such a manner as not to impair the strength of the metal. A shop drawing giving complete information for fabrication of the component parts of the structure including the location, type, size, length and details of rivets, bolts or welds, shall be prepared in advance of actual fabrication and approved by the Engineer-In-Charge. The drawing shall indicate the shop and field rivets, bolts and welds. The steel members shall be distinctly marked or stenciled with paint with the identification marks as given in the shop drawings.

Great accuracy shall be observed in fabrication of various members so that these can be assembled without being unduly packed, strained or forced into position and when built up, shall be made to correspond to each member and rivet holes shall be marked accurately on them and drilled. The templates shall be laid on the steel members and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting. All stiffeners shall be formed by pressure and where practicable, the metal shall not be cut and welded in making these.

8.4.2 Making Holes

Holes shall be drilled with a bit at right angles to the surfaces, and shall not be made or enlarged by burning holes. All bolt holes shall be clean-cut without any burrs or ragged-edges resulting from drilling. When loose bolt holes are employed, the shape of loose bolt holes shall be shown on the drawings or a directed by the Engineer-In-Charge. Diameters of holes provided for insertion of bolts shall be as in Table-8.2.

Table-8.2

Nominal diameter of Bolt (D)	Diameter of Bolt Hole
More than 20 mm	D + 1.5 mm
Not more than 20 mm	D + 1.0 mm

8.4.3 Assembly

Before making holes in individual members for fabrication, the steel work intended to be riveted or bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting or lapping of the surface of the different members. All stiffeners shall bear tightly bolt at top and bottom without being drawn or caulked. The abutting joints shall be cut or dressed true and straight and fitted close together. Web plates of girders which have no cover plates, shall have their ends flush with the tops of angles unless otherwise required. The web plates, when sliced, shall have clearance of not more than 5 mm. the erection clearance for cleated ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. the erection clearance at the ends of beams without web cleats shall not be more than 3 mm at each end but where for practical reasons, greater clearance is necessary suitably designed seating shall be provided.

Butt joints of struts and compression members depending on contact for stress transmission shall be accurately machined and close-butted over the whole section. Connecting angles or channels shall be fabricated and placed in position with great accuracy so that they are not unduly reduced in thickness by machining. The ends of all bearings stiffeners shall be machined on ground to fit tightly both at top and bottom.

8.4.4 Bolting

The nominal length of the bold shall be the distance from the underside of the head to the further end of the shank. The nominal diameter of the bolts shall be the diameter at the shank above the screwed threads. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. All bolt heads and nuts shall be hexagonal unless specified otherwise. The screw threads shall conform to IS 1363 and the threaded surface shall not be tapered. The bolts shall be of such length as to project at least two clear threads beyond the nuts when fixed in position and these shall fit in the holes without any shake. The nuts shall fit in the thread end of bolts properly.

Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads and nuts of bolts a satisfactory rearing. The threaded portion of each bolt shall project through the nut at least one thread. In all cases where full bearing area of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. Where there is risk of the nuts being removed of becoming loose due to vibration or reversal of stresses, these shall be secured from slackening by the used of lock-nuts, spring washers or cross-cutting as directed by the Engineer-In-Charge.

8.4.5 Welding

Welding shall be done by electric process as per IS-816 and IS-823, Gas welding shall not be permitted. Welding shall be done as shown in the shop drawings, which should clearly

indicate various details of the joint to be welded, type of welds, shop and site welds as well as the types of electrodes to be used. Symbol for welding on plans and shop drawings shall be according to IS-813.

As far as possible every effort shall be made to limit the welding that must be done after the structure is erected so as to avoid the improper welding that is likely to be done due to heights and difficult positions on scaffolding, etc. apart from the aspect of economy. The max. diameter of electrodes for welding any work shall be as per IS-814 and Appendix-B of IS-823. Joint surfaces which are to be welded together shall be free loose mill scale, rust, paint, grease or other foreign matter, which adversely affect the quality of weld and workmanship.

8.5 Erection

Steelwork shall be hoisted and erected in position carefully, without any damage to itself, other structure and equipment and injury to workmen. The method of hoisting and erection, proposed to be adopted by the Contractor, shall be got approved from the Engineer-In-Charge. The Contractor, however, shall be fully responsible for the work being carried out in a safe and proper manner without unduly stressing the various members. Proper equipment such as derricks, lifting tackles, winches, ropes, etc. shall be used.

The work may be erected in suitable units as may be directed by the Engineer-In-Charge. Fabricated members shall be lifted at such points as to avoid the deformation or excessive stress in members. The structure or the part of it placed in position shall be secured against overturning or collapse by suitable means. During execution, the steel work shall be securely bolted or otherwise fastened and when necessary, temporarily braced to provide for all loads to be carried safely by the structure during erection including those due to erection equipment and its operations. The steel work shall be placed in proper position as per approved drawing. Final riveting or permanent bolting shall be done only after proper alignment has been obtained.

Trusses shall be lifted only at the nodes and shall not be slinged at the apex, as it will develop compression stresses in the bottom tie member. They shall be lifted by sling at two mid-points of rafters, which shall be temporarily braced by a wooden member of a suitable section. After the trusses are placed in position, purlins and wind bracing shall be fixed as soon as possible. The end of the truss, which faces the prevailing winds, shall be filled with holding down bolts, and the other end kept free to move.

8.6 Steel Roofing

8.6.1 General

8.6.1.1 CGI Sheet Roofing

Roofing shall be of built up with C.G.I. sheeting. The CGI sheets shall be 0.63 mm (24G) thick and of 750 grade of coating, conforming to IS-277. The sheets shall be free from cracks, split edges, twists, surface flaws, etc. They shall be clean, bright and smooth. The galvanizing shall be non-injured and in perfect condition. The sheets shall not show any sign of rust or white powdery deposits on the surfaces. The corrugations shall be uniform in depth and pitch and parallel with the side.

8.6.1.2 Color Coated Sheet Roofing

Roofing shall be of built up with colour coated Galvanized trapezoidal steel sheet roofing or equivalent. The thickness of the sheet shall be of 0.50 mm and shall conform to IS-277 or equivalent standards. The colour coated trapezoidal sheet shall be of 1075 mm width (effective cover width 1000 to 1020 mm) & nominal pitch of 200 mm to 250 mm and crest depth of 28 to 30 mm. The end rib shall be designed for anti-capillary action, to avoid any seepage of water through the lateral overlap. The Zinc coating shall be of minimum 120 grams per square meter. The organic coating of polyester paint shall be of 16-18 microns over a coat of 5-7 microns epoxy primer and the back coat shall be of 7-10 microns epoxy paint. The colour of the sheet shall be decided and approved by the Engineer-In-Charge.

The steel sheet shall be fastened with Hex head, self-drilling screw as per relevant standards or AS 3566 Class 3 fasteners of approved make with EPDM washer on each crest of sheets for connecting with purlin (or as per design) perpendicular to the sheeting and in the centre of the corrugation or rib. The fastener size shall be calculated as per the design requirement or as per relevant standards.

Ridge & Gutters are manufactured from same colour, finish and thickness as roof panels (or manufacturer's recommendation).

8.6.2 Steel Purlins

Purlins shall be of MS rolled sections of requisite size and shall be fixed over the principle rafters. Maximum spacing of purlins shall not exceed 1.60 meter which may vary in case of colour coated Galvanized sheet. The top surfaces of the purlins shall be uniform and plane. They shall be painted before fixing on top. Embedded portions of wooden purlins shall be coals tarred with two coats.

8.6.3 Slope

Slope of the roof shall be pitched as shown in the drawing or as directed by Engineer-In-Charge or as depicted in drawings

8.6.4 Laying and Fixing for CGI Sheet

The sheets shall be laid and fixed in the manner described below or otherwise shown in the drawings or as directed by the Engineer-In-Charge. The sheets shall be laid on the purlins to a true plane with the lines of corrugations parallel or normal to the sides of the area to be covered unless otherwise required as in special shaped roofs.

The sheets shall be laid with a minimum lap of 20 cm at the ends and two ridges of corrugation at each side. The above end lap of 20 cm shall apply to slopes of 1 vertical to 3 horizontal and flatter slopes. For steeper slopes the minimum permissible end lap shall be 15 cm. The minimum lap of sheets with ridge hips and valleys shall be 20 cm measured at right angles to the line of the ridge, hip and valley respectively. These sheets shall be cut to suit the dimensions or shape of the roof, either along their length or their width or in a slant across their lines of corrugations at hips and valleys. They shall be cut carefully with a straight edge and chisel to give a smooth and straight finish.

Lapping in C.G.I sheets shall be painted with a coat of approved steel primer and two coats of painting with approved paint for steel work before fixing in place. Sheets shall not generally be built into gables and parapets. They shall be bent up along their side edges close to the wall and the junction shall be protected by suitable flashing or by a projecting drip course, the later to cover the junction by at least 7.5 cm. The laying operation shall include all scaffolding work involved.

Sheets shall be fixed to the purlins or other roof members such as hip or valley rafters etc. with galvanized J or L hook bolts and nuts, 8 mm diameter, with bitumen and G.I. limpet washers or with a limpet washer filled with white lead as directed by the Engineer-In-Charge. The length of the hook bolt shall be varied to suit the particular requirements. The bolts shall be sufficiently long so that after fixing they project above the top of the nuts by not less than 9 mm. The grip of J or L hook bolt on the side of the purlin shall not be less than 25 mm. There shall be a minimum of three hook bolts place on the ridges of corrugations in each sheet on every purlin and their spacing shall not exceed 30 cm. Coach Screws shall not be used for fixing sheets to purlins.

Where slopes of roofs are less than 21.5 degrees (1 vertical to 2.5 horizontal) sheets shall be joined together at the side laps by galvanized iron bolts and nuts 25 x 6 mm size, each bolt with bitumen and a G.I. limpet washer or a G.I. limpet washer filled white lead. As the overlap at the sides extends to two corrugations, these bolts shall be placed zigzag over the two overlapping corrugations, so that the ends of the overlapping sheets shall be drawn tightly to each other. The spacing of these seam bolts shall not exceed 60 cm along

each of the staggered rows. Holes for all bolts shall be drilled and not punched in the ridges of the corrugations from the underside, while the sheets are on the ground. Sheets with wrongly drilled holes shall be rejected. The holes in the washers shall be of the exact diameter of the hook bolts or the seam bolts. The nuts shall be tightened from above to give a leak proof roof. The roof when completed shall be true to lines, and slopes and shall be leak proof.

8.7 Wind Ties

Wind ties shall be of 40 x 6 mm flat iron section or of other size as specified. These shall be fixed at the eaves ends of the sheets. The fixing shall be done with the same hook bolts, which secure the sheets to the purlins.

8.8 Ridges and Hips for CGI Sheet

Ridges and hips of C.G.I. roofs shall be covered with 600 mm ridge and hip sections of plain G.I. sheet with a minimum lap of 20.0 cm on either side over the C.G.I. sheets. The end laps of the ridges and hips and between ridges and hips also are not less than 20.0 cm. The ridges and hips shall be of 60 cm overall width plain G.I. sheets and shall be properly bent to shape.

Ridges shall be fixed to the purlins below with the same 8 mm dia. G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to the purlins. Similarly, hips shall be fixed to the roof members below such as purlins, hip and valley rafters with the same 8 mm dia. G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fix the sheets to those roof members. At least one of the fixing bolts shall pass through the end laps of ridges and hips, on either side. If this is not possible extra hook bolts shall be provided. The end laps of ridges and hips shall be joined together by galvanized iron seam bolts 25 x 6 mm size each with a bitumen and G.I. washer or as directed by the Engineer-In-Charge. There shall be at least two such bolts in each end lap.

The edges of the ridges and hips shall be straight from end to end and their surfaces should be plane and parallel to the general plane of the roof. The ridges and hips shall fit in squarely on the sheets.

8.9 Gutters for CGI Sheet

Gutters shall be fabricated from plain G.I. sheets 24g. The overall width of the sheet referred to shall mean the peripheral width of the gutter including the rounded edges. The longitudinal edges shall be turned back to the extent of 12 mm and beaten to form a rounded edge. The ends of the sheets at junctions of pieces shall be hooked into each

other and beaten flush to avoid leakage. Gutters shall be laid with a minimum slope of 1 in 120.

Gutters shall be supported on and fixed to MS flat iron brackets bent to shape and fixed to the requisite slope. The maximum spacing of brackets shall be 1.20 meters. Where these brackets are to be fixed to the sides of rafters, they shall be of 40 x 3 mm section bent to shape and fixed rigidly to the sides of rafters with 3 Nos. 9 mm dia. Bolts, nuts and washers. The brackets shall overlap the rafter not less than 30 cm and the connecting bolts shall be at 12 cm centers.

Where the brackets are to be fixed to the purlins, the brackets shall consist of 40 x 3 mm MS flat iron bent to shape, with one end turned at right angle and fixed to the purlin-face with a 9 mm dia. bolt, nut and washer. The perpendicular over hung portion of the 40 x 3 mm flat bent to right angle shape with its longer leg connected to the bracket with 2 Nos. 6 mm dia. MS bolts, nuts and washers and its shorter leg shall be fixed to face of purlin with 1 No. 9 mm dia, bolt, nut and washer. The overhang of the vertical portion of the flat iron bracket from the face of the purlins shall not exceed 20 cm with this arrangement. The gutters shall be fixed to the brackets with 2 Nos. G.I. bolts and nuts 6 mm dia, each fitted with a pair of G.I. and bitumen washer. The connecting bolts shall be above the water line of the gutters.

For connection to down take pipes, a proper drop end or funnel shaped connecting piece shall be made out of G.I. sheets of the same thickness as the gutter and riveted to the gutter, the other end tailing into the socket of the rain-water pipe. Wherever necessary stop ends, angles, etc. should be provided. The gutters when fixed shall be true to line and slope and shall be leak proof.

8.10 Measurement and Payment

8.10.1 Measurement and Payment for Structural Steel

Measurement for payment of structural steel shall be based on weight in kg. Quantity shall be computed according to the approved shop drawings. All materials including high strength bolt, stud bolt, anchor bolt, medium finished bolt deck plate and other steel parts shall be measured. Weight of grout mortar, rust resistance paint and other materials which are not steel but necessary for the work shall not be counted in the quantity. Scraps produced at manufacturers or site during the fabrication of steel member except bolt holes shall not be included in the quantity.

Payment for structural steel shall be made at the relevant unit prices in the Bill of Quantities. The unit prices shall include all labour, materials, tools, construction equipment and any other inspection, quality control and other auxiliary works such as mortar grout, scaffoldings, preparation of surfaces of embedded parts, required shattering etc. to do the work as specified under this chapter, shown in the Drawings or as directed by the Engineer-In-Charge.

No separate payment shall be made for supply, preparations and application of rust resistant paint, galvanization and coating. All costs and efforts therefore shall be included in the unit prices. Anchors and other provisions required to attach metal parts temporarily to concrete shall not be measured for payment and will not be paid for.

8.10.2 Measurement and Payment for Roof Sheeting

The length and breadth of the roof shall be measured correct to 10 mm. Area shall be worked out in sq. m correct to two places of decimal. The superficial area of roof coverings shall be measured on the flat without allowance for laps and corrugations. Portion of roof coverings overlapping ridge or hip etc. shall be included in the measurements of the roof. Roofs with CGI sheets and transparent sheets shall be measured and paid for separately. Measurements shall be taken on the flat and not girth. No deduction in measurement shall be made for opening up to 0.4 sq. m. For any opening exceeding 0.4 sq. m in area, deduction in measurements for the full openings shall be made and in such cases the labour involved in making these openings shall be paid for separately. Cutting across corrugation shall be measured on the flat and not girth.

Payment for roof sheeting shall be made as per the unit rate in the Bill of Quantities. The Unit rate shall include the cost of all the materials and labour involved in all the operations described above including a coat of approved steel primer and two coats of approved steel paint on overlapping of CGI sheets. This includes the cost of roof sheets, galvanized iron J or L hooks, galvanized iron seam bolts and nuts bitumen and (galvanized iron) limpet washers.

The payment for colour coated Galvanized sheet shall be inclusive of materials and labour required for all the operations and all the fittings & fixtures required for fixing of colour coated Galvanized sheet as directed and approved by Engineer-In-Charge.

The cost of the ridges / hips, gutters and ties shall be paid for separately as per the BoQ rates.

8.10.3 Measurement and Payment for Hardware Accessories

Measurement and payment of the hardware accessories shall be made as per the BoQ rates. The rate shall include the cost of materials, screws and labour involved in all operations in fixing in position, etc.

9. PLASTERING

9.1 Scope of Works

The Scope of works under this clause covers for Plastering including installation of fittings and fixtures, preparation of foundation surfaces, adjustment of surfaces adjacent to the

walls, scaffolding, finishing, curing, protection, maintenance etc and other miscellaneous works till handing over of the works.

The scope of works shall also include supply of all labour, materials, equipment, tools and plants, scaffolding, transportation, loading, unloading, testing and quality control and all other operations and incidentals as required to complete the work of plastering with allied works as shown in the Drawings and as specified herein and / or as directed by the Engineer-in-Charge.

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-in-Charge during plastering at his own cost and responsibility. However, approval given by the Engineer-in-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of works, or of liability for injuries to, or death of persons, or any obligations under this Contract.

9.2 Submission

At least **ten (10) days** prior to commencement of plastering , the Contractor shall submit to the Engineer-in-Charge, the source of receipt of different types of cement along with details of quality and test reports / manufacturer's recommendations, etc in respect of aggregates, flooring materials viz. marble chips, pigments, etc. along with their samples.

The Contractor shall also submit in advance of commencement, scheduling and sequence of the plastering, in details, to the Engineer-in-Charge for his approval. However, the Contractor for finishing items shall remain fully responsible for all normal precautions and vigilance to prevent any damages whatsoever until handling over.

9.3 Standards and Codes

All works related to plastering and the materials and production thereof, procedures of placing, curing and testing , etc shall conform to the 'Specifications for Building and Road Works,2009: Royal Govt. of Bhutan' and /or relevant Indian Standards and Guidelines.

9.4 Preparation of Mortar

9.4.1 General

Mortar for plastering shall be a homogeneous mixture of sand and cement in the appropriate proportion as specified above and / or as directed by the Engineer-in-Charge. If directed by the Engineer-in-Charge, the Contractor shall use approved water proofing admixtures of reputed manufacturer in the mortar in accordance with the manufacturer's instructions subject to the approval of the Engineer-in-Charge. The quantity of water shall be as necessary to obtain a satisfactory workability regarding the use of the mortar.

Quality of mortar shall in general, meet the requirements specified in IS: 2250 (Code of Practice and Use of Masonry mortar).

9.4.2 Mixing of Mortar

Mortar for plastering shall be produced similar to the method described in Clause 5.5.2 in Masonry Works.

9.5 Execution

9.5.1 Surface preparation

All joints in masonry walls shall be raked out and brushed down with stiff wire brushes to remove all loose dust from joints and thoroughly washed with water. All laitance shall be removed from concrete to be plastered. In case of concrete slab or masonry surface, the surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

At any point, the level of base shall be lower than the theoretical finished floor level by the thickness of floor finish. Any chipping or filling to be done to bring the base to the required level shall be brought to the notice of the Engineer-in-Charge and his approval shall be taken regarding the method and extent of rectification work required. Prior to commencement of actual finishing work, the approval of the Engineer-in-Charge shall be taken as to the acceptability of the base.

9.5.2 Execution/Application of Plaster

9.5.2.1 General

Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is taken down. To ensure even thickness and true surface, patches of plaster about 15 x 15cm, shall be first applied, horizontally and vertically, at not more than 2m intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The method of application shall be 'thrown on' rather than applied by trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. The surface shall then be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and sideways movements at a time. Finally surface shall be finished off true with trowel or wooden float accordingly as a smooth or a sandy granular texture is achieved. Excessive trowelling or over working the float shall be avoided.

Plaster more than 12 mm thick, shall be applied in two coats, a rendering coat followed by the finishing coat. The thickness of rendering coat shall however, be 10mm or 12mm in thickness as specified above. The surface of the under coat shall be scratched with a scratching tool diagonally both ways or roughened before it is fully hardened to form a mechanical key. The under coat shall be allowed to dry and shrink before applying the second coat of plaster.

