BIDDING DOCUMENT

FOR

THE PROCUREMENT OF

Drilling and Installation of Shallow Tube Well in Soft Formation Using Slude/Manual Rotary/Bogie Method along with Supply and Installation of Water Treatment Plant with all complete works

Sealed Quotation

Issued by:

Federal Water Supply and Sewerage Management Project, Biratnagar

Biratnagar Morang

Sealed Quotation Number	46/81-82/SQ-Works/Jhapa/FWSSMP_BRT
Issued On	19-06-2025

Abbreviations

BDS..... Bid Data Sheet

BD ..... Bidding Document

DCS..... Delivery and Completion Schedule

DP …….Development Partner

EQC ..... Evaluation and Qualification Criteria

GCC ..... General Conditions of Contract

GoN ..... Government of Nepal

ICC..... International Chamber of Commerce

IFB ..... Invitation for Bids

Incoterms..... International Commercial Terms

ITB ..... Instructions to Bidders

LGRS ..... List of Goods and Related Services

NCB ……. National Competitive Bidding

NA..... Not Applicable

PAN ……..Permanent Account Number

PPA .....Public Procurement Act

PPR .....Public Procurement Regulation

PPMO ……Public Procurement Monitoring Office

SBD..... Standard Bidding Document

SBQ..... Schedule of Bidder Qualifications

SCC……. Special Conditions of Contract

SR ..... Schedule of Requirements

TS..... Technical Specifications

UNCITRAL …….United Nations Commission on International Trade Law

VAT …… Value Added Tax

Table of Contents

Invitation for Sealed Quotation

Name of the Office:Federal Water Supply and Sewerage Management Project, Biratnagar

Address of the Office:
Biratnagar Morang

Sealed Quotation No:46/81-82/SQ-Works/Jhapa/FWSSMP_BRT

Date of Publication : 19-06-2025

1. The Federal Water Supply and Sewerage Management Project, Biratnagar invites sealed quotations from registered contractors for the construction of Drilling and Installation of Shallow Tube Well....

2. The Estimated amount for the works is(in NRs.): 1,671,416.92 (Exclusive of VAT and Contingencies)

3. Eligible Bidders may obtain further information and inspect the Sealed quotation Forms at the office of Federal Water Supply and Sewerage Management Project, Biratnagar at Biratnagar Morang or by reaching out to them at Telephone 021463884 or by dropping a mail at chakraacharya@gmail.com [or may visit PPMO website www.bolpatra.gov.np.]

4. Sealed Quotation Forms may be purchased by eligible Bidders on the submission of a written application and upon payment of a non-refundable fee of 1000.0 NRs.

Or

Bidder who chooses to submit their bid electronically shall deposit the cost of bidding document in the account specified below:

Name of the Bank:	Agricultural Development Bank Ltd.
Name of the Office:	Federal Water Supply and Sewerage Management Project, Biratnagar
Office Code no:	31301103
Office Account no:	0100201277009016
Rajaswa (revenue) Shirshak no:	14229

5. Sealed bids must be submitted to the above office by hand or through e-GP system i.e www.bopatra.gov.np/egp on or before 04-07-2025 10:00 hours . Bids received after this deadline will be rejected.

6. Sealed Quotations shall be opened in the presence of Bidders' representatives who choose to attend at 04-07-2025 10:28 hours at the office of Federal Water Supply and Sewerage Management Project, Biratnagar, Bids must be valid for a period of 45 days after bid opening and must be accompanied by a bid security amounting to a minimum of NRs.46000 which shall be valid for 30 days beyond the validity period of the bid i.e 75 days.

7. If the last date of purchasing and /or submission falls on a government holiday, then the next working day shall be considered as the last date. In such case the validity period of the bid security shall remain the same as specified for the original last date of bid submission.
[Note : As mentioned in clause 49ka of PPR 2064 clause 49ka ,add more relevant information as per required]

Section - II
Instruction to Bidders

Section I. Instruction to Bidders(ITB)

1. Scope of Works	1.1 The Employer stated in the BDS for the construction of works as detailed in attached specifications, drawings and the bill of quantities provided herein. The name of *Employer, name of project and contract identification number of Contracts* are **provided in the BDS**.
2. Eligible Bidder	2.1 This Invitation for Bids is open to all registered contractors with eligibility criteria specified in section III Eligibility Criteria. A bidder declared blacklisted and ineligible by the GoN, Public Procurement Monitoring Office (PPMO) and/or the DP in case of DP funded project, shall be ineligible to bid for a contract during the period of time determined by the GoN, PPMO and/or the DP. 2.2 In case of a natural person or firm/institution/company which is already declared blacklisted and ineligible by the GoN, any other new or existing firm/institution/company owned partially or fully by such Natural person or Owner or Board of director of blacklisted firm/institution/company; shall not be eligible bidder. 2.3 Firms shall be excluded if the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV shall not be eligible to participate in procurement process till the concerned Court has not issued the decision of clearance against the Corruption Charges
3. One Bid per Bidder	3.1 Each Bidder shall submit only one quotation. A Bidder who submits more than one quotation shall cause all the quotations with the Bidder's participation to be disqualified.
4. Cost of Bidding	4.1 The Bidder shall bear all costs associated with the preparation and submission of his bid and the Employer shall in no case be liable for those costs.
5. Site Visit	5.1 The Bidder at his own cost, responsibility and risk may visit the site of the works and acquire all necessary information for preparing the bid and entering into a contract for construction of the works.
6. Content of Quotation Form	6.1 The Quotation Form comprise the documents listed below: Section I: Instructions to Bidders Section II: Bid Data Sheet Section III : Eligibility Criteria Section IV: Bidding Forms Section V: Works Requirements Section VI: Bill of Quantities Section VII: General Conditions of Contract (GCC) Section VIII: Special Conditions of Contract (SCC) Section IX: Contract Forms

7. Clarification	7.1 A prospective Bidder may obtain clarification on the Quotation Form from the Employer on or before 5 days prior to the deadline for submission of quotation.
8. Language of Bid	81. All documents relating to the bid shall be in English /Nepali.
9. Documents Comprising Bid	The bid by the Bidder shall comprise the following: • Letter of Bid • Eligibility Information/Document • Bid Security and • Priced Bill of Quantities
10. Bid Prices	10.1 The contract shall be for the whole works described in scope of works based on the priced Bill of Quantities submitted by the Bidder. The Bidder shall fill in rates and prices for all items of the works in Nepali Rupees. Items for which no rate or price is entered shall be deemed covered by the other rates and prices in the Bill of Quantities and shall not be paid separately by the Employer. All duties, taxes and other levies payable by the contractor under the contract shall be included in the rates, prices and total Bid Price submitted by the Bidder.
11. Bid Validity	11.1 Bids shall remain valid for the period **specified in the BDS** after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
12. Bid Security	12.1 The Bidder shall furnish as part of its bid, in original form, a bid security **as specified in the BDS.** In case of e-submission of bid, the Bidder shall upload scanned copy of Bid security letter at the time of electronic submission of the bid. The Bidder accepts that the scanned copy of the Bid security shall, for all purposes, be equal to the original. The details of original Bid Security and the scanned copy submitted with e-bid should be the same otherwise the bid shall be non-responsive. 12.2 The bid security shall be, at the Bidder's option, in any of the following forms: (a) an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law or; (b) a cash deposit voucher in the Employer's Account as specified in BDS. In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included in Section III (Bidding Forms) or in another Form acceptable to the employer. The form must include the complete name of the Bidder. The bid security shall be valid for minimum thirty (30) days beyond the original validity period of the bid 12.3 Any bid not accompanied by an enforceable and substantially compliant bid security shall be rejected by the Employer as nonresponsive. In case of e-Submission, if the scanned copy of an acceptable Bid Security letter is not uploaded with the electronic Bid then Bid shall be rejected. 12.4 The bid security shall be forfeited if: (a) a Bidder requests for withdrawal during the period of bid validity specified by the Bidder on the Letter of Bid, after bid submission deadline. (b)a Bidder changes the prices or substance of the bid while providing information; (c) a Bidder involves in fraud and corruption pursuant to clause 27; (d) the successful Bidder fails to:

	(i) furnish a performance security in accordance with clause 25 and 26; (ii) sign the Contract in accordance within the period stipulated in Letter of Acceptance; or (iii) accept the correction of arithmetical errors pursuant to clause 21.1
13. Format and Signing of Bids	13.1 The bid shall be typed or written in indelible ink and shall be signed by an authorized person. Any entries or amendments including alternations, additions or corrections made shall be initialed by the same authorized person.
14. Sealing and Marking of Bids	14.1 Bidders may submit their bids by hand copy or by electronically. When so **specified in the BDS**, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows: (a) Bidders submitting bids by hand copy: The Bidder shall submit his bid in sealed envelopes. The envelope shall be addressed to the Employer specified in the Invitation for Quotation and shall bear the name and identification number of the quotation. (b) Bidders submitting Bids electronically shall follow the electronic bid submission procedure **specified in the BDS**
15. Deadline for Submission of Bids	15.1 Bids shall be delivered to the Employer at the address no later than the time and date **specified in BDS.**
16. Late Bids	16.1 Any bid received by the Employer after the deadline shall not be accepted and shall be returned unopened to the Bidder upon request.
17.Modification And Withdrawal of Bids	17.1 Bids once submitted shall not be withdrawn or modified.
18. Bid Opening	18.1 The Employer shall open the bids in the presence of the Bidders' representatives who choose to attend at the time and in the place **as specified in the BDS**. The Employer shall prepare and provide minutes of the bid opening including the information disclosed to those present.
19. Process to be Confidential	19.1 Information relating to the examination, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any efforts by the Bidder to influence the Employer in the bid evaluation, bid comparison or contract award decisions may result in rejection of Bidder's bid.
20.Examination of Bids	201. Prior to the detailed evaluation of Bids, the Employer shall determine whether each bid (a) meets the eligibility criteria defined in Clause 2; (b) has been properly signed; (c) is accompanied by the required securities; and (d) is substantially responsive to the requirements of the Bidding documents.
21. Evaluation and Comparison of Bids	21.1 In evaluating the Bids, the Employer shall determine for each bid the evaluated Bid Price by adjusting any corrections for errors. Bids shall be checked by the Employer for any arithmetic errors. Errors shall be corrected by the Employer as follows:

	(a) only for unit price Contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected; (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and (c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Bid will be corrected. (d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) ,(b) and (c) above. 21.2 In case of e-submission of bid, upon notification from the employer, the bidder shall also submit the original of documents comprising the bid as per ITB 9 for verification of submitted documents for acceptance of the e-submitted bid. If a Bidder does not provide original of document of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected. 21.3 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its bid shall be disqualified and its bid security shall be forfeited. 21.4 If the corruption case is being filed to Court against the Natural Person or Board of Director of the firm/institution /company or any partner of JV, such Natural Person or Board of Director of the firm/institution /company or any partner of JV such bidder's bid shall be excluded during the evaluation.
22. Award of Contract	22.1 The Employer shall decide the award of the contract to the Bidder whose bid is within the approved estimate and who has offered the lowest evaluated Bid Price within bid validity period provided that such Bidder has been determined to be eligible in accordance with the provisions of Clauses 2. 22.2 if the bid for an Unit Rate Contract, which results in the lowest Evaluated Bid Price is seriously unbalanced or front loaded **or extremely low** in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analysis, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder as **mentioned in BDS** to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract **or may consider the bid as non-responsive**.
23. Employer's Right to Accept any Bid and to Reject any or all Bids	23.1 The Employer reserves the right to accept or reject any bid or to cancel the bidding process and reject all bids, at any time prior to the award of the contract, without assigning any reasons whatsoever and without thereby incurring any liability to the affected Bidder or Bidders.
24. Notification of Award and	24.1 The Bidder whose bid is accepted and all other participating bidders shall be notified of the award by the Employer.

Signing of Agreement	24.2 The notification (hereafter called the "Letter of Acceptance") to the successful Bidder shall state the sum that the Employer shall pay the Bidder in consideration of the execution, completion, and maintenance of the works as described by the contract. Within 7 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver the Performance Security pursuant Clause 25and sign the Agreement. 24.3 Inability of the Bidder to make an Agreement within the above stated period shall result in cancellation of the Contract Award and forfeiture of the Bidder's Bid Security, upon which the Contract shall then be awarded to the next successive successful Bidder.
25.Performance Security	251. Within seven (7) days of the receipt of Letter of Acceptance from the Employer, the successful Bidder shall furnish the performance security as under mentioned from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal in accordance with the conditions of Contract using Sample Form for the Performance Security included in Section IX (Contract Forms), or another form acceptable to the Employer. i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price. ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows: **Performance Security Amount =** **[(0.85 x Cost Estimate – Bid Price) x 0.5] + 5%of Bid Price.** The Bid Price and Cost Estimate shall be inclusive of Value Added Tax.
26.Additional Securities	26.1 The Bidder may be required to provide additional Performance Security if the Employer determines that the rate quoted by the Bidder in the Bill of Quantities, front loaded or unbalanced. In such case, the Employer shall instruct the Bidder to provide additional 8% security for signing of the Contract Agreement. Bidder's failure to do provide additional security shall result in forfeiture of the Bid Security and award of the Contract to the next lowest evaluated Bidder.
27.Corrupt or Fraudulent Practices	27.1 The Employer shall reject a bid for award if it determines that the Bidder recommended for award of contract has engaged in corrupt or fraudulent practices in competing for the contract in question.
28.Conduct of Bidders	28.1The Bidder shall be responsible to fulfill his obligations as per the requirement of the Contract Agreement, Bidding documents, GoN's Procurement Act and Regulations. 28.2 The Bidder shall not carry out or cause to carry out the following acts with an intention to influence the implementation of the procurement process or the procurement agreement : a) give or propose improper inducement directly or indirectly, b) distortion or misrepresentation of facts c) engaging or being involved in corrupt or fraudulent practice d) Interference in participation of other prospective bidders. e) coercion or threatening directly or indirectly to cause harm to the person or the property of any person to be involved in the procurement proceedings,

	f) collusive practice among bidders before or after submission of bids for distribution of works among bidders or fixing artificial/uncompetitive bid price with an intention to deprive the Employer the benefit of open competitive bid price.. g) contacting the Employer with an intention to influence the Employer with regards to the bid or interference of any kind in examination and evaluation of the bids during the period after opening of bids up to the notification of award of contract
29.Blacklisting Bidder	29.1 Without prejudice to any other right of the Employer under this Contract, GoN, Public Procurement Monitoring Office may blacklist a bidder for his conduct up to three years on the following grounds and seriousness of the act committed by the bidder: a) if it is proved that the bidder committed acts pursuant to the Sub-Clause 28.2, b) if it is proved later that the bidder/contractor had committed substantial defect in implementation of the contract or had not substantially fulfilled his obligations under the contract or the completed work is not of the specified quality as per the contract , c) if convicted by a court of law in a criminal offence which disqualifies the bidder from participating in the contract. d) if it is proved that the contract agreement signed by the bidder was based on false or misrepresentation of bidder's qualification information, 29.2 A firm declared blacklisted and ineligible by the GON shall be ineligible to bid for a contract during the period of time determined by the PPMO.
30. Provision of PPA and PPR	If any provision of this document is inconsistent with Public Procurement Act (PPA), 2063 or Public Procurement Regulations (PPR), 2064, the provision of this documents shall be void to the extent of such inconsistency and the provision of PPA and PPR shall prevail.

Section - II
Bid Data Sheet

Bid Data Sheet

ITB 1	The scope of work is : WORKS SEALED QUOTATION
ITB 1	The number of the Invitation for Bids is : 46/81-82/SQ-Works/Jhapa/FWSSMP_BRT
ITB 1	The Employer is : Federal Water Supply and Sewerage Management Project, Biratnagar
ITB 11	The bid validity period shall be: 45 days.
ITB 12.1	The Bidder shall furnish a bid security, from 'A' class commercial bank with a minimum of 46000, which shall be valid for 30 days beyond the validity period of the bid.
ITB 12.2	Cash Deposit Account for Bid Security : Bank Name: Agricultural Development Bank Ltd. Bank Address: Bnaking Branch Biratnagar Account Name: Federal Water Supply and Sewerage Management Proje Account Number: 0100201277009016
ITB 14.1	Bidders shall have the option of submitting their bids electronically. Electronic submission procedure shall be : i. The bidder is required to register in the e-GP systemhttps://www.bolpatra.gov.np/egpfollowing the procedure specified in e-GP guideline. ii. Interested bidders may either purchase the bidding document from the employer's office as specified in the Invitation for Bid (IFB) or bidders may download the IFB and bidding document from e-GP system. iii. The registered bidders need to maintain their profile data required during preparation of bids. iv. In order to submit their bids electronically the cost of the bidding document shall be deposited in the account specified in IFB. In addition, electronic scanned copy (.pdf format) of the bank deposit voucher/cash receipt should also be submitted along with the bid. v. The bidder can prepare their bids using data and documents maintained in bidder’s profile and forms/format provided in bidding document by Employer. The bidder may submit bids as a single entity. vi. Bidders should update their profile data and documents required during preparation and submission of their bids. The required forms and documents shall be part of technical bids. 1. Letter of Bid (Mandatory) 2. Bid Security/Bank Guarantee (Mandatory) 3. Company registration (Mandatory) 4. VAT registration (Mandatory) 5. Tax clearances certificate or evidence of tax return submission (Mandatory) 6. Power of Attorney of Bid signatory (Mandatory) 7. Completed BoQ (Mandatory) 8. Bank Voucher for cost of bid document (Mandatory) 9. Additional documents specified in Bidding Document (If required) Note : The documents specified as “Mandatory” should be included in e-submission. vii. After providing all the details and documents, bid response documents will be generated from the system. Bidders are advised to download and verify the response documents prior to bid submission. viii. For verifying the authentic user, the system will send one time password in the registered email address of the bidder. System will validate the OTP and allow bidder to submit their bid. ix. Once bid is submitted, bidders won’t able to modify/withdrawal their bid. x. The Bidder / Bid shall meet the following requirements and conditions for e-submission of bids : The e-submitted bids must be readable through PDF reader. The facility for submission of bid electronically through e-submission is to promote transparency, non-discrimination, equality of access, and open competition in the bidding process. The Bidders are fully responsible to use the e-submission facility properly in e-GP system as per specified procedures and in no case the Employer shall be held liable for Bidder's inability to use this facility. When a bidder submits electronic bid through the PPMO e-GP portal, it is assumed that the bidder has prepared the bid by studying and examining the complete set of the Bidding documents including specifications, drawings and conditions of contract.
ITB 15	The deadline for Sealed Quotation submission is:04-07-2025 10:00 Address:Biratnagar Morang

ITB 18	The bid opening shall take place at : Address :Federal Water Supply and Sewerage Management Project, Biratnagar Biratnagar Morang Koshi Pradesh Nepal Date and Time:04-07-2025 10:28 a) e-GP system allows to download the bid response document only after bid opening date and time are met. Simultaneous login of two members of the opening committee is required for bid opening. b)The Employer shall conduct the opening of bid at the address on the same date and time as specified in bidding document in the presence of Bidders' representatives who choose to attend

Section - III
Eligibility Criteria

Eligibility Requirements
All Bidders shall submit following documents as pre- requisites for eligibility:

1 Firm/Company Registration Certificate

2 Business Registration Certificate (License)

3 PAN/VAT Registration Certificate

4 Tax Clearance Certificate/ Extension Letter/Tax return submission evidence for the F/Y-080/81

5 Power of Attorney

6 Letter of Bid

7 insert addition document if required

Notes to Bidders :

The information to be filled in by Bidders in the following pages shall be used for purposes of eligibility as provided for in Clause 2of the Instructions to Bidders. This information shall not be incorporated in the Contract. Attach additional pages as necessary.