9.5.2.2 Preparation of Lime Putty

Three sufficiently large slaking vessels or tanks shall be made, one of these 500mm deep shall be at the higher level, the remaining 800mm deep shall be at lower level, such that the contents of upper tank can flow into the next by gravity. The upper tank shall be filled to half the depth with water and sufficient quick lime added gradually to fill up the vessel to about half the depth of water. Lime shall be added to water and not water to lime. Stirring and hoeing shall start at once, taking care that lime does get exposed above water. The mix shall be stirred all through the slaking process at least 5 minutes after the boiling has stopped, and as the mix thickens, more water shall be added. The lime in a state of suspension shall then be allowed to pass through IS sieve designation 3.35mm and flow into another tank at a lower level, where it shall be kept standing for at least 72 hours before use. The lower tank shall be made of dry brick masonry with joints filled with sand. Water shall get partly evaporated and partly absorbed in ground and surplus water at top shall be removed, leaving lime putty in the form of paste. Lime putty so formed shall be kept wet till it is completely used. It can be stored without getting spoiled for a fortnight, provided it is

is to be protected from drying out.

9.5.2.3 Proportioning

Lime putty and brick powder shall be used in 1:2 proportions. They shall be measured in boxes of suitable sizes.

9.5.2.4 Mixing and Grinding

Lime putty, and brick powder shall be mixed on watertight platform or in troughs. This shall then be sprinkled with necessary quantity of water and ground in masonry lined mortar mill. The mill shall be constructed of best available bricks (with frog down-wards) or stone in lime mortar. The outer edge of the mill shall be raised above the track followed by the driving animal. The track itself shall be sloped outwards and kept well consolidated and watered. No dust or mud shall be allowed to fall into the mortar being ground. The mill shall be provided with tell-tale arrangement for automatic counting of the revolutions. The mortar shall be ground by not less than 180 revolutions or for a minimum of three hours. The mortar shall be continuously raked and turned over during the grinding particularly from corners and sides. Water shall be added as required during grinding, care being taken not to add more water than that which shall bring the mortar to the

consistency of a stiff paste. Alternatively, a mechanical mortar mill may be used for grinding. The ingredients shall be mixed on watertight masonry platform or in trough as above. The mix shall then be fed into a mechanical mortar mill with the required addition of water, which shall be just sufficient to make mortar of a workable consistency. The mortar shall be mixed at least for three minutes after addition of water, when it shall be emptied from the mill.

9.5.2.5 Measurements

The cubical contents shall be worked out to the nearest two places of decimal in cubic meters.

9.5.2.6 Rates

The rates shall cover the cost for carrying out all the required operations in the preparation of mortar including cost of labour, materials, equipment hired/owned, tools and plants, and incidentals necessary to complete the work.

9.5.2.7 Finish

The finished wall surface shall be true to plumb and any irregularity shall be made good without any extra cost. All vertical edges of pillars, door jambs, etc. shall be chamfered or rounded off as directed by the Engineer-in-Charge. All drips, grooves, moldings and cornices as shown on drawings or instructed by the Engineer-in-Charge shall be done with special care to maintain true lines, levels, and profiles. After the plastering work is completed, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

Finish to masonry and concrete shall fully comply with the drawings, specifications, approved samples and instructions of the Engineer-in-Charge with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the body of the specification or as shown on drawing. Generally, the standard finish shall be used unless otherwise shown on the drawings or directed by the Engineer-in-Charge. Whenever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the Engineer-in-Charge regarding the texture, colour and finish.

9.6 Scaffolding

Scaffolding shall be strong enough to withstand all the dead, live and impact loads, which are likely to come upon it. It shall also be so designed to ensure the safety of the workmen. For all types of exterior works, scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. For all other masonry in buildings, single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding

poles shall rest in the holes provided only in header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one meter in width. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

9.7 Curing

Curing of plaster / pointing shall be started as soon as the applied plaster has been hardened enough so as not to be damaged. The decision as to when the plaster has hardened will be given by the Engineer-in-Charge. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days. During this period, plaster shall be suitably protected from all damages at the Contractor's expense by such means as the Engineer-in-Charge may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched

9.8 Precaution

Any cracks which appear in the surface and all portions which sound hollow when tapped or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Engineer-in-Charge.

When ceiling plaster is done, it shall be finished to chamfered edge at an angle at its junction with a suitable tool when plaster is being done. Similarly, when wall plaster is being done, it shall be kept separate from the ceiling plaster by a thin straight groove not deeper than 6mm drawn with any suitable method with the wall while plaster is green. The plastering of walls and beam / column in one vertical plane shall be carried out in one go.

9.9 Sampling, Testing And Quality Control

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards or internationally accepted standards or practices and shall conduct such tests as are called for by the Engineer-in-Charge. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted engineering practice to the directions of the Engineer-in-Charge. Tests shall be done in the field laboratory approved by the Engineer-in-Charge and the Contractor shall submit to the Engineer-in-Charge, the test results in triplicate within three days after completion of a test.

Material / work found unsuitable for acceptance shall be removed and replaced by the Contractor. The works shall be redone as per specification requirements and to the satisfaction of the Engineer-in-Charge.

9.10 Measurement And Payments

9.10.1 Measurement and Payment for Plaster

Measurement for plastering shall be made on the basis of actual areas in square meters plastered in accordance with the Drawings and the Specifications and as directed by the Engineer-in-Charge and shall be paid at the unit rates as per the BOQ. The measurements of the wall plaster shall be taken between the walls or partitions for the length and from the top of the floor or skirting up to the full height.

Deductions for openings, etc. shall be regulated as specified in the Specifications for Building and Road Works, 2009: Royal Govt. of Bhutan

The unit price shall include all necessary materials including admixtures, wire lath, expansion bead, joint, caulking, labour, scaffolding, curing and incidentals, etc involved in all operations to complete the work as per specification and or as directed by the Engineer-in-Charge.

9.11 V-Shaped Drain

9.11.1 General

Trenches shall be made along the edge of the road where the drain is to be constructed. The excavation shall be done exactly to the required profile giving specified slope. The surface shall be leveled to uniform grade/level and rammed. The drain shall be maintained throughout the construction and defect liability period therefore the contractor shall keep provision in his rates for such maintenance and nothing extra shall be paid.

For the lined drain the relevant specification for concreting, soling and plastering shall be followed. The surface of the concrete shall be finished smooth. Any rough surface shall be made smooth by adding dry mix of cement and sand 1:3 (1 cement: 3 sand) on the surface immediately after concreting when the concrete is still green. No extra shall be paid for such finishes. All work shall be carried out as per the drawing and specification or as directed by the Engineer

QA/QC

Check the slope of the drain; it should be uniform to avoid ponding

- The size of the drain shall not be more than the specified size
- In case of earth drain, it shall be made by excavation and compaction of sides and bottoms, neatly finished. If the drain is made by filling, the filled earth shall be compacted as per the specification for embankment and filling.
- In case of lined drain sufficient time should be given to set and hardened the concrete before allowing the water to flow.

- All concrete and masonry work shall be thoroughly cured not less than 28 days.

9.11.2 Measurement

The length shall be measured in running meter correct to 10mm.

9.11.3 Rates

The rates shall include the cost of all material and labour involved in the above operation.

10. FLOORING

10.1 Scope of Works

The scope of works under this clause covers for flooring including furnishing, preparation of foundation surfaces, and adjustment of surfaces adjacent to the walls, finishing, curing, protection, maintenance etc. and other miscellaneous works till handing over of the works.

The scope of works shall include supply of all labour, materials, equipment, tools and plants, scaffolding, transportation, loading, unloading, testing and quality control and all other operations and incidentals as required to complete the work of floor finish with allied works as shown in the drawings and as specified herein / or as directed by Engineer-In-Charge.

10.2 Submission

At least **ten (10) days** prior to commencement of flooring works, the Contractor shall submit to the Engineer-In-Charge, the source of receipt of different types of cement along with the mill test reports, details of quality and test reports manufacturer's recommendations, etc. in respect of aggregates, flooring materials viz. marble chips, pigments, etc. along with their samples.

The Contractor shall also submit in advance of commencement, scheduling and sequence of the flooring works, in details, to the Engineer-In-Charge for his approval. However, the Contractor for finishing items shall remain fully responsible for all normal precautions and vigilance to prevent and damages whatsoever until handing over.

10.3 Standards and Codes

All works related to flooring and the materials, production, procedures of placing, curing and testing, etc. shall conform to the **'Specifications for Building and Road Works, 2020: Royal Govt. of Bhutan'** and / or relevant Indian Standards and Guidelines.

10.4 Material for Flooring

Materials required for individual finishing items are specified under respective items. In all cases, the materials shall be of the best quality of specified manufacturers and based on approval of samples by the Engineer-In-Charge. The materials shall be ordered, procured and stored well in advance to maintain the construction schedule. The materials shall be as per the following:

Marble chips shall be standard quarry product of machine crushed of specified size and of approved colour and uniform grade. Colour pigments, as selected shall be pure mineral pigments, lime proof and non-fading.

10.5 Execution

10.5.1 Preparation of Base Surface

For all types of flooring, skirting, dado and similar works, the base to receive the finish shall be adequately roughened by chipping, raking out joints and cleaning thoroughly all dirt, grease etc. with water and hard brush and detergent if required, unless otherwise directed by the manufacturer of any special finishing materials, or specifically indicated in this specification under individual items.

To prevent absorption of water from the finishing treatment, the base shall be thoroughly soaked with water and all excess water mopped up. The surface shall be done dry where adhesives are used for fixing the finishes.

Prior to commencement of actual finishing work the approval of the Engineer-In-Charge shall be taken as to the acceptability of the surface.

10.5.2 Terrazzo Tile Flooring

a. Terrazzo Tiles

Terrazzo tiles shall generally conform to IS: 1237. The size of tiles shall be 300 x 300 x 25 mm in general or as required by the Engineer-In-Charge. Half tiles for use with the full tiles shall be such as to make two half tiles when joined together, match with the dimensions of one full tile. Tolerances on length and breadth shall be plus or minus on millimeter, and tolerance on thickness shall be plus 5 mm. The range of dimension in any one delivery of tiles shall not exceed 1 mm on length and breadth and 3 mm on thickness.

The tiles shall be manufactured in a factory under pressure process subjected to hydraulic pressure of not less than 140 kg per square centimeter and shall be given the initial grinding with machine and grouting of the wearing layer before delivery to site. The wearing layer

shall be free from projection, depressions, cracks, holes, cavities and other blemishes. The edges of wearing layer may be rounded.

The proportion of cement to aggregate in the backing of tiles shall be not leaner than 1:3 by weight. Where colouring material is used in the wearing layer, it shall not exceed to 10 percent by weight of cement used in the mix.

The finished thickness of the upper layer shall not be less than top layer of 10 mm thick with white, black, chocolate, grey, yellow or green marble chips of sizes from ½ to 2B size laid in cement marble powder mix.

b. Laying

Base concrete or RCC slab, on which the tiles are to be laid, shall be cleaned, wetted and mopped. The bedding for the tiles shall be with lime mortar of 1:3 proportions (1 lime putty: 3 coarse sand). The ingredients shall be thoroughly mixed by volume in dry form. Care shall be taken to ensure that there are no hard lumps present. Water shall then be added and the ingredients thoroughly mixed. The average thickness of the bedding mortar shall be 30 mm and the thickness at any place shall not be less 10 mm.

Lime mortar bedding shall be spread, tamped and corrected to proper levels and allowed to harden for a day before the tiles are set. Over the bedding, neat grey cement slurry of honey like consistency shall be spread at the rate of 4.4 kg of cement per square meter over such an area as would accommodate about twenty tiles. Tiles shall be washed clean and shall be fixed in this grout one after another, each tile being gently tapped with a wooden milled till it is properly bedded, and in level with the adjoining tiles. The joints shall be kept as this as possible not exceeding 1.5 mm and in straight lines or to suit the required pattern.

The surface of the flooring during laying shall be frequently checked with a straight edge at least 2 meter long, so as to obtain a true surface with the required slope. Where full tiles or half tiles cannot be fixed, tiles shall be cut (sawn) from full tiles to the required size and their edges rubbed smooth to ensure a straight and true joint. Tiles which are fixed in the floor adjoining the wall shall enter not less than 12 mm under the plaster, skirting or dado. The junction between wall plaster and tile work shall be finished neatly and without waviness. After the tiles have been laid, surplus cement grout that may have come out of the joints shall be cleared off.

c. Curing, Polishing and Finishing

The day after the tiles are laid, all joints shall be cleaned of the grey cement grout with a wire brush or trowel to depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall than be ground with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles. The same cement slurry

shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pin holes that may exist on the surface.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grounded evenly with machine fitted with coarse grade grit block (No. 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the colour of the topping of the wearing surface in order to fill any pin hole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No. 120).

The final grinding with machine fitted with the finest grade blocks (No. 320) shall be carried out the day after the second grinding described in the preceding para or before handing over the floor, as ordered by the Engineer-In-Charge. For small areas or where circumstances so require, hand polishing may be permitted in lieu of machine polishing after laying. For hand polishing the following carborandum stones, shall be used:

First grinding – coarse grade stone (No. 60)

Second grinding – medium grade (No. 80)

Final grinding – fine grade (No. 120)

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square meter sprinkled with water and rubbed hard with a 'namdah' block (pad of woolen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished and clean. If any tile is disturbed or damaged, it shall be refitted or replaced properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

10.5.3 Terrazzo Marble-chips Flooring

a. General

Terrazzo marble chips flooring shall consist of 40 mm thick marble chips flooring rubbed and polished to granolithic finish with 30 mm thick under layer of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 12.5 mm nominal size) and top layer of 10 mm thick with white, black, chocolate, grey, yellow or green marble chips of sizes from ½ to 2B size laid in cement marble powder mix.

b. Under Layer

Cement concrete of 1:2:4 mix as stated above shall be laid in panels. The panels shall be of uniform size, not exceeding 2 sq. m in area or 2 m in length for inside situations. In exposed situations, the length of any side of the panel shall not be more than 1.25 meter. Cement

slurry @ 2.00 kg per sq. m shall be applied before laying of under layer over the cement concrete / RCC base.

c. Fixing of Strips

4 mm thick glass strips or 2 mm thick aluminum strips as approved by the Engineer-In-Charge shall be fixed with their top at proper level to required slope.

d. Top Layer

The mix for terrazzo topping shall consist of white cement with or without pigment, marble powder, marble aggregate (marble chips) and water. The cement and marble powder shall be mixed in the proportions of 3 parts of cement to one part marble powder by weight. For every part of cement – marble powder mix, the proportion of aggregate shall be as follow:

Table-10.1

Mix Proportion of Aggregate to Binder

Size of Aggregate	Proportion of Aggregate to Binder mix
For grade 00.0 and 1	1.75 parts
For grade 2 and 3	1.50 parts
For grade 4 and 5	1.25 parts
Mixed size aggregate	1.50 parts

e. Mixing and Laying

The chips shall be hard, sound, dense and homogenous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

Before starting the work, the contractor shall get the sample of marble chips approved by the Engineer-In-Charge. The cement to be used shall be ordinary grey cement, white cement, or coloured cement with admixture of colouring matter of approved quality in the ratio specified in the description of the item or in the ratio to get the required shade as approved by the Engineer-In-Charge.

Colouring material where specified, shall be mixed dry thoroughly with the cement and marble powder and then marble chips added and mixed as specified above. The full quantity of dry mixture of mortar required for a room shall be prepared in a lot in order to ensure a uniform colour. This mixture shall be stored in a dry place, well covered and protected from moisture. The dry mortar shall be mixed with water in the usual way as and

when required. The mixed mortar shall be homogeneous and still and to contain just sufficient water to make it workable.

The terrazzo topping shall be laid while the under layer is still plastic, but has hardened sufficiently to prevent cement from risking to the surface. This is normally, achieved between 18 to 24 hours after the under layer has been laid. Cement slurry preferably, of the same colour as the topping shall be brushed on the surface immediately before laying is commenced. It shall be laid to a uniform thickness slightly more than that specified in order to get the specified thickness after rubbing. The surface of the top layer shall be trowelled over, pressed and brought true to required level by a straight edge and steel floats in such a manner that the maximum amount of marble chips come up and are spread uniformly over the surface.

f. Polishing, Curing and Finishing

Polishing shall be done by machine. About 36 hours after laying the top layer, the surface shall be watered and ground evenly with machine fitted with special rapid cutting grit blocks (carborandum stone) of coarse grade (No. 60) till the marble chips are evenly exposed and the floor is smooth. After the first grinding, the surface shall be thoroughly washed to remove all grinding mud and covered with a grout of cement and colouring matter in same mix and proportion as the topping in order to fill any pin holes that appear. The surface shall be allowed to cure for 5 to 7 days and then rubbed with machine fitted with fine grit block (No. 120). The surface is cleaned and repaired as before and allowed to cure again for 3 to 5 days. Finally, the third grinding shall be done with machine fitted with fine grade grit blocks (No. 320) to get even and smooth surface without pin holes. The finished surface should show the marble chips evenly exposed.

Where use of machine for polishing is not feasible or possible, rubbing and polish shall be done by hand, in the same manner as specified for machine polishing except that carborandum stone of coarse grade (No. 60) shall be used for the 1st rubbing, stone of medium grade (No. 80) for second rubbing and stone of final grade (No. 120) for final rubbing and polishing.

After the final polish either by machine or by hand, oxalic acid shall be dusted over the surface @ 33 gm per square meter sprinkled with water and rubbed hard with a pad of woolen rags. The following day, the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

Curing shall be done by suitable means such as laying moist sawdust or ponding water.

g. Precautions

Flooring in lavatories and bathrooms shall be laid after fixing of water closet and squatting pans and floor traps. Traps shall be plugged, while laying the floors and opened after the floors are cured and cleaned. Any damage done to water closets, squatting pans and floor traps during the execution of work shall be made good.

During cold weather, concreting shall not be done when the temperature falls below 4°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not exceed 38°C. No concrete shall be laid within half an hour of the closing time of the day unless permitted by the Engineer-In-Charge.

10.5.4 White Glazed Tile Walling / Dado

a. General

Glazed tile walling shall be composed of glazed earthen coarse tiles with an under bed laid over cement plaster base. The total thickness shall be minimum 17 mm including the under bed. The tile finish on vertical surface shall project out 6 mm uniformly from the adjacent plaster wall finishes. The necessary cutting into the surface receiving the finish to accommodate the specified thickness shall be done. Height of tile walling shall be as per the drawing or as directed by the Engineer-In-Charge.

b. White Glazed Tiles

The tiles shall be of earthenware, covered with white glaze of approved quality conforming to IS: 777-1988 (Latest Revision). These tiles shall be of approved design and size as directed by the Engineer-In-Charge and 5 mm thick unless otherwise specified. The tolerance shall be $\pm$ 1.5 mm for length and breadth and $\pm$ 0.5 mm for thickness. Specials like internal and external angles, beads, covers, cornices, comer pieces etc. shall match. The top surface of the tile shall be glazed with floss or matt unfading stable finish as desired by the Engineer-In-Charge. The tiles shall be flat and true to shape. The colour shall be uniform and fractured section shall be fine grained in texture, dense and homogeneous. The tile shall be strong and free from flaws like cracks, chips, craze, specks, crawling etc. and other imperfection. The edges and the underside of the tiles shall be completely free from glaze and the underside shall have ribs or indentations for better anchorage with the fixing mortar.

c. Laying

The joints shall be raked out to a depth of at least 15 mm in masonry walls, while the masonry is being laid. In case of concrete, the surface shall be hacked and roughened with wire brushes. The surface shall be cleaned, thoroughly washed with water and kept before tiling is commenced.

12 mm thick plaster of cement mortar 1:3 (1 cement: 3 coarse sand) shall be applied and allowed to harden. The surface shall be roughened with wire brush or by scratching diagonally at close intervals. The tiles shall be kept soaked in water, washed clean. A coat of cement slurry applied literally at the back of the tiles and set in the bedding mortar. The tiles shall be tamped and correct to proper plane and lines. The tiles shall be set in the required pattern and but jointed. The joints of the tiles shall be as close as possible and not more than 1.5 mm wide.

d. Finishing

The joints shall be cleaned off the grey cement grout with wire brush or trowel to a depth of 2 mm or 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement with pigment added if required to match the colour of the tiles.

The wall shall then be kept wet for 7 days. After curing the surface shall be washed and finished clean. The finished floor shall not sound hollow when tapped with a wooden mallet.

10.5.5 Measurement and Payment

10.5.5.1 Measurement and Payment for Flooring

Flooring of different types shall be measured separately in sq. m length and breadth shall be measured before laying skirting and dado or wall plaster. No deduction shall be made or extra paid for any opening in the floor of area up to 0.10 sq. m. The flooring done with strips shall not be measured separately. Payment shall be made at the unit rates as per the Bill of Quantities.

Terrazzo tile flooring laid in floor borders and similar band shall be measured under the item of terrazzo tile flooring. Nothing extra shall be paid in respect of these and similar bands formed of half size or multiply of half size standard tiles or other uncut tiles.