Section - IV
Bidding Forms

Letter of Bid

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

Date: ……
Name of the contract: ……
Invitation for Bid No.: ……

To: ……

We, the undersigned, declare that:

(a) We have examined and have no reservations to the Bidding Documents.
(b) We offer to execute in conformity with the Bidding Documents the following Works:
(c) The total price of our Bid, excluding any discounts offered in item (d) below is:……
(d) The discounts offered and the methodology for their application are:……
(e) Our bid shall be valid for a period of 45 days from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
(f) If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Document;
(g) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed;
(h) We declare that, we have not been black listed and no conflict of interest in the proposed procurement proceedings and we have not been punished for an offense relating to the concerned profession or business.
(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive; and
(j) If awarded the contract, the person named below shall act as Contractor's Representative:
(k) We agree to permit the Employer/DP or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the Employer.

Name: ……

In the capacity of ……

Signed ……

Duly authorized to sign the Bid for and on behalf of ……

Date ……

Bid Security

Bank Guarantee

Bank's Name, and Address of Issuing Branch or Office
(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

Beneficiary: ..... name and address of Employer…….
Date:……
Bid Security No.:.....

We have been informed that . ……. .[***insert name of the Bidder***] (hereinafter called "the Bidder") intends to submit its bid (hereinafter called "the Bid") to you for the execution of …….. name of Contract …… under Invitation for Quotations No. …… ("the IFQ").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we……. . name of Bank. ……hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of. . ……..amount in figures …… (. ……..amount in words ……) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

(a) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
(b) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB.
(c) is involved in fraud and corruption in accordance with the ITB

This guarantee will remain in force up to and including the date ……number……days after the deadline for submission of Bids as such deadline is stated in the instructions to Bidders or as it may be extended by the Employer, notice of which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee should reach the Bank not letter than the above date.

This Bank guarantee shall not be withdrawn or released merely upon return of the original guarantee by the Bidder unless notified by you for the release of the guarantee.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 758.

. . .Bank's seal and authorized signature(s) . . .

Note:

The bid security of …….. has been counter guaranteed by the Bank ……..on ……. ..... …… (Applicable for Bid Security of Foreign Banks).

Section - V
Works Requirements

Scope of Work

Specifications

Notes on the Specifications

A set of precise and clear specifications is a prerequisite for Bidders to respond realistically and competitively to the requirements of the Employer without qualifying or conditioning their Bids.The specifications must be drafted to permit the widest possible competition and, at the sametime,present a clear statement of the required standards of workmanship, materials, and performance of the goods and services to be procured. Only if this is done will the objectives of economy, efficiency and fairness in procurement be realized, responsiveness of Bids be ensured, and the subsequent task of bid evaluation facilitated. The specifications should require that all goods and materials to be incorporated in the Works be new, unused, of the most recent or current models, and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.

Samples of specifications from previous similar projects are useful in this respect. The use of metric units is encouraged by the Funding Agency in case of funding assisted projects. Most specifications are normally written specially by the Employer or Project Manager to suit the Contract Works in hand. The available standard specification of works of Ministry of Physical Infrastructure and Transport, DoLIDAR and Other line Ministries can be adopted for respective civil construction works.

There are considerable advantages in standardizing General Specifications for repetitive Works in recognized public sectors, such as highways, urban housing, irrigation, and water supply, in the same country or region where similar conditions prevail. The General Specifications should cover all classes of workmanship, materials, and equipment commonly involved in construction, however it may not necessarily be adequate to be used in a particular Works Contract and may necessitate preparation of Particular (Special) Specifications to amend and or supplement the provision of the General Specifications to meet the requirement of the particular Works.

Care must be taken in drafting specifications to ensure that they are not restrictive. In the specification of standards for goods, materials, and workmanship, recognized international standards should be used as much as possible. Where other particular standards are used, whether national standards of Nepal or other standards, the specifications should state that goods, materials, and workmanship that meet other authoritative standards, and which ensure substantially equal or higher quality than the standards mentioned, will also be acceptable.

Employers should decide whether technical solutions to specified parts of the Works are to be permitted. Alternatives are appropriate in cases where obvious (and potentially less costly) alternatives are possible to the technical solutions indicated in the Procurement Documents for certain elements of the Works, taking into consideration the comparative specialized advantage of potential bidders. For example:

The Employer should provide a description of the selected parts of the Works with appropriate references to Drawings, Specifications, Bill of Quantities, and Design or Performance criteria, stating that the alternative solutions if applicable shall be at least structurally and functionally equivalent to the basic design parameters and specifications.

Such alternative solutions shall be accompanied by all information necessary for a complete evaluation by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, proposed construction methodology, and other relevant details.

Sample Clause: Equivalency of Standards and Codes Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a particular country or region other authoritative standards that ensure a substantially equal or higher quality than the standards and codes specified will be accepted subject to the Project Manager's prior review and written consent. Differences between the standards specified and the proposed alternative standards shall be fully described in writing by the Contractor and submitted to the Project Manager at least 30 days prior to the date when the Contractor desires the Project Manager's consent. In the event the Project Manager determines that such proposed deviations do not ensure substantially equal or higher quality, the Contractor shall comply with the standards specified in the documents.

These Notes for Preparing Specifications are intended only as information for the Employer or the person drafting the Procurement Documents. They should not be included in the final documents.

4 ELECTRICAL INSTALLATIONS

4.1 Scope

This specification covers the general standards to be achieved when installing lighting and small power systems. i.e. guardhouse, operators quarters and site lighting. Details of the electrical works, including relocation of existing NEA lines etc. described in Appendix A; all materials and workmanship on the NEA power system shall be as per NEA practice.

4.2 Interpretations

4.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 Item of General Application
b) 2.2 Earthworks

4.2.2 Application

This specification contains clauses that are generally applicable to electrical installations and associated work.

4.2.3 Abbreviations

Wherever the following abbreviations are used they shall have the meanings below:

Institutional:

AIEE-American Institute of Electrical Engineers

BSI-British Standards Institution

DIN-Deutsches Industrie Normen

IE-Indian Electricity Rules

IEC-International Electrotechnical Commission

ISO-International Organisation for Standardisation

ISI-Indian Standards Institute

NEA-Nepal Electricity Authority

NEC-US National Electrical Code

NEMA-National Electrical Manufacturers' Association

Technical:

R-red phase

Y-yellow phase

B-blue phase

ac-alternating current

dc-direct current

A-amp

mA-milliamp

V-volt

HRC-High Rupturing Capacity

kW-kilowatt

kVA-kilovolt amp

kWh-kilowatt hour

MVA-megavolt amp

Hz-hertz (cycles per second)

SP-single pole

SPN-single pole and neutral

DP-double pole

TP-triple pole

TPN-triple pole and neutral

SPSwN-single pole and switched neutral

TPSwN-triple pole and switched neutral

MCB-miniature circuit breaker

MCCB-moulded case circuit breaker

RCD-residual current device

GES-General Electric Standard

4.3 Materials

4.3.1 Low Voltage Distribution Boards

Low voltage distribution boards shall be of fabricated sheet metal construction, arranged for conduit and/or cable entry as required, fully rust-proofed, painted to an approved finish and protected against ingress of solid foreign bodies and liquid according to IEC Recommendation 144 Degree IP 32. All boards shall be rated as required and shall conform in all respects with IS 13947. Exterior boards shall be protected to IP 65.

Low voltage distribution boards shall have banks of fuses or miniature circuit breakers which are easily removable and readily accessible for easy wiring. All boards shall have 25% spare ways fitted within the case. Incoming supplies to the distribution board shall enter by means of a lockable isolator, switch fuse, residual current device or moulded case circuit breaker.

Boards which have feeders looped in or out at the busbars shall have double terminal blocks on each busbar.

All boards shall have insulating barriers installed between phases and between each phase and earth.

When required suitable holes/knockouts shall be provided to the top or bottom of the board to accommodate all incoming and outgoing cables through rubber washer glands.

Distribution boards shall be fitted with a permanent label giving details of fuses or miniature circuit breakers when their replacement by equipment of other makes or types would adversely affect the protection or discrimination provided.

4.3.2 Fuses

Fuses shall be Category AC 80, 660 volt to IS 13703. Fuse carriers and bases shall comply with IS 13703: Part 2.

4.3.3 Miniature and Moulded Case Circuit Breakers

Miniature and moulded case circuit breakers shall comply with IS 13032 and IS 13947 respectively. All breakers shall be selected in accordance with the Indian Standards with due regard to operating characteristics, current rating, calibration and discrimination. Adequate back-up protection by HRC fuses shall be provided.

Miniature circuit breakers shall be unconditionally rated at a category of duty M6 or higher. The effect of ambient temperatures, operating duty, and application shall be fully considered in applying de-rating factors for application at site.

Miniature and moulded case circuit breakers shall have means for preventing any one pole of a multi pole circuit breaker being operated or tripping independently of the other poles.

Miniature and moulded case circuit breakers shall have locking facilities and be supplied with all keys, or shall be enclosed in cases with locking facilities which shall be provided with keys.

Miniature and moulded case circuit breakers shall be of the same type throughout the Contract.

4.3.4 Residual Current Circuit Breakers

Residual current operated devices are to be either 3 phase and neutral or 1 phase and neutral. Both types will be of the circuit current rating and rated tripping current as stated elsewhere in this Specification or on the drawings. Either type must isolate all poles and neutral and be complete with a test button marked 'PUSH TO TEST'. The unit must be of robust construction and be mounted in an enclosure of pressed steel.

Where residual current circuit breakers are used they shall be of the ac/dc current operated type complying with IS 12640 when incorporated in fixed socket outlets, except that they shall be suitable for the service conditions as defined at site.

4.3.5 Cables

All cables shall be manufactured to Nepalese Standards

(i) Low voltage (600/1000 V grade)

- PVC/SWA/PVC and XLPE/SWA/PVC multicore cable. Installed direct in the ground, in ducts, on tray or clipped direct. Aluminum wire armouring shall be used for single core cables.

(ii) Low voltage (600/1000 V grade)

- PVC/PVC multicore cable to BS 6346. Installed in floor ducts, trunking or conduits.
- PVC single core non-sheathed (450/750 V grade). Installed in conduit or trunking.
- PVC single core non-sheathed (600/1 000 V). Installed as internal wiring within switchgear and control assemblies.

(iii) Instrumentation

- PE/PSCR/OSCR/PE/SWA/PVC Plain annealed multistranded copper conductors, solid polyethylene insulation with aluminium-mylar pair screening including drain wire, with collective aluminium mylar screen including drain wire, solid polyethylene bedded steel wire armour with an outer sheath of flame retardant PVC. PVC sheath to be blue colour for intrinsically safe circuits, black for ac and dc non-intrinsically safe circuits, 300/500 V grade.

(iv) Control Digital

- PE/OSCR/PE/SWA/PVC Plain annealed multistranded copper conductors, solid polyethylene insulation collective aluminium mylar screen including drain wire, solid polyethylene bedded steel wire armour with an outer sheath of flame retardant PVC. PVC sheath to be blue colour for intrinsically safe circuits, black for ac and dc non-intrinsically safe circuits, 300/500 V grade.

4.3.6 Site Lighting

Poles shall have:-

(i) A weatherproof access door to the base compartment, fitted with tamper proof lock, to provide easy access to the equipment. The doors shall be inter-changeable between poles without adaption, and keys shall be supplied. Doors shall be provided with an earthing terminal for connection of an earth continuity conductor to the earth terminal block installed in the base compartment.

(ii) A non-rusting earthing terminal bar near to the point of electrical supply and clearly marked 'earth'. This terminal shall be capable of accommodating an earth continuity conductor not less than 6 mm2 nominal cross sectional area.

(iii) Cable slot entries of not less than 150 mm long by 50 mm wide. The top of the slots shall be no more than 350 mm below ground level.

(iv) A treated base board, within the compartment, of suitable size to accommodate all necessary control gear, cable terminations and looping type fuse service cut out. The base board shall be securely fixed within the pole.

Cut-outs housed in the base compartments of lighting poles shall be designed primarily for use in street lighting poles and shall be suitable for termination or looping-in of the cables used. They shall consist of a substantial moulded plastic drip-proof enclosure with separate terminals for live, neutral and earth conductors, and incorporate a fuse carrier suitable for a fuse to IS 13703. Terminals shall be large enough to take the service cables used.

Three way type earth terminal block capable of accepting a cable size up to 6 mm2. shall be fixed to the base board adjacent to the cut-out. The terminal block may be incorporated within the cut-out.

Ballast units shall comply with IS 1534 and shall be drip-proof, totally enclosed, polyester filled, symmetrically wound type, silent in operation, and suitable for use on a 240 volt 50 Hz supply. Tappings shall be brought to suitable marked terminals to which lamp and supply connections can be made. Terminals shall be shrouded non-track type, and separate earth terminals shall be provided.

Capacitors shall comply with IS 1569 and shall be of the unfused type, totally enclosed and proofed against condensation and climatic conditions, complete with discharge resistor, with sealed-in PVC insulated cable tails. Capacitors shall be suitable for working with the lamps and associated equipment specified and shall correct the power factor to not less than 0.85 lagging. The capacitors shall be marked with the manufacturer's name, capacitance and working voltage. Ballasts and capacitors shall carry the ISI mark.

Wiring between the terminal block in the lantern and the components in the base of the pole shall be PVC insulated, PVC sheathed cable of 1000 V grade having a copper conductor of not less than 2.5 mm2 cross sectional area to IS 694. All cables shall be correctly colour coded. Unsupported lengths of wiring shall be kept to a minimum and taped such that they do not come into contact with components.

All metalwork other than current carrying parts shall be earthed.

Road lighting luminaries shall be die cast from aluminum alloy suitable for side entry spigot mounting. The luminaries shall be complete with polished aluminum reflector for use with the lamps and remotely mounted control gear. The impact resisting bowl shall be sealed to provide a totally weatherproof unit and hinged to facilitate revamping.

Discharge lamps shall carry a 6000 hour guarantee, and shall be controlled by ballasts and capacitors, as recommended by the lamp manufacturer. High pressure sodium discharge lamps shall be provided with an external ignitor unit.

4.3.7 Lighting Luminaries

All 'discharge' luminaries shall be provided with a capacitor for the purpose of power factor correction to a value in excess of 0.85 lagging.

Breakjoint rings or 'biscuit' rings of approved colour shall be provided by the Contractor for all suspended luminaries and fluorescent batten luminaries where the batten is of insufficient width to completely cover the conduit box and its associated clearance hole in the finished ceiling.

Heat resisting cables shall be installed as the final connection to all tungsten luminaries.

All flexible cords to be used in conjunction with lighting luminaries shall be white 3 core circular 300/500 volt grade PVC insulated and sheathed manufactured to IS 694. Conductors smaller than 0.75 mm2 cross sectional area shall not be used unless previously approved by the Engineer.

Fluorescent and incandescent luminaries shall be of the following types:

- A. Tubular fluorescent luminaries:
    - Reflection
    - Diffuser
- B. Incandescent type:
    - Reflection/Shade
    - Diffuser
    - Water proof
    - Bulk head

4.3.8 Lamps

Tungsten lamps shall be coiled coil pattern to IS 418 and IS 6702. Fluorescent lamps shall be manufactured to IS 2418. High pressure mercury lamps shall be manufactured to IS 9900. High pressure sodium lamps shall be manufactured to IS 9974.

Incandescent lamps shall have IEC type B22d caps. Tubular fluorescent lamps shall have bi-pin caps. Discharge lamps shall have type ES 40 caps (GES).

4.3.9 Lighting Switches

Lighting switches for domestic and office purposes shall comply with IS 3854. They shall be of approved manufacture with shuttered outlets.

4.3.10 Small Power Outlets

For domestic and office applications, 13 amp socket outlets which comply with IS 1293 shall be used. These shall be switched unless otherwise indicated and supplied with a plug fitted with a fuse rated according to IS 13703. The fuse shall suit the apparatus served.

Where cooker control units are installed, double pole switches of suitable rating shall be installed without a socket outlet.

Fused spur units shall be of approved manufacture, of the same type and finish as socket outlets installed. Fuses to IS 13703 shall be sized to suit the connected load.

4.3.11 Ceiling Fans

Propeller fans of the non-ducted ceiling mounting type together with their associated control units shall comply with IS 374 and IS 3588.

4.3.12 Conduits

Rigid conduit shall be super high impact heavy gauge PVC conduit (HIP) and PVC accessories complying in all respects with IS 9537 and IS 3419. Each length of conduit shall bear the manufacturer’s name or trademark and be smooth inside and out and free from imperfections.

20 mm diameter conduit shall have minimum 1.8 mm wall thickness; 25 mm diameter conduit shall have a minimum 1.9 mm wall thickness.

Flexible conduit shall be of the waterproof galvanized type or PVC wire-wound type with cadmium plated mild steel couplings.

4.3.13 Earth Electrodes

Earth electrodes shall be 38 mm diameter galvanized iron rods made up in sections to the required length. Couplings joining rods shall be silicone bronze aluminum counter bored and of sufficient length to cover the rod thread.

Earth plates shall be of a minimum size of 600 x 600 x 6 mm copper or galvanised iron.

4.4 Plant And Equipment

Plant, equipment, and tools for the execution of electrical installations shall be sufficient in number and capacity, in good working order, and in accordance with the requirements of the applicable safety regulations.

4.5 Construction and Workmanship

4.5.1 Regulations and Standards

The electrical installation shall comply with all relevant IS regulations, statutory instruments and regulations current at date of Bid (unless otherwise indicated.

The Contractor shall be responsible for complying with all local byelaws, supply authority and local authority requirements. It shall be the Contractor's responsibility to determine the existence of these requirements and to comply with them.

4.5.2 Cable Installation

Cables to lighting and small power circuits shall be of one of the following sizes unless indicated otherwise:

i) 1.5 mm2 single core PVC for circuits loaded less than 1 kW.
ii) 2.5 mm2 single core PVC for circuits loaded up to 3 kW.
(iii) 4 mm2/6 mm2 2 core PVC for circuits loaded above 3 kW
iv) 1.0 mm2 light duty multicore PVC for control circuits.

Cables shall be segregated into the following categories:

i) power (less than 1 000 V phase to phase)
ii) instrumentation/telemetry
iii) control
iv) Telecommunications.

Cables shall be laid in a manner such that any electrical interference between cables shall not have a detrimental effect on the life and operation of equipment installed within the installation. As a general rule the following minimum clearances shall be adhered to wherever practical.

	HV power (mm)	MV/LV power (mm)	Instrumentation Telemetry Control (mm)	Telecommunications (mm)
HV power	-	-	-	-
MV/LV power	300	-	-	-
Instrumentation/ telemetry/control	300	150	-	-
Telecommunications local area network	300	150	150	-

LV power cables may be bundled together where allowance is made for any derating factors.

Digital and analogue signals shall be segregated within junction boxes.

Cables shall be drawn into conduits simultaneously without twists. Cables bunched into circular groups shall have the appropriate de-rating factor applied in accordance with Appendix 9 of the IEE Regulations.

Cables shall be installed on the 'loop-in' principle, no joints or junction boxes being permitted. Single core cables in conduit shall have the line conductors looped at switches and the neutral conductors looped at lighting points. Multicore cables, shall have the line and neutral conductors looped at the lighting point.

Wiring shall not be looped at terminal blocks internal to lighting luminaries. For fluorescent or similar luminaries having internal terminal blocks, the fixed wiring shall terminate at the conduit box with tails taken into the fitting. The arrangement shall be such that the fittings and tails may be removed without causing the other lighting luminaries on the circuit to be disconnected.

Wiring to 13 A socket outlet circuits shall be ring wired throughout. Spur circuits shall be used only where specified.

(i) General

Cables shall be installed in such a way that the minimum bending radii are not reduced when installed or during installation. Cables shall not be installed in ambient temperatures below that recommended by the cable manufacturer.

Cables grouped together shall have insulation capable of withstanding the highest voltage present in the group.

(ii) Direct in Ground

Buried cable up to 600/1000 V shall have a minimum cover of 500 mm measured to the top of the highest cable. On crossing roadways the cable shall be run through a PVC-U duct of minimum diameter 100 mm with a minimum of 1000 mm cover and encased on all sides by 150 mm of concrete.

The bottom of the cable trench shall be freed of sharp stones and such like and 75 mm of sieved sand laid below the cable. After cable laying 75 mm of sieved sand shall be laid above the cable.

Interlocking cable protective covers, minimum 1 m long x 150 mm wide, marked `Danger -Electric Cable' in English, and Nepali shall be laid on top of the sieved sand. Covers shall extend the whole length of the cable trench and shall overlap cables by a minimum of 50 mm.

Warning tape shall be laid a minimum of 200 mm above the protective covers.

Cables are to be installed without tees or through joints unless otherwise approved by the Engineer. Single core cables are to be run in trefoil formation.

(iii) In Underground Ducts

Underground ducts shall be constructed of impact resistant PVC-U, glazed earthenware or concrete and laid at a minimum depth of 500 mm. Ducts shall be surrounded by at least 75 mm of sieved sand except at road crossings where they shall be 1 m deep and encased on all sides by concrete.

The Contractor shall ensure that sufficient draw-in points have been provided and that adequate room has been allowed for installation of cables. Drawstrings shall be provided in all ducts to enable additional cables to be installed when required.

Where cables pass in or out of any duct entries into or within buildings such entries, together with any spare ducts shall be sealed against the ingress of moisture by means of duct stoppers and bituminous compounds or other method approved by the Engineer. The stopper shall have a fire resistance of at least 30 minutes. Single core cables in trefoil formation shall pass through the same duct and shall not be separated.

(iv) Conduit

Particular care shall be taken with the storage of conduit. A rack shall be provided for this purpose to ensure that the finish is not defaced. Conduit which is allowed to spread across the floor when stored so that the surface finish becomes damaged by being walked over or similar shall be rejected and removed from site.

All conduits shall be of sufficient size to permit the easy withdrawal and replacement of cables at a later date, no conduit smaller than 20 mm shall be used.

A space factor of 40% shall not be exceeded. The tubing shall be perfectly smooth inside and out and free from flaws and imperfections of any kind. Both ends of every length of tubing shall be properly reamed with all sharp edges removed before erection.

All bends shall be formed using bending springs in complete accordance with the manufacturer's instructions, and without alteration to the conduit section. Bends may be formed cold but in severe weather it may be necessary to warm the conduit slightly at the point where the bend is to be made. The inside radius of any bend shall not be less than 8 times of outside diameter of the conduit.

All conduit boxes on to which lighting fittings are to be affixed shall be capable of withstanding a dead weight of 10 kg and shall be fixed using two screws and washers. No weight shall be taken by any suspended ceiling.

For conduit boxes, couplers and all items of equipment that require adhesives, the manufacturer’s recommended adhesive shall be used. Connection to square or rectangular boxes shall be made using female threaded sockets and male screwed bushes. On no account shall the conduit protrude into such items as switch boxes or socket boxes. Inspection bends, elbows, couplings and tees shall not be used.

Circular PVC boxes, having spout entries, shall be used at the termination of all lighting points and as draw-in boxes on long runs. For 20 mm conduits round boxes shall be used as draw-in points, but for 25 mm and larger conduits, rectangular boxes shall be used. In each case heavy quality lids shall be used and secured by brass screws.

Sufficient draw-in boxes shall be installed to permit the re-wiring of the installation and they shall be positioned to ensure that all boxes are in accessible positions. The Contractor shall check all proposed positions with the Engineer before installation. In the case of flush draw-in boxes the Contractor shall fit a joint ring or spacer ring to finished plaster level.

Generally not more than two bends or offsets or one coupling will be permitted without a suitable inspection accessory. Fish wires shall not be left in conduits after erection. The whole of the installation shall be arranged for a loop-in type of system with joints being carried out at switches, isolators, etc. Intermediate joints in the cable will only be allowed by arrangement with the Engineer. Where terminal blocks are necessary, they shall be of the porcelain type with brass pinching screws.

For entry into trunking and any item requiring holes to be cut, the method shall be by bell mouth bushes and sleeves. For entry into sheet metal boxes and any item complete with pre-cut holes, the method shall be by threaded female sockets and male screwed bushes.

Ends of conduits which are liable to be left open for any length of time during building operations shall be plugged to prevent the ingress of dirt, cement, etc. and covers, either temporary or permanent, shall be fitted on all boxes.

The conduits shall be completely assembled, fixed and swabbed out before wiring is commenced.

Generally, conduits shall not cross expansion joints of buildings, but where they cannot be installed in any other manner then a flexible conduit shall be used across the expansion joint. A total 150 mm movement shall be allowed.

The Contractor shall provide a typical installation method drawing for all conduit installations, when requested by the Engineer.

Where conduits are taken through walls and/or floors, the holes shall be made good with incombustible material.

All conduits to the telephone, TV and radio systems shall be installed with draw wires.

All conduits to lighting and small power systems shall be installed with a circuit protective conductor.

(a) Surface Installation

All surface work, work in ducts or ceiling voids, etc., shall be secured by means of heavy quality spacer bar saddles secured by screws driven into rawlplugs, or equivalent fiber, PVC, metal or compound types. The spacing of fixings shall not exceed 1.25 m for 20 mm, 25 mm and 32 mm conduit or less in hot temperatures. It should be noted that saddles are designed to be a sliding fit for PVC conduits and it is important to ensure that all fixings are sliding due to the requirement for expansion.

Due to the materials used in PVC conduits a rise in temperature of 25^0 C would cause an increase of approximately 6 mm in a 4 m length of conduit. Where long straight runs in excess of 4 m occur in conditions of varying temperature, expansion couplers must be used in accordance with the manufacturer's installation instructions. A draw wire must be installed in runs where expansion couplings are used.

An efficient means shall be adopted to provide for the drainage of condensation and the runs shall be properly ventilated. All surface conduit runs shall be marked out for approval by the Engineer before the installation is carried out. Where large multiple parallel conduit runs would occur, use may be made of galvanized cable trunking.

(b) Concealed Installation

If the floor of any building is of solid concrete construction, conduits shall not be run in the screed rising to the outlets, etc., unless specifically instructed elsewhere in this Specification.

Where, due to the type of construction, it is necessary to cast conduits into concrete to serve lighting points, backed outlet boxes shall be used, using female threaded sockets and male screwed bushes, with the conduit installed in such a manner as to be self draining in accordance with the IEE Regulations.

Concealed conduits shall be securely fixed to prevent movement before laying of screeds, floating of plaster, casting of columns or other building operations necessary after the conduit installation. Crampets or similar fixings shall be used for attaching the conduit to blockwork, etc. Building nails will not be accepted.

At least 15 mm cover shall be allowed for finishes over the conduit. Where this cover cannot be maintained then expanded metal shall be fitted with the conduit. Conduit cast into reinforced concrete floors shall be fixed to the steel reinforcing with binding wire and the conduit boxes filled with expanded polystyrene or enclosed in a plastic bag to prevent the ingress of concrete when poured. Where possible, the conduit boxes shall be fixed to shuttering to give a flush finish.

Conduit installed in voids, false ceilings, and other concealed routes shall be installed as specified for the surface conduits. Wiring shall be carried out after the false ceiling or permanent ducts have been completed. Conduit installed in floors shall be sealed against ingress of moisture.

The conduit installation shall be inspected by the Engineer before the building operation conceals the work.

(c) Flexible Conduit

Flexible conduit shall be of the waterproof galvanized type or PVC wire-wound type with cadmium plated mild steel couplings. Lengths of flexible conduits shall be sufficient to permit withdrawal, adjustment or movement of the equipment to which it is attached and shall have a minimum length of 300 mm. Flexible conduit shall not be used as a means of providing earth continuity. A single earth conductor of adequate size shall be installed external to the conduit complete with earth terminations.

Where conversion from rigid conduit to flexible metallic conduit is to be made, the rigid conduit shall terminate in a through type box and the flexible conduit shall extend from this box to the equipment. The earth continuity cable shall be secured to the box and to the piece of equipment by properly designed earthing screws. The use of lid facing screws, etc., will not be permitted. Adapters shall incorporate a grub screw or a gland to prevent the flexible conduit becoming loose.

(d) Clipped Direct

All cable hangers, clips, cleats and saddles shall be of an approved type and appropriate to the type and size of cable installed.

Their spacing shall be such as to ensure a neat appearance and prevent sagging of the cables at all times during their installed life.

(e) In Internal Floor Trenches

In shallow trenches used for electrical services only, cables may be laid in a neat and orderly manner on the floor of the trench. One layer only shall be allowed. Additional cables shall be installed on the walls of the trench in an approved manner.

Where the trench is shared by other services, cables shall be installed on the walls of the trench in an approved manner.

4.5.3 Distribution Boards

Where boards are fixed on steelwork or concrete columns, reinforced concrete or brick walls, they shall be mounted on the surface with conduits and/or trunking rising vertically from them.

Where boards are fixed on plaster finished walls, they shall be surface mounted on the finished face of the plaster with an adaptable galvanized metal box (minimum size 150 x 150 x 75 mm), recessed into the wall at the back of each board.

The adaptable box and fuse board shall be electrically and mechanically linked together, but independently fixed on the wall by bolts and expansion shields.

4.5.4 Small Power Outlets

Low voltage socket outlets for small power applications shall be fixed at a height of 300 mm from the finished floor level to the horizontal centre line of the switch.

Where recessed spur units control appliances such as incinerators, fans, water heaters, etc. a conduit shall be taken from the spur outlet box to an outlet box located immediately adjacent to the appliance in order to conceal the final connection to the appliances.

Wiring of spur units shall be carried out on 'ring' or 'radial' circuits as specified and shall conform to IEE Regulations.

4.5.5 Lighting Switches

Lighting switches of a single pole type shall be connected to the phase conductor. Switches shall be fixed at a height of 1410 mm from the finished floor level to the horizontal centre line of the switch. Where grouped switches are used, they shall be mounted in multi-gang boxes with plates.

All lighting switches shall be suitable for the power supply to which they are connected.

Lighting switches shall be mounted in separate boxes for separate circuits derived from different distribution boards.

Where multi-gang switches are supplied from opposite phases, phase barriers and warning labels shall be provided. Single gang switches connected to opposite phase polarity shall, in no case, be positioned less than 2 m apart.

4.5.6 Lighting Luminaries

The Contractor shall check final positions of all lighting points with the Engineer and obtain his approval before installation commences.

All lighting luminaries shall be mounted and located in such positions as to be readily accessible for maintenance purposes from ladders or steps.

Fixing and suspension plates shall be suitable for direct connection to conduit boxes or as otherwise specified. Luminaries having conduit suspensions shall be provided with earthed pattern ball and socket back plates. The rigid type of backplate will not be accepted. Tubular fluorescent luminaries shall have at least two separate fixings at the manufacturers recommended spacings.

4.5.7 Earthing and Bonding

The earthing system shall comply with Clause 67 of the Indian Electricity Rules.

All low voltage systems shall be properly and efficiently earthed in accordance with BS/IS 3043.

The Contractor shall ensure that complete earth continuity exists throughout the system and that the resistance of the earth parts complies with the IEE Regulations.

Each control room building shall have a main earth bar consisting of a hard drawn high conductivity copper bar of at least 150 x 25 x 6 mm, mounted on stand-off insulators. Connections to this bar shall be by brass bolts, flat washers, nuts and locknuts.

The system neutral, where applicable, earth bars of all switchboards and all earthing terminals of all transformers shall be securely bonded to the main earth bar. For bonding purposes, a galvanised iron earthing strip may be used, at least 25 x 6 mm in cross section.

Metal sheaths and armouring of all incoming, outgoing and interconnecting sub-station cables shall be securely bonded to the main earth bar. The sizes of bonding conductors shall be in accordance with IS 3043. Bonding conductors may be connected to the earth bar of the switchboard or other apparatus served.

All cables and conduits used throughout the installation shall be securely bonded to the associated equipment, and earthing straps shall be fitted. To facilitate such bonding, all cable glands shall be supplied with substantial armour clamps, having additional earthing lugs. Compression glands shall be fitted with earth tags and brass set screws.

Earthing terminals of every distribution board, isolator or switchgear item or other apparatus shall be securely bonded through 14 SWG copper conductor or 25 x 6 mm galvanised iron strip or by connecting the bonding conductors to the earth bar of the apparatus.

All electric motors and other items of electrical equipment within the Contract shall be bonded to earth by flexible copper cables, braids, or conductors of not less than 6mm2 equivalent size connected to the armouring of armoured cables unless stated otherwise.

All bonding of motors shall be to the stator frame of the motor. Bonding to end-shields, terminal boxes etc. is not acceptable.

Incoming gas, water, piped services and ducting shall be bonded in accordance with the requirements of IEE Regulation 413-2. The minimum size of the bonding conductor shall be 6mm2. Copper strip of green and yellow PVC insulated single core copper cables shall be used.

Earth clamps shall comply with IS 3043. In dry areas tinned brass clamps shall be installed. In areas where dampness is to be expected phosphor bronze clamps shall be used.

Where electrical components are mounted on custom built frames, each of the above earth bonds shall include the metalwork of the support structure.

Conduit or trunking shall not be used as the sole circuit protective conductor.

4.5.8 Earth Electrodes

Where connections to the mass of earth are specified for lightning protection or system earthing, the Contractor shall supply, install and test the connection in accordance with the following Clauses.

The Contractor shall, at the commencement of the Contract, carry out soil resistivity tests over the area of the Site indicated on the Drawings. A minimum of two tests of different spacings shall be carried out at each test location.

The results of these tests shall be used to determine the type and number of rods, plates or strips required.

The top end of rods shall be terminated at least 300 mm below finished ground level. Where rods are installed in areas accessible to persons or animals this depth shall be increased.

The position of earth rods shall be indicated by pre-cast concrete inspection pits.

Where multiple earth rods are installed, interconnections shall be made using bare galvanized iron strips. The strip shall be buried at a minimum of 600 mm below finished ground level.

The earth electrodes shall be connected to the main earth bar through test links. The earth electrode installation shall be tested in the presence of the Engineer when disconnected from the main system, using the method shown in Appendix 15 of the IEE Regulations.

Where the earth connection forms a link between a high voltage system and a low voltage system the earth connection resistance to earth when disconnected from the earth bar shall not exceed one ohm.

Where earth plates are required to carry a heavy system fault current these shall be buried at a depth of at least 2 m. Connection of copper tapes to earth plates shall be brazed and protected against corrosion.

Marker posts and plates shall be provided to mark the position of all electrodes and buried conductors.

4.5.9 Site Lighting

The installation shall be in accordance with layouts with exact positions of control equipment, poles and lighting points determined on site to the approval of the Engineer, prior to starting erection.

The equipment shall be supplied in new and unused condition, having been tested in the course of manufacture and stored in weatherproof accommodation on site.

The Contractor shall carry out all unloading, slinging, stacking, erection and fixing of poles and brackets in accordance with the manufacturer's instructions.

Excavation for poles shall not be by mechanical means unless agreed by the Engineer. The bottom portion of pole shall be fixed in a solid precast concrete block not less than 450 mm square for the full depth of the block. Final adjustment shall be carried out using aluminum or hardwood wedges and the remaining annulus packed with sand. A cable duct shall pass through the concrete block into the column cable entry. Precast blocks shall be supplied and installed by the Contractor. The cable entry slot shall be temporarily plugged to ensure that it is maintained free from material during the backfilling process. The block shall be bedded on a 100 mm thick concrete base.

Poles shall be erected in a truly vertical position. The Contractor shall be responsible, until the expiry of the Defect Liability Period for correcting the alignment of any column which he has erected which has departed from the vertical position, excepting where it is established that such departure is due to an event outside the control of the Contractor.

Poles shall have their lanterns fixed and aligned in accordance with the manufacturer's instructions to prevent rotation in service. All joints shall be resistant to the ingress of moisture into the column and lantern.

4.6 Test and Acceptance

Tests shall be carried out on site and witnessed by the Engineer or his representatives as follows for LV cables:-

(i) Insulation resistance at 500 V dc shall not be less than 0.5 mega ohm.

(ii) Earth continuity and earth resistance.

(iii) Phasing and polarity (every fuse and single pole control and protective device shall be connected in phase conductors only).

4.7 Measurement and Payment

Work shall be measured according to types as an all inclusive rate or as specified on the BOQ.

5 PLUMBING

5.1 Scope

These Specifications cover the general requirements for plumbing services including fixing of pipes, fittings and sanitary appliances in buildings and general requirements external (outside buildings) water supply and sewerage works.

For the purpose of water supply arrangements inside buildings, the work can be considered as to start from ferrules and service pipes.

All the items under this group shall conform to the detailed Specifications given for each of the items, in addition to the bye-laws of the local bodies within whose jurisdiction the items are executed. Where the bye-laws of the local bodies differ from the detailed specification for an item, the bye-laws shall override these Specifications.

5.2 Interpretations

5.2.1 Supporting Specifications

The following specifications shall, inter alia, form part of and shall be read in conjunction with this specification:

a) 1 Item of General Application
b) 2.1 Site Clearance
c) 2.2 Earthworks
d) 2.3 Concrete Works
e) 2.4 Brickworks
f) 2.4 Cement Plaster Works

5.2.2 Application

This specification contains clauses that are generally applicable to plumbing and associated work.

5.2.3 Applicable codes

All materials used in the construction of any of the works or any of the appliances shall conform to the relevant Indian Standards where applicable. Where no such standards exit, the materials shall be of the quality and workmanship acceptable to Authority, and shall be open to inspection at the manufacturer's works before dispatch.