Treads of stairs and similar band shall be measured under the item of terrazzo tile flooring. Nothing extra shall be paid in respect of these and similar bands formed of half size or multiply of half size standard tiles or other uncut tiles. Treads of stairs and steps paved with or without nosing, shall also be measured under flooring. Mounded nosing shall be paid in running meter except where otherwise stated, returned mounded ends and angles to moldings shall be included in the description. Extra shall, however be paid for such areas where the width of treads does not exceed 30 cm.

The rate shall include the cost of all materials and labour and all other charges including cost for sampling & testing, etc. involved in all operations for each type of flooring as described above. The rate shall also include application of cement slurry on RCC slab or on sub-grade including roughening and cleaning the surface and providing glass / asbestos sheet strips and also shuttering, wherever used. Nothing shall be paid extra for laying the floor at different levels.

10.5.5.2 Measurement and Payment for glazed tiling on wall /dado

Area of wall tiling shall be measured in sq. m length and height shall be measured along the finished face of walling or dado and shall be paid at the unit rate.

The rate shall include the cost of all materials and labour and all other charges including cost for sampling & testing, etc. involved in all operations for tiling as described above. The

rate shall also include application of cement plaster including raking out of masonry joints, roughening and cleaning the concrete surface. Nothing shall be paid extra for wall tiling at different levels.

10.6 Concrete Flooring

a. Cement concrete

Cement concrete of specified mix shall be used. The concrete shall conform to specifications given under the head "Concrete work".

b. Sub-grade

Flooring shall be laid on concrete sub-grade where so provided. The sub-grade shall be provided with the slopes required for the flooring. Flooring in veranda, kitchens, baths, water closets and courtyards shall invariably be provided with suitable slope to drain off washing and rain water. Plinth masonry off-set shall be depressed so as to allow the sub-grade concrete to rest on it. If the sub-grade consists of lime concrete, it shall be allowed to set for seven days and the flooring shall be laid in the next three days. If the sub-grade is of lean cement concrete, the flooring shall be commenced preferably within 48 hours of the laying of sub-grade. If the cement concrete flooring is to be laid directly on the R.C.C. slab, the surface of R.C.C. slab shall be cleaned and the laitance shall be removed and a coat of cement slurry at 2 kg of cement per sq.m shall be applied, so as to get a good bond between R.C.C. slab and concrete floor.

c. Laying:

Flooring of specified thickness shall be laid in the pattern as given in the drawings or as directed by the Engineer. The border shall have mitred joints at the corners of the room and intermediate joints shall be in straight line with the panel joints. The panels shall be of uniform size and no dimension of a panel shall exceed 2 m and the area of a panel shall not be more than 2 sq.m.

d. Laying with strips

Normally cement concrete flooring shall be laid in one operation using glass/plain asbestos sheet strips at the junction of two panels. This method ensures uniformity in colour of all the panels and straightness at the junction of the panels.

i. Strips fixing

Aluminium strips, Glass strips or plain asbestos sheet/strips shall be fixed with their top at proper level, giving required slopes.

ii. Concreting

Cement concrete shall be placed in position, in one operation, in the panels. It shall then be levelled with the help of straight edge and trowel and beaten with a wooden rammer or mason's trowel. The blows shall be fairly heavy in the beginning but as consolidation takes place, light but rapid strokes shall be given. Beating shall cease as soon as the surface is found covered with cream of mortar. The surface shall be tested with straight edge and made true to required slopes.

e. Laying without Strips

Laying of cement concrete flooring in alternate panels may be allowed by Engineer in case strips are not to be provided.

i. Shuttering

The panels shall be bounded by wooden/angle iron battens. The battens shall have the same depth as the concrete flooring. These shall be fixed in position, with their top at proper level, giving required slopes. The surface of the battens or flats, to come in contact with concrete, shall be smeared with soap solution or non-sticking oil (form oil or raw linseed oil) before concreting. The flooring shall butt against the masonry wall, which shall not be plastered.

ii. Concreting

The concreting shall be done in the alternate panels. The battens used for shuttering shall be removed on the next day of the laying of cement concrete. The ends thus exposed shall be repaired, if damaged, with cement mortar 1:2 (1 cement: 2 coarse sand) and allowed to set for minimum period of 24 hours. The alternate panels shall then be cleaned of dust, mortar droppings etc. and concrete laid. While laying concrete, care shall be taken to see that the edges of the previously laid panels are not damaged and fresh mortar is not splashed over them.

f. Finishing

The finishing of the surface shall follow immediately after the cessation of beating. The surface shall be left for some time, till moisture disappears from it. Excessive troweling shall be avoided. Use of dry cement or cement and sand mixture sprinkled on the surface to stiffen the concrete or absorb excessive moisture, shall not be permitted.

Fresh quantity of cement at 2.0 kg of cement shall be mixed with water to form thick slurry and spread over an area of one sq. m of flooring while the concrete is still green. The cement slurry shall then be properly pressed and finished smooth. The edges of sunken floors shall be finished and rounded with cement mortar 1:2 (1 cement: 2 coarse sand) and finished with a floating coat of neat cement. The junctions of floor with wall plaster, dado, or skirting shall be rounded off where so specified. The men engaged on finishing operations shall be provided with raised wooden platform to sit on, so as to prevent damage to new work

g. Curing

The curing shall be done for a minimum period of ten days. Curing shall not be commenced until the top layer has hardened. Covering with empty cement gunnies shall be avoided, as the colour is likely to be bleached with the remnants of cement matter from the bags.

h. Measurement

Length and breadth shall be measured correct to 10 mm and its area as laid shall be calculated in sq. m correct to two places of decimal. Length and breadth shall be measured before laying skirting, dado or wall plaster. No deduction shall be made or extra paid for any opening in the floor of area up to 0.10 sq. m. The flooring done with strips (in one operation) and without strips (in alternate panels) shall be measured together.

i. Rate

The rate shall include the cost of all materials and labour involved in all the operations described above excluding application of cement slurry on R.C.C. slab or on sub-grade including roughening and cleaning the surface and cost of glass sheet or asbestos sheet strips. Nosing of steps where provided shall be paid for separately in running metre. Nothing extra shall be paid for laying the floor at different levels in the same room or courtyard and rounding of edges of sunk floors. In case the flooring is laid in alternate panels, it includes the cost of shuttering.

11. PIPELINES, WATER FILTRATION SYSTEM AND PUMPS

11.1 G.I. & HDPE Pipes

11.1.1 G.I. Pipes

The pipes (tubes) shall be galvanized mild steel hot finished seamless (HFS) or welded (ERW) screwed and socketed conforming to the requirements of IS 1239 (Part. I) for medium grade. These shall be of the diameter (nominal bore) specified in the description of the item. Galvanizing shall conform to IS 4736. The zinc coating shall be uniform, adherent, reasonably smooth and free from imperfections as flux, ash and dress inclusions, bare patches, black spots, pin holes, lumpings, runs, rust stains, bulky white deposits and blisters. The pipes and sockets shall be cleanly finished, well galvanized in and out free from cracks, surface flaws laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with the axis of the tube.

All screwed tubes sockets shall have pipe threads conforming to the requirements of IS 554. Screwed tubes shall have taper threads while the sockets shall have parallel threads. All tubes shall withstand a test pressure of 50 kg/cm^2 without showing defects of any kind. The fittings shall be of mild steel tubular or wrought steel fittings conforming to IS 1239 (Part II). The fittings and sockets shall be designated by the respective nominal bores of the pipes for which these are intended.

11.1.2 HDPE Pipes

The pipes shall confirm to IS 14333:1996. It shall be designated according to the pressure rating given below:

Table 11.1 Pressure rating of HDPE pipes and ratings

Pressure rating of pipes	Maximum permissible working pressure(Mpa)
PN 2.5	0.25
PN 4	0.40
PN 6	0.60
PN 8	0.80
PN 10	1.00
PN 12.5	1.25
PN 16	1.60

11.1.3 Laying of Pipelines

The specified pipes and fittings shall be laid in trenches. The width and depths of the trenches of different diameters of the pipes shall be as per drawings.

At joints, trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications for earthwork in trenches. In case of GI pipes, the pipes shall be painted with two coats of anticorrosive bitumastic paint of approved quality. The pipes shall be laid in a layer of 7.5 cm sand and filled upto 20 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed by the Engineer. When excavation is done in rock, the bottom shall be cut deep enough to permit the pipes to be laid on a cushion of sand of minimum 7.5 cm. In case of bigger diameter pipes where the pressure is very high thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area.

11.1.4 Testing the joints

After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed

and replaced without extra cost. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6kg/cm 2 (60 metres). The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw off takes and the stop-cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped the test pressure should be maintained without loss for atleast half an hour. The pipes and fittings shall be tested in sections as the work of laying proceeds, keeping the joints exposed for inspection during the testing.

11.1.5 Measurement

The lengths shall be measured in running metre correct to 10 mm for the finished work, which shall include pipe and fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples, flanges, nuts, etc. but exclude brass or gun metal taps (cocks), valves, lead connection pipe and shower rose. The length shall be taken along the central line of the pipe and fittings. All pipes and fittings shall be classified according to their diameters, method of jointing and fixing substance, quality and finish. The diameter shall be the nominal diameter of the internal bore. The pipe shall be described as including all cuttings and waste. In case of fittings of equal bore, the largest bore shall be measured. Digging and refilling of trenches shall be measured separately.

11.1.6 Rate

The rate shall include the cost of labour and material involved in all operations described above including testing(excluding the cost for excavation in trenches, refilling of trenches, thrust block, painting of pipes and sand filling all round the pipes).

11.2 PVC Pipes

11.2.1 Underground installation

For laying PVC pipes in trenches, trench width shall not be less than pipe diameter plus 125mm in each side. Laying of pipes, trench filling, depth of trenches, precaution, etc shall be as described above for CI pipes.

11.2.2 Concealed installation

For concealing the drain lines, slots shall be made in the wall or concrete. The slot size shall be such that the system remains stress free at the time of installation. Sharp edges should be avoided. All PVC pipes and fittings shall be cleaned and a light coat of solvent cement applied externally before they are inserted in the slots. Leakage test shall be carried out before concealing the system.

11.2.3 Jointing

The commonly used joints are as follows:

i. Solvent welded joints

The solvent welded joint may be achieved either by heat application method or non-heat application method.

Non-heat application method: In this method, the pipe shall be cut perpendicular to the axis of the pipe length with a saw. The pipe ends have to be beveled slightly with beveling tool at an angle of about 30-degree. The total length of insertion of socket shall be marked on pipe and checked how far the pipe end should go into the fitting socket up to 1/3 to 2/3 of the socket length. After cleaning, the coating of solvent cement shall be applied evenly on the inside of the fitting for full length of insertion and then on the outside of the pipe end up to the marked line.

Heat application method: This method of jointing makes use of spigot and socket shapes of pipes. The female end is beveled on the bore. The other pipe end to be inserted is beveled at an angle of 20 to 30 degrees on the outer periphery. The female end of the pipe is expanded by heating a length of 1.5 times the pipe diameter to a temperature of about 130-degree C by blowtorch or any other suitable medium.

ii. Flanged joints

Flanged joint is preferred for larger diameter pipes. The joint shall be made by the compression of a gasket or a ring seal set in the face of the flange.

11.2.4 Support Spacing:

The minimum support spacings for PVC pipes shall be as given below:

Table: MINIMUM SUPPORT SPACINGS FOR PVC PIPES

Outside diameter (mm)	Horizontal spacing (mm)
50 mm	1200
90 mm	1200
110 mm	1500

For vertical runs support spacing may be increased by 50%.

Anchorage blocks shall be same as for CI pipes.

11.2.5 Measurement:

The pipes shall be measured in running meters and the fittings shall be measured in numbers in similar manner as specified for C.I. pipes/ fittings above.

11.2.6 Rate:

The rate shall include the cost of labour and materials involved in all the operations described above including testing.

11.3 Carbon Steel Seamless pipe

11.3.1 Scope of work

The scope of work would be Supply & Installation of drinking water Pipelines from Drinking water tank to Power house & Transformer house building including all accessories. The items would as follows

- CS Seamless Pipe- 250NB, Sch-40
- Isolating Valve- 250NB, CL-150
- Motorized valve-250NB, CL-150
- Flange Joints- 250NB (including hardware & Gasket)
- Backwash line (80NB Sch-40) from Filter
- Pipe- 100NB, Sch-40, CS Seamless
- Elbows- 100NB, Sch-40, CS Seamless
- Flange joints- 100NB (containing 800 flanges, hardware & gasket)
- Isolating valve 100NB, Class 150
- Pipe- 40NB, Sch-40, CS Seamless
- Elbows- 40NB, Sch-40, CS Seamless
- Tees, Equal and Unequal (100NB, 100-100-40 NB) CS Seamless
- Isolating valve 40 NB, Class 150

11.3.2 CS Pipe details

All pipes shall be new and of highquality steel material, seamless manufactured with examination, inspection and testing confirming to ASTM A 106.

All pipes shall be manufactured by seamless process with examination, inspection and testing confirming to applicable ASTM specification mentioned here-in and latest Revision of the ASME code shall be referred for applicable ASTM specifications.

All Chemical and Mechanical properties shall as per applicable ASTM specifications.

The supplier shall submit all relevant certified test reports along with the consignment, including actual material test report for chemical and mechanical properties, Dimensional test, Hydro-test reports other inspection reports as applicable.

11.3.3 CS pipe fittings, Bends, Elbows and other fixtures

The dimensions and specifications shall be as per relevant ASTM standard.

11.3.4 Testing

The pipes shall be tested at site after laying and jointing, before the backfilling of trenches. Only after completion of testing in presence of client, filling of trenches would be permitted.

11.3.5 Measurement:

The pipes shall be measured in running meters and the fittings shall be measured in numbers in similar manner as specified for CS pipes/ fittings above.

11.3.6 Rate

The rate shall include the cost of labour and materials involved in all the operations described above including testing.

12. SANITARY AND PLUMBING WORKS

12.1 Scope of Works

The scope of works under this clause shall cover to:

- Supply, laying and installation of pipes for supply of drinking water, surface drains for draining off rain water / surface water, sewage and waste water, etc. with all fittings and fixtures including jointing.

The scope of works shall also cover to supply of all labour, materials equipment, tools and plants, scaffolding, transportation, loading, unloading, preparation of foundation surfaces, cutting chases etc. and all other operations including testing and quality control, etc. as required for complete execution of in-house water supply and sanitary works, etc. as shown in the drawings and as specified herein and / or as directed by the Engineer-In-Charge.

12.2 General Requirements

All materials and structural parts incorporated in the permanent work shall be new and unused. Quality and dimensions shall comply with these Specifications and approved Standards. All works covered under this section shall be carried out in a workman like manner at the highest standards and all works shall be coordinated with the other works carried out at the site to allow the performance of all works simultaneously without causing any hindrance to other works.

The Contractor shall make his own arrangements for locating the coordinates and positions of all work and reduced levels (RLs) at these locations based on two reference grid lines and one bench mark which will be furnished by the Engineer-In-Charge. The Contractor shall provide all requirements al site so that the work can be carried out accurately according to the specification and drawing and / or as directed by the Engineer-In-Charge.

The Contractor shall make good to the satisfaction of the Engineer-In-Charge all cuttings / damages resulting from his operations during the installation. He shall also dispose of all unserviceable materials at least 50 m away from office / colony complex, unless otherwise directed by the Engineer-In-Charge. All serviceable material shall be stacked within a lead of 50 m as directed by the Engineer-In-Charge.

12.3 Submissions

At least 30 (thirty) days prior to starting installation of any material or equipment, the Contractor shall submit to the Engineer-In-Charge for his approval the following:

- Details of Water Supply and Sanitation System
- Details of piping with fittings and supports, etc.
- Sufficient descriptive materials such as catalogues, diagrams and other data published by the manufacturer to demonstrate the conformance to the Specifications and the Drawings as required by the Engineer-In-Charge.

The Contractor shall also provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-In-Charge during all types of installations at his own cost and responsibility. However, approval given by the Engineer-In-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution or of liability for injuries to, or death of persons, or any obligations under this contract.

12.4 Standards and Codes

All works and the materials therefore, procedures of placing, curing and testing, etc. shall conform to the 'Specifications for Building and Road Works, 2021: Royal Govt. of Bhutan' and / or relevant Indian Standards and Guidelines.

12.5 Materials

12.5.1 General

All water supply and sanitary appliances and fittings shall be of modern pattern, fancy type and are subject to approval of the Engineer-In-Charge before they are purchased / installed.

All pipes, fittings, fixtures, appliances and accessories shall conform to the relevant Standards and / or as directed by the Engineer-In-Charge. These shall be obtained from a reputed manufacturer and shall be approved by the Engineer-In-Charge before supply at site. Wherever indicated by the Engineer-In-Charge, the Contractor shall submit samples of materials. These may be retained by him for subsequent comparison.

12.5.2 Appliances and Accessories

All appliances and accessories shall conform to the relevant Standards and Code of practices.

a. Water Closet

European type water closer shall be white vitreous China pedestal, wash down type and of one piece construction, provided with ISI marked white solid plastic seat and lid, 10 lt. low level white PVC flushing cistern of approved make, with fittings and bracket, 40 mm flush bend, 20 mm overflow pipe with specials of standard make and mosquito proof coupling of approved municipal design, complete. The WC shall conform to IS-2556 (I&II).

b. Urinal

The urinal installation shall be vitreous China urinals with partition plates. Size of the urinals shall be 440 x 265 x 355 mm with side fixing arrangements or as directed by the Engineer-In-Charge. The urinals shall conform to IS-2556 (Part-VI). Bowl shall be of one piece construction with flat back and flushing box rim with minimum 12 holes, well distributed in the rim to ensure satisfactory flushing. Size of distribution flush pipe shall be 15 mm nominal bore. Inside and outside visible surface of urinals shall be glazed, uniform and smooth.

Urinal shall be fixed at a height of 60 cm from the standing level to the top of the lip of the urinal, unless otherwise directed by the Engineer-In-Charge. Each urinal shall be connected to 32 mm dia. waste pipe which shall discharge into a glazed channel of sufficient width, or a floor trap. The white glazed vitreous china partitions shall be provided between the urinals at 60 cm apart.

Partition plates shall be of one piece construction and provided with fixing arrangement at the fat back top and bottom. A counter sunk hole of 8 mm (min 0 at the bottom may also be provided for the purpose of keeping it fixed.

c. Wash Basin

Wash basins shall be of white vitreous china flat back type, 630 x 450 mm or 550 x 450 mm size unless otherwise specified, with CI brackets painted white. Each basin shall be provided with chromium plated, fancy mixer type pillar tap with Hot and Cold markings of approved quality and design, CP brass chain with rubber plug, 32 mm CP brass waste of standard pattern, 32 mm CP brass trap and unions, complete. The wash basins shall conform to IS-2556 (P-IV).

d. Mirror

The mirror shall be superior sheet glass with edges beveled of approved make. It shall be free from flaws, speaks or bubbles. The size of the mirror shall be 600 x450 mm and the thickness shall not be less than 6 mm. it shall be uniformly silver plated at the back and shall be free from silvering defects. Silvering shall have a protective uniform covering of lead paint. The mirror shall be fixed over 6 mm thick hard board and ground fixed to wooden cleats with CP brass screws and washers, firmly embedded in the walls.

e. Glass Shelf

Glass shelf shall consist of an assembly of glass shelf with anodized aluminum angle frame to support the glass shelf. The shelf shall be of glass of best quality with edges rounded off. The size of the shelf shall be 450 x 120 mm and thickness not less than 6 mm. The shelf shall have chromium plated brass guard rail and brackets which shall be fixed with chromium plated brass screws and washers to wooden cleats firmly embedded in the walls.

f. Towel Rail / Towel Ring

Towel rail and supporting brackets shall be made of chromium plated brass. Size of the rail shall be 600 x 20 mm dia. unless otherwise specified. It shall be fixed in position by means of 2 nos. brackets which shall be fixed with chromium plated brass screws and washers to wooden cleats firmly embedded in the walls. Towel ring shall have about 150 mm dia. and 12 mm chromium plated brass rod.

g. Toilet Paper Holder

The toilet paper holder shall be of recessed ceramic, roll type and of size 150 x 150 mm and design as approved by the Engineer-In-Charge. It shall be fixed in position by means of chromium plated brass screws and washers to wooden cleats firmly embedded in the walls.

h. Soap Tray

Soap tray shall be made of stainless steel. Its size shall be 100 cm dia. or elliptical as directed by the Engineer-In-Charge. It shall fixed in position as approved by the Engineer-In-Charge.

i. Pillar Taps

Pillar taps shall be chromium plated brass, fancy type of approved make and quality. The nominal size of pillar taps shall be 15 mm, combined with Hot and Cold water supply system.

j. Bib / Stop Cock and Gate Valve

All bib cocks and stop cocks used in sanitary appliances shall be of chromium plated brass, fancy type of approved make and quality with nominal size of 15 mm. Ordinary type bib cocks and stop cocks shall be made of brass and shall be polished bright.