The following Indian Standard codes, unless otherwise specified herein, shall be applicable. In all cases, the latest revision of the codes shall be referred to:

IS:458	Concrete pipes (with and without reinforcement)
IS:651	Salt Glazed stoneware pipes and fittings
IS:771 (Part I to IV)	Glazed fireclay Sanitary appliances
IS:772	CI Sanitary Appliances
IS:774	Flushing Cisterns For W/C And Urinals
IS:775	CI Brackets And Supports For Wash Basins And Sinks
IS:778	Gunmetal Gate, Globe and Check valves for general purposes
IS:779	Water Meters (Domestic Type)
IS:781	Sand-cast brass screw down bib and stop taps for water services
IS:782	Caulking lead
IS:783	Code of practice for laying of concrete pipes
IS:784	Prestressed concrete pipes
IS:804	Rectangular prestressed steel tanks
IS:1200 (Part XVI)	Method of measurement for Building and Civil Engineering works - Laying of water, sewer lines including appurtenant items
IS:1239	Mild steel tubes, tubular and other wrought steel fittings
IS:1536	Centrifugally cast (spun) iron pressure pipes for water, gas and sewage
IS:1538 (Part I to XIII)	Cast Iron fittings for pressure pipes for water, gas and sewage
IS:1545	Solid drawn copper alloy tubes
IS:1700	Drinking fountains
IS:1703	Ball valves (horizontal plunzer type) including floats for water supply purposes
IS:1711	Method for simple torsion testing of steel wire
IS:1729	Nahani Trap

IS:1742	Code of practice for building drainage
IS:1795	Pillar Taps
IS:1916	Steel cylinder reinforced concrete pipes
IS:2064	Code of practice for selection, installation and maintenance of sanitary appliances
IS:2065	Code of Practice for Water Supply in buildings
IS:2104	Water meter boxes (domestic type)
IS:2326	Automatic Flushing Cisterns For Urinals
IS:2379	Color code for identification of pipe lines
IS:2401	Code of practice for selection, installation and maintenance of domestic water meters
IS:2470	Code of practice for design and construction of septic tanks
IS:2548	Plastic water closet seats and covers
IS:2556 (Part I to XV)	Vitreous sanitary appliances
IS:2692	Ferrules for water services
IS:3076	LDPE pipes for Potable Water Supplies
IS:3114	Code of practice for laying of cast iron pipes
IS:3438	Silvered glass mirror for general purpose
IS:3589	Electrically welded steel pipes for water, gas and sewage (200 to 2000 mm nominal diameter)
IS:3950	Surface boxes for sluice valves
IS:4111	Code of practice for ancillary structures in sewerage system
IS:4127	Code of practice for laying of Glazed stoneware pipes
IS:4827	Tower Rail
IS:5329	Code of practice for sanitary pipe work above ground for buildings
IS:5455	Cast Iron steps for manholes
IS:5822	Code of practice for laying of welded steel pipes for water supply
IS:6295	Code of practice for water supply and drainage in high altitudes and or sub-zero temperature regions
IS:7231	Plastic Flushing Cisterns For W/C And Urinals
IS:10067	Material constants in building works

Other IS codes not specifically mentioned herein but pertaining to the work of internal water supply form part of these Specifications.

5.3 General Requirements

The following general requirements are applicable, though these are not explicitly specified / stated in the Drawings or designs given by the Engineer.

All work shall be done with skilled workmen experienced in the trade. All water supply installation work shall be carried through licensed plumbers.

All work shall be adequately protected, to the satisfaction of the Engineer, so that the whole work is free from damage throughout the period of construction upto the time of handing over.

No work shall be covered without the approval of the Engineer.

The Contractor shall be responsible for coordinating this work with works of other trades sufficiently ahead of time to avoid unnecessary hold-ups. Hangers, sleeves, recesses etc., shall be left in time as the work proceeds.

The Contractor shall submit as directed by the Engineer, samples, shop Drawings, manufacturer's Drawings, equipment characteristics and capacity data etc., of all equipment, accessories, devices etc., that he proposes to use in the installation, to the Engineer for approval.

Any damage caused to the building or to electric, sanitary, water supply or other installations etc., therein either due to negligence on the part of the Contractor, or due to actual requirements of the work, shall be made good and the building or the installations shall be restored to its original condition by the Contractor.

It is most important to ensure that the wholesome water supply provided for drinking and culinary purposes, is in no way liable to contamination from any less satisfactory water. There shall, therefore, be no cross connection whatsoever between a pipe or fitting for conveying or containing wholesome water and a pipe or fitting for conveying or containing

impure water or water liable to contamination or of uncertain quality of water which has been used for any purpose. The provision of reflux or non-return valves or closed and sealed valves shall not be construed a permissible substitute for complete absence of cross-connection.

No piping shall be laid or fixed so as to pass into, through or adjoining any sewer, scour outlet or drain or any manhole connected therewith nor through any ashpit or manure-pit or any material of such nature that would be likely to cause undue deterioration of the pipe, except as permitted in the next Clause.

Where the laying of any pipe through fouled or corrosive soil or pervious material is unavoidable, the piping shall be properly protected from contact with such soil or material by being carried through an exterior cast iron tube or by some other suitable means approved by the Engineer. Any piping or fitting laid or fixed, which does not comply with the above requirements, shall be removed and relaid in conformity with the above requirements and to the satisfaction of the Engineer.

Where lines are to be laid in close proximity to electric cables or in corrosive soils, adequate precautions should be taken to avoid electrical accidents and corrosion.

To reduce the frictional losses, piping shall be as smooth as possible inside. Methods of jointing shall be such as to avoid internal roughness and projection at the joints, whether of the jointing material or otherwise.

Change in diameter and in direction shall preferably be gradual rather than abrupt to avoid undue loss of head. No bend or curve in piping shall be made which is likely to materially diminish or alter the cross-section.

All pipe work shall be so laid or fixed, and maintained as to be and to remain completely watertight, thereby avoiding waste of water, damage to property and the risk of contamination of the water conveyed.

Underground piping shall be laid at such a depth that it is unlikely to be damaged by frost or traffic loads and vibrations. It shall not be laid in ground liable to subsidence, but where such ground cannot be avoided, special precautions shall be taken to avoid damage to the piping. Where piping has to be laid across recently disturbed ground, the ground shall be thoroughly consolidated so as to provide a continuous and even support.

The bottom of water service pipe, at all points, shall be at least 30 cm above the top of the sewer line at its highest point.

Water for drinking or for culinary purposes as far as possible shall be on branch pipes connected directly to the service.

In flats and tenements supplied by a common service pipe a stop tap shall be fixed to control the branch each separately occupied part. In large buildings a sufficient number of stop valves shall be fixed on branch pipes, and to control groups or ball valves and draw off taps, so as to minimize interruption of the supply during repairs, all such stop valves shall be fixed in accessible positions and properly protected from being tampered with, they may be of the gate type to minimize loss of head of friction.

Where the service pipe is of diameter less than 50 mm the stop valves shall be of the screw down type and shall have loose washer plates to act as non-return valves. Other stop valves in the service line may be of the gate type.

Service pipes shall be so constructed as to avoid air-locks, so that all piping and fittings above ground can be completely emptied of water to facilitate repairs. There shall be draining taps or draw-off taps (not underground) at the lowest points, from which the piping shall rise continuously to draw-off taps, ball valves, cisterns, or vents (where provided at the high points).

Piping shall be confined, as far as possible, to rooms where appliances are fixed, it shall have easy bends, and where quietness is particularly desired, holder bats or clamps shall be insulated from the piping by suitable pads.

The rising pipe to the storage cistern, if any, of any feed cistern shall be taken as directly as possible to the cistern and shall be fixed away from windows or ventilators.

Piping shall not be buried in walls or solid floors. Where unavoidable, piping may be buried for short distance provided that adequate protection is given against damage and that no joints are buried. If piping is laid in ducts or chases, these shall be roomy enough to facilitate repairs and shall be so constructed as to prevent the entry of vermin. To facilitate removal of pipe casing, floor boards covering piping shall be fixed with screws or bolts.

When it is necessary for a pipe to pass through a wall or floor, sleeves shall be fixed therein for reception of the pipe and to allow freedom for expansion and contraction and other movement. Piping laid in wooden floors shall, where possible, be parallel with the joist.

Where storage tanks are provided to meet over all requirements of water, connection of service pipe with any distributing pipe shall not be permitted except one direct connection for culinary or drinking requirements.

No service pipe shall be connected to any water closet or urinal. All such supplies shall be from flushing cisterns which shall be supplied form storage tank.

No service or supply pipe shall be connected directly to any hot water system or to any apparatus used for heating other than through a feed cistern thereof.

The service pipe shall pass into or beneath the building at a depth below the external ground level of not less than 0.75 m (provided the foundation is deeper than 0.75 m) and at its point of entry through the structure, it should be accommodated in a sleeve which should have previously been solidly built in. The space between the pipe and the sleeve shall be filled with bituminous or other suitable material for a minimum length of 15 cm at both ends.

5.4 Pipes and fittings

In order to supply water inside and premises of the building, piping arrangements of Galvanized Iron (GI) pipes, medium class, conforming to IS: 1239, shall be used. For sewerage works uPVC or Reinforced Cement Concrete (RCC) pipes shall be used as specified. Specifications for laying of these pipes are given in Clauses 3 .

5.5 Material, fittings, appliances and structures for water supply

5.5.1 General

All pipes, fittings and appliances shall be free from cracks and other flaws before fixing and shall be undamaged in all respects during and after fixing. Any damages shall have to be rectified satisfactorily.

All the pipes, fittings and appliances shall be thoroughly cleaned before fixing and particular care shall be taken to see that no extraneous material gets into them during fixing. All items required for ensuring leak proof jointing and efficient functioning of the pipes and appliances shall be carried out without extra claim. The pipes shall be carefully cleared of all foreign matter before being laid. They shall be thoroughly brushed out internally with a well-fitting hard brush, and after laying the open end shall be temporarily plugged to prevent ingress of water, soil etc., precaution shall be taken to prevent floatation of the plugged pipes.

All cutting and waste of pipes involved in fitting them shall be included in the rate.

All diameters of pipes shall be the diameters of the inside bore. All the pipes, appliances, fixtures and all other materials to be used shall be new and of good quality. Pipes and fittings

5.5.2 Fixtures and Appliances

6.5.2.1 Brass or Gunmetal water fittings

All brass or gunmetal fittings shall be of heavy quality and of approved manufacture and pattern. The fittings shall conform to IS: 778 and IS: 781. A sample of fittings shall be got approved by the Engineer and all fittings shall be provided according to the approved samples.

The standard size of bronze or gun metal fittings shall be designated by the nominal bore of the pipe outlet to which the fittings are attached. A sample of each kind of fittings shall be got approved from the Engineer and all supplies made according to the approved samples.

All cast fittings shall be sound and free from laps, blow holes and pittings. Both internal and external surfaces shall be clean, smooth and free from sand etc. Burning, plugging stopping or patching of the casting shall not be permissible. The bodies, bonnet, spindles and other parts shall be truly machined so that when assembled the parts shall be axial, parallel and cylindrical with surfaces smoothly finished. The area of the water way of the fittings shall not be less than the area of the nominal bore. Chromium plating wherever specified shall be of 0.3 micron thick, conforming to IS:4827. The chromium shall never be deposited on brass unless a heavy coating of nickel is interposed. In the case of iron fittings, a thick coat of copper shall first be applied, then one coat of nickel and finally the coat of chromium shall be applied. In finish and appearance the plated article, when inspected, shall be free from plating defects such as blisters, pits, roughness and unplated areas and shall not be stained or discoloured. Before fitting is plated the washer plate shall be removed from the fittings, the gland packing shall be protected from the plating solution.

6.5.2.2 Bib cock (tap)s and stop cock (tap)

Bib cock and stop cock shall be of specified size and shall be of screw down type and shall conform to IS 781. The handle shall be either crutch or butterfly type, securely fixed to the spindle. Valve shall be of the loose leather seated pattern. The cocks (taps) shall open in anti-clockwise direction.

The bib cock and stop cock shall be polished bright. The minimum finished weights of bib tap and stop tap shall be as specified in the following table:

Size (mm)	Minimum finished weight	
	Bib tap (kg)	Stop tap (kg)
8	0.25	0.25
10	0.30	0.35

15	0.40	0.40
20	0.75	0.75

6.5.2.3 Screw Down Wheeled Stop Tap

The item shall conform to the Specifications covered in Clause 6.5.2.2 in all respects except that it shall have an operating wheel. The material of the wheeled stop valve shall be gun metal or brass as specified in the item.

6.5.2.4 Self closing taps and other special fittings

Self closing taps and other special fittings of approved makes are to be used on direct pipes and distributing pipes from tanks. Self-closing taps shall be of non-concussion type and shall comply with IS: 1711.

6.5.2.5 Valves for Plumbing

6.5.2.5.1 Wheel Valves (Globe valves)

The wheel valves shall be of size as specified and conforming to IS: 778 (Globe Valves).

6.5.2.5.2 Gate Valves

The gate valve shall be of size as specified and conforming to IS: 778.

6.5.2.5.3 Non-Return valve (Brass)

The valves shall be of quality approved by the Engineer and shall generally conform to IS: 778. Weights of these valves shall be as prescribed in the following table with a tolerance of 5 percent.

Diameter (mm)	Weight (kg)	
	Horizontal type	Vertical type
15	0.30	0.25
20	0.55	0.25
25	0.90	0.75

6.5.2.5.4 Non-Return valve (Gunmetal)

The valves shall be of quality approved by the Engineer and shall generally conform to IS: 778.

6.5.2.5.5 Float / Ball valves

The float valves or ball valves shall be of specified size as per Specification conforming to IS: 1703. The valve shall be of Brass or Gunmetal of specified size conforming to IS: 1703. The valve shall be of following two classes:

- High Pressure (HP) for use on mains having pressure of 1.75 kg/cm^2 and above. These shall remain closed at a test pressure of 10.5 kg/cm2.
- Low Pressure (LP) for use on mains having a pressure up to 1.75 kg/cm^2. These shall remain closed at a test pressure of 3.5 kg/cm2.

The ball valves shall be of the nominal sizes 15 mm, 20 mm and 25 mm. The nominal size shall correspond with the nominal bore of the inlet shanks. Polyethylene floats shall conform to IS 9762. These valves shall be of the following dimensions and weights:

Sr. No.	Item	Nominal Size of valve (mm)		
		15	20	25
1.	Diameter of Spherical float (mm)			
	High pressure	127	152	203
	Low pressure	114	127	178
2.	Minimum weight of ball valve including back nut, body and piston	283	446	823

6.5.2.5.6 Landing Valves

Landing valves shall be of the specified size and class and shall in all respects conform to the requirements of IS: 5290, type B.

6.5.2.5.7 Full Way Valve (Brass)

The valve shall be of brass fitted with a cast iron wheel and shall be of gate valve type conforming to IS:780, opening full way and of the size as specified. The valve shall be of best quality as approved by the Engineer.

6.5.3 Water Storage tanks on terraces

These tanks shall of HDPE circular in shape of required capacity and shall be as per approved by the Engineer and as per drawing Drawings.

For inlet, outlet and other connections fully threaded GI connections with hexagonal check nuts and washers on either side of the tank wall shall be provided. Holes for threaded connections shall be drilled and not punched. Pipes entering / leaving the tank shall be provided with unions and suitably supported on a firm basis to avoid damage to the tank walls. No separate payment shall be done for fixing of inlet, outlet, washout arrangement and associate work.

6.5.4 Underground Water Storage Tanks

Underground Storage tanks shall be of RCC, as per the Specifications given for RCC storage tanks The following requirements shall also be complied with:

- The tank shall project at least 30 cm above the highest flood level. Where this is not possible the manhole cover shall be raised 30 cm above the highest flood level of the locality or ground level whichever is higher.
- The construction of the tank shall be such as to provide for the draining of the tank when necessary and water shall not be allowed to collect round about the tank.
- The tank shall be perfectly watertight.
- The inner surface of the tank shall be rendered smooth as far as possible.
- The top of the tank shall be so leveled as to prevent accumulation of water thereon.
- The tank shall have complete cement concrete cover leaving a manhole opening provided with a properly fitting mosquito-proof hinged cast iron cover fitted with a leak proof cast iron frame. Where tank is of a large size, adequate number of manholes shall be provided.
- No gap shall be allowed to remain round the suction pipe and arrangement shall be provided for proper discharge of spill water from the electric pump by connecting the pump cabin to the water drain, or by providing a small hole which will enable the water to flow out

The overflow pipes or vent shafts, if provided, shall have a wire gauge cover of 1.5 mm mesh properly screwed tightly to the opening.

6.5.5 Fittings and accessories for RCC Water Reservoirs

Where necessary, the pipes etc., shall be embedded during the casting of concrete. Where not so necessary in the opinion of the Engineer, holes may be left while casting of the concrete and the accessories fixed later. All these holes shall be made good and waterproofed after fixing of the accessories. The frame of the manhole shall be embedded into the concrete while casting.

The following fittings and accessories are included under this item as given elsewhere:

- Ball cock of the diameter of the supply pipe.
- Galvanized iron overflow pipe with mosquito proof coupling.
- Required number of 45 cm diameter manholes with cover and frame,
- Connecting galvanised iron pipes,
- 45 cm wide mild steel ladder of 40 mm x 6 mm mild steel flat stringers and stops of 20 mm diameter mild steel bars,

The intake and outtake pipes shall be as provided separately and shall not be included in this item.

6.6 Sanitary fittings and appliances

6.6.1 General

All porcelain sanitary ware shall be of approved make. All fittings shall be of first quality, free from warps, cracks and glazing defects. All sanitary ware, fittings and fixtures shall be as shown in Drawings and as described in detail in Bill of Quantities.

6.6.2 Protection

Fixtures shall be protected throughout the progress of the work from damage. Special care shall be taken to prevent damage and scratching of chromium plated fittings. Tool marks on chromium fixtures etc., shall not be accepted.

All fixtures shall be fixed with chromium plated brass screws with washers wherever necessary. Protective paper on fixtures shall be removed with hot water only at the final completion of work.

6.6.3 Workmanship

All sanitary ware shall be fixed in a neat workmanlike manner, true to level and plumb. Manufacturer's instructions shall be followed closely regarding installation and commissioning.

6.6.4 Testing

When the installation has been completed to the satisfaction of the Engineer, it shall be tested in the following manner:

- The entire system shall be slowly filled with water, allowing any trapped air to escape.
- When all outlets are closed the system shall be checked for water tightness.
- Each outlet shall then be checked for rate of flow and correct operations.

6.6.5 Bath, Lavatory and Mixing Taps

Bath, lavatory and mixing taps shall generally comply with the requirements specified for bib taps in Clause 6.5.2.2. Combination taps, mixing valves or blenders shall conform to IS : 1701. For mixing hot and cold water and discharging the mixture through a single outlet shall be fed with both hot water and cold water under pressure only from cisterns at the same level or from the same cistern.

6.6.6 Wash basins

The item pertains to the provision and fixing of wash basin of the specified size including all necessary fixtures and pipe connections upto the outside face of the wall.

The basin shall be fixed and supported on a pair of rolled steel or cast iron cantilever brackets embedded in wall or fixed to wall with wooden cleats and screws. The height of the top of the basin from the floor shall be 75 cm unless other heights are ordered by the Engineer. All the pipe connections shall be made as shown on the plan or as found necessary and ordered by the Engineer for the item. Chromium plated brass screw down stop tap shall be fixed on the supply pipe. The pipe connections shall conform to IS: 1742. The waste pipe shall be provided with a C.P. Brass bottle trap. All the exposed pipes and brackets shall be painted with one coat of red lead and two coats of good oil paint of approved shade.

Wash basins shall be of white vitreous china conforming to IS: 2556 (Part -I) and IS: 2556 (Part IV). Wash basins either of flat back or angle back as specified shall be of one piece construction, including a combined over-flow. All internal angles shall be designed so as to facilitate cleaning. Each basin shall have a rim on all sides, except sides in contact with the walls and shall have a skirting at the back. Basins shall be provided with single or double tap holes as specified. The tap holes shall be 28 mm square or 30 mm round or 25 mm round for pop up hole. A suitable tap hole button shall be supplied if one tap hole is not required in installation. Each basin shall have circular waste hole to which the interior of basin shall drain. The waste hole shall be either rebated or bevelled internally with 65 mm diameter at top. Each basin shall be provided with non-ferrous 32 mm waste fitting. Stud slots to receive the brackets on the underside of the wash basin shall be suitable for a bracket with stud not exceeding 13 mm diameter, 5 mm high and 305 mm from the back of basin to the centre of the stud. The stud slots shall be of depth sufficient to take 5 mm stud. Every basin shall have an integral soap holder recess or recesses, which shall fully drain into the bowl. A slot type of overflow having an area of not less than 5 cm^2 shall be provided and shall be so designed as to facilitate cleaning of the overflow.

Wash basins shall be enumerated. Rate shall include the cost of all the materials and labour involved in all the operations described above.

6.6.7 Mirror

The mirror shall be of superior sheet glass with edges rounded off or bevelled, as specified. It shall be uniformly silver plated at the back and shall be free from silvering defects and with marine plywood back. Mirror shall conform to the Specifications of IS:3438.

Mirror shall be fixed in position by means of 4 Chromium Plated (C.P) brass screws and C.P brass washers, over rubber washers and wooden plugs firmly embedded in walls. C.P brass clamps with C.P brass screws may be an alternative method of fixing, where so directed. Unless specified otherwise the longer side shall be fixed horizontally.

The item, if measured separately, will be by number. It may be included in other items it so specified in BOQ.

6.6.8 Sink

Kitchen sink shall be provided at the location shown in the Drawing and as per the size mentioned.

Kitchen sink shall be of white glazed fire clay conforming to IS 771 (part II) and shall have combined overflow of weir type and their inverts shall be 30 mm below the top edge. Each sink shall be provided with a non-ferrous 50 mm diameter waste fitting. The waste fitting shall be of brass with chromium plated (CP).

The sink shall be provided with 40 mm CP brass union. CI brackets for supporting sink shall conform to IS:775. Installation of sink shall consist of assembly of sink C.I brackets, union and GI waste pipe. The sink shall be supported on CI cantilever brackets, embedded in cement concrete (1:2:4) block of size 100 X 75 X 150 mm. Brackets shall be fixed in position before the dado work is done. The CP brass union shall be connected to 40 mm nominal bore GI waste pipe which shall discharge into a floor trap. The height of front edge of sink from the floor level shall be 80 cm. This item shall be measured by number including all items stated above and shall include cost of all fixing material.

Sinks shall be enumerated. Rate shall include the cost of all the materials (bottle trap, waste pipe, washers, CI brackets, unions, other fittings and etc) and labour involved in all the operations described above.

6.6.9 Floor Trap

Floor Traps shall be of CI and self cleaning and deep water seal type with a 50 mm water seal. It shall have a 100 mm diameter grating. These shall be fixed in cement concrete blocks 1:2:4, to the required level and position. The gratings shall be got approved before use in work.

6.6.10 Water closet

6.6.10.1 Orissa Pattern Water Closet

Squatting pans shall be of white vitreous china conforming to IS: 2556 (Part-I) for general requirements and IS: 2556 (Part-III) for Orissa pattern water closet

This item pertains to provision and fixing of Orissa type white glazed earthenware Water Closet pan of specified dimensions with cast iron high level flushing cistern of 12.5 litres capacity, and other accessories and necessary pipe connections upto the soil and vent pipes fixed on the outside of walls.

Each pan shall have an integral flushing rim of suitable type. It shall also have art inlet or supply horn for connecting the flush pipes. The flushing rim and inlet shall be of the self draining type. It shall have weep hole at the flushing inlet to the pan. The flushing inlet shall be in the front unless otherwise specified or ordered by the Engineer The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and the surface shall be uniform and smooth to enable easy and quick disposal while flushing. The exterior surface of the outlet below the flange shall be an unglazed surface which shall have grooves at right angles to the axis of the outlet. In all cases a pan shall be provided with a (100 mm) S.C.I. trap with ‘P’ or ‘S’ type with approximately 50 mm water seal and 50 mm diameter vent horn, where required by the Engineer.

The pan shall be placed into position with the trap joined in cement mortar 1:1 and the connecting pipes duly connected including the lead pipe from the flushing cistern. The jointing of various pipes shall conform to IS: 1742.

The jointing of cast iron pipes shall be with 1:1 cement mortar with hemp yarn caulking.

The pan shall be sunk into the floor and embedded in a cushion of average 15 cm thick cement concrete 1:5:10 (1 cement : 5 fine and : 10 graded brick ballast 40 mm nominal size). The concrete shall be left 115 mm below the top level of the pan so and to allow flooring and its bed concrete. The joint between the pan and the trap shall be made leak proof with cement mortar 1:1 (1 cement : 1 fine sand). The pan shall be fixed slightly at a lower level than the level of the general flooring, which should slope on all sides towards the pan. If the pan is damaged in handling or fixing, it shall be replaced by the Contractor at his own expenses.

The flushing cistern shall be fixed on two iron or mild steel cantilever brackets fixed in the wall at the height indicated on the Drawing or as ordered by the Engineer. The inlet end shall be connected to the distribution pipe through a stop tap, pipe and bends. The lead flushing pipe shall be connected to the outlet nipple and tail pipe with a coupling brass nut. The 20 mm diameter overflow pipe shall be slightly bent downwards and shall be fixed with a mosquito proof coupling.

The C.P. flushing pipe shall be bent leaving a straight length of about 30 cm at the top and the lower portion after the bend shall be housed into the recess cut in the wall and shall be concealed with plaster.

The whole installation shall be tested for leak proof joints and satisfactory functioning.

The cistern, brackets and all the exposed pipes shall be painted with a base coat of red lead oil paint and the two coats of approved shade of good oil paint.

6.6.10.2 European type white glazed earthenware water-closet

The item pertains to the provision and fixing of European type white glazed earthenware water-closet pan, with 12.5 liters white steel enameled low level flushing cistern and other flushing accessories and necessary pipe connections up to the soil and vent pipes fixed on the outside of the wall. The pan shall be fixed into position in 1:1 cement mortar with the connecting pipes duly connected including the flushing cistern, piping etc., and the test shall be done as in previous Clause. The seat and lid shall be fixed to the pan with chromium plated brass hinges.

6.6.10.3 Measurement

Water closets shall be enumerated. Rate shall include the cost of all the materials and labour involved in all the operations described above.

6.6.11 Urinals

6.6.11.1 Half stall Urinals

The item pertains to the provision and fixing of a half stall type urinal with 10 litre auto flushing cistern (or any other type as defined in the BOQ) including all fittings and soil pipe connections upto the outside face of the wall. The installation of the urinal shall conform to paragraph 6.6 of IS 2064.

The urinal shall be securely fixed to the wall with the top of the bowl at 65 cm., from the floor or such distance as may be directed by the Engineer. All the pipe connections shall be made as shown on the Drawings or as necessary for the item.

The jointing shall confirm to paragraph 5 of IS: 1742. A 32 mm diameter GI pipe shall be provided with C.P. bottle trap.

The flushing cistern, its fixing and the pipe connections shall conform to the details given in Clause 6.6.10 above. All the exposed lead and ferrous pipes and the bracket for the flushing cistern shall be painted with one coat of red lead and two coats of good anti-corrosive oil paint of approved shade.

Half stall urinals shall be of white vitreous china conforming to IS 2556 (Part VI Sec 2). They shall be of one piece construction with or without an integral flushing box rim provided with slots or alternative fixing arrangement at the flat back end. They shall be provided with ridges where integral flushing is not provided in the sides of the interior of the bowl, to divert the water towards the front line of the urinal where integral flushing box rim is specified, water spreaders provided shall conform to IS:2556 Part VI: Sec 6. These shall be vitreous china of one piece construction with one integral flush inlet.

6.6.11.2 Squatting Plate Urinal

The Squatting Plate Urinal shall be of vitreous china conforming to IS 2556 (Part I) and IS 2556 (Part VI / Sec 3) with internal flushing rim with front or side inlet. Squatting plate shall be of one piece construction. Each urinal shall have integral longitudinal flushing pipe of suitable type which may be connected to flush pipe. There shall be 100 mm diameter white glazed vitreous china channel with stop and outlet piece in front.

6.6.11.3 Measurement

Urinals shall be enumerated. Rate shall include the cost of all the materials and labour involved in all the operations described above.

6.6.12 Toilet Requisites

6.6.12.1 Towel Rail

It shall be of anodised aluminum with two aluminum anodised brackets. The size of the rail shall be 75 cm x 20 mm diameter or 60 cm x 20 mm diameter, 1.25 mm thick as specified. The bracket shall be fixed by means of CP 1 brass screws to wooden cleats firmly embedded in wall.

6.6.12.2 Toilet paper holder

The toilet paper holder shall be of CP brass or vitreous china as specified and of size and design as approved by the Engineer-in charge. It shall be fixed in position by means of CP brass screws and plugs embedded in the wall.

6.6.12.3 Shower

These shall be of CP finish swivel type as specified.

6.6.12.4 Towel pipe and towel cloth stand etc.

These shall be of CP / anodized aluminum as specified. These shall be fixed by means of CP brass screws to wooden cleats firmly embedded in the wall.

6.6.12.5 Measurement

All the items mentioned above under Clause ‘Toilet Requisites’ shall be measured per number and the quoted rates shall be on this basis which shall include the cost of respective materials, necessary fixtures, fixing in position.

6.6.13 Water Heaters

These shall be of best approved make, type and capacity as per BOQ. They shall be mounted on the wall / lift with necessary bolts of approved type. They shall have a 8 mm PVC inlet pipe, 12 mm lead pipe outlet and 15 mm non-return valve.

These shall be measured per number basis and the quoted rates shall include:

- Cost of water heater with all the built-in electrical accessories like pilot lamp, thermostat, standard length of cable and three pin plug,
- PVC inlet lead outlet pipe and non-return valve,
- Fixing accessories like bolts, nuts etc.

6.6.14 Soil, Water and Vent Pipes

Unless otherwise mentioned in BOQ, soil, water and vent pipes shall be of Cast Iron conforming to IS: 1729 or IS:3989. Pipes and fittings with irregular bore, blow holes and other manufacturing defects shall not be allowed to be used for work. All the fittings shall be of the degree specified or as required at site.

6.6.14.1 Cast Iron Rain Water Pipes

Cast Iron pipes shall be treated with Dr. Angus Smith's solution before use. Cast Iron grating shall be of a slightly bigger diameter than that of the pipe.

In the case of terraced roof, the cast iron grating shall be fixed at the inlet end of the pipes properly secured in the parapet wall to receive the rain water. The cast iron grating shall be recessed at a slightly lower level than the adjacent terrace floor.

The joints shall be sealed with a few turns of spun yarn soaked in bitumen or tar. It shall be pressed home with a caulking tool for 1/3rd the depth of the joint. More skein yarn shall be wrapped if necessary and well rammed home. The joint shall then be filled with cement mortar 1:3. At the ground level, they shall be supported on a 1:2:4 cement concrete block of 30 cm x 30 cm and of sufficient height.

All the necessary fittings shall be included in the pipeline at proper places. The inlet end shall be carefully fixed to admit water from the roof. The outlet shall be with a shoe.

The pipe shall be painted with one coat of red lead oil paint and two coats of good anticorrosive oil paint of approved shade.

Pipes, fittings and joints shall be tested for leakage, any defects noticed shall be rectified without any extra cost to the corporation.

6.6.14.2 Cast Iron Soil Vent Pipes

Cast iron pipes of specified diameter shall have sockets for underground and sockets with lugs for fixing on walls. They shall be treated with Dr. Angus Smith's solution. All the pipes, fittings, etc., should be free from cracks and flaws. The interior of the pipes and fittings shall be clean and smooth. All the fittings shall be of the same quality as that of the pipes. The fittings shall have cleaning eyes with plugs where necessary.

The socket end shall be the inlet end for the soil or waste pipes. In vent pipes the socket shall face up. The joints shall be filled with lead. The joining shall conform to IS: 1742. Where the cast iron pipes are fixed on the wall they shall be supported on a 1:2:4 cement block of 30x30 cm and of sufficient height in the ground. The pipes shall be fixed on the wall with nails driven through the lugs to the holder battens. Necessary fittings shall be included in the pipes. The exposed pipes shall be painted with a base coat of red lead and two coats of good anti corrosive oil paint of approved shade. For pipes fixed on the walls, smoke test shall be carried out.

6.6.15 Gully traps

Gully traps shall be of salt glazed stoneware conforming to IS 651. Each gully trap shall have one CI grating of square size corresponding to the dimensions of inlet of gully trap. It will also have a water tight CI cover with frame inside dimensions 300x300 mm the cover weighing not less than 4.50 kg and the frame not less than 2.70 kg. The grating cover and the frame shall be of sound and good casting and shall have truly square machined seating faces. These shall be housed in masonry chambers of 300 mm x 300 mm internal size.

The masonry chambers shall be constructed in first class bricks in cement mortar 1:5 with a 10 cm brick work round the gully trap from the top of the bed concrete upto ground level. The space between the chamber walls and the gully trap shall be filled with cement concrete 1:5:10. It shall be plastered with cement mortar 1:3 finished with a floating coat of neat cement.

CI cover with frame shall be fixed on the top of brick masonry with cement concrete 1:2:4 and rendered smooth. Cement concrete in bed shall be 10 cm thick and in 1:5:10 mix (40 mm nominal size stone aggregate), projecting 7.5 cm outside the chamber walls.

6.6.16 Cast iron Nahani trap

Nahani trap shall be P or S type with minimum 50 mm seal. However if the plumbing is in two pipe system and with a gully trap at the ground level the minimum water seal shall be 35 mm. The traps shall be of self cleansing design and shall have exit of same size as that of waste pipe. These shall conform to IS 1729.

Section - VII
Drawings

Note:

1. It is customary to bind the drawings in a separate volume, which is often larger than other volumes of the contract documents. The size will be dictated by the scale of the drawings, which must not be reduced to the extent that details are reduced illegible.

2. A simplified map showing the location of the Site in relation to the local geography, indicating major roads, posts, airports, and railroads, is helpful.

3. The construction drawings, even if not fully developed, must show sufficient details to enable bidders to understand the type and complexity of the work involved and the price the Bill of Quantities.

7 PUMPS AND RELATED ACCESSORIES

The submersible pump is used for pumping of clean, cold water, non-corrosive and non-abrasive to the pumpset material in the drinking water purpose.

Pumps supplied and installed shall be capable of satisfying the performance requirements in the relevant technical specification. However, the offered submersible pump must be operated at optimum efficiency and well perform in its duty load point. Low maintenance costs, reliability and trouble-free operation will be the prime consideration when selecting pumps.

Pumps shall be quiet in operation and free from vibration. Pump speed shall not exceed 1450/2900 RPM. The pump should have the maximum efficiency at the specified duty point. Approximate power inputs[1] are given in Schedule of Requirements; however, the minimum efficiency of the pump shall not less than 70%, and should meet the stipulated design discharge and head.

Pumps shall be designed to handle the described liquids and shall run unattended for long periods (15 – 22 hr/day). A corrosion resistant metal nameplate shall be permanently attached to the pump. Pumps shall have stable characteristic curve, the characteristic of continuously rising head with decreasing capacity from rated capacity to shut-off, unless otherwise specified. Pumps shall have in-built dry-running protection and shall be started by motor control switch panels or electric starters as specified in section 9.14. Pump characteristic curves showing head/discharge, efficiency and power absorbed shall be submitted with the contractor's Tender.

7.1 Pumps

The pump set in general shall confirm to IS: 8034 or equivalent British and other International Standard. In case of the proposal for Indian Production the pump set shall bear ISI mark. The manufacturer shall be certified as per ISO 9001.

7.2 Components of Submersible Pumps

Submersible pump set shall be a compact unit made up of a submersible pump and a submersible motor with shafts connected by a sleeve and operates beneath the surface of water. This low maintenance pump set is suspended vertically/ horizontally as per pumpset design configuration from raising main when installed.

7.3 Submersible Pumps

The submersible pumps shall be multistage centrifugal pumps with radial or mixed flow impellers. The casing of the radial flow impeller pumps shall be clamped together by flat steel hook bolts, whereas that of mixed flow impeller pumps by studs. Between the pump and the motor is the suction casing, a non-return valve shall be fitted to the pump discharge.

7.4 Submersible Motors

Submersible motors shall be water filled, water lubricated squirrel cage type. The axial thrust generated by the pump is absorbed by a trust bearing fitted at the bottom of the motor. The diaphragm below the thrust bearing compensates the overpressure which arises as a result of the thermal expansion of the water filled, when the temperature of the winding rises. Refer detail in section 9.11.

7.5 Bearings

The pump shall be provided with radial bearings. The motor has radial as well as axial thrust bearings. All the bearings shall be water lubricated and protected to a large degree against the ingress of sand by suitable structural elements.

7.6 Pump Set/Assembly Components

Submersible pump set shall have the following minimum components with the following specifications: -

a) Pump Head Assembly
b) Riser pipe
c) Pump Bowl Assembly
d) Suction case with Strainer
e) Submersible motor
f) Electric cable (submersible and armoured)
g) Motor Control panel

9.7 Pump Head Assembly

Pump head assembly shall comprise of a minimum of the following:

a) Surface Discharge Plate (refer Section 14.1)

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[1] Approximate power required for a submersible pump-set is calculated by using minimum overall efficiency as 60% and 1.15 as safety factor (excess factor). However, offered pump-set should be as energy efficient and effective as possible and should meet the stipulated design discharge and head.

b) Gate Valve (refer Section 3.3.2.7.1.2)
c) Air Valve (refer Section 3.3.2.7.2)
d) Non Return Valve (refer Section 3.3.2.7.4)
e) Mechanical Coupling (refer Section 3.3.2.6)
f) Water Meter (refer Section 4)
g) Other accessories like pressure gauges, bends, tail pieces etc. (refer section 3.3.2)

9.8 Riser Pipe and Fittings

Riser or column pipe shall be made of minimum medium class galvanized mild steel pipe and shall confirm to IS 1239 (Part-1) 2004, BS: 1387 or equivalent standards. It may be ERW or seamless. Each riser pipe shall be 3 m in length except the top and lowest pipe, which shall be 1 m long or as defined by the Engineer considering the site conditions. The pipes shall be flanged ended with welded flange in each end. Flanges which meet with pipes shall be drilled as per BS EN 1092-2 (ISO 2531). The flange should have two cuttings of the size of the cable with sufficient depth and shall be galvanized. The maximum size of the flange should be at least 2 cm less than the inner diameter of the tube-well. Nipple of various lengths as required by the Employer shall be manufactured of Medium/Heavy duty galvanized mild steel pipes conforming to IS: 1239 (Part I) - 1990 or equivalent and threads to conform with IS: 554 - 1975 or equivalent. Bolts and nuts shall be hexagonal, galvanized and shall be in accordance with BS 4190 or equivalent. Washer shall be of proper quality and strength. Each set of flange jointing materials shall be supplied complete with nuts, bolts, washers and joint rings with an additional 10% as spares.