Gate valve, wherever provided on main inlet pipe, shall be made of brass. Unless specified otherwise Class-I, non-rising stem, solid wedge type valve shall be provided.

k. Pipes

Unless otherwise specified and / or as directed by the Engineer-In-Charge, following types of pipes shall be used:

i. For water supply to buildings, pipes and the pipe fittings shall be galvanized mild steel pipe, medium grade of approved make and brand.
ii. For inlet connecting pipes to appliances / fittings, galvanized mild steel pipes, medium grade of 15 mm NB with union of approved make shall be used. Standard length of 300 to 450 mm pipe shall be used to suit the site requirements.
iii. For sanitary work above ground, sand cast iron / centrifugally (Spun) cast iron pipes, fittings and accessories shall be used. Pipes shall be coated with coal-tar by hot dipping process for both inner and outer surfaces.
iv. For drain and sewer line work in bad or unstable ground condition and under building centrifugally cast (Spun) iron pressure pipes shall be used. Class LA pipe with spigot and socket ends shall be used. Pipes shall be coated with coal-tar.
v. For roof drain PVC pipes shall be used for rain water pipes.

12.6 Installation of Appliances and Fittings

12.6.1 General Requirements

All fittings and fixtures shall be installed in best workman-like manner by skilled workers. These shall be perfect in level. Plumb, plane, location and symmetry. All items shall be securely anchored to wall and floors. All cutting in walls and floors shall be made good in conformity with the wall / floor finish.

12.6.2 Water Closet

Water closet shall be installed along with necessary appliances and fittings including flushing cistern with flush pipe, seat and cover. The wash down water closet shall be fixed

to the floor by means of 75 mm long, 6.5 mm diameter, counter sunk bolts and nuts embedded in floor. The seat shall be fixed to the pan, by means of two 8 mm diameter corrosion resistant hinge bolts, provided with washer.

12.6.3 Wash Basin

The installation of wash basin shall consist of an assembly of wash basin, pillar taps, C.I. brackets, chromium plated brass union as specified. The height of front edge of wash basin from the floor level shall be 75 to 80 cm. The basin shall be supported on a pair of C.I. Cantilever brackets with cement mortar 1:3 (1 cement: 3 sand). The bracket shall be embedded in cement concrete (1:2:4) block and protected by suitable impervious paint. The bracket shall be fixed in position before dado work is done. The wall plaster on the rear shall be cut to rest over the top edge of the basin. Centre to centre distance between 2 basins shall be 75 cm.

The chromium plated brass bottle trap and union shall be connected to 32 mm dia. waste pipe which shall be suitable bent towards the wall and shall discharge into an open drain leading to floor trap or direct into the floor trap on ground floor and shall be connected to a waste pipe stack through a floor trap on upper floors.

12.6.4 Mirror

The mirror shall be mounted on 6 mm thick plain asbestos sheet ground and shall be fixed in position by means of 4 nos. C.P. brass screws and C.P. washers, cover rubber washers and wooden plugs firmly embedded in the walls. Unless specified otherwise, the longer side shall be fixed horizontally. The mirror shall be fixed at a nominal height of 1.45 m.

12.6.5 Brass and Gun Metal Water Fittings

The fitting shall be fully examined and cleared of all foreign matter before being fixed. The fitting shall be fitted in the pipeline in a workman like manner. The joints between fittings and pipes shall be leak proof when tested to a pressure of 6 kgf/sq. cm. the defective fittings and joints shall be replaced or redone.

12.7 Laying, Installation and Jointing of Pipes and Pipe Fittings

12.7.1 General Requirements

Relevant Standard Practices shall be followed as general guidance for laying, installation and jointing of different types of pipes and fittings. Some important aspects pertaining to a few commonly used pipes are described in the following clauses for ready reference.

a) Unless otherwise shown on the drawing, the minimum gradients of soil and drainage pipes shall be as followed for maintaining minimum self cleaning velocity of 0.75 m/sec.

Diameter in mm	Gradient
100	1 in 57
150	1 in 100
200	1 in 175
250	1 in 195
300	1 in 240

b) The pipes and special shall be handled with sufficient care to avoid damage to them. These shall be lined upon one side of the alignment of the trench with socket facing upgrade.

c) Cutting of pipes may be necessary when pipes are to be laid in lengths shorter than the lengths supplied. The pipe shall be so marked that the cut is truly at right angle to the longitudinal axis of the pipe.

d) Drainage and soil pipes shall not be allowed to come close to water supply pipe lines.

e) For water pipe lines, meticulous care shall be taken to avoid chances of airlock and water hammer. The layout of pipe work shall be such that there is no possibility of backflow towards the source of supply from any cistern / appliance whether by siphon or otherwise. The pipes for internal works shall be concealed with cutting of proper chases in masonry or concrete of the structure. Clamps and fittings shall be as per standard practice and as approved by the Engineer-In-Charge.

f) For entry of the pipe lines into any building or structure, suitable conduits under the structure or sleeves shall be used to facilitate installation and maintenance of the services. When openings or chases are required to be made in the structure for entry of pipe lines, locations and sizes shall be marked and got checked from the Engineer-In-Charge. After laying of the pipeline the opening and chases shall be mended.

g) Where soil, waste and ventilating pipes are accommodated in ducts, access to cleaning eyes shall be provided. Connection to drain shall be through a fully with seal cover to guard against ingress of sewer gas, vermin or back flow.

12.7.2 Requirement above Ground Level

a) Galvanized Mild Steel Pipes for Water Supply.

Unless specified and / or directed, all pipes for water supply shall be concealed. To conceal the pipes, chasing may be adopted or pipes fixed in the dusts or recess etc. union joints shall be provided for all required locations to facilitate maintenance. Before embedding, the pipes it should be painted with anti-corrosive bituminastic paints. All pipes and fittings shall be properly jointed and made completely water tight. Burr from the joint shall be removed after screwing.

The pipes and fittings shall be checked under working pressure. Any joint found leaking, shall be rectified and all leaking pipes removed and replaced. The pipes and fittings shall be tested to a hydraulic pressure of 6 kgf/sq. cm.

b) Cast-iron Pipe for Sanitary work above Ground.

Sanitary pipe work above ground shall be followed for general guidance. Types of pipe systems shall be as shown on the drawings. Proper ventilation shall be provided in the piping system. The single stack system shall not generally be provided and shall be secured to the walls at all joints with MS holder bat clamps of approved size and shape. The clamps shall be fixed to the wall by embedding their hook in cement concrete block 10 x 10 x 10 cm (1:2:4 mix) for which necessary holes shall be made in the wall at proper places. The clamps shall be kept about 24 mm clear of finished face of wall. All soil pipes shall be carried up above the roof and shall have sand cast iron terminal guard. The pipes above parapet shall be secured to the wall by means of MS. Stay and clamps.

The pipes shall be fixed perfectly vertical or to the lines as directed. The spigot of the upper pipes shall be properly fitted in the socket of the lower pipe such that there is a uniform annular space for filing with the jointing material. The interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of treated spun yarn, twisted into ropes of uniform thickness well caulked into the back of the socket. No piece of yarn shall be shorter that the circumference of the pipe. The jointed pipe line shall be at required levels and alignments. The leading of pipes shall be made by means of ropes covered with clay or by using special leading rings. The lead shall be melted so as to be thoroughly fluid and each joint shall be filled in one pouring.

Floor trap shall be suitably lowered to accommodate the trap and the top of the floor shall be properly sloped towards the trap for effective drainage. A chromium plated/galvanized grating shall be provided on the trap. The sunken floor slab shall be filled with light weight materials like cinder mixed with cement. Sunken slab shall be made watertight by means of bitumen coating, plastering etc.

c) Rain Water Down-Comers.

Rainwater down comers and fittings shall be standard PVC pipes. Rainwater down comers shall run along and be secured to walls, columns etc. Where desired by the Engineer-In-Charge, these may have to be installed in chases cut in the structure. All pipes shall be wrought clevis type slip ring type or perforated strap iron type, as approved by the Engineer-In-Charge. Suitable spacer blocks shall be provided against the vertical surface

on which the pipe is fixed. All bends and junctions shall be supplied with water tight cleaning eyes. Joints between successive lengths of pipe can be made by collars. All rainwater down comers shall be provided with roof drain head of the shape and type as shown on the drawing. Unless otherwise specified, dome type drain head shall be used.

12.7.3 Pipe Lines Jointing

(1) Jointing Cast Iron Pipes with Stoneware Pipes.

Where any cast iron soil pipe, waste pipe, ventilation pipe or trap is connected with a stoneware or semi-vitrified, waste pipe or drain communicating with a sewer, the beaded spigot end of such cast iron soil pipe, waste pipe, ventilating pipe or trap shall be inserted into a socket of such stoneware or semi-vitrified waste pipe or drain and part of clean sand after placing a tarred gasket or hemp yarn soaked in neat slurry round the joint and inserted in it by means of a caulking tool.

(2) Jointing Stoneware with Cast Iron Pipe.

Where any earthen-ware trap connected to water closet pan is to be jointed with a cast iron soil pipe, the joint between the stone ware spigot and the cast iron socket shall always be of a flexible (non-rigid) nature. Such joint shall be made preferably with a mixture of bitumen and chopped asbestos fibre (not dust).

(3) Jointing Cast Iron Pipes.

i. Lead Run Joints (Cast Lead Joints).

The spigot shall be centered in the adjoining socket by tightly caulking in, sufficient turns of tarred gasket or hemp yarn to leave unfilled half the depth of socket for lead. When gasket or hemp yarn has been caulked tightly home, a jointing ring shall be placed round the barrel and against the faces of the socket. Molten pig lead shall then be poured into for filling remainder of the socket. The lead shall then be solidly caulked with suitable tools and hammers of not less than 3 kg. weight, right round the joint to make up for the shrinkage of the molten metal on cooling and shall preferably be finished 3 mm behind the socket face. The pipes shall essentially be dry before lead run joints are made.

ii. Cement Joints.

The joint is first yarned with hemp yarn dipped in the cement slurry. The yarn is first inserted to slight depth and well pressed in the same manner as in lead jointing.

iii. Tylon Joints.

The pipe manufacturer's instructions shall be strictly followed in making such joint. Tylon joints shall be made by push on the 'Tylon' rubber gasket and such rubber gasket shall conform to the specifications stipulated by the pipe manufacturer. The tools specified by the pipe manufacturer shall be used to secure the joints fully.

12.8 Surface Drains

All surface drains shall be made of stone masonry or as approved by the Engineer-In-Charge. Bed concrete for the drains shall be 100 mm thick cement concrete (1:3:6). The inside of the walls and the top shall be flush pointed with cement mortar (1:4).

The surface drains shall be of the size as specified in BOQ and laid to such gradients and locations as shown on the drawings or as directed by the Engineer-In-Charge. The drains shall be provided, as far as possible, uniform slope from the starting point to the discharge point.

12.9 SW Gully Trap

The Gully traps shall be fixed on cement concrete foundations, 65 cm square and not less than 10 cm thick. The mix for concrete shall be 1:5:10 (1 cement: 5 sand: 10 graded stone aggregate 40 mm nominal size). The jointing of the gully outlet to the branch drain, shall be done similar to jointing SW pipes.

After fixing and testing gully and branch drain a brick masonry chamber 300 x 300 cm (inside) in brickwork of specified glass in cement mortar 1:5 (1 cement : 5 sand) shall be built with a ½ brick thick brick work round the gully trap from the top of the bed concrete up to ground level. The space between the chamber walls and trap shall be filled in with cement concrete 1:5:10 (1 cement: 5 sand: 10 graded stone aggregate 400 mm nominal size). The upper portion of the chamber i.e., above the top level of the trap shall plastered inside with cement mortar 1:3 (1 cement: 3 sand) finished with a floating coat of net cement. The comers and the bottom of the chamber shall be rounded off so as to slope towards the grating.

12.10 Overhead Water Storage Tank

Overhead storage tanks shall be made of Virgin HDPE granules of approved quality and make unless otherwise specified. Tank shall have seamless constructions, moulded by rotational moulding, conforming to IS 12701. Shape of tank shall be cylindrical-vertical type with corrugation along with length and bottom of the tank. Tank shall have closed top provided with lid and suitable and second ball valve. The material of construction of tank, lid and fittings which come in contact with water shall be such that it dies not impart any taste, color or odour to water, nor have any toxic effect. It shall not contaminate water thereby making it unportable. The internal and external surface of the tank shall be smooth, clean and free from other hidden internal defects, such as air bubbles, pits and metallic or other foreign material inclusions. The tensile strength of the wall of the water tanks shall not be less than 12 N/mm^2.

Tanks shall be provided with all fittings for inlet, overflow, outlet pipes and ball valves including mosquito-proof coupling. These shall be leakage proof and shall be installed with proper support and anchorage for applicable wind and seismic condition. These tanks shall be placed on the roof of the building.

Unless otherwise specified, the outlet pipes shall be 50 mm or 40 mm above the bottom of the tank. The wash out or draining pipe shall be made flush at the bottom of the tank at its lowest point. The floor of the tank shall be given a slight fall to the washout pipe for the tank. Water level indicator shall be provided, if asked for.

12.11 Plastic tank

12.11.1General

Tank shall be of cylindrical vertical and Rectangular Loft types, and shall conform to IS 12701. The material of construction of tank, lid and fittings which come in contact with water shall be such that it does not impart any taste, colour or odour to water, nor have any toxic effect, it shall not contaminate water thereby making it unpotable.

12.11.2Fittings

Each tank shall be provided with 40 mm dia G.I scour pipe, which shall terminate into a socket and a plug, 25 mm G.I over flow pipe with fittings and brass mosquito proof coupling conforming to the municipal design and approved by the Engineer and ball valve with copper or plastic float of specified size and pressure. The ball valve shall be securely fixed to the tank independent of the inlet pipe and set in such a position that body of the ball valve cannot become submerged when the tank is full up to waterline.

12.11.3Hoisting

The hoisting of tanks into position as directed by the Engineer shall be carried so that no part of the tank or structure is damaged in the operation. The tank shall be installed in position truly level and secure to concrete members with necessary bolts and nuts.

12.11.4Measurements

Water storage tanks shall be counted in numbers for complete job.

12.12 Sampling, Testing and Quality Control

12.12.1General

The Contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards and / or International Standards and shall conduct such tests as are called for by the Engineer-In-Charge. Where no specific testing procedure is mentioned, the tests shall be carried out as per the directions of the Engineer-In-Charge. Tests shall be done in the field and at a laboratory approved by the Engineer-In-Charge and the Contractor shall

submit to the Engineer-In-Charge, the test results in triplicate within three days after completion of a test. The Engineer-In-Charge may, at his discretion, waive off some of the stipulations given for small and unimportant operations.

Material/work found unsuitable for acceptance, shall be removed and replaced by the Contractor. The work shall be re-done as per specification or requirements and to the satisfaction of the Engineer-In-Charge.

12.12.2Testing after Installation

a. General

All soil pipes, waste pipe, ventilating pipes and all other pipes, when above ground, shall be gastight. The pipe systems shall be tested for gas tightness and for hydraulic performance as given hereunder:

(i) Air Test

Air test shall be applied by inserting expanding rubber testing plugs in the lower and upper ends of the main soil pipe and main ventilating pipe and sealing the plugs with water, where possible. The testing plug at the upper end of the ventilating pipe shall be fitted with a tee-piece with a cock on each branch, one branch being connected by a flexible tube into a manometer. Air pressure shall then be introduced into the system through the other branch of the tee piece until the desired pressure is shown in the manometer scale. The pressure applied should be equal to 65 mm water gauge. For locating the fault position, smoke test shall be carried out.

(ii) Smoke Test

All soil pipes, waste pipes and vent pipes and all other pipes, when above ground, shall be tested by a smoke test conducted under a pressure of 24mm of water and maintained for 15 minutes, after all trap seals have been filled with water. The smoke is produced b burning only waste or tar paper or similar material in the combustion chamber of a smoke machine. Care shall be taken to ensure that the system is filled with smoke before sealing with plugs. Chemical smoke is not satisfactory.

(iii) Water Test

Water test may be applied before the appliances are connected and may be carried out in sections so as to limit the static head to 4.5m. it is necessary to seal at openings affected by the test and provide support to the plugs uses as stoppers.

b. Obstruction / Straightness Test

The obstructions shall be checked by inserting a smooth hall, of diameter 13mm less than the pipe bore at the high end of the sewer or drain. In the absence of any obstruction, such as yarn or mortar projecting through the joints, the bass will roll down the invert of the

pipe and emerge at the lower end. The straightness shall be checked by means of a mirror at one end of the line and lamp at the other, if the pipe line is straight, the full circle of the light may be observed. The mirror will be also indicated obstruction in the barrel, if the pipe line is not straight.

c. Testing of Service Pipes

The service pipes shall be slowly and carefully charged with water, allowing all air to escape avoiding all shock or water hammer. The service pipe shall then be inspected under working condition of pressure and flow, when all draw off taps are closed. The service pipes shall be checked for satisfactorily support and protection from damage corrosion and frost.

d. Testing Fixtures

Ail fixtures and fittings shall be connected by water tight joints. No dripping of water shall be acceptable.

12.13 Maintenance during Construction

The Plumbing system small be maintained and protected by the Contractor in a satisfactory condition until final acceptance by the Employer. Defective materials and equipment damage in the course of installation or testing shall be replaced or repaired at the expense of the Contractor in a manner as approved by the Engineer-in-Charge

12.14 Measurements and Payment

Measurement and payment for the supply land installation of the plumbing system and sanitary works shall be made on the basis of unit rates as tendered in the Bill of Quantities. The rates shall constitute full compensation for the cost of all labors, tools , equipment and materials, cutting of chases, incidentals, etc including those for the tests, periodical maintenance till acceptance of the works and any other items necessary to complete the function of the system stipulated in the specification.

13. PAINTING AND POLISHING

13.1 Scope of Works

The Scope of works under this clause shall comprise of performance of all works necessary for finishing of walls both interior and exterior surfaces of plaster and painting, varnishing and / or French polishing over wood work, structural and other miscellaneous steel items, external surfaces of the pipes, roof drains, service water pipes and other ferrous and non-ferrous metal items, etc.

The Scope of Works shall also cover for supply of all materials, labour, equipment, tools and plants, and all other incidentals etc as needed for performance of the works as per specification and / or direction of the Engineer-in-Charge.

13.2 General Requirements

Painting/varnishing, etc shall not be stared until the Engineer-in-Charge has inspected the items of works to be painted/varnished, etc and satisfied himself about their proper quality and given his approval to commence the finishing works.

Painting/varnishing, etc except the priming coat shall generally be taken up in hand after practically finishing all other work. The rooms shall be thoroughly swept out and the entire building clean up at least one day in advance of the painting works being started. Painting of external surface should not be down in adverse weather conditions.

The Contractor shall provide all safety measures for the workmen and others as per standard practices and requirements and / or direction of the Engineer-In-Charge during all types of work at his own cost and responsibility. However, approval given by the Engineer-In-Charge to the Contractor's methods and equipment shall not relieve the Contractor of his full responsibility for a proper and safe execution of works, or of liability for injuries to, or death of persons, or any obligation under this contract.

The Contractor shall also undertake all precautions to prevent damage, disfiguration or straining to work of other trades or other installations.

13.3 Submission

At least fifteen (15) days prior to commencement of finishing works, the Contractor shall submit the schedule, sequence and methodology of works, to the Engineer-In-Charge for approval. He shall also submit colour samples, distempers and paints, etc. with their specifications, to the Engineer-In-Charge for approval.

13.4 Standards and Codes

All distempering and painting/ varnishing works and the materials therefore, production, procedures of works, curing and testing, etc. shall conform to the **'Specifications for Building and Road Works, 2020: Royal Govt. of Bhutan' and / or relevant Indian Standards and Guidelines.**

13.5 Materials

13.5.1 General

Materials for painting and varnishing, etc. shall be highest grade products of well known approved manufacturers and shall be delivered to the site in original sealed containers, bearing brand name, manufacturer's name and colour shade with labels intact and seal unbroken, in sufficient quantity. All materials shall be subject to inspection and approval by the Engineer-In-Charge. It is desired that the materials of one manufacturer only shall be used as far as practicable and paint of particular shade be obtained from the single batch.

All prime coats shall be compatible to the material of the surface to be finished as well as to the finishing coats to be applied. All unspecified materials such as shellac, turpentine or linseed oil shall be of the highest quality available and shall conform to the latest Standards. All such materials shall be made by reputed recognized manufacturers and shall be approved by the Engineer-In-Charge.

13.5.2 Water Proof Cement Paint

Water proof cement wash shall be made from best quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides.

13.5.3 Dry/ Acrylic Distemper (washable)

Dry/ Acrylic distemper of required colour conforming to IS: 427 / IS: 428 and of approved brand and manufacturer shall be used. The primer where used shall be cement primer or distemper primer as approved by the Engineer-In-Charge. These shall be of same manufacturer as that of distemper.

13.5.4 Varnish/ French Spirit Polish

Varnish conforming to IS: 347 shall be of approved manufacturer, for French polish, pure shellac conforming to IS: 16 varying from pale orange to lemon yellow colour, free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm of shellac to 1 liter of spirit. Suitable pigment shall be added to get the required shade. Readymade polish conforming to IS: 348 can also be used.

13.5.5 Synthetic Enamel Paint

Paint to be used for various items of work shall be of best quality, conforming to IS: 1932 and shall be obtained ready mixed in sealed containers from approved manufacturer. The Contractor shall obtain the approval of the Engineer-In-Charge for the make and colour of the paint he proposes to use.

13.6 Storage

The Contractor shall arrange for safe and proper storage of all materials and tools. Paints etc. shall be kept covered at all times, and mixing shall be done in suitable containers. All necessary precautions shall be taken by the Contractor against fire hazards.

13.7 Preparation of Surface

13.7.1 Preparation of Surface Over Cement Plaster

The surface of the plaster shall not be painted until it has dried completely. Trial patches shall be laid at intervals and where drying is satisfactory, painting shall be taken up in hand. Surface shall be free from all oil, grease, efflorescence, mildew, loose paint or other foreign and loose materials.

Masonry cracks shall be cleared out and patch filled with mortar similar to the original surface and uniformly textured. Where this type of resurfacing may lead to the finishing paint being different in shade from the original surfaces, the resurfaced area shall be treated with minimum one cost of cement primer which should be continued to the surrounding area for a distance of minimum 100 mm.

Surface with mildew and efflorescence shall be treated as below:

a) Mildew

All mildew surfaces shall be treated with an approval fungicide such as ammoniacal wash consisting of 7 g of copper carbonate dissolved n 80 ml liquid ammonia and diluted to 1 liter with water, or 2.5 percent magnesium silicon fluoride solution and allowed to dry thoroughly before paint is applied.

b) Efflorescence

All efflorescence shall be removed from affected surfaces with a solution of muriatic acid in water (1:6: to 1:8), washed fly with clear water and allowed to dry thoroughly.

13.7.2 Preparation of Wood Surface for Varnishing / Polishing / Painting

The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted. Knots if visible shall be covered with a preparation of red lead and glue shall be laid on while hot. Holes and indentations on the surface shall be closed with glazier's putty or wood putty conforming to IS: 419. The surface shall then be given a coat of wood filler made by mixing whiting (ground chalk) in methylated spirit at the rate of 1.5 kg of whiting per liter of spirit. The surface shall again be rubbed down perfectly smooth with sand paper and wiped clean.

13.7.3 Preparation of Metal Surface for Painting

All metal surfaces shall be absolutely clean, dry and free from wax, grease and soap films. All rust and scales shall be removed by scribing or by brushing with steel wire brushes. Hard skin of oxide formed on the steel and iron surfaces, which become loose by rusting, shall be removed.

All galvanized iron surfaces shall be pretreated with a compatible primer according to the manufacturer's direction. Any abrasion in shop coat shall be touched up with the same quality of paint as the original coat. If the surface is wet, it shall be dried before priming coat is undertaken.

13.8 Application

13.8.1 General

The method of application in each case shall be as recommended by the manufacturer. In case of selection of special shades and colour (not available in standard shades) the Contractor shall mix different shades and prepare test panels of minimum size 1 meter square as per instruction of the Engineer-In-Charge and obtain his approval prior to application of finishing paints. Proper tools and implements shall be used. Scaffoldings if used shall be independent of the surface to the painted to avoid shade differences of the freshly repaired anchor holes.

Painting shall be done by skilled labours in a workman like manner. All materials shall be evenly applied, so as to free of sags, runs crawls or other defects. All coats shall be of proper consistency. In case of application by brush, no brush marks shall be visible. The brushes shall be clean and in good condition before application of paints. All priming undercoats for painting shall be applied by brush only, and rollers, spray equipment etc. shall not be used.

No work shall be done under conditions that are unsuitable for production of good results. No painting shall be done when plastering is in progress or is drying. Application of paint

which seals the surface to moisture shall only be done after the moisture on and below the surface has dried out.

All coats shall be thoroughly dry before being sand papered or before the succeeding coat is applied. Coats of painting as specified are intended to cover surfaces perfectly. In case the surface is not covered properly by applying the specified number of coats, further coats shall be applied by the Contractor when so directed by the Engineer-In-Charge.

Finished coats shall be of exact colour and shade as per approved samples and all finish shall uniform in colour and texture. All parts of mouldings and ornaments shall be left clean and true to finish.

13.8.2 Application of Painting Priming Coat

Primer for plaster / wood work / Iron & Steel surface shall be as specified below:

Table-12.1

Specifications for Primer

Sl. No.	Surface	Primer to the used
	Wood work (hard and soft wood)	Pink conforming to IS: 3536
	Resinous wood and plywood	Aluminum primer conforming to IS: 3585
	Iron, Steel and Galvanized steel	Red oxide Zinc chromate Primer conforming to IS: 2074
	Plastered surfaces to receive paint finish	Cement primer conforming to IS: 109

The primer shall be ready mixed primer of approved brand and manufacturer or otherwise may be mixed at site. Where primer for wood work needs to be prepared at site. It shall be prepared from a mixture of red lead, white lead and double boiled linseed oil in the ratio of 0.7 kg: 0.7 kg : 1 liter. For steel work, primer shall be mixed at site from a mixture of red lead, raw linseed oil and turpentine in the ratio of 2.8 kg: 1 liter: 1 liter. The specifications for the base and thinner for mixed on site primer shall be as follows and shall be of approved manufacture and brought to sit in their original packing in sealed conditions:

a) White Lead

The white lead shall be pure and free from adulterants like barium, sulphate and whiting. It shall conform to IS: 103.

b) Red Lead

This shall be in powder from and shall be pure and free from adulterants like brick dust etc. It shall conform to IS: 102.

c) Raw Linseed Oil

Raw linseed oil shall be lightly viscous but clear and of yellowish colour with light brown tings. Its specific gravity at a temperature of 30 degree C shall be between 0.923 and 0.928. The oil shall be mellow and sweet to the taste with very little smell. The oil shall be of sufficiently matured quality. Oil turbid or thick, with acid and bitter taste and rancid odour and which remains sticky for a considerable time shall be rejected. The oil shall conform in all respects to IS: 75. The oil shall be approved brand and manufacture.

d) Double boiled Linseed Oil

This shall be more viscous than the raw oil, have a deeper colour and specific gravity between 0.931 and 0.945 at a temperature of 30 degree C. It shall dry with a glossy surface. It shall confirm in all respects to IS: 77. The oil shall be approved and manufacture.

e) Turpentine

Mineral turpentine i.e. petroleum distillate which has the same rate of evaporation as vegetable turpentine (distillate product of oleoresin of conifers) shall be used. It shall have no grease or other residue when allowed to evaporate. It shall conform to IS: 533.

13.8.3 Application of Waterproof Cement Paint

Waterproof cement painting shall be applied in two coats over one coat of priming. Waterproof cement paint shall be mixed in such quantities as can be used up within an hour of its mixing. Avoid setting or thickening of the mix. Cement paint shall be mixed in two stages. The first stage shall comprise of 2 parts of cement paint and 1 part of water stirred thoroughly and allowed to stand for 5 minutes. The second stage shall comprise adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency.

Surface to be coated with cement paint shall be washed and brushed down. As soon as the moisture has disappeared, the surface shall be given one coat of paint. Care shall be taken so that the paint does not dry out too rapidly. After 4 to 6 hours, the water shall be sprinkled over the surface to assist curing and prevent cracking. After the first coat has dried (24 to 48 hours), the second coat shall be applied. However, three or more coats of waterproof cement paint may be necessary to get a uniform shade. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetter. In a similar manner the finished surface shall be kept moist by occasional sprinkled with water for seven days after painting. Waterproof cement paint shall not be applied on surface already treated with white wash.

13.8.4 Application of Dry Distemper / Acrylic Distemper (oil bound)

The dry distemper shall be of approved colour, brand and manufacturer and shall be mixed in clean water using 0.6 liter of water per kg of distemper or as specified by the manufacturer. It shall then be allowed to stand for at least 30 minutes (or if practicable over night) before use. The mixture shall be well stirred before and during use to maintain an eve consistency. Distemper shall not be mixed in larger quantity than is actually required for one day's work. The dry distemper shall be applied in two coats over one coat of priming.

Before the work is distempered, the new plastered surface shall be allowed to dry for at least two months. Before application of the distemper, the surface shall be thoroughly brushed free from mortar droppings and other foreign matter and sand papered smooth. Pitting in plaster if any shall be made good with plaster of pairs mixed with the colour to be used. The surface shall than be rubbed down again with a fine grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before the regular coat of distemper is applied.

A priming coat of whiting (white chalk, mixed with solutions of gum dissolved separately in hot water @2 kg of gum and 0.4 kg of copper sulphate per cum of whiting starry) shall be applied over the prepared surface and allowed to dry. No white washing coat shall be used as a priming coat for distemper.

After application of the priming coat, the entire surface shall be coated with the mixture of distemper uniformly, with proper distemper brushes in horizontal stokes followed immediately by vertical ones which together shall constitute one coat. The subsequent coat shall be applied only after the previous coat has dried. Two or more coats of distemper shall be applied to make the finished surface shall be even and uniform and shall show no brush marks.

Any varnish left over in the small container shall not be poured back into the stock tin, as it will render the latter unite unfit for use. Special fine haired brushes shall be used and not ordinary paint brushes. Brushes shall be well worn and perfectly clean.

13.8.5 Application of Varnish / French Polish

a. Application of Varnish

The varnish shall be applied in two coats over one coat of priming and shall be applied liberally with a full brush and spread evenly with short light strokes to avoid frothing. If the work is vertical, the varnish shall be crossed and recrossed and then laid off, later being finished on the upstrokes so that varnish, as it sets, flows down and eliminates brush marks, the above process will constitute one coat. If the surface is horizontal, varnish shall be applied in every directions, with light quick strokes and finish in one definite direction so that it will set without showing brush marks, in handling and applying varnish. Care

should be taken to avoid forming froth or air bubble. Brushes and containers shall be kept scrupulously clean.

Rubbing down and flatting the surface shall be done after each coat except the final coat with fine sand paper. The work shall be allowed to dry away from droughts and damp air. The finished surface shall then present a uniform appearance and fine glossy surface free from streaks, blister, etc. special fine haired varnishing brushes shall be used for the work.

b. Application of French polish

Two coats of French polish shall be applied over one coat of priming. A pad of woolen cloth covered by a fine cloth shall be used to apply the polish. The pad shall be moisture with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oils on the face of the pad facilities this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

13.8.6 Application of Paints over Steel Work

In general, painting work shall be in accordance with IS: 1477 (Part I & II) (Latest Revision). Surface of steel work to be painted shall be thoroughly cleaned of all grease, oil, dirt, rust, foreign matter like cement splashing, etc. by suitable solvent and mild rubbing with abrasive paper/hand scrapping to the full satisfaction of the Engineer-In-Charge. Cleaning with solvents/scrapping shall be limited to the affected area only.

In case where the existing primer is removed while cleaning the surface damaged portions shall be provided with a coat of wash or etching primer on suitable chemical pre-treatment solutions and another coat of red oxide, zinc chromate primer. The payment for red oxide primer will be made as per item of Bill of Quantities.

After the surface is prepared in a manner described above, the primer coat shall be dry cut without scratching or in any way damaging the primer coasts and cleans the surfaces from dust. Over this dry surface apply an optimum coat of undercoating (synthetic enamel paint) by spray with minimum brush marks. Allow the film to dry hard, wet rub, cutting down to a smooth finish (ensuring that at no place the undercoat is completely removed). Allow the water to evaporate. Finishing coats shall consist of two coats of synthetic enamel paint of approved colour and brand. Additional finishing coat, if found necessary shall be applied to ensure properly uniform glossy surface. The total dry film thickness of each shall be not less than 25 microns.

The paint shall be applied by brushing/spraying. Spraying shall be adopted with prior approval of Engineer-In-Charge generally on large surface areas. Paints shall be stirred

frequently to keep the pigment in suspension. Paint shall be ready mixed in original sealed containers as packed by the paint manufacturers and no thinners shall be permitted. No painting shall be done in frosty/foggy rainy weather or when humidity is high enough to cause condensation on the surface to the painted. Paint shall not be applied when the temperature of the surface to be painted is 5° C or lower.

Contractor shall provide and use sufficient number of drops, clothes, covers, tarpaulins and other screens to protect adjacent surfaces and shall remove all splatter and stains from such surfaces. The Contractor shall also protect his own work. Any and all damage to adjacent work or any part of the premises due to painting carelessness or accidental performance of the Contractor shall be repaired or made good at the Contractor's expense.

Painting shall be discontinued when exposed to rain and dust storm and shall not commence until the surfaces are perfectly dry and clean. Wherever practicable, surfaces shall be painted when under shade or when temperature is falling.

13.9 Scaffolding

Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface being washed. For all exposed masonry, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces.

In case of special type of brick work, scaffolding shall be got approved by the Engineer-In-Charge in advance. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damages or scratches to walls. For white washing the ceiling, the proper stage scaffolding shall be erected.

13.10 Clean-Up

All furniture, fixtures, glazing, floor, etc. shall be protected by covering during finishing work. The Contractor, upon completion of white/colour washing, distempering or painting, etc. shall remove all marks and make good surfaces, where paint has been spilled or spattered, including all equipments, fixtures, glass, fittings etc. to the satisfaction of the Engineer-In-Charge.

13.11 Acceptance Criteria

i. All finished surfaces shall be uniform and pleasing in appearance.

ii. The colour, texture, etc. shall match exactly with approved samples.

Iii. All stains, splashes and spatters of white/colour wash, distemper or paint shall be removed from surrounding surfaces.

13.12 Measurement and Payment

Measurement and payment for each of the finishing work shall be made separately at the unit rates based upon the area measured in sq. m, except when otherwise started .Small articles not exceeding 0.1 sq. m of painted surfaces where not in conjunction with similar painted work shall be enumerated

Painting up to 15 cm in width or in conjunction with similar painted work shall be given in running meters. Components of trusses, and similar word shall, however be given in sq .meters irrespective of the size or girth of members,

In measuring painting, polishing etc .of plastering / wood work or steel etc, the coefficient as mentioned in Table (Page 351) in the **Specifications for Building and Road works, 2020** will be adopted.

Painting of rain water, soil ,waste ,vent and water pipes etc shall be measured in running meters of the particular diameters of the pipe concerned .Piping of specials such as bends heads , branches ,junctions ,shoes etc, shall be included in the length and not separate measured shall be taken for these or for painting, clamps etc.

Unite rates shall included the cost of materials, labour , treatment ,tool and all other allied works /operational necessary for performance of the finishing work , competed as per specification and /of direction of the engineer –in-charge.

13.13 Traditional Painting

Traditional Painting shall not be started until the Engineer has inspected the items of work to be painted and satisfied himself about their proper quality and given his approval to commence the painting work. Painting, except the priming coat, shall be started after practically finishing all other builder's work. Traditional Painting of external surface should not be done in adverse weather condition like hail or dust storm etc. The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the painting work being started. The contractor shall bring approved painting materials to the site of work, in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The empties shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer. Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface being painted. For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and

strong, tied together with horizontal piece over which scaffolding planks shall be fixed. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damages or scratches to walls.

13.13.1Classification

Traditional Bhutanese paintings are classified into four categories namely *Rab*, *Ding*, *Thamar* and Yut*shon*. Bill of quantities shall be based on these categories.

Note: The labeling given in the figures in the following pages are not meant to depict/imply the Traditional Bhutanese painting nomenclatures but they are for the structural members only.

13.13.2Preparation of Traditional Paint

Round mud paint (Sa-tshoen) as available in the market shall be put in a tin, filled with water and kept for about 25 to 30 minutes. Water shall then be poured out taking care that mud ball is not shaken / distributed. When the water is completely drained out, either animal glue or fevicol shall be mixed with the soaked mud ballas follows:

a) Mixing with animal glue

Animal glue and water shall be mixed in the ration of 1:2 (1 animal glue: 2 water) and boiled until whole of the glue is melted and it becomes sticky. The prepared gum shall then be mixed with mud ball already soaked in water in the ratio 1:1 (1 gum: 1 soaked mud) and the paint is ready for painting.

b) Mixing with Fevicol

Fevicol shall be mixed with cold water and stirred well in the ratio 1:1(1 water: 1 fevicol). The fevicol solution shall then be mixed with mud soaked in water in the proportion of 1:1 and stirred well. The paint is ready for painting.

13.13.3Brush for Painting

Selection of brush for painting shall be based on the painters' judgment for design painting round brush is recommended.

13.13.4Mud Colour

Four primary mud paint colours are Red, Yellow, White and Black or grey. Supplementary colour, if required may be prepared by mixing the four primary colours as follows:

- Pink - Red and white

- Green - Black/blue and yellow
- Sky-blue - Black and white
- Aquamarine - Black, yellow and white
- Brown - Black and red

All the above 10 colours shall be used for medium and ordinary painting. The ready-made packet powder colours shall not be used for traditional paintings unless otherwise allowed by the Engineer. For special painting, a special paint called Chomur or distemper shall be added to the prepared paint to raise the thickness of the design.

13.13.5Washable Paint

The following steps shall be followed to prepare the washable paint:

1. Dry mud ball paint shall be ground to fine powder;
2. Fine powder shall be Sieved by a thin cloth;
3. The sieved powder shall then be mixed with synthetic enamel paint in the proportion one litre of synthetic paint with one kilogram of mud powder and kept for about 30 minutes to get a thick paint;
4. A small quantity of turpentine oil shall be added to the thick solution and stirred; and
5. Packet colours shall not be added.

13.13.6Precautions

All furniture, fixtures, glazing, floor etc. shall be protected by covering and stains, smears, splashing, in any shall be removed and any damage done shall be made good by the contractor at his cost.

13.13.7Preparation of Surface

a) Wooden surface

The woodwork to be painted shall be dry and free from moisture. The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sandpaper and shall be well dusted. Appropriate filler material shall be used where specified.

The surface treated for knotting shall be dry before painting is applied. Apply two coats of yutshon painting as primer on the surface to be painted.

b) Iron & Steel Surface

All rust and scales shall be removed by scraping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling, which becomes loose by rusting shall be removed. All dust and dirt shall be thoroughly wiped away from the surface. If the surface is wet, it shall be dried before priming coat (yutshon) is undertaken.

c) Plastered surface

The surface shall ordinarily not be painted until it has dried completely.

Trial patches of primer (yutshon) shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations shall be filled up with plaster of paris and rubbed smooth.

d) Drawing Chapa

Adjust the paper to the surface to be painted, draw the design on the paper, and prick the lines of the design by a pin. Place the paper back to the surface to be painted and rub the powder soaked cloth on the design paper. When the paper is withdrawn, powder marks are left on the surface, which is to be painted for specified painting. This process is continued for painting the required surface.

13.13.8Painting on Old Surface

If the old paint is firm and sound, it shall be cleaned of grease, smokeetc. The surface shall then be rubbed down with sandpaper and dusted. Rusty patches, etc shall be cleaned up. If the old paint is blistered and flaked, it shall be completely removed. Chadam (Bangchang + animal glue together) shall be boiled and applied on the surface to be painted. Drawing Chapa shall be same as for the new work.

13.13.9Physical checking

Physical checking shall be carried out on the quality of painting only after two days after paintings. The following steps shall be used as thumb rule to check the quality of the completed works:

1. Rub the surface already painted with palm and feel for smoothness.
2. When rubbed with palm, the colour should not be seen in the palm. If the colour comes when rubbed, the mixture is not proper and vice versa.

13.13.10 Applicability

Generally, the following types of painting shall be applicable against the type of structures specified unless otherwise directed and approved by the Engineer.

i. Sumdang:

- Rab painting shall be used in office, Dzong and other important places;

- Ding painting shall be used in institutional buildings such as school, hospital, etc.