9.9 Pump Bowl Assembly

The pump bowl Assembly shall made of close-grained cast iron, free from blowholes, sand holes or other detrimental defects. The bowl unit shall be capable of withstanding a hydraulic pressure equal to twice the pressure at the rated capacity or, 1.5 times the shot off head, whichever is greater. The pump shall be equipped with replaceable bearing, whichever provided. The pump shaft shall be made of stainless steel. Impeller may be of enclose or semi open type and shall be properly balanced. Impeller shall be made of bronze or Noryl i.e. modified Ppo as per IS: 8034-1984 or equivalent British Standard. Each impeller shall be securely fastened to the shaft. The delivery outlet of the bowl assembly shall comprise of a spring loaded Non-Return Valve.

The pump must be manufactured with non-corrosive materials, Ceramic or equivalent non corrodible materials must be used for bearing. For submersible Pump, Pump body and rotors and impellers must be made of stainless steel with a minimum grade of AISI 304 or higher. In the pump set/assembly, materials having higher grade or better performance may also be considered provided that there is a sufficient reason and documentary proof of the materials in the present operating conditions.

The bowl assembly shall bear a nameplate giving the following information:

a) Manufacturer's name or trade-mark (if any)
b) Model
c) Serial No.
d) No of stages
e) Head, at specified duty point
f) Discharge, as specified duty point

9.10 Suction Case with Strainer

The opening of the suction case for the entrance of the liquid shall be of proper size and shape to avoid eddy currents. The suction case shall be fitted with a strainer made of corrosion resistant material. Suitable sand guard shall be provided just above the suction case bearing to prevent the entry of foreign matter into the suction case.

9.11 Submersible Motor

Submersible Motor shall confirm IS 9283-1979 or equivalent British or International Standard and squirrel case induction type suitable for operation on 415± 10% Volt A.C. with 50 HZ frequency. The motor should be water filled and water lubricated. The thrust bearing design is to be Mitchell type with self-adjusting thrust pads resting on individual steel balls to absorb axial thrust under adverse conditions. The thrust bearing shall be of adequate size to withstand the weight of all rotating parts as well as the imposed hydraulic thrust. It shall have sufficient capacity to permit the pump to operate for short periods with discharge valve closed. The starter should be fully rewindable with special PVC insulated winding wire with overhang design to facilitate easy maintenance and repair; the starter stampings are to be suitably locked both in horizontal and circumferential directions to insure positive locking. The motor shall be protected by means of cable glands; rubber seals etc. from ingress of borehole water, sand and other foreign matters. The thrust bearing housing shall be provided with a drain plug to empty the pure water filled into the thrust bearing housing/motor. The rotor shaft shall be provided with a breathing attachment like bellows, diaphragm, etc to compensate the volumetric variations due to the change in temperature. The motor (casing, shaft, bolts/nuts etc.) shall be made of corrosion resisting

materials or suitably treated materials to resist corrosion under normal conditions. The motor should have at least 10% margin at duty point as well as should not get overloaded in the entire range of operation. The motor shall have following information:

Name of manufacturer
Motor rating (KW or HP)
Nominal speed
Rated current (A)
Rate Voltage (V)
Frequency (Hz)
Connection system
Starting system
Type of duty (continuous)
Materials of casing, shaft, bolts/nuts

There shall be an indication to identify the motor with its pump. A suitable Coupling arrangement shall be provided to couple the pump-set directly, which shall be capable of transmitting the total torque of the unit regardless of direction of the rotation.

9.12 Submersible Cable (Cable for Submersible pumps)

The electric cables must be well connected and sealed into the motor and delivered with a length of minimum 3 meters. Submersible cable shall confirm to 4.4 of IS 9283-1979 or equivalent British or International Standard. Submersible cable shall be sized not less than $4mm^2$ up to 20 HP and 6-10 mm^2 for 30-40 HP motor, unless otherwise specified in Schedule of Requirements. The offered cable must meet the important parameter like starting current and continuous full load current. It shall be sized to limit the voltage drop to 5% at the motor's terminals. They shall be made of copper conductors. The conductor insulation shall be water and oil resistant, suitable for continuous immersion. The submersible cable will be joined by a watertight joint in the submersible motor cable. The connection shall be a permanent type and non-possibility for separation after installation. The Contractor shall for each of the submersible pump, supply adequate faster. The fastener shall be reusable and robust.

9.13 Armoured Power Cable

Suitable sizes of LT power cables for connecting the autotransformer starter to motor shall be supplied and delivered. The power cables shall 3.5-core Copper/Aluminium armoured power cables of 1.1 KV grade and suitable for 415 V, 3-phase, 50Hz, LT electric system. The sizes of the power cables are given in Schedule of Requirements. The offered cable must meet the important parameter like starting current and continuous full load current. The electric power cable shall be manufactured and tested in full compliance with latest version of NS, BS, IS, ISO or equivalent international standard.

Control wiring shall be done by 1.1 KV grade PVC wires with minimum 2.5 mm^2 copper conductor. Suitable size of control cables for connecting the starter to motor shall be also be supplied.

9.14 Motor Control Panel

The Motor Control Panel Board may be either self supported or wall mounted type made of mild steel sheet of thickness at least 1.6 mm and suitable shape and size. The board shall be painted with one coat of priming and two coats of anti corrosion paint. The switch panel might be installed outside at the well or under a shelter on an ambient temperature of 0 ^oC and 50 ^oC and in a sealable weatherproof cover.

The motor control panel must be safe to operate the pump motor. Provisions for the protection of motor against over loading, dry running, single phasing and opposite phasing should be provided.

In general, use DOL starter for maximum up to 7.5 HP, STAR/ DELTA: for above 7.5 HP to 40 HP and Autotransformer/Soft Starter: above 40 HP motor unless otherwise specified in the technical specification, suitable for the submersible pumps, 415 Volts and 50 Hz, 3 phases. Specifications must be according to IP54 or equivalent standards.

The motor control panel must be compatible with the pump-motor set, to be manufactured by same manufacturer or certified by pump-motor manufacturer or their authorized supplier adds an extra layer of assurance that the system will function correctly and meet the necessary standards.

The motor controller shall be equipped with all the required components and features for its proper functioning and safety requirements that included, but not limited to the following: -

a. Molded case Circuit Breaker (MCCB) of suitable capacity - AT /AF = 1.5 x line current / 3 x line current
b. Fully automatic air break type Starter with magnetic contactors of capacity: 3 X line current for DOL and line current rating for Star-Delta, Bi-metallic overload relay (phase current ± 20%) and electronic timer.
c. Low Water Level Guard/ Float- less Switch

d. Single Phase Preventer and Phase Sequence Relay.

e. Voltmeter with Selector Switch between all phases.

f. C/T Ammeter with Selector Switch.

g. Push Button Switches for ‘START’ and ‘STOP’ the motor.

h. Indicating Lamps for various actions.

i. Cable connector (2 x full current capacity)

j. Proper earthing should be provided to all electrical devices like, motor control panel, distribution box (DB), pump prime mover etc.

The details of technical specification may vary depending on types of motor control panel selected. The detailed information for the selected types of motor control panels should include specific to each type control panel.

Major items in one Auto-Transformer Starter (ATS) shall consist, but may not be limited, of the following unless otherwise specified in the technical specifications:

S. No	Descriptions	Quantity
1	Auto transformer tap setting 65%, 80% and 100% air cooled	One set
2	Heater 100w, 230 V A.C.	One set
3	Thermostat 0 to 110 degree centigrade	One set
4	Hour meter	One set
5	Ammeter with Selector Switch (200/5 operated)	One set
6	200/5 Current Transformers	Three sets
7	Time delay relay	One set
8	Contactor (about 2.5 times the fall load current) & Ampere TP, (coil voltage 230V, 50 Hz)	Three sets
9	Overload Relay (of suitable range) or as required Ampere rating	One set
10	Control Terminals	One set
11	Auxiliary Contact Blocks (mechanical latching type)	One set
12	Insulation/Moister/Thermister relay	One set
13	Voltage monitoring relay having phase failure and under voltage release	One set
14	ON/Trip indication	Two set
15	Push buttons (on/off)	One set
16	Control fuses	One set
17	Push button for mute of alarm hooter	One set
18	Control relay for alarm hooter with control fuses	One set
19	Indicating lamps with control fuses	One set
20	Earth fault relays	One set
21	Probe for water level	One set
22	Phase indicating lamps with fuse	One set
23	Water lever controller	One set

The indication Lamps are as following:

- ON green
- OFF red
- Fault red
- Alarms yellow

Each indicating lamp shall be of illuminated push-button type; centralized lamp test is not accepted. All the instruments, devises and parts of the panel shall be facing the front of the panels. Writing on the panel must be in English language.

The motor must be protected by a thermal overload relay of suitable adjustable range and shall be installed between the running conductor and motor. The overload range shall be approximately from 80% to 120% of the nominal current rating of the motor. The starter shall be rated to stand a minimum of four starts per hour at an ambient temperature.

Motor thermal protection relay to protect motor from overheating. The sensor provided in the motor starter winding resistor sensor as following:

- Digital indication
- Adjustable from 0 to 100 trip
- Change over contacts
- Resistor sensor
- Supply voltage of 220 Volts

Separate current transformer to be provided for protection and instrumental duties. Fuses and links shall be grouped where appropriated according to the functions and must be clearly marked both on panels and the associated wiring diagrams. All cable and piping shall be made through glands in a plate covering the base of the switchboard.

The Auto Transformer Starter (ATS) shall have the following features:

- Air cooled design
- The core and coil shall be impregnated under vacuum in high temperature grade
- Designed and tested to meet the requirement of IEC 292-4.
- Tap setting at 65%, 80% and 100%
- Insulation class F

The Auto Starter must be fully assembled by the manufacturer and where modifications such as additions of extra protection devises or indications are required; these modifications shall be performed in a similar manner by the manufactures. In this case full details of modifications and circuits diagrams shall be provided. The manufacturer should conduct the required tests on each starter as per IEC 439-1 1990.

9.15 Documentation

The following information/documents to be furnished by the Contractor for the offered model pump-motor set with their technical offer:

- Certification for relevant Standards
- Performance Curves
- Discharge vs. overall efficiency
- Head V/s Discharge Curve
- BHP (power input) V/s Discharge Curve
- Efficiency V/s Discharge Curve
- NPSH V/s Discharge Curve

Besides, following additional information the Contractor shall also be furnished from the Supplier:

- No of stages
- Discharge in l/s or l/m or m^3/hr
- Total pumping or duty head in meter
- Shut-off head
- Pump-input at duty point in KW or HP
- Efficiency of the pump at rated Duty Point
- Details of motor
    - Rating in KW or HP
    - Type
    - Details of power supply
    - Rated speed

On delivery of the pump-motor set, Contractor shall furnish following documents:

- Test certificate from the manufacturer
- Guarantee of workmanship and materials

Documentation for the cables and Auto Transformer Starter (ATS)/ motor control panel shall be furnished as per the technical specifications, along with wiring diagram of the electric panel board.

9.16 Guarantee of Performance

The pump-set shall be guaranteed for their performance of the pumping rate, head, overall efficiency and overall power input. The pump-set shall be guaranteed by the manufacturer against the defects in material and workmanship under the normal use and service for at least 12 months from the date of delivery to the purchaser or as specified in the Conditions of Contract.

9.17 Operation Maintenance Manual and Spare Part List

The Contractor must provide with each submersible pump-motor set and electric control panel board in English language:

- Installation manual
- Operating and maintenance instruction manual
- Works manual for repair and maintenance works
- Spare parts list/ manual

Contractor shall submit with their tender sufficient information to show the Contracting Authority that the proposed pumps will comply with the performance requirements.

10 TRANSFORMERS, ELECTRICAL FEEDER LINES AND INSTALLATIONS

The Scope of works includes specifications of all requirements for electricity feeder line including transformers, poles, conductors, insulators, fittings and control equipment. The specifications and associated drawings mentioned in this contract shall be according to the latest specification and construction drawing standards adopted by Nepal Electricity Authority (NEA).

10.1 Transformer

10.1.1 Distribution Transformer

10.1.1.1 Scope

These specifications cover the requirements of oil-immersed, natural-cooled single and three- phase distribution transformers suitable for outdoors installation on 11kV, 50 Hz distribution systems.

10.1.1.2 Service Condition

The transformers shall be designed and constructed for outdoor installation and operation under the following conditions:

Ambient temperature:	-5 deg. C to 50 deg. C
Relative humidity:	up to 99%
Altitude:	up to 3000m above the mean sea level

10.1.1.3 Standards and Quality Certification

10.1.1.3.1 The equipment specified in this Section of the Contract shall conform to the latest edition of the appropriate IEC specifications and/or other recognized international standards. In particular:

IEC 60076 Power transformers

IEC 60137 Insulating Bushings for alternating voltages above 1 kV

IEC 60156 Insulating liquids-Determination of the breakdown voltage at power frequency- test method

IEC 60296 Specification for unused mineral insulating oils for transformers and switchgear

IEC 60551 Determination of transformer and reactor sound levels

IEC 60616 Terminal and tapping materials for power transformer

IEC 60722 Guide to lightning and switching impulse testing of power transformers and reactors

IEC 60733 Determination of water in insulating oils.

10.1.1.3.2 The manufacturer of the offered transformers must have been accredited with the latest edition of ISO 9001 (including design in the scope of registration) quality certification.

Item	Description	Units	11/0.4KV, Rated KVA as per rated
1.	Applicable Standards		
2.	Rated Power Output	KVA	As per BOQ
3	Number of Phases		3
4	Rated Frequency	Hz	50
5	Rated Primary Voltage	V,	11000
6	Rated Secondary Voltage	V	400
7	Vector Group		Dyn 11
8	Type		
	-Duty		Outdoor
	-Cooling		ONAN
9	Off-Load Tapping, Primary	%	+5,0,-3 X 5%
10	Temperature Rise in	0C	
	-Winding		55
	-Top Oil		50
11	Applied Test Voltage 1min, 50Hz	KV	
	-Primary winding		28
	-Secondary Winding		3
12	Impulse Test Voltage	KV	
	Full wave, primary winding		75
13	No Load Losses	Watts	As per NEA Standard
14	Load Losses	Watts	As per NEA Standard
15	Impedance Voltage	%	4
16	Material of Windings		

	-High Voltages		Copper
	-Low Voltages		Copper
17	Approximate Dimensions		
	-Length		
	-Height		
	-Width		
18	Total Weight		As per NEA Standard
19	Oil Quantity		As per NEA Standard

10.2 Diesel Generator

Genset Specification	
Genset rating	Prime
Genset output (KVA/KW)	As per BOQ
Aspiration/Cooling	TCAC
No. of cylinders/arrangement	4/ Inline
Displacement	4.87
Bore x stroke (mm)	108 x 133
Compression ratio	17.2
Rated RPM	1500
Overspeed trip (RPM)	1650
Governor type/DG Performance Class	Mech/G2
Frequency regulation	Isochronous
Air cleaner type/qty	Dry/01

Alternator Specification	
Voltage (3P)	415
Frequency (Hz)	50
Current (Amps)	As per rating of DG
Type	4P, rotating field
Voltage regulator	Solid State
Voltage regulation (%)	+ or – 1%
Insulation Class	H
Temperature rise (Deg C)	125
Bearing (qty/type)	1, sealed
Coupling	Flex disc
One step load acceptance	100% of rating
Unbalanced load acceptance	25% of rated amps

Cooling System	
Max ambient capacity (Deg C)	50
Coolant capacity (Eng+Rad) (L)	25

Exhaust System	
Max allowable backpressure (kPa)	5.5
Exhaust temperature (Deg C)	500
Silencer type	Residential

Engine Electrical System	
Charging Alternator VDC/Amps	12V /35A
Starter motor rated voltage (DC)	12
Battery Voltage (DC) / Capacity (AH)	12V/88AH

Standard Scope of Supply
Engine: Direct injection, water cooled, four-cylinder, 4 stroke, rated at 1500RPM, confirming to ISO 3046/BS 5514 with the following: -Radiator cooling -Mechanical Governor -Exhaust manifold with SS exhaust flexible - Flywheel and flywheel housing - Fuel and lube oil filters -Dry type air cleaner -Starter motor, battery charger
Alternator: Meccalte/Leroy somer/Stamford/CG
Acoustic Enclosure: Power coated weather proof canopy. Engine and alternator mounted on AV mounts, with silencer and SS exhaust bellow optimized to meet stringent MOEF/CPCB norms for sound and emission -Base rail with draw out type fuel tank, drain plug, inlet and outlet connections, air vent, level gauge
Control Panel: Fabricated from CRCA Sheet and powder coated with RAL 9003 with the following: -MCCB of suitable rating with short circuit protection

-Controller with multi feature display - Load on and set running indication lamps -Copper conductor cables between alternator and control panel
Literature: -Operation and spare parts manual in CD format -Installation and general maintenance guidelines -Foundation drawings - Alternator and control panel wiring drawings -Test Certificate

10.3 Voltage Stabilizer

Capacity	As per BOQ
Input Voltage	300 to 470 V.AC
Output Voltage (Normal)	400V Ac ± 1% (Adjustable
Supply	3-Phase- 4 Wire System
Supply Frequency	47 to 53 Hz
Load and Line Regulation	1%
Ambient Temperature	0 to 45° C
Effect of Load Power Factor	None
Correction Speed	30-45 V/Sec
Efficiency	Better than 90%
Duty Cycle	100% continuous
Cooling	Air/Oil as per site condition
Panel Control: -Input/ output select switch, Auto/Manual select switch - Buck / Boost Switch to adjust the output Voltage in manual mode. - Volts adjust program to set required output voltage in auto mode	
Panel Indication: Output -on/input- Low/Input-High and Digital Display	

10.4 11 KV AAAC XLPE Insulated Covered Conductor

10.4.1 Scope

This specification covers details of All Aluminum Alloy Stranded XLPE Insulated Covered Conductors for use on 11KV transmission system. The conductor covered insulation shall mark EN 50397-1:2006 by embossing/printing on it at every meter throughout the length.

10.4.2 Service Conditions

The conductor to be supplied against these specifications shall be suitable for satisfactory continuous operation under the following tropical conditions.

a) Maximum ambient temperature (Degree C) ----------50
b) Maximum temperature of air in shade (Degree C) ----------3.5
c) Relative Humidity (%) ----------10 to 100
d) Maximum Annual Rainfall (mm) ----------1450
e) Maximum Wind Pressure (kg/sq.m) ----------150
f) Maximum altitude above mean sea level (meter) ----------1000
g) Isoceraunic Level (days/year) ----------50
h) Seimic Level (Horizontal acceleration) ----------0.3g

10.4.3 Conductor Sizes

a) 7/2.00mm (22 sq.mm)
b) 7/2.50mm (34 sq.mm)
c) 7/3.15mm (55 sq.mm)
d) 7/3.15mm (80 sq.mm)
e) 7/4.26mm (100 sq.mm)
f) 19/3.15mm (148sq.mm)
g) 19/3.94mm (232sq.mm)

10.4.4 Application Standards:

Unless otherwise stipulated in this specification, the conductor shall conform to the following Indian/International Standards.

S.No.	INDIAN/INTERNATIONAL STANDARDS	
1.	IS:398 (Part IV) / 1994	Specification for aluminium conductors for overhead transmission purpose
2.	EN 50397-1:2006	XLPE Insulation covered conductor Specification for Voltage 1KV to 33KV
3.	IS: 10418	Reels and drums for bare conductors.

10.4.5 Properties of Conductor

The properties of stranded all aluminium alloy conductors of Various sizes shall be as in Table-I.

Table-I All Aluminium Alloy Stranded Conductor

Actual Area	Stranding & Wire dia.	Approx. overall dia.	Approx. mass	Calculated resistance at 20 d.c. (max)	Approx. calculated Breaking Load	Reactance per Km	Current Rating
1	2	3	4	5	6	7	8
Sq.mm	mm	mm	Kg/km	Ohm/km	kN	Ohms	Amps
22	7/2.00	6.0	60.16	1.5410	6.45	0.3556	115
34	7/2.50	7.5	94.00	0.9900	10.11	0.3556	150
55	7/3.15	9.45	149.20	0.6210	16.03	0.3556	234
80	7/3.81	11.43	218.26	0.4250	23.41	0.3394	270
100	7/4.26	12.78	272.86	0.3390	29.26	0.3394	325

10.5 Disc Insulator Fittings

10.5.1 Scope

This specification covers the fabrication and supply of tension type disc insulator fittings.

10.5.2 Description

10.5.2.1 The disc insulator fittings shall be supplied with ball and socket couplings (socket eye, ball eye/ball clevis etc.), twisted straps, and bolted type tension clamps. Number of U-bolts in tension set shall be 3 (three).

10.5.2.2 Tension clamp shall be suitable for ACSR conductor, diameter ranging from 5 mm. to 16.5 mm.

10.5.2.3 The ultimate strength of disc insulator fittings shall be more than 45 kN.

10.5.2.4 All components of disc insulator fittings shall be such that they fulfill all requirements of this specification and compatible with disc insulator specified in SPECIFICATION: SP-11.0

10.5.2.5 All parts of different fittings, which provide for interconnection, shall be made such that sufficient clearance is provided at the connection point to ensure free movement of insulator assembly.

10.5.2.6 The twisted strap shall be suitable for 50×100×50 mm. cross arm. Size of the holes for bolt, which anchors twisted strap with cross arm shall be suitable for insulator pins specified in SPECIFICATION: SP-11.0 and width of the twisted strap shall be designed accordingly. Diameter of nuts and bolts of strap shall be equal to shank diameter of insulator pins. Nuts and bolts shall also be provided with spring washer and split pin.

10.5.2.7 Unless otherwise specified in these specifications, disc insulator fittings shall be in accordance with IS: 2486 (Part I & II) or any other equivalent national or international standards.
2.8 The manufacturer of the disc insulator fittings must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

10.5.3 Material

10.5.3.1 The tension clamp shall be made of the aluminium alloy type. Other accessories like ball eye/ball clevis, socket eye, nuts, and bolts shall be made of hot rolled steel and obtained preferably by process of forging. Twisted cross arm strap shall be made of MS sheet metal. Cotter bolts and U-bolts shall be of galvanized steel. Cotter pins shall be stainless steel. Chapter 2. Specification of Electrical Equipment and Line Materials 2-199

10.5.3.2 All forging and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as at the eye, socket and holes, shall be rounded.

10.5.4 Galvanizing

10.5.4.1 All ferrous fittings and the parts other than those of aluminium alloy and stainless steel, shall be hot dip galvanized in accordance with IS: 2629-1985 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

10.5.5 Tests

10.5.5.1 The disc insulator fittings shall comply with the following tests as per IS: 2486 (Part I) or any other equivalent national or international standards.

1. Type Test:

- Verification of Dimensions,
- Visual Examination Test
- Slip Strength Test
- Mechanical Test
- Electrical Resistance Test
- Heating Cycle Test
- Galvanizing Test

2. Acceptance Tests:

- Verification of dimensions
- Galvanizing Test
- Mechanical Tests

3. Routine Tests:
- Visual Examination Tests
- Routine Mechanical Test

10.5.6 Marking

10.5.6.1 The tension clamp shall be marked on it following:

a) Name or trademark of manufacturer
b) Name of the Purchaser as follows: "NEA-NEC''

10.6 Galvanised Steel Bolts, Nuts And Miscellaneous Fastening Components

10.6.1 Scope

This Specification covers the fabrication and supply of galvanized steel bolts and nuts, as specified herein, for use in overhead electric line construction.

10.6.2 Material

10.6.2.1 The bolts and nuts shall be manufactured and tested in accordance with IS: 1363 (Part I)-1984 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

10.6.3 General

10.6.3.1 Bolts and nuts shall be furnished in the types, diameters and lengths specified in the Schedules of Rates and Prices. However, the dimensions and length of threading of bolt must be confirmed with the Project prior to manufacture.

10.6.3.2 Thread forms shall be consistent with all material/items listed herein and shall not strip or slip under sustained tensile loading equal to the design tensile strength of the threaded material item.

10.6.3.3 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

10.6.4 Machine Bolt and Nut

10.6.4.1 Each machine bolt shall be furnished with two (2) hexagonal nuts and two (2) plain washers assembled thereon.

10.6.5 Double-Arming Bolt and Nut

10.6.5.1 Each double-arming bolt shall be furnished with four (4) hexagonal nuts and two (2) washers assembled thereon.

10.6.6 Galvanizing

10.6.6.1 The stranded stay wire shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

10.6.7 Tests

10.6.7.1 The bolt and nut shall undergo type and routine tests in accordance with the relevant governing standard.

10.7 Crossarms And Bracing Angles

10.7.1 Scope

This Specification covers the fabrication and supply of galvanized steel cross-arms and bracing members commonly used in overhead power line construction.

10.7.2 Material

10.7.2.1 The steel cross-arms shall be fabricated from hot rolled channels and angles.

10.7.2.2 The steel channels and angles shall be fabricated and tested in accordance with Indian Standards IS: 226-1975 and IS-808-1964 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

10.7.3 Description

10.7.3.1 The steel cross-arms and bracing angles shall be of sizes shown in the Table 1: Cross-arms and bracing angles, contained herein.

10.7.3.2 Conceptual hole pattern and size of holes on cross-arm channels are shown in appropriate drawings herein, however, the Supplier must confirm with the Project the locations and sizes of holes prior to the manufacture.

10.7.3.3 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

10.7.3.4 The steel cross-arm and bracing angles shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.

10.7.4 Galvanizing

The steel cross-arms and bracing angles shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

10.7.5 Tests

Apart from the tests indicated herein in the referenced standards, the channels and angles shall undergo following tests:
- Visual Inspection;
- Verification of Dimensions

S.No.	Description	Type	Dimension in mm
1.	11KV, Single Pole, Triangular: 1.1 Pole Top 1.2 Standard	 Channel Channel	 100 x 50 x 6.4 x 5 x 300 100 x 50 x 6.4 x 5 x 1200
	11KV, Double Pole: 4.1 Standard 4.2 Bracing Member 4.3 Bracing Member	 Channel Angle Angle	100×50×6.4×5×2390 40×40×5×2071 40×40×5×2719
3.	Transformer Platform Complete set	Channel Channel	100 x 50 x 6.4 x 5 x2500 100 x 50 x 6.4 x 5 x 1200
4.	Lightening Arrester and Cut-out Support (at Transformer Platform): 5.1 Support	Channel	100 50 x 6.4 x 5 x 2348

10.8 Flat Crossarm Brace

10.8.1 Scope

This Specification covers the fabrication, testing and supply of flat, galvanized steel cross-arm braces.

10.8.2 Material

10.8.2.1 The flat cross-arms brace shall be fabricated out of hot rolled steel flat.

10.8.2.2 The steel flat for cross-arms brace shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

10.8.3 Description

10.8.3.1 The brace shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.

10.8.3.2 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

10.8.3.3 The brace shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.

10.8.3.4 The brace shall be capable of being bent 10 degrees at the bolt hole or slot and 140 degrees at any point between hole and slot without cracking of the base metal on the outside of bent portion.

10.8.3.5 The brace shall be drilled and dimensioned in accordance with Dwg. CA10 attached herein.

10.8.4 Galvanizing

The flat cross arm brace shall be hot dipped galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

10.8.5 Tests

Apart from the tests indicated herein in the referenced standards, the flat cross arm brace shall undergo following tests: - Visual Inspection; - Verification of Dimensions

10.9 Pole Clamps

10.9.1 Scope

This Specification covers the fabrication and supply of galvanized steel pole clamps with nuts, bolts and washers for use on overhead power line construction.

10.9.2 Material

10.9.2.1 The pole clamp shall be fabricated out of hot-rolled steel flat.

10.9.2.2 The steel flat for pole clamp shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm^2.

10.9.3 Description

10.9.3.1 Outline details of pole clamps are shown in the drawings Dwg: CA13. Dimensions may be changed to comply with the final pole sizes selected. Therefore, the dimensions must be confirmed with the Project prior to manufacture.

10.9.3.2 Two (2) numbers of galvanized, 16 mm. (dia.) × 60mm. (length), fully threaded bolts with two (2) nuts and washers shall be provided with each pole clamp.

10.9.3.3 The fittings shall be free of burrs, splinters, splits, sharp points and edges, which may damage conductors or show evidence of poor workmanship.

10.9.3.4 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

10.9.3.5 The pole clamps shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.

10.9.4 Galvanizing

The pole clamps and nut, bolts and washers shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

10.9.5 Tests

Apart from the tests indicated herein in the referenced standards, the pole clamps shall undergo following tests:
- Visual Inspection;
- Verification of Dimensions

10.10 Surge Arrester

10.10.1 Scope

This specification covers the general requirements of the design, manufacture, testing, supply and delivery of Surge Arrester of Gapless Metal-Oxide type commonly installed on overhead
11kV power lines of the Nepal Electricity Authority.

10.10.2 System Parameters

a)	Nominal Voltage	11kV
b)	System Highest Voltage	12kV
c)	System frequency	50Hz
d)	No. of Phases	3
e)	Neutral Earthing	Effective
f)	System fault current	20kA rms

10.10.3 Service Condition

a)	Ambient temperature	-5 to 55 deg. C
b)	Annual average ambient temperature	30 deg. C
c)	Maximum relative humidity	99%
d)	Environmental condition	Humid Tropical climate
e)	Operational altitude	Up to 3000m above msl
f)	Isokeraunic (Thunder Day) level	90 days
g)	Solar Radiation	1.6kW/m2

10.10.4 Applicable Standards

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof and the NEA Specifications specified hereafter.

a)	IEC 60099-4 Part 4 Surge Arresters	Metal-oxide surge arresters without gaps for a.c. systems
b)	IEC 60099-5 Part 5	Selection and application recommendations
c)	IEC 61109	Composite insulator for a.c. over headlines with a nominal voltage greater than 1000V - Definitions, test methods and acceptance criteria
d)	IEC 60507	Artificial pollution tests on high voltage insulators to be used on a.c. Systems

10.10.5 Technical Parameters

10.10.5.1 Minimum Technical Requirements

	Description S.N.	Description	Unit	Unit	Required ratings/features	Required ratings/features
1	Voltage rating		kV		9	
2	Nominal system voltage		kV		11	
3	Maximum system voltage		kV		12	
4	System frequency		Hz		50	
5	Nominal discharge current		kA		10	
6	Type of Housing Insulator				Polymeric	
7	Creepage distance (terminal to base)		mm		390	
8	Minimum power-frequency withstand Voltage					
8.1	Wet		kV		50	
8.2	Dry		kV		70	
9	Impulse withstand (1.2/50μsec) Voltage		kV (Peak)		95	
10	Maximum discharge (residual) voltage at 10kA lighting impulse current		kV (Peak)		29	
11	Steep current residual voltage		kV (Peak)		32	
12	Line Discharge Class				1	
13	Energy absorption Capability with (4/10		kJ/kV		Not less than 3.2	
	wave)					

14	Pressure relief class		B
15	High current		for 0.2s 20 kA
16	Low current		for 0.5s 0.8 kA
17	One Second TOV withstand capability	kV	>1.15x12
1	Voltage rating	kV	9
2	Nominal system voltage	kV	11
3	Maximum system voltage	kV	12
4	System frequency	Hz	50
5	Nominal discharge current	kA	10
6	Type of Housing Insulator		Polymeric
7	Creepage distance (terminal to base)	mm	390
8	Minimum power-frequency withstand Voltage		
8.1	Wet	kV	50
8.2	Dry	kV	70
9	Impulse withstand (1.2/50μsec) Voltage	kV (Peak)	95
10	Maximum discharge (residual) voltage at 10kA lighting impulse current	kV (Peak)	29
11	Steep current residual voltage	kV (Peak)	32
12	Line Discharge Class		1
13	Energy absorption Capability with (4/10	kJ/kV	Not less than 3.2
	wave)		
14	Pressure relief class		B
15	High current		for 0.2s 20 kA
16	Low current		for 0.5s 0.8 kA
17	One Second TOV withstand capability	kV	>1.15x12

10.10.5.2 Power Frequency Voltage vs Time Characteristics

The manufacturer shall provide the power frequency voltage vs time characteristics, preheated to 60°C with no prior energy and with prior energy (specified by the manufacturer) in order to verify the TOV capability of the Arrester.

If a particular manufacturer is unable to meet the TOV condition of 1.15Ur (rated voltage of the Arrester) for 1 sec. duration, has the option of offering of an Arrester of a higher rating.

10.10.6 Basic Features

10.10.6.1 Design

The Surge Arresters shall be designed for outdoor service conditions stipulated above. They will be connected between phase and earth to protect distribution transformers and switchgear. It shall be complete with the following:

a) Clamps suitable to receive Copper/Aluminum (Line) Conductors from 4 mm-16mm
b) The mounting clamps suitable for bracket mounting on a structure made out of 100x50x6mm Channel Iron.

10.10.6.2 Manufacture

The Surge Arrester shall be of the non-linear metal-oxide resister type without spark gaps and the non-linear metal-oxide resister shall be housed in a hermetically sealed insulator casing to prevent ingress of moisture.

10.10.6.3 Insulator Details

The housing insulator of the surge arrester shall be of polymeric type and the insulator sheds shall be designed to minimize trapping of contamination.

The complete arrester shall withstand a 1000h salt fog test at continuous voltage as described in IEC 61109/IEC 60507. Additional cycle tests as described in IEC 61109 shall also be passed satisfactorily.

10.10.6.4 Moisture Sealing

The manufacturing procedure shall include an effective leak test and the manufacturers shall carry out the Special Thermal Stability Test as specified in IEC 60099-4.

10.10.6.5 Partial Discharge

Each surge arrester shall be tested to prove absence of partial discharge contact noise as specified in IEC 60099-4.

10.10.6.6 Arrester Disconnector

The Surge Arrester shall have a device for disconnecting it from the system in the event of arrester failure to prevent a persistent fault in the system and it shall give a visible indication when the arrester has failed. The arrester disconnector shall be tested as per IEC 60099-1.

10.10.6.7 Insulating Bracket

A robust insulating bracket together with suitable mounting clamps to mount the Surge Arrester to 100x50x6mm Channel Iron Cross Arms shall be supplied with the Surge Arrester. The power frequency withstand voltage of the insulating bracket shall not be less than 20kV.

10.10.7 Additional Requirements

10.10.7.1 Rating Plate Markings

The following ratings and data of the arresters shall be provided and it shall be weather proof and corrosion proof. The plate shall be positioned at the bottom flange base and visible from the ground level.

(a) Number and year of the standard adopted
(b) Rated voltage / frequency
(c) Continuous operating voltage
(d) Arrester type and discharge class
(e) Nominal discharge current
(f) Manufacturer's identification
(g) Year of manufacture
(h) Serial number
(i) Contract No.

10.10.7.2 Packing

Each set of Surge Arrester shall be packed in a suitable box. Number of these boxes shall be held together in a firm position and measures shall be taken to avoid damage against jerks and collision between adjacent units during transportation.

Each packing shall contain a copy of installation instruction in English Language. The voltage rating, manufacturer's name/identification, Country of Origin, and the quantity shall be clearly marked on each packing.

10.10.8 Inspection And Testing

10.10.8.1 Acceptance Test

The successful Bidder shall make necessary arrangements for pre-shipment inspection and tests by the nominated NEA Inspectors to carry out in his presence the necessary Sample/Acceptance tests conforming to the relevant IEC on equipment and materials offered. Routine test report for all the items shall be furnished for the observation of the Inspector.

The acceptance tests as per IEC shall be witnessed by the NEA Inspector. (a) Power

frequency reference voltage test
(b) Partial discharge test.
(c) Lightning Impulse Residual voltage test. (d) Thermal
Stability test

10.10.8.2 Routine Test

The Routine Tests shall be carried out on all the arresters as per the relevant IEC and the test report shall be made available for the observation of the NEA Inspector at the time of inspection.

(a) Power frequency reference voltage test.
(b) Residual voltage tests.
(c) Partial discharge test.
(d) Leakage test

10.10.9 Bid Documentation

10.10.9.1 The following shall be furnished with the offer.

(a) Product Catalogues/Technical literature describing the constructional features, materials used for components, operational feature of the equipment, indicating the model number etc.
(b) Energy withstand capability & a description of the test carried out to measure the same.
(c) Power frequency withstand voltage versus time characteristic curve covering the time range from 0.1 sec. to 24 minutes.
(d) Dimensional drawings of the bracket mounting base, live conductor clamps, earth lead and automatic earth disconnecting device and overall dimensional drawing.
(e) Drawing of name plate to scale incorporating the particulars called for.
(f) Completed Schedule of Guaranteed Technical Particulars
(g) A copy of the Manufacturer's ISO 9001 Certificate conforming to design and manufacture
(h) Type Test Certificates: The Type Test Certificates shall be from an Accredited Independent Testing Authority acceptable to the Purchaser.
(i) Copy of the Governing Standards
(j) Technical Literature in English Language on installation, operation and maintenance with necessary circuit

diagrams and drawings.

10.10.9.2 Type Test Certificates

Following Type Test certificates conforming to IEC 60099-4, IEC 60507 and IEC 61109 shall also be submitted with the offer.

(a) Insulation withstand test,
(b) Residual voltage tests,
(c) Long duration current impulse
(d) Operation duty test
(e) Tests of arrester disconnector,
(f) Partial discharge test,
(g) Seal leakage test,
(h) Tracking & erosion test for polymeric insulation

Test Certificates shall clearly identify the equipment concerned showing the manufacturer's identity, Type, Model and Serial Number of the equipment tested. Type Test Report shall include complete drawings and the model/type of the offered Arrester. Type Test Report shall be from a recognized accredited independent testing authority acceptable to the purchaser.

10.11 Distribution Cutout (Drop-Out Fuses)

10.11.1 Scope

This Specification covers the general requirements of the design, manufacture, testing, supply and delivery of drop out fuse complete with fuse carriers and mounting brackets commonly used on the primary side of 11 kV distribution transformers as protective device.