- Thama painting shall be used in residential, staff quarter, and other similar Buildings

ii. Dangtshon:

- All the three types of paintings (Rab, Ding, Thama) may be used for internaldecoration of all types of buildings only and external decoration for Royalcottages

13.13.11 Measurements

The length and breadth shall be measured correct to 10 mm. The area shall be calculated in sq.m correct to two places of decimal. The co-efficient in Table 1 above shall be applied to the areas measured flat and not girth for all the items listed in the table wherever applicable. For railings either for staircase or balcony, the area shall be measured flat and equivalent area calculated for payment using 0.5 co-efficient for each side. Measurement of areas of for all types of cornices including at lintel level shall be measured flat. Length of the cornices being measured along with junction of wall and cornice (separate measurement for boh, kah, etc. shall not be allowed). For wall decoration design such as *Tashi-tagey symbols, Tashi-Zeegay, Za-Tshering, and alike,* the area shall be measured flat as squire or rectangle and equivalent area calculated for payment using 0.8 as the co-efficient or actual painted area calculated using appropriate method of area measurement.

13.13.12 Rate

Rate shall include cost of all labour and materials involved in all the operations described above.

14. STEEL FOR REINFORCEMENT

14.1 Scope of Work

The Specification describe hereinunder relate to the work which includes all labour, materials, equipment and services required for the supply, handing, storing, cutting, bending, cleaning, placing and fastening into position all reinforcing steel, as shown on the drawings, to be carried out by the contractor under this contract.

14.2 Submittals

I. Within 30 days from the date of issue of latter of Award, but before procuring or mobilizing to the site, the equipment, the Contractor shall submit to the

Engineer- in- Charge, the description and drawings showing sufficient details of the layout, type and capacity of the equipment proposed for the fabrication of reinforcement steel.

II. At least 30 days in advance of the reinforced concrete Works being carried out on the site, the Contractor shall submit to the Engineer- in- Charge for approval, detailed bar list and bending diagrams showing the number, size, length and bending of all bars required for various parts of the work on the basis of the reinforcement drawings issued by the Engineer- in- Charge from time to time during progress of works.

III. The Engineer- in- Charge reserves the right to require any additional information deemed necessary to be included in the submitted documents.

14.3 Standards

I. The cutting, welding, placement and binding of reinforcing steel shall conform to following Indian Standards or, where not covered by these Standards, to their equivalent international Standards.
   a) IS: 456-2000(reaffirmed 2005)
   b) IS: 1786-1985(reaffirmed 2004)
   c) IS: 2502-1963(reaffirmed 2004)
   d) IS: 2751-1979(reaffirmed 1998)
   e) IS: 9417-1989(reaffirmed 1994)

II. In case of conflict between the above Standards and the Specifications given herein, the specifications shall take precedence.

14.4 Fabrication

I. All bars shall be cut and bend in accordance with the bar bending Schedule approved by the Engineer- in- Charge.

II. Reinforcing steel bars shall be cut and bend on the site of Works.

III. Reinforcing steel shall not be straightened or rebent in a manner that will damage the materials. Bars with kinks or bends other than those indicated on the drawings and Schedules shall not be used.

IV. Shorter length of steel shall not be used in places where continuous lengths are required as per the drawings without approval of Engineer- in- Charge. Shorter bars, if approved for use, shall be lapped or spliced to achieve

continuity in accordance with the requirement of relevant Indian Standards or as approved by the Engineer- in- Charge.

V. Bars shall be bend cold to the shape and dimensions shown on the drawings using a bar bender operated by the hand or power to attain the proper radii of bends.

VI. Heating of reinforcement bars to facilitate bending shall not be permitted.

VII. The reinforcement available from rejected reinforced concrete shall not be used without prior approval of the Engineer- in- Charge.

14.5 Placing

I. Before being placed in position, the reinforcing steel shall be thoroughly cleaned of loose mill scale and rust, grease, paint, or other coating that would reduce bond. All splashed concrete which has dried on reinforcing steel shall be removed.

II. Reinforcing steel to be incorporated in the Works shall be placed accurately in positions as shown on the drawings and shall be held firmly in place during the placing and setting of concrete.

III. Special care shall be exercised to prevent any disturbances of the reinforcement in concrete that has already been placed.

IV. The longitudinal bars shall be straight and fixed parallel to each other and to the sides of the form as shown on the drawings. The ties, links and stirrups connected to the bars shall be tightly fixed so that the bars are properly braced.

V. Wires for tying reinforcement shall be black annealed iron wire. The diameter of wire shall be adequate and shall have ultimate strength of 5.63 tonnes per sq.cm and yield point of not less than .87 tonnes per sq.cm

VI. The steel bars shall be joined by providing lap joints in accordance with the requirements of the relevant Indian Standards or as approved by the Engineer- in- Charge.

VII. Sufficient concrete coverage, as indicated on the drawings shall be provided to protect reinforcement from corrosion.

14.6 Welding for Reinforcement

I. Lap splices shall not be used for bars larger than 36mm diameter, which may be welded with the approval of the Engineer- in- Charge. In cases where welding is not practicable, lapping of bars larger than 36mm may be permitted, in which cases, additional spirals shall be provided around the lapped bars. Where welding is approved, the Contractor shall prepare at least three samples of butt weld as directed by the Engineer- in- Charge. If the results are satisfactory, the Engineer- in- Charge may allow welding in place of lap joints. The joint shall be butt welded by the electric-arc- method. The Ends of the bars shall be cleaned of all loose scale, rust, grease, or other foreign materials and all welding shall conform to the relevant Standard Specifications for welding of reinforcement bars used in reinforced concrete construction or as directed by the Engineer- in- Charge.

II. A weld shall be considered unsatisfactory if it fails to sustain a tensile stress of at least 90% of the tensile strength of the bar in which the weld has been made.

III. Welding shall be done as per IS:9417-1989

14.7 Measurement and Payments

I. Measurement for payment for reinforcing bars will be of the weight of reinforcing steel including hooks, bends and splice actually installed and approved by Engineer- in- Charge. Actual lengths of reinforcement bars including permissible hooks, bends and splice will be measured. The weight of reinforcing bars will then be calculated for each size of bar from Unit Weight as stated on the certified copies of manufacturers reports, which the contractor shall submit to the Engineer- in- Charge.

II. Before starting concreting, the Contractor shall make sure that the measurement of reinforcing bars placed in position have been recorded and that the Engineer- in- Charge has certified the correctness of the reinforcement used.

III. For the purpose of payment, a welded joint will be considered as equivalent to the length of the bar 30 times the diameter of the bar in which the weld is made.

IV. Payment will be made at the Unit Rate per metric tonne entered in the Bill of Quantities, which shall includes the entire cost of supply, handling, storage, cutting, bending, placing, wire clips, ties, separators and any other fastening devices.

14.8 Exclusions

I. No extra measurement for payment or payment will be made for the following:
   a) Wire for tying reinforcement.
   b) Reinforcement in precast RCC lagging and the cost thereof shall be included in the applicable Unit Rates for such concrete element.
   c) Any additional reinforcement or splice required when Contractors casting sequences differ from construction joints shown on the drawings.
   d) Any reinforcing steel placed by the contractor for his own convenience in addition to those shown on the drawings.
   e) Devices like steel chairs, hangers, spacers, small concrete blocks, other supports, ties and anchorage rods etc. used to maintain reinforcing steel in position.
   f) Any reinforcing steel delivered for testing.
   g) Carrying out tests for checking butt welds to replace lapping/ splicing of reinforcing bars.

15. ELECTRICAL WORKS

15.1 General

The following technical specifications cover the Internal Wiring Installations and include:

- Concealed conduit installations
- Wiring conductors
- Switches and Fixtures
- Point Wiring
- Circuit Wiring
- Mains and sub-mains

15.2 Standards and Codes

The relevant Indian and Bhutanese Standard Specifications and Codes of Practice will apply

15.3 Concealed Conduit Installations

15.3.1 Ceiling Outlet Boxes

Outlet boxes shall be of 16 SWG sheet steel galvanized with 14mm projected threaded collars and so installed as to maintain continuity throughout. These shall be so protected at the time of laying that no mortar finds its way inside during concrete filling or plastering.

For fluorescent fittings the boxes shall be provided 300mm off centre for a 1200mm fitting and 150mm off centre for a 600mm fitting so that the wiring is taken directly to the down rod 3mm thick Perspex/hylam sheet cover of matching colors shall be provided.

15.3.2 Fan Hook Boxes

Ceiling boxes for an hooks shall be made out of sheet steel not less than 15 SWG and round in shape with one 'U' shaped 15mm dia rod inside screwed tightly with the top reinforcement of the roof. 3mm thick Perspex/hylam sheet cover of matching colour shall be provided.

15.3.3 Switch Boxes

16 SWG sheet steel galvanized boxes suitable for modular type switches of required sizes shall be provided to house speed regulators and switches. These will be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors and check nuts at conduit entries.

The Grid plates and sheet steel galvanized boxes shall be fitted with a spin riveted brass earth terminal.

These shall be attached to conduits by means of check nuts on either side of their walls. The M.S boxes shall be completely concealed leaving edges flush with wall surface. Moulded front covers made from high impact resistant, flame retarded and ultra violet stabilized engineering plastics shall be fixed to these by means of brass machine screws. No timber shall be used for any supports.

Switch boxes shall be located at 1000mm above floor level unless otherwise indicated.

15.3.4 Outlet Boxes

16 SWG galvanized sheet steel boxes suitable for modular type outlets of the required sizes shall be provided to house the switch socket outlets, telephone, T.V., buzzer and other outlets as may be required. These will be so designed that accessories are mounted on a gird plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors and check nuts at conduit entries.

The Grid plates and sheet steel galvashised boxes shall be fitted with a spin reverted brass earth terminal.

These shall be attached to conduits by means of check nuts on either side of their walls. These shall be completely concealed leaving edges flush with wall surface.

Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be used to mount the outlets and shall be fixed to the outlet M.S. boxes by means of brass machines screws. No timber supports shall be used.

15.3.5 Draw Boxes

16 SWG mild steel draw boxes fo ample dimensions shall be provided at convenient points on walls to facilitate long runs of conductors. They will be completely concealed with 3mm Perspex/hylam covers flush wit plaster work. These boxes will be located at suitable locations.

15.3.6 Inspection Boxes

Inspection boxes of 16 SWG mild steel and having smooth external and internal finish shall be provided to permit inspection and maintenance. These shall be mounted flush with wall/ceiling surface are required and shall have screwed covers of 3mm thick Perspex/hylam sheet. Adequate ventilation holes shall be provided on the cover.

15.3.7 Cross Section

The conduits shall be of ample sectional area to facilitate the drawing of cables. In no case shall the total cross section of cables measured overall be more than half the area of the conduit. The maximum number of wires that can be accommodated in conduits of varying sizes will be limited as per details given in the specification.

15.3.8 Erection of Conduit Runs

Conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes.

Vertical drops shall be buried in columns or walls.

Wherever necessary, chases will be cut by the Contractor with the written orders to the Site Engineer to sufficient depth to allow full thickness of plaster over conduits. The width of the chases will be such as to accommodate the required number of conduits. The cases will be filled with cement, coarse sand mortar (1:3) and properly cured by watering. If a chase is cut in an already finished surface, the Contractor shall fill the chase and finish it to match the existing finish.

Contractors should not out any iron bars to fix the conduits.

When the conduit is to be embedded in a concrete member, it shall be adequately tied to the reinforcement to prevent displacement during casting. Conduits in chases or laid in the slab shall be supported at maximum of 1m centres.

Suitable expansion joint fitting shall be provided at all the points where the conduit crosses any expansion joint the building.

15.3.9 Painting of Boxes

All draw/junction/fan-hook boxes shall be painted with red oxide in its manufactured form. All boxes before they are laid shall be painted with two coats of red oxide paint.

15.3.10 Protection of Conduits

To safeguard against filling up with plaster etc. all the outlet and switch boxes will be provided with temporary covers and plugs within the tendered cost which shall be replaced by sheet/plate covers as required. All screwed and socketed joints shall be made fully water tight by the use of white lead for steel conduits.

15.3.11 Cleaning of Conduit Runs

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

15.3.12 Earthing

Continuous earth wire should be provided for all outlets and sub-mains. Earthing terminals shall be provided inside all switch boxes, outlet boxes and draw boxes etc.

15.3.13 Laying of Dummy Conduits

The dummy conduits shall be the same as conduits for electrical work and specified before. The minimum size shall be 25mm dia. junction boxes shall be provided at distance not exceeding 10m. the Contractor must make such modifications as the system designer/manufacturer desires in consultation with the Owners. These conduits shall be provided with steel draw boxes of at least 16 SWG.

All telephone conduits shall be at least 300mm away from electrical conduits.

15.3.14 Fish Wires

To facilitate drawing of wiring through conduits/G.I pipes etc., G.I fish wire of 18 SWG, wherever needed, shall be provide along with recessed conduit/pipes, without any extra cost.

15.4 Wiring Conductors

15.4.1 Wires

All wires shall be been manufactured in accordance with the relevant latest I.S specifications. The wires shall be of 1.1 kV grade.

15.4.2 Bunching of Wires

Wires carrying current shall be so bunched in the conduit that the outgoing and return wire are drawn into the same conduit. Wires originating from two different phase shall not be run in the same conduit.

15.4.3 Joints

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside circuits and junction boxes.

Conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any specified reasons, prior permission, in writing shall be obtained from the Architect before the use of such connection.

15.4.4 Load Balancing

Balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

15.4.5 Colour Code of Conductors

Colour code shall be maintained for the entire wiring installation – red, yellow, blue for three phases, black for neutral and green for earth.

15.5 Switches and Fixtures

15.5.1 Switches

All 6 and 16 amps switches shall be of the modular enclosed type flush mounted 240 Volt AC of the best quality and standard. The switch moving and fixed contracts shall be of silver nickel ad silver graphite alloy and contact tips coated with silver. The housing of switches shall be made from high impact resistant, flame retarding and ultra violet stabilized engineering plastic material.

15.5.2 Fan Regulator Mounting

All fan regulators shall be fixed inside the switch boxes on grid plates with tapped holes and brass machine screws, leaving ample space at the back and side foe accommodating wires.

15.5.3 Flush Plates

Switches, receptacles and telephone system outlets in wall shall be provided with moulded poly carbonate cover plates of approved shape and size made from high impact resistant, flame retarding and ultra violet stabilized engineering plastic materials, and secured to the box with counter sunk round head chromium plated brass screws. Where two or more switches are installed together, they shall be provided with one common switch cover plate as described above with notches to accommodate all switches either in one, two or three rows.

One and two gang switch cover plate, telephone outlet cover plate, 6 and 16 amps switched/unstitched palates, shall have the same shape and size. Three and four gang switch cover plates shall have the same shape and size. Six and eight gang switch cover plates shall have the same shape and size. Nine and twelve switch cover plates shall have the same shape and size. Wherever five switches, seven switches, tens switches and eleven switches are to be fixed the next higher size of gang switch cover plate to be used and extra openings shall be provided with blank-offs.

15.5.4 Externally Operated Switches

Externally operated switches, shall be of general purpose type, 240 volts of the proper size and rating and shall be provided in weather proof enclosures, complete with weather proof gasketed covers. The MCB's for all externally operated switches shall be separate and of proper rating.

15.5.5 Wall Socket Outlets

All 6/16 amps wall socket outlets unless otherwise mentioned on the drawings shall be switched, three round pin and fitted with automatic linear safety shutters to ensure safety from prying fingers. Unswitched 6/16 amp will socket outlets where called for in the drawings shall be of three round pin type. The socket outlets shall be made from high impact resistant, flame retarding and ultra violet stabilized engineering plastic material.

The switch and sockets shall be located in the same plate. The plates for 6 amp switched/unswitched plugs and telephone outlets shall be of the same size and shape.

All the switched and unswitched outlets shall be of the best standard.

The switch controlling the socket outlet shall be on the phase wire of the circuit.

An earth wire shall be provided along the cables feeding socket outlets for electrical appliances. The earth wire shall be connected to the earthing terminal screw inside the box. The earth terminal of the socket shall be connected to the earth terminal provided inside the box.

15.6 Point Wiring

15.6.1 General

The point wiring shall be carried out as per following

In recessed conduit system, fixing of conduits and including providing and fixing of conduits, bends, junction boxes, wooded/plastic bushes check nuts etc.

Looping system shall be adopted through-out including supply and drawing of required sizes of wires without damaging the same.

All flush type accessories will be used.

The point will be complete with conduit including accessories, point and circuit wires, necessary junction outlet and switch boxes, connector or ceiling roses, switch plates and flush plates, necessary earthing connections etc.

For the purpose of determining the load per circuit the following rating of points shal be assumed.

Light points	100 Watts
Convenience plug point	100 Watts
Fan points	60 Watts
Exhaust fan points	300 Watts or as specified
16 amp socket outlet	1000 Watts

Lights and fans may be wired on a common circuit. Such circuit shall not have more than a total of ten points of light, fan and socket outlets or load of 00 Watts whichever is less.

The size of conduit shall be such that the number of wires provided inside occupy not mre than 50% of the area and as per table given below:-

This table shows the maximum capacity of conduit for the simultaneous drawing of 1.1 kv grade PVC insulated wires. The columns headed S apply to runs of conduit which have distance not exceeding 4.25 meters between draw boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed B apply to runs of conduit, which deflect from the straight by angle of more than 15 degrees.

Nominal Cross-sectional Area of Conductor in sq.mm	Diameter of conduits in mm									
	20		25		32		38		51	
			S	B	S	B	S	B	S	B
1.5			10	8	12					
2.5			8	6	10					
4.0			6	5	8					
6.0			5	4	7					
10.0			4	3	5					
16.0			2	2	3					
25.0			-	-	2					

The rates shall include for cleaning of dust, splashes of colour wash or paints from all fixtures such as fans fitting etc. at the time of taking over of the installation.

The rate per point shall include all materials and labour required for completing the point as mentioned.

15.6.2 Light Point

Point wiring in the case of light shall commence from the Distribution Board and terminate at the ceiling rose connector/lamp holder/ceiling box as required including the controlling

switch, junction/draw/inspection boxes as necessary along with a continuous run of bare copper/GI wire as specified for earthing.

15.6.3 Convenience Outlet

The convenience plug points shall be as for light point above and complete with 3 pin 6 Amps socket enclosed in a M.S box with the controlling switch as required and third pin shall be earthed with bare copper wire as specified.

15.6.4 Ceiling Fans

The ceiling fan points shall be as for light point above and complete with ceiling box, recessed fan hook, moulded cover plate and a provision in the M.S switch box for mounting the fan regulator which shall be earthed with bare copper wire as specified.

15.6.5 Exhaust Fans

The exhaust fan and regulator point shall be as for light point above and complete with a provision for mounting the regulator in the M.S switch box. The outlet shall be provided in recessed M.S box with moulded cover and switch and outlet shall be earthed with bare copper/G.I wire as specified.

15.6.6 Power Outlets

Wiring for power plugs shall be as for light point above and shall be complete with a 3/6 pin 16 amps socket and 16 Amps controlling switch mounted in a M.S box with cover.

Each circuit shall have a maximum of one power outlet unless otherwise specified.

All power outlets shall be provided with bare copper/G.I earth wire as specified.

Separate circuit shall be run with PVC insulated copper conductor wires for each water heaters, kitchen equipment, window Air Conditioners and similar locations as shown on drawings.

15.7 Circuit Wiring

The minimum size of PVC insulated copper conductor wires for all circuit wiring for lights, exhaust fans, ceiling fan points and convenience outlets shall be 3/0.036" unless otherwise specified.

Circuit wiring shall not be separately measured and paid for. The point wiring rates shall include the cost of providing circuit wiring as required.

15.8 Mains and Sub-mains

Mains and sub-mains shall consist of wires, cables, conduits, bends, junction boxes, brass bushes, check nuts etc. as specified herein before.

The sizes and capacities of the conduits shall be as stated in the Schedule of Quantities and will commence from main switches to various distribution boards.

Wires shall be drawn in the concealed or surface conduits as required, without being damaged. For this purpose, draw boxes shall be located at convenient places.

Every main and sub-main will run in an independent conduit with an independent earth wire of bare copper wire as specified running along the entire run of conduit. For single phase, one earth wire shall run and for three phase two earth wires shall run.

Necessary provision of wire lengths entering and emerging from the conduit must be made for connections.

Measurement will be taken of the actual conduit run containing the wire from one point to the other.

Rates quoted shall include all materials, connections, labour etc. as specified.

B. MEDIUM VOLTAGE DISTRIBUTION BOARDS

15.9 Miniature Circuit Breakers

* The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.

* The MCB's shall have a rupturing capacity of 10 kA at 0.5 p.f.

The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with H.R.C. fuse/PVC cable characteristic.

* Type test certificates from independent authorities shall be submitted with the tender.

15.10 Final Distribution Boards

* Final distribution boards shall be flush mounting, totally enclosed, dust and vermin proof and shall comprise of miniature circuit breakers, earth leakage circuit breakers, neutral link etc. as detailed in the schedule of quantities.

* The distribution equipment forming a part of the Distribution Boards shall comply to the relevant Standards and Codes of the Bureau of Indian Standards and as per detailed specifications included in this tender document.

* The board shall be fabricated from 14 gauge CRCA sheet steel and shall have a hinged lockable spring loaded cover. All cutouts and covers shall be provided with synthetic rubber gaskets. The entire construction shall give a IP 54 degree of protection.

* The bus-bar shall be of electrical grade copper having a maximum current density of 1.6 ampere per square mm and PVC insulted throughout the length.

* All the internal connections shall be with either solid copper PVC insulated or copper conductor PVC insulated wires of adequate rating.

* All the internal connections shall be concealed by providing a hinged protective panel to avoid accident contact with live points.

* All outgoing equipment shall be connected direct to the bus bar on the live side. The equipment shall be mounted on a frame work for easy removal and maintenance.

* The sheet steel work shall undergo a rigorous rust proofing process, two coats of filler oxide primer and final powder coated paint finish.

* All the circuits shall have a independent neutral insulted wire, one per circuit, and shall be numbered and marked as required by the Owners.

* A sample of the completed board is to be got approved by the architects/owners before commencement of supply and erection.

15.11 Sheet Steel Treatment and Painting

* Sheet steel materials used in the construction of these units should have undergone a rigorous rust proofing process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognized phosphating process. The steel work shall then receive two coats of oxide filler primer before final painting. Castings shall be scrupulously cleaned and fettled before receiving a similar oxide primer coat.

* All sheet steel shall after metal treatment be given powder coated finish painted with two coats of shade 692 to IS 5 on the outside and white on the inside. Each coat of paint shall be properly stoved and the paint thickness shall not be less than 50 microns.

15.12 Name Plates and Labels

* Suitable engraved white on black name plates and identification labels of metal for all Switch Boards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

C. EARTHING

15.13 General

All the non-current carrying metal parts of electrical installations shall be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution fuse boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All earthing shall be in conformity with Indian Electricity Rules.

The Earthing System shall in totally comprise the following:

a) Earth Electrodes

b) Earthing Leads

C) Earth Conductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

15.14 Earthing Material

Materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion. The material shall be as specified in the schedule of quantities and shall comply to the following requirement:

a) Galvanized Steel – Galvanized steel used shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS: 2309:1969.

b) The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

15.15 Earth Electrodes

PLATE EARTH ELECTRODES

The electrodes shall be of GI plate of size 600 x 600 x 6 mm. The electrode shall be buried in ground with its face vertical and top not less than 3 meters below ground level.

*** EARTH ELECTRODE PIT**

METHOD OF INSTALLATION WATERING ARRANGEMENT

In the case of plate earth electrode, a watering pipe of 50 mm dia. of medium class GI. Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. The watering funnel attachment shall be housed in masonry enclosure of not less than 1000 x 500 x 600 mm. A cast iron/M.S. frame

with cover having locking arrangement shall be suitably embedded in the masonry enclosure.

LOCATION OF EARTH ELECTRODE

The following guidelines shall be followed for locating the earth electrodes.

An earth electrode shall not be situated less than 5 metres from any building.

The excavations for electrode shall not affect the column footings or foundations of the buildings. In such cases electrode may be further away from the building.

The location of the earth electrode shall be such where the soil has reasonable chance of remaining moisture, as far as possible.

Entrances, pavements and road ways shall not be used for locating the earth electrode.

NUMBER OF EARTH ELEECTRODES

In all cases the relevant provision of rule 33, 61 & 67 of the Indian Electricity Rules 1956 as amended shall be complied with.

Metallic covers or supports of all medium or HT. apparatus or conductors shall, in all cases be connected to not less than two separate and distinct earth electrodes.

15.16 Earthing Leads

The strip earthing leads shall be connected to the Earth Electrode at one end and to the metallic body of the main equipment at the other end. The earthing lead shall connect to the earthing network in the installation.

*** EARTHING LEAD SIZES**

Strip earthing leads shall be of GI and as per specifications.

*** EARTHING LEAD INSTALLATION**

The length of buried strip earthing lead shall be not less than 15 meters and shall be buried in trench not less than 0.5 m deep.

If conditions necessitates use of more than one earthing lead they shall be laid as widely distributed as possible preferably in a single straight trench or in a number of trenches radiating from one point.

*** METHOD OF CONNECTING EARTHING LEAD TO EARTH ELECTRODE**

In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts, check nuts and washers as required by IS: 3043 : 1987.

All materials used for connecting the earth lead with electrode shall be GI in case of GI Pipe and GI Plate earth electrodes or tinned brass in case of Copper plate electrode.

*** PROTECTION OF EARTHING LEAD**

The earthing lead from electrode onwards shall be suitably protected from mechanical injury and corrosion by a 15 mm dia. GI pipe in case of wire and 100/40 mm dia medium class GI pipe.

The portion of the GI pipe within ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing or pavement). The portion within the building shall be recessed in walls and floors to adequate depth.

15.17 Earthing Conductors

Earthing conductors shall form the earthing network throughout the installation for earthing of all non-carrying metal parts.

***** CONNECTION OF EARTHING CONDUCTORS

a) Main earthing conductors shall be taken from the earth connections at the main switch boards to all other switchboards in the network.

b) Sub-mains earthing conductors shall run from the main switch board to the sub-distribution boards and to the final distribution boards.

c) Loop earthing conductors shall run from the distribution boards and shall be connected to any point on the main/sub-main earthing conductor, or its distribution board or to an earth leakage circuit breaker.

d) Metal conduits, cable sheathing and armoring shall be earthed at the ends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Switches, accessories, lighting fitting etc. shall be effective connected to the Loop Earthing Conductors. These though rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered earthed, even though the run of metallic conduit is earthed.

*** EARTHING CONDUCTOR INSTALLATION**

The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size.

Joints shall be reverted and brazed in approval manner.

Sweated lugs of adequate capacity and size shall be used for termination. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

*** SIZING OF EARTHING CONDUCTORS**

All fixtures, outlet boxes and junction boxes shall be earthed with 14 SWG copper/12 SWG GI wire.

All 3 phase switches and distribution boards up to 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia. copper/6 mm dia. GI wires. All 3 phase switches and distribution boards up to 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia. copper/8 mm dia. GI wires. All switches, bus bar, ducts and distribution boards of rating 200 amps and above shall be earthed with a minimum of 2 Nos. separate and independent 25 mm x 3 mm copper/25 mm x 6 mm GI tape.

15.18 Prohibited Connections

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system.

15.19 Resistance to Earth

No earth electrode shall have a greater ohmic resistance than 3 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be up to 5 ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate fuses or circuit breakers, and shall not exceed 1 ohm.

D. SPECIAL INSTRUCTIONS TO TENDERERS

15.20 General

***** Only the preferred makes of material as stipulated shall be accepted.

***** Installation of light fittings shall be with the use of two junction boxes placed 600 mm apart for 36/40-watt fixtures and 300 mm apart for 20-watt fixtures. The junction boxes shall form a part of the conduiting and shall be place in the slab at the time of concreting.

* For any fixtures and fittings required to be fixed to the RCC slab, the Contractor shall drill the required holes with the use of an appropriate drilling machine with drill bits and no extra charges shall be payable on this account.

* the rates quoted shall be for work to be carried out at all heights and levels as at site and no extra payment shall be made for the same.

* The rates quoted for wiring shall be applicable for concealed or surface conduiting as required.

15.21 Conduiting

The rates to be quoted by renderers' shall include any or all of the following. No. additional coats shall be paid for tools etc. as required to complete the work.

* All cutting of chassis in brick walls shall be with chase cutting tools.

* Whenever required chases shall be cut in stone walls with a chase cutting machine and with specific tools as required prior to plastering.

15.22 Point Wiring

* The Point Wiring shall commence from the Distribution Board and shall include the circuit wiring of length as required via the switch to the fitting/socket outlet as called for unless otherwise specified.

* The Circuit Wiring shall be with 2 nos. 1.5 sq. mm PVC insulated stranded copper conductor 1.1 kV grade wires in Conduit.

* The rates for all point wiring shall include the supplying and fixing of:

a) ISI approved conduits.

b) Conduit accessories conforming to IS.

c) MS draw, inspection and junction boxes.

d) Zinc chromate passivated switch boxes, outlet boxes etc.

e) All fixing accessories such as clips, brass screws etc.

f) Embedding conduits and accessories in walls and floors etc. during construction and/or cutting chases and making good as necessary in the case of concealed conduit work and/or providing and fixing saddles, hangers, stirrups, etc. and grouting of the same as required for surface conducting.

g) Switches, wiring accessories and moulded cover plate as required.

h) Bare copper earth wire for fixture, switch, outlet box and third pin of socket outlet to common earth.

i) All work necessary for wiring a point circuit of any length from the Final Distribution Board to ceiling rose or connector via switch including circuit wiring with 2 x 1.5 sq. mm PVC stranded copper conductor 1.1 kV grade wires in conduit as required.

j) Painting all conduits, outlet boxes and junction boxes.

15.23 Exhaust Fan Wiring

The wiring shall be as for point wiring above and including provision for a 6 amp shuttered socket outlet located adjacent to the exhaust fan and the controlling 6 amp switch located at the Switch plate position in the room.

15.24 Geyser Point Wiring

The wiring shall be as for point wiring above and including provision for 16 amp shuttered socket outlet located adjacent to the Geyser and the controlling 16 amp moulded switch located at the Switch plate position in the room.

15.25 Switches, Outlets and Accessories

All switches, socket outlets and other accessories shall be approved by the Owners prior to installation. The Contractor shall furnish samples of all materials within 7 days of the award of the work.

15.26 Main and Sub-mains

The rate for all items shall include:

a) ISI approved & marked PVC conduits.

b) Conduit accessories conforming to IS.

c) MS draw inspection and junction boxes.

d) Providing and fixing approved saddles, hangers trays, etc. and grouting the same as required for exposed conduits.

e) Embedding conduits and accessories in walls and floors etc. during construction and / or cutting chases and making good as necessary in the case of concealed conduit work

and/or providing and fixing saddles, hangers, stirrups etc. and grouting of the same as required for surface conduiting.

f) Providing and fixing junction boxes with 3-mm thick Perspex sheet covers including painting covers on inner side to match the colour of the surrounding walls.

g) Bare copper earth wire for fixture, switch, outlet box and third pin of socket outlet to common earth.

h) Effecting adequate and proper connections at termination.

i) Providing all fixing accessories such as clamping devices, nuts bolts and screws.

j) Providing sealing compound thimbles, crimping etc. at joints and termination as called for.

15.27 Distribution Boards

The rates for the distribution boards apart from the switches, and instruments shall also include:

a) Supporting rigid steel framework.

b) Cubicle type 2 mm thick MS sheet enclosure with 1.6 mm thick MS sheet door.

c) Interconnections.

d) Proper bonding of earth.

e) Touching up all damaged paint with one coat of red oxide primer and two finishing coats of approved synthetic enamel paint.

f) Painting/lettering on switches and distribution boards, the location they serve, providing on each board its circuit diagram.

g) Termination of incoming cables at the incoming unit in the distribution boards.

15.28 Earthing

The rates for earthing items include:

a) All fixing accessories such as brass saddles, brass screws rawl plugs etc.

b) Jointing by riveting and soldering after tinning.

c) Cutting chases, holes and making good the same wherever required.

d) Effecting adequate and proper interconnections.

e) Use of copper thimbles.

f) Excavation of earth, refilling, watering and ramming and making good as approved.

15.29 Fixing of Lighting Fixtures

The rates shall include the following:

1. All components that may be required to make the installation complete in all respects such as;

a) Suitable length of down rod, hanger and connecting wires where called for. The Down rod shall be paid for separately on a running meter basis.

b) Internal wiring between accessories.

c) Wiring for connecting the fixtures to the point through connection blocks.

d) All metal blocks to serve as base of fixtures.

e) Bonding with each wires.

2. Drilling holes in supports where required.

3. Fixing clamps, GI bolts and nuts, brass screws, saddles, raw bolts and other fixing accessories as required.

15.30 Drawings

General Arrangement drawings with constructional details shall be submitted to the Architects for all Distribution Boards etc. and their approval obtained prior to commencement of fabrication. Equipment shall not be accepted unless the drawings have been approved by the Architects. These drawings shall be prepared and submitted within one month of the award of work.

15.31 Wires and Cables

All wires and cables used shall be of the approved make. The contractor shall provide a certificate from the manufacturer confirming that all wires and cables supplied to site are of their make irrespective whether the wires/cables are purchased from the manufacturer directly or through a dealer.

Payment for wires/cables shall not be made without the manufacturer's certificate being furnished to the owners.

15.32 NOTES

1. Mixing of two phases in one conduit is not permitted.

2. Pull Boxes shall be provided after every 8-10 m conduit run & every two bends.

3. Flexible coupling shall be used wherever conduit crosses through expansion joint.

4. The following colour code shall be adopted;

Phase : Red/Yellow/Blue

Neutral : Black

5. No joints in wires / cables shall be permitted.

6. Electrical driven chase cutting machine shall be used for cutting chase in brick work for conduit laying. No manual hand cutting shall be allowed. Nothing extra shall be paid for this.

7. Test certificates for wires & conduits shall be submitted along with the material supplies in addition to above random test for wires & conduits (at least one for each) shall be carried out at Contractors risk & cost.

SECTION VII

FORMS

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Form 1: Proforma for Agreement

[Note; This Proforma is included in the Bidding Documents only for the information of Bidders. Only the successful Bidder shall, in due course, be required to fill this Proforma].

THIS AGREEMENT MADE the _____ day of _____ BETWEEN Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) _____ of (Mailing address of PHPA-I) _____ (hereinafter called "the PHPA-I") of the one part and (Name of Contractor) _____of (Mailing address of Contractor) _____ (hereinafter called "the Contractor") of the other part.

WHEREAS the PHPA-I is desirous that "_____" (herein after referred to as "the Work") should be executed by the Contractor AND WHEREAS by a Letter of Award No._____dated _____ the PHPA-I has accepted a Bid by the Contractor for the execution and completion of such Works AND WHEREAS the Contractor has agreed to undertake such work and furnish a performance security/bond.

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 be read and construed as part of this Agreement, viz;
   - 2.1 The Agreement
   - 2.2 The Letter of Award
   - 2.3 Corrigendum/Amendments if any
   - 2.4 Documents furnished by bidder
   - 2.5 Notice Inviting Tender
   - 2.6 Instructions to bidders
   - 2.7 Bid Data Sheet
   - 2.8 General Conditions of Contract
   - 2.9 Special Condition of Contract
   - 2.10 General Technical Specifications
   - 2.11 Appendix/Forms
   - 2.12 Bill of Quantities
   - 2.13 Drawings
   - 2.14 Any other documents as forming part of the Contract

3. The aforesaid documents shall be taken as complementary and mutually explanatory of one another, but in case of ambiguities or discrepancies, shall take precedence in the order set out under para 2 above.

4. In consideration of the payment to be made by the PHPA-I to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the PHPA-I to execute and complete the Works in conformity, in all respects, with the provisions of the Contract.

5. The PHPA-I 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 time and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused their respective common Seals to be hereunto affixed (or have hereunto set their respective hands and Seals) the day and year first above written.

SIGNED, SEALED AND DELIVERED

_____	_____
NAME _____	NAME _____
on behalf of the Contractor	on behalf of the PHPA-I
in the presence of:	in the presence of;
_____	_____
NAME _____	NAME _____
Address _____	Address _____
_____	_____

Form 2: Proforma for Bank Guarantee for Bid Security

To

The Punatsangchhu-I Hydroelectric Project Authority (PHPA-I)

_____

_____

(Address of PHPA-I)

WHEREAS, (Name of Bidder)_____ (hereinafter called "the BIDDER") has submitted his bid dated (_____ for the construction of (Name of Contract) _____ (hereinafter called "the Bid")).

KNOW ALL MEN by these presents that we (Name of Bank) _____ of (Name of Country)_____ having our registered office at _____ (hereinafter called "the Bank") are bound unto the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) in the sum of _____ for which payment well and truly to be made to the PHPA-I the Bank binds himself, his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this _____ day of _____.

THE CONDITIONS of this obligation are;

1. If the Bidder withdraws his Bid during the period of bid validity specified in the Proforma of Bid; or
2. If the Bidder having been notified of the acceptance of his Bid by the PHPA-I during the period of bid validity;
    - 2.1 fails or refuses to execute the Proforma of Agreement in accordance with the Instructions to Bidders, if required; or
    - 2.2 fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders,

We undertake to pay to the PHPA-I up to the above amount upon receipt of its first written demand, provided that in its demand the PHPA-I will note that amount claimed by it is due to it owing to the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This Guarantee will remain in force up to and including the date ***120 days*** after the closing date for submission of bids as stated in the Invitation to Bid or as extended by you at any

time prior to this date, notice of which extension to the Bank being hereby waived, and any demand in respect thereof should reach the Bank not later than the above date.

DATE ……. SIGNATURE OF THE BANK ……..

WITNESS …… SEAL ……..

(Signature, Name and Address)

Form 3: Proforma for Bank Guarantee for Performance Security

To

The Punatsangchhu-I Hydroelectric Project Authority,

_____

_____

(Address of PHPA-I)

WHEREAS (Name and Address of Contractor) _____(hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute (Name of Contract and Brief Description of Works) _____ (hereinafter called "the Contract").

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

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

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Nu. _____ (Amount of Guarantee in words to be inserted by the Guarantor), representing the percentage of the Contract Price, specified in the Contract, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Nu. _____ (Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

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

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

This guarantee is valid until the date of ***30 days*** after issuing of the Completion Certificate.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank

Address

Date

Note: The Bidders are not required to fill this Proforma.

Form 4: Proforma for Bank Guarantee for Mobilization Advance

In consideration of the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) (which expression shall unless repugnant to the subject or context include its administrators, successors and assigns), (hereinafter called the "Principal") having agreed to make advance payment to (Name and full address of the Contractor) _____ (hereinafter called "the Contractor(s)", (which expression shall unless repugnant to the subject or context or meaning thereof include its successors, administrator, executors and permitted assigns), whose bid for (Name of the Contract) _____ has been accepted and to whom the acceptance of the bid has been communicated by a Letter of Award and who is required to execute a formal agreement on conditions of production of a Bank Guarantee for Rs……(Both in figures and words) _____ we, the _____ Bank (any financial institutions in Bhutan) hereinafter referred to as "the Bank") do hereby undertake promise and guarantee payment to the Principal on demand all the amounts advanced by the Principal to the said Contractor.

1. The Bank further agrees that;

   1.1. The Principal shall have the fullest liberty without affecting in any way the liability of the Bank under the Guarantee or Indemnity, from time to time, to vary any of the terms and conditions of the said Contract or to extend time for performance by the said Contractor or to postpone for any time and from time to time any of the powers exercisable by it against the said Contractor and either to enforce or forbear from enforcing any of the terms and conditions governing the said Contract or the securities available to the Principal and the Bank shall not be released from its liability under these presents by any exercise by the Principal of the Liberty with reference to the matters aforesaid or by reason of time being given to the said Contractor or any other forbearance, act or omission on the part of the Principal or any indulgence by the Principal to the said Contractor or of any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect of a releasing the Bank from its such liability.

   1.2. These presents shall be governed by and constructed in accordance with Bhutanese laws.

   1.3. The Bank hereby declares that it has the power to issue this Guarantee and the undersigned has full power to do so.

   1.4. It shall not be necessary for the Principal to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank, notwithstanding any other security which

the Principal may have obtained or obtain from the Contractor, shall at the time when proceedings are taken against the Bank hereunder, be outstanding or unrealized.

1.5. The Guarantee herein contained shall remain in full force and effect, during the period that would be taken for the performance of the terms and conditions of the said Contract, Letter of Award and the Agreement which is to be executed as aforesaid and that it shall continue to be enforceable until all the dues of the Principal have been duly paid and its claims satisfied and discharged and till the Principal discharges the Guarantee in writing or until _____ whichever is earlier.

2. The Bank lastly undertakes not to revoke this Guarantee until all the dues of the Principal have been duly paid except with the previous consent of the Principal in writing.

Dated the _____ Day of _____2021

Here affix the Common Seal of the

Bank for _____ Bank Ltd.

Note: The Bidders are not required to fill this Proforma.

Form 5: Proforma for Bank Guarantee for Retention Money.

To

The Punatsangchhu-I Hydroelectric Project Authority,

_____

_____

(Address of PHPA-I)

WHEREAS (Name and Address of Contractor) _____(hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute (Name of Contract and Brief Description of Works) _____ (hereinafter called "the Contract").

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

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

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Nu. _____ (Amount of Guarantee in words to be inserted by the Guarantor), representing the amount of retention money, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of Nu. _____ (Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

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

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

This guarantee is valid until the date of ***30 days*** after completion of Defects Liability Period.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank

Address

Date

Note: The Bidders are not required to fill this Proforma.

Form 6: Pre-Contract Integrity Pact.

Note: This Proforma is included in the Bidding Documents for information of Bidders and shall be signed by successful Bidder when the work(s) is awarded. Signing authorities will be the head of the client (agency) or the authorized representative of the bidder.

1. General:

Whereas the Punatsangchhu-I Hydroelectric Project Authority (PHPA-I) 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), hereinafter referred to as the "Bidder" on the other part hereby execute this agreement as follows:

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

2. Objectives:

Whereas, the Employer and the Bidder agree to enter into this agreement, hereinafter referred to as IP, to avoid all forms of corruption or deceptive practice by following a system that is fair, transparent and free from any influence/unprejudiced dealings in the Bidding process and Contract Administration, with a view to:

2.1 Enabling the Employer to obtain the desired Contract at a reasonable and competitive price in conformity to the defined specifications of the works or 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 officials 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 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 shall not favor 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 followings:-

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.

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 the 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 (place) _____ on (date) _____

EMPLOYER BIDDER

Witness: Witness:

_____ _____

Form 7: Bidder's Information Form

[The Bidder shall fill in this Form in accordance with the instructions indicated below. No alterations to its format shall be permitted and no substitutions shall be accepted.]

Date: .....[insert date of Bid submission] .....

NIT No.: .....

1.	Bidder's Legal Name:
2.	Bidder's or each member of JV's Country of Registration:
3.	Bidder's Year of Registration:
4.	Bidder's Legal Address in Country of Registration:
5.	Bidder's Local Address in Bhutan (if any):
6.	Bidder's Website Address:
7.	Bidder's Business Activities:
8.	Bidder's Authorized Representative 1. Name: 2. Designation: 3. Address: 4. Telephone/Fax numbers: 5. E-mail Address:
9.	Attached are copies of the following original documents: [check the box(es) of the attached original documents] Tax Clearance Certificate of Bidder named in 1 or 2 above Trade License of Bidder named in 1 or 2 above

Signature.....

Date :

Place :

Name.....

Designation.....

Form 8: Past Performance Data

Bidder's Name & Address: ……. NIT No: ……

To

[PHPA-I's Name & Address]

Details of similar Works in last five (5) years

Sl. No.	Owner/ Client	Scope of Work	Order Value	Date of Order	Schedule Completion Date	Actual/ Completion Date	Reason for Delay (if any)

Date :

Place :

Signature.....

Name.....

Designation.....

Seal.....

Note:

1. Continuation sheets of like size and format, may be used and annexed to this Form if required.
2. Relevant documents/LOA/Orders to be furnished to justify the data above.

Form 9: Present Order Book Position.

Bidder's Name & Address: ……. NIT No: ……

To

[PHPA-I's Name & Address]

List of works under execution and their present status

S. No.	Owner/ Client	Scope of Work	Order Value	Date of Order	Schedule Time of Completion	Value of Outstanding Work	Actual/ Expected Time of Completion	Reason for Delay (if any)

Date :

Place :

Signature.....

Name.....

Designation.....

Seal.....

Note:

1. Continuation sheets of like size and format, may be used and annexed to this Form if required.
2. Relevant documents/LOA/Orders to be furnished to justify the data above.

Form 10: Data regarding Key Construction Personnel

Bidder's Name & Address: …… NIT No: ……

To

[PHPA-I's Name & Address]

The qualification and experience of key construction personnel proposed for administration and execution of the Contract at the Site are as follows:

Position	Quantity	Name	Qualification	Years of experience

Date :

Place :

Signature.....

Name.....

Designation.....

Seal.....

Note:

1. Please furnish the complete Site organization chart proposed to be set up for execution of the Contract.
2. Continuation sheets of like size and format, may be used and annexed to this Form if required.

Form 11: Data regarding available Equipment/ Machinery

Bidder's Name & Address: …… NIT No: ……

To

[PHPA-I's Name & Address]

Items of equipment	Quantity	Description, make, Capacity and age (years)	Condition (new, good, poor) and number available	Owned, leased (from whome?), or to be purchased (from Whom?)

Date :

Place :

Signature.....

Name.....

Designation.....

Seal.....

Note: The above list of Equipment & Machineries indicates minimum requirements. However, we shall deploy any additional Equipment and Machineries, which may be required as per the directive of the Engineer-in-Charge to execute the work satisfactorily and as per the time schedule stipulated.

Form 12: Performa for hindrance register

Sl.no	Nature of hindrance	Items of works which could not be executed on account of this hindrance	Date of start of hindrance	Date of removal of hindrance	Overlapping period if any	Net hindrance in days	Weightage of this hindrance	Net effective days of hinderance	Signature of PHPA-I's representatives	Signature of Contractor

SECTION VIII

BILL OF QUANTITIES

BILL OF QUANTITIES

CONSTRUCTION OF AUTOMATIC BACKWASH STRAINER & BOOSTER PUMP HOUSE, WATER SUPPLY AND FILTERATION UNIT HOUSE AT PHEP-I, WANGDUE, BHUTAN (NIT No. PHPA-I/CE(C&P)/146-03/2023)

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
A. CIVIL WORKS						
1	**Clearing and Grubbing**					
1.1	Clearing jungle including uprooting of vegetation and trees of girth<300mm, disposal with all leads of the site.	Sqm	230.00			
2	**Earthwork**					
2.1	Surface dressing of ground, including removal of vegetations and inequalities < 150mm deep, disposal of rubbish within 50m lead and 1.5m lifts-Hard soil	Sqm	170.00			
2.2	Excavation in foundation trenches or drains not exceeding 1.5m in width or area 10 sq.m on plan, including dressing & ramming, disposal of surplus soil within 50m lead & 1.5m lift					
2.2.1	Ordinary Soil	Cum	200.00			
2.2.2	Hard Soil	Cum	80.00			
2.2.3	Ordinary rock with or without blasting	Cum	120.00			
2.3	Earth work in excavation over areas, depth >300mm, width >1.5m, area >10 Sq.m on plan, including disposal of excavated earth within 50m lead and 1.5m lift & disposed soil to be neatly dressed: Hard Soil					
2.3.1	Ordinary Soil	Cum	135.00			
2.3.2	Hard Soil	Cum	55.00			
2.4	Providing &laying dry earth bedding, including consolidating each deposited layer by watering, ramming and dressing	Cum	38.00			

Punatsangchhu-I Hydroelectric Project Authority
Contracts Circle
BHUTAN

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
2.5	Filling of trenches, sides of foundations etc. in layers <200mm using selected excavated earth, ramming etc. within lead 50 m & lift 1.5m.	Cum	480.00			
2.6	Providing &laying sand bedding, including watering, ramming, dressing	Cum	55.00			
3	**Drainage**					
3.1	Providing and laying 50mm thick Plinth Protection and grouted with fine sand mix including well rammed, finishing the top smooth-With cement concrete 1:3:6, 20mm aggregates, laid over 75mm thick layer of compacted gravel (40mm).	Sqm	55.00			
3.2	Constructing random rubble masonry open surface drain in cement mortar 1:6 including earth work in excavation, 100mm thick concrete base 1:5:10, 40 mm aggregate 25mm thick cement concrete 1:2:4, 12mm aggregate for filling haunches, including 20mm cement plaster with a floating coat of neat cement, disposal of surplus earth: 150mm x 200mm	m	105.00			
4	**Random Rubble Masonry**					
4.1	Providing and laying Hand packed stone filling or soling with stones	Cum	8.00			
5	**Damp Proofing**					
5.1	Providing and laying damp-proof course with cement concrete 1:2:4, 12.5mm aggregate-25mm thick	Sqm	22.00			
6	**Plain Cement Concrete**					

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
6.1	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)	Cum	65.00			
6.2	Providing and laying in position plain cement concrete excluding the cost of centering and shuttering - All work upto plinth level- 1:4:8 (1 cement : 4 sand : 8 graded crushed stone 40 mm nominal size)	Cum	20.00			
7	**Reinforced Concrete**	Cum				
7.1	Providing & laying in position reinforced cement concrete excluding the cost of centering, shuttering and reinforcement - all work upto plinth level-1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20 mm nominal size)	Cum	38.00			
7.2	Providing & laying in position reinforced cement concrete work in plinth and skirting courses, fillets, columns , pillars, posts and struts upto floor five level excluding the cost of centering, shuttering and reinforcement-1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20 mm nominal size)	Cum	50.00			
7.3	Providing & laying in position reinforced cement concrete work in beams, lintels, bands, plain window sills, staircases, spiral staircases upto floor five level excluding the cost of centering, shuttering and reinforcement-1:1:2 (1 cement : 1 sand : 2 graded crushed rock 20 mm nominal size).	Cum	16.00			
7.4	Providing & laying NP2 class R.C.C pipes, including collars, jointing in cement mortar 1:2 including testing of joints etc. complete	m	10.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
8	**Traditional Cornices**					
8.1	Bhutan type Traditional Cornices in R.C.C 1:1.5:3, 20 mm aggregate including cost of formwork including finishing with 6mm thick plaster on the exposed surface with cement mortar 1:3, excluding reinforcement & decorative painting cost as per standard design (Measurement to be taken along the cornice and wall junction)- Lintel Cornice (only cornice portion at external face)	m	6.00			
9	**Steel Reinforcement**					
9.1	Providing & fixing Thermo-Mechanically Treated reinforcement bar (Yield Strength 500 MPa) for R.C.C work including cutting, bending, binding and placing in position complete.	kg	13,500.00			
10	**Formwork**					
	Providing & fixing centering and shuttering (formwork), including strutting, propping etc. and removal of formwork					
10.1	Foundation and plinth etc.	Sqm	145.00			
10.2	Lintels, beams, girders, bresummers, cantilevers etc.	Sqm	115.00			
10.3	Columns, pillars, post, struts etc.	Sqm	240.00			
10.4	Suspended floor, roof, landing, shelves and their supports,balconies, chajjas, etc.	Sqm	42.00			
11	**Brickwork**					

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
11.1	Providing and laying autoclaved aerated cement blocks masonry (AAC blocks) in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Engineer-in-Charge. (The payment of RCC band and reinforcement shall be made seperately).	Cum	65.00			
12	**Steel**					
12.1	Steel work welded, in built up sections, trusses, frame-works including cutting, hoisting, fixing and appl. priming coat of red lead paint-In Tees, angles, flats and channels	kg	1,800.00			
12.2	Steel work welded, in built up sections, trusses, frame-works including cutting, hoisting, fixing and appl. priming coat of red lead paint-In Tubular sections	kg	2,100.00			
13	**Roofing**					
13.1	Providing & fixing Corrugated Galvanised Iron (CGI) sheeting, including bolts, hooks and nuts 8mm dia. with bitumen and G.I limpet washers filled with white lead for connection, excluding the cost of purlins, rafter and trusses: 24g	Sqm	180.00			
13.2	Providing & fixing 600mm ridges or hips in plain G.I. including bolts, hooks and nuts 8mm dia G.I limpet and bitumen washers for connection: 24g	m	36.00			
13.3	Providing & fixing 450mm over all semi-circular plain G.I gutter, including brackets, bolts, nuts, washers & rain water pipes connections, excluding the cost of pipes: 24g	m	65.00			
13.4	Providing & fixing wind tie of 40 x 6 mm flats	m	65.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
13.5	Providing and fixing on wall face single socketed rigid PVC (Working pressure 4kgf per sq.cm) rain water pipes including jointing with seal ring leaving 10 mm gap for thermal expansion- complete: 75 mm dia.	m	160.00			
14	**Flooring**					
14.1	Providing & laying cement concrete flooring 1:2:4, finished with a floating coat of neat cement: 20mm aggregates, 50mm thick	Sqm	125.00			
15	**Plastering**					
15.1	Providing & laying 12mm cement plaster: CM 1:4	Sqm	240.00			
15.2	Providing & laying 15mm cement plaster on rough side of single or half-brick wall: CM 1:4	Sqm	240.00			
15.3	Providing & applying putty of thickness 2mm or more over plastered surface to prepare the surface even and smooth complete.	Sqm	470.00			
15.4	Providing Chicken wire mesh at RCC and AAC block joints	m	750.00			
16	**Woodwork**					
16.1	Providing & fixing Eaves board (225x25mm) with moulding fitted and fixed with necessary screws- mixed conifer.	m	100.00			
16.2	Providing & fixing bison panel (pre-laminated both sides for wall/ceiling) lining with necessary nails/screws etc. complete, excluding the cost of frame - 8mm.	Sqm	65.00			
17	**Painting Items**					
17.1	Providing & applying one coat of primers- Cement primer	Sqm	470.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
17.2	Providing & applying one coat of primers- Metal work - synthetic red oxide primer	Sqm	340.00			
17.3	Bituminastic enamel, for steel work, two coats on new work	Sqm	340.00			
17.4	Synthetic enamel, for steel & wood work, two coats on new work	Sqm	60.00			
17.5	Vinyl plastic emulsion paint, for cement, masonry, plaster, two coats on new work	Sqm	470.00			
17.6	Providing, preparing and applying Sumdang painting (washable)- Rab	Sqm	3.00			
18	**Internal/External water supply pipework**					
18.1	Providing & fixing G.I. pipes including G.I. fittings & clamps & repair walls					
18.1.1	25mm	m	21.00			
18.1.2	32mm	m	40.00			
18.1.3	40mm	m	45.00			
18.2	Providing & laying G.I. pipes including G.I. fittings (excluding trenching, refilling & thrust block)					
18.2.1	100mm	m	1,040.00			
18.3	Providing & fixing brass full way valve with wheel					
18.3.1	25 mm	each	4.00			
18.3.2	32 mm	each	5.00			
18.3.3	40 mm	each	4.00			
18.3.4	100 mm	each	6.00			
19	**Water Filtration System and drinking pipeline**					
19.1	Supply, Installation, Jointing and testing of Carbon Steel Pipelines from Cooling water tank to Makeup water tank including the following accessories					

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
19.1.1	CS Seamless Pipe- 250NB, Sch-40	m	210.00			
19.1.2	Isolating Valve- 250NB, CL-150	each	3.00			
19.1.3	Motorized valve-250NB, CL-150	each	2.00			
19.1.4	Flange joints- 250 NB (containing flanges, hardware & gasket)	each	45.00			
19.1.5	Elbows - 250 NB, Sch 40, CS Seamless	each	10.00			
19.3	Backwash line (80NB Sch-40) from Filter	m	50.00			
19.3	Supply, Installation, Jointing and testing of Carbon Steel Pipelines from Drinking water tank to Power house & Trasformer house building including the following accessories					
19.4.1	Pipe- 100NB, Sch-40, CS Seamless	m	1,190.00			
19.4.2	Elbows- 100NB, Sch-40, CS Seamless	each	50.00			
19.4.3	Flange joints- 100NB (containing flanges, hardware & gasket)	each	250.00			
19.4.4	Isolating valve 100NB, Class 150	each	6.00			
19.4.5	Pipe- 50NB, Sch-40, CS Seamless	m	70.00			
19.4.6	Elbows- 50NB, Sch-40, CS Seamless	each	10.00			
19.4.7	Flange joints- 50 NB (containing flanges, hardware & gasket)	each	15.00			
19.4.8	Tees, Equal and Unequal (100NB, 100-100-50 NB) CS Seamless	each	4.00			
19.4.9	Isolating valve 50 NB, Class 150	each	2.00			
19.4.10	Globe Valve as per IS: 9338 , Flanged drill as per IS: 1538 with Hand Wheel - 100 NB	each	1.00			
19.4.11	Air Release valves as per IS: 14845-2000 with Isolation sluice valve - 100 NB	each	1.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
20	**Sewage works**					
20.1	Providing & fixing P.V.C soil waste and vent pipes, single or double socketed, including pipe clip complete (excluding the cost of PVC fittings)					
20.1.1	75φ PVC Pipe	m	135.00			
20.2	Providing & fixing P.V.C Coupler					
20.2.1	75φ	each	15.00			
20.3	Providing & laying H.D.P.E pipes, 10 PN, including H.D.P.E fittings (excluding trenching, refilling & thrust block)					
20.3.1	110φ	m	135.00			
21	**Storage Tanks**					
	Providing & fixing plastic tank including all accessories complete					
21.1	2000 l	each	2.00			
21.2	3500 l	each	1.00			
21.3	5000 l	each	4.00			
B. ELECTRICAL WORKS						
1.1	Wiring for light, fans, call bell and 2 pin light socket outlet with 1.5 sq.mm 1.1kV grade, PVC insulated copper conductor cable in recessed HDPE pipe including connections, painting, testing and commissioning etc. as required (Medium Point)					
1.1.1	Medium point (WH0301)/ WC0291	Each	3.00			
1.1.2	Long point (WH0302)/WC0292	Each	15.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
1.2	Wiring for lighting circuit with 1.1kV grade, PVC insulated copper conductor cable in recessed HDPE pipe including connections, painting, testing and commissioning etc. as required of 2x2.5 sq.mm including the earth wire. (WH0391)/(WC0391)	LS	3.00			
1.3	Wiring for 5/6 pin, 6/16 ampere plug point with 4 sq.mm 1.1kV grade, PVC insulated copper conductor cable in recessed HDPE pipe with providing and fixing 5/6 pin, 6/16 ampere socket outlet and switch including earthing the third pin, connections, painting, testing and commissioning etc. as required LONG POINT (WH0342)/WC0342	Each	6.00			
1.4	Supply of SPN distribution board (DIN type) with metal door, 230 volt A.C complete with all accessories without MCB/isolator/RCCB out going or incoming etc. as required 6WAY	Each	3.00			
1.5	Supply of miniature circuit breaker (MCB) double pole, 230 volt A.C complete with all accessories suitable to fix on a din-bar etc. as required 32AMPS	Each	3.00			
1.7	Supply & Fix of miniature circuit breaker (MCB) single pole, 230 volt A.C complete with all accessories suitable to fix on a din-bar etc. as required					
1.7.1	6/10A,SP MCB	Each	3.00			
1.7.2	16A,SP MCB	Each	6.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
1.8	Installation, testing and commissioning of SPN DB (DIN type, horizontal/vertical) with metal door / arcylic door (double/single door) complete with all accessories such as incoming MCB/ RCCB DP 32/40A sensitivity 30/100/300mA and outgoing SP MCB 6/10/16A on/in prefabricated MS surface /MS cubical control panel board including drilling holes, connections etc. as required.	Each	3.00			
1.9	Supplying and fixing of LED tube light 240 volts A.C - 18W complete as required.(IL0381)	Each	15.00			
1.10	Providing & fixing of the holder/Ceiling Rose as per required at site	Each	12.00			
1.11	Supplying of exhaust fan 240 volt A.C 900 rpm ,450mm sweep with all accessories such as frame with arm 3 Nos., sweep 3 Nos., condenser and fan body etc. complete as required	Each	3.00			
1.12	Providing and fixing of earthing including all accessories, machinery enclosure, C.I cover plate having locking arrangement, watering pipe 20/40 mm dia GI with excavation and refilling work including charcoal or coke and salt complete as required as per standard (with copper earth plate 600x600x6mm)	Each	3.00			
1.13	Providing and laying of metal strip at 0.5m below ground level of 25x4mm G.I strip as earth electrodes including soldering etc as required	m	30.00			

Sl. No.	Description	Unit	Qty	Rate (Nu./Rs.)		Amount
				In figures	In words	
1.14	Installation, testing and commissioning of exhaust fan upto 450mm sweep the existing opening including making the hole to suit the size of the indicated fan making good the damages, and connection with PVC insulated copper conductor	Each	3.00			
C. OHS at construction site						
1	Incorporation of Occupational Health and Safety measures at construction sites as per the attached quirements list. The standards and specifications for the Insurance, OHS materials and (or) equipment shall be in compliance with the Labour and Employment Act - 2007, Regulation on ccupational Health, Safety and Welfare 2012, and other relevant national documents. All OHS items will remain as the property of the bidder upon completion of the project.	L/S	1.00			
D. Temporary Living Accommodation						
1	Providing temporary living accommodation which includes bed room, kitchen, and toilet cum bathroom including proper water supply and electricity as per the drawing and temporary living accommodation standards. The accommodation facilities must be dismantled and cleaned upon the completion of project. All reusable materials of the accommodation facilities will remain as the property of the bidder upon completion of the project.	L/S	1.00			
X	**Total Amount**					
y	**Rebate, if any**					
	Final Total Amount (X-Y)					

SECTION IX

DRAWINGS