10.11.2 System Parameters

a)	Nominal Voltage	11kV
b)	System Highest Voltage	12kV
c)	System frequency	50Hz
d)	No. of Phases	3
e)	Neutral Earthing	Effective
f)	System fault current	20kA rms

10.11.3 Service Condition

a)	Ambient temperature	-5 to 55 deg. C
b)	Annual average ambient temperature	30 deg. C
c)	Maximum relative humidity	99%
d)	Environmental condition	Humid Tropical climate
e)	Operational altitude	Up to 3000m above msl
f)	Isokeraunic (Thunder day) level	90 days
g)	Solar Radiation	1.6kW/m2

10.11.4 Applicable Standards

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof and the NEA Specifications specified hereafter.

a)	IEC 60282-2	H.V. Fuses - Expulsion and similar fuses
b)	IEC 60071-1	Insulation co-ordination.- Part I Definitions, principles and rules
c)	IEC 60071-2	Insulation co-ordination - Part 2 - Application guide
d)	IEC 60273	Characteristic of indoor & outdoor post insulators for systems with nominal voltages greater than 1000V
e)	IEC 60694	Common Specifications for high-voltage switchgear & control gear standards
f)	IEC 60060-2	High-voltage test techniques -Part 2 Measuring systems

10.11.5 Technical Parameters

10.11.5.1 Minimum Technical Requirements

S.N.	Description	Unit	Required ratings/features
1	Rated Voltage	kV	12
2	Rated Frequency	Hz	50
3	Rated Continuous Current	A	100
4	Dry Impulse withstand voltage (peak)		
4.1	Across isolating distance of the fuse base	kV	85
4.2	To earth and between poles	kV	75
5	Power Frequency withstand voltage (Wet 1min)		
5.1	Across isolating distance of the fuse base	kV	32
5.2	To earth and between poles	kV	28
6	Minimum power frequency withstand voltage		
6.1	Dry	kV	35
6.2	Wet	kV	30
7	Mounting Angle (to vertical plane)	deg	~15-20
8	Interrupting Rating		
8.1	Symmetrical Interrupting rating (min) rms	kA	8.0
8.2	Asymmetrical Interrupting rating (min) rms	kA	9.6
8.3	X/R ratio		4.0
9	Interrupting capacity	kA	10
10	Temperature Rise Limit (In air)		
10.1	Copper contacts silver faced	deg. C	40
10.2	Terminals	deg C	30

10.11.6 Basic Features

10.11.6.1 Design

The Dropout Fuse shall be of Class A as per IEC 60282-2. It shall be suitable for use in outdoor circuits under tropical conditions. The Dropout Fuse shall be complying with the minimum technical requirements stipulated above.

10.11.6.2 Manufacture

a) The Dropout Fuse shall be designed with a solid core, bird proof, one-piece Porcelain Insulator and should robust enough to withstand shocks due to frequent operations. The fuse carrier shall drop-out immediately following the blowing of the fuse.
b) Dropout Fuse within the same voltage class shall be so designed that fuse carrier together with mounting assembly shall be dimensionally compatible to facilitate the interchange of fuse carriers of the cutouts of corresponding rating.
c) The Dropout fuse shall be able to mount on a single channel iron cross arm (100mm x 50mm x 6mm) at an angle of 15 to 20 degrees to the vertical. The whole unit shall be complete with long mounting bracket, bolts, nuts & washers.
d) Fuse carrier shall be made of high strength fiberglass filament wound tube or suitable insulating material and it shall be protected from weather and environment by ultraviolet resistant coating. Inside liner of the fuse tube shall be constructed of a synthetic arc quenching material.
e) Copper Arc Shortening rod shall be attached to the cap of the fuse tube to obtain higher interrupting rating. A removable button head type fuse link having M6x1 thread shall be able to fix to the arc shortening tube.
f) The installation and removal of the fuse carrier shall be facilitated by inserting the operating rod into a lifting eye at the hinge end (lower) of the fuse carrier when it is in the dropped-out position. An operating lever eye shall be provided at the top of the carrier to facilitate a downward pull by the operating rod to release the latch incorporated in the stationary upper contact.
g) All castings such as upper and lower moving and fixed contacts, clamp type terminals, toggle mechanism shall be of phosphor bronze, silicon bronze, aluminum bronze or Silver- plated brass.

10.11.6.3 Stationary and Movable Contacts

a) The Stationary and Movable Contact surfaces shall be silver plated to minimize the contact resistance.
b) The upper stationary contact assembly shall be provided with a safety latch to prevent the fuse carrier from dropping due to vibration and the upper contacts shall be protected from any airborne contaminants.
c) A back up spring made out of stainless steel or phosphor bronze shall be provided to ensure constant pressure between the upper stationary contact and the upper movable contact of the fuse carrier.
d) The lower stationary contact support and the fuse carrier shall be machined at the swiveling or axle point to enable the fuse carrier with the fuse link to be correctly guided into the latching position by an operating rod. The hinge at the stationary contact shall be so designed to prevent the dropping off of the fuse carrier in the drop-out position,

due to shock and vibration.
e) A suitable guiding arrangement shall be provided in the upper contact to ensure easy engagement of the fuse carrier.
f) The Asymmetrical breaking current ratings shall be permanently marked on the upper metal part.

10.11.6.4 Terminals

a) The upper and lower terminals shall be of Bi-metallic type, suitable to accommodate Copper/Aluminum Conductors of Sizes from 5mm to 14mm diameter.
b) The upper terminal shall be positioned to receive the conductor from either side or upward direction while the lower terminal shall be able to receive the conductor from either side or downward direction.
c) The maximum temperature rise for contacts (movable and stationary) shall not be more than 40°.C and, for terminals the temperature rise shall not be more than 30° C.

10.11.6.5 Galvanizing

All iron and steel parts such as mounting and support brackets, bolts and nuts, washers etc. shall be galvanized after processes such as sawing, shearing, drilling, punching, filling, bending and machining are completed. Galvanizing shall be the hot-dip process to comply with the standard ISO 1461.

10.11.7 Additional Requirements

10.11.7.1 Rating Plate Markings

The ratings and data of the Dropout Fuse shall be provided in the rating plate, which shall be weather and corrosion proof. The main rating plate near the supporting bracket of the insulator base shall carry the following information:
a) Number and year of the Standard adopted
b) Rated voltage/Rated maximum current
c) Class designation/Manufacturer's name or trademark,
d) Asymmetrical current rating/Symmetrical current rating/X/R Ratio.
e) Year of manufacture
f) Contract No.

The following information shall be marked on the fuse carrier.
a) Manufacturer's name or trademark
b) Rated Voltage/Rated frequency
c) Rated maximum current
d) Rated breaking capacity (Asymmetrical/Symmetrical current rating & X/R Ratio).

10.11.7.2 Packing

The pre-assembled dropout fuse unit (Dropout Fuse Base, Fuse Carrier and Mounting Bracket) shall be packed in a suitable hardboard box and the rated voltage of the unit shall be clearly marked on the box. Spare fuse carrier shall be supplied in suitable hardboard boxes, the quantity and the voltage rating applicable shall be clearly marked on the boxes.

10.11.8 Inspection And Testing

10.11.8.1 Acceptance Test

The successful Bidder shall make necessary arrangements for pre-shipment inspection and tests by the nominated NEA Inspectors to carry out in his presence the necessary Sample/Acceptance tests conforming to the relevant IEC on equipment and materials offered. Routine test report for all the items shall be furnished for the observation of the Inspector.

The acceptance tests as per IEC shall be witnessed by the NEA Inspector.

(a) Dimensional Verification
(b) Dielectric tests
(c) Mechanical Tests
(d) Measurement of resistance of fuse-links

10.11.9 Bid Documentation

10.11.9.1 The following shall be furnished with the offer.

(a) Product Catalogues/Technical literature describing the constructional features, materials used for components, operational feature of the equipment, indicating the model number etc.
(b) Energy withstand capability & a description of the test carried out to measure the same.
(c) Power frequency withstand voltage versus time characteristic curve covering the time range from 0.1 sec. to 24 minutes.
(d) Dimensional drawings of the bracket mounting base, live conductor clamps, earth lead and automatic earth disconnecting device and overall dimensional drawing.
(e) Drawing of name plate to scale incorporating the particulars called for.
(f) Completed Schedule of Guaranteed Technical Particulars
(g) A copy of the Manufacturer's ISO 9001 Certificate conforming to design and manufacture
(h) Type Test Certificates. The Type Test Certificates shall be from an Accredited Independent Testing Authority acceptable to the Purchaser.

(i) Copy of the Governing Standards
(j) Technical Literature in English Language on installation, operation and maintenance with necessary circuit diagrams and drawings.

10.11.9.2 Type Test Certificates

Following Type Test certificates conforming to IEC 60282-2, IEC 60060 at a reference frequency of 50 Hz. where applicable shall also be submitted with the offer.

a) Dielectric Tests
b) Temperature Rise Tests
c) Artificial Pollution Tests
d) Mechanical Tests
e) Breaking Tests
f) Interrupting Tests
g) Beam Strength of Porcelain Base

Test Certificates shall clearly identify the equipment concerned showing the manufacturer's identity, Type, Model and Serial Number of the equipment tested. Type Test Report shall include complete drawings and the model/type of the offered Arrester. Type Test Report shall be from a recognized accredited independent testing authority acceptable to the purchaser.

10.12 Fuse Link

10.12.1 Scope

This Specification covers the supply of button head fuse links commonly used in the protection of distribution transformers with the Distribution Cutouts above.

10.12.2 Description

The button-head fuse link shall be fabricated in full compliance with the relevant IEC, or latest revision thereof or any other international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable.

The fuse link shall have fast characteristics and shall be suitable for protection of distribution transformers. The fuse link shall be supplied in accordance with the type and ratings shown in the bid package.

10.12.3 Tests

The distribution cutout and surge arrester shall be tested in accordance with the relevant provisions of the governing standard.

10.12.4 Bid Documentation

The Bidder shall furnish copies of governing standards for fabrication and testing of fuse links
The Bidder shall furnish copies of catalogue of fuse links.
The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.
The Bidder shall also furnish with the Bid copies of the following data with respect to the fuse links furnished:

a) Time-Current (TC) characteristic curves at 30°C, including minimum melting time and total clearing time.
b) Preloading adjustment factors or curves.
c) Ambient temperature adjustment factors or curve

All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents

10.13 Distribution Panel Board

10.13.1 Scope

This Specification covers the design, fabrication, testing and supply of Distribution Panel Boards to be used in the Low Voltage Overhead Distribution system of the Nepal Electricity Authority (NEA) to provide overload and short circuit protection for Distribution lines up to Customer Distribution Panel.

10.13.2 Description

The panel board shall be pole-mounted and used in conjunction with pole-mounted distribution transformers to house

moulded case circuit breaker (MCCB) feeding 400/230 Volt circuits.

The panel board shall be rectangular in shape with an entrance door in the front of the panel board. The panel board shall be equipped with interior standoffs suitable for mounting MCCB and for supporting cables. The panel board will be fixed to the pole by exterior mounting brackets attached to the back of the panel board. Details of these components shall be as specified in the following text.

The panel board shall be fabricated to prevent ingress of moisture due to rainfall and dripping. The panel board shall be provided with means for natural ventilation.

10.13.2.1 Material

The panel board case and door shall be fabricated out of steel sheet of minimum 2 mm. in thickness and pole mounting brackets shall be fabricated out of mild steel flat of 6 mm. in thickness. The interior standoffs shall be fabricated of steel sheet of sufficient thickness to support installed circuit breaker and cables without lateral movements.

10.13.2.2 Construction

The panel board case and all interior and exterior attachment shall be spot-welded. All welding shall be of the highest quality. The panel boards shall be formed and welded square and all attachments to the interior and exterior surfaces shall be welded square and perpendicular to the panel attached.

The panel board shall be so constructed as to be water tight from blowing of free-falling rain. There shall be no apertures in the panel board case other than those provided for the entrance door, cable fittings, or ventilation. The top extension and bottom shall be so formed to provide a drip edge and prevent water from flowing on the respective under-surfaces.

All individual pieces of metal shall be edge finished prior to assembly to provide surfaces and edges which are free from sharp points and edges. After welding in place, all welds shall be finished to smooth condition.

10.13.2.3 Panel board Front

The front panel shall be fabricated as a separate piece containing the panel board door and doorframe. The front shall be attached to the panel board housing by suitable bolting arrangements to provide a watertight and dust tight seal at the perimeter.

The door shall be equipped with a gasketed removable door, door-handle lock, and suitable hinges. The door and panel frame shall be so fabricated to provide an integrated structure which is warp-resistant and which will maintain dust-tight and watertight seal. Gasketing material shall be heat-resistant and shall retain its resilience over time to precluded degradation of dust-tight and watertight properties.

The insertable (and removable) door handle shall provide a door a locking function. The handle shall be insulated.

The door hinge may be continuous type or separate hinge units. However, the type of hinge furnished must accommodate, and not degrade, the dust-tight and watertight characteristics and must provide adequate door alignment and support over time.

10.13.2.4 MCCB Standoffs

The standoffs shall be shaped and dimensioned to accommodate the MCCBs as required by Bid Packages. The standoffs shall be precisely located.

10.13.2.5 Cable Standoffs

The cable standoffs shall be properly shaped and dimensioned. The standoff shall have the metal edges contoured and smoothed to prevent abrasion of applied cable serving. The standoff shall be located within the panel board to make allowance for cable bending radii and the location of other components.

10.13.2.6 Bus bars

The neutral and phase bus bars shall consist of copper bus bar insulated from the panel board by 600 V porcelain insulators. The copper bus bar shall be of proper size (ampere capacity) and properly dimensioned. The bus bars shall be located within the panel board to provide adequate clearance for the installation and correct functioning of all items.

If it is required to drill or penetrate the panel board back to install 600 V insulators, the outside of the panel board shall be permanently sealed over the attachment to retain water-tightness.

10.13.2.7 Cable Entrance Fittings and Knockouts

Knockouts for cable entrance fittings (bushings) shall be provided in the bottom of the panel board. All necessary cable entrance fittings shall be supplied for proper connection of all circuits to fulfil the requirement of the Bid Package. The fittings shall be designed to be suitable for exposed cables entering the panel board from below and shall secure the cable with inserts to prevent lateral and longitudinal movement of the cables.

The fittings shall be threaded multi-piece construction which when installed securely locks the fittings to the panel board. The fittings may be of metal or polymer material. Metal fittings shall be galvanized or plated as appropriate. The fitting inserts may be single or multi pieces and shall be of material sufficiently elastic and resilient to securely grip the PVC cable sheath without damage. The fitting components shall enable capturing of the inserts to preclude insert creep and fallout due to clamping pressure.

10.13.2.8 Ventilation

The panel board shall be provided with apertures for natural draft ventilation in the panel board bottom and in the top overhang. The ventilation apertures shall be covered with bronze screen materials of a mesh sufficiently to preclude passage of small insects. The edges of the bronze screening shall be surely fastened to the panel board by means of soldering or epoxy adhesive. The mesh shall be protected during panel board fittings to preclude clogging of mesh openings by finished materials.

10.13.2.9 Pole Mounting Bracket

The panel board shall be provided with two (2) pole mounting brackets. The size of poles will be confirmed by the purchaser before manufacturing.

10.13.2.10 Grounding Stud

The panel board shall be provided with a brass grounding stud located in an approved location. The grounding stud shall be fitted to the panel board to insure low resistivity and water tightness of the installation. The grounding stud shall be complete with pressure washer, lock washer, and nuts.

10.13.2.11 Finish

After fabrication, the panel board shall be thoroughly cleaned of all dirt, grease, mill scale, and weld slag on all interior and exterior surfaces and all surfaces of all component. After thorough cleaning of panel board one (1) coat of red oxide metal priming paint and two (2) finish coats of paint color shall be thoroughly applied. The paint color shall be of light grey (RAL 7032). The finish coats shall be of oil based or epoxy paint. Alternatively, powder coating of panel board may also be acceptable.

The bronzed screen ventilation holes, working surfaces of door hinge and door lock, and outside face of grounding stud shall be free from all finishing materials.

10.13.3 Bid Documentation

The following shall be furnished with the offer.

(a) The Bidder shall furnish fabrication drawings showing all views, section, and dimensions of individual components and assembled panel board.
(b) The Bidder shall furnish complete description of all materials to be used, including cable entrance fittings and finishing materials.
(c) The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.
(d) All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.
(e) Completed Schedule of Guaranteed Technical Particulars
(f) A copy of the Manufacturer's ISO 9001 Certificate conforming to design and manufacture
(g) Technical Literature in English Language on installation, operation and maintenance with necessary circuit diagrams and drawings.

10.14 Moulded-Case Circuit Breakers (MCCB)

10.14.1 Scope

This specification covers the design, manufacture and testing of Moulded Case Circuit Breakers (MCCB) used with Distribution Panel Board in the Low Voltage Overhead Distribution system of the Nepal Electricity Authority (NEA) to provide overload and short circuit protection for Distribution lines up to Customer Distribution Panel

10.14.2 System Parameters

a)	Nominal Voltage	400/230V, 3 Phase and Neutral
b)	System Highest Voltage	440/250V, 3 Phase and Neutral
c)	System frequency	50Hz
d)	Method of Earthing	Solidly earthed neutral
e)	System fault current	25kA

10.14.3 Service Condition

a)	Ambient temperature	-5 to 55 deg. C
b)	Annual average ambient temperature	30 deg. C
c)	Maximum relative humidity	99%
d)	Environmental condition	Humid Tropical climate
e)	Operational altitude	Up to 3000m above msl
f)	Isokeraunic (Thunder day) level	90 days
g)	Solar Radiation	1.6kW/m2

10.14.4 Applicable Standards

The equipment and components supplied shall be in accordance with the latest editions of the standards IEC 60947 and amendments thereof and the NEA Specifications specified hereafter.

10.14.5 Technical Parameters

10.14.5.1 Minimum Technical Requirements

S.N.	Description	Unit	Requirements
1	No. of Poles		3
2	Rated frequency	Hz	50
3	Rated operational voltage (Ue)	V	400/230
4	Rated insulation voltage (Ui)	V	750
5	Impulse withstand voltage (Uimp)	kV	8
6	Continuous Current Rating (In)	A	80, 160, 250, 320, 500
7	Ultimate Short Circuit Breaking Capacity (Icu) (up to 100 A)	kA	25
8	Ultimate Short Circuit Breaking Capacity (Icu) (above 100 A)	kA	50
9	Operating Short Circuit Breaking Capacity (Ics)		50 % of Icu
10	Utilization Category		A
11	Rated duty		uninterrupted
12	Trip device		Thermal adjustable magnetic
13	Rated current adjustment		(0.8-1)In
14	Instant opening current adjustment		10 x In
15	Mechanical Life Operation		>15000
16	Electrical Life Operation		>10000
17	Line load reversibility features		Yes
18	Interrupting Capability		(IEC category P2)
19	Thermal Rating declared at 50 deg C		Yes
20	Operating Range		-5 to 55 deg. C
21	Creepage distance suitable for		Pollution Degree 3 and suitable for isolation
22	Suitable for isolation		Yes
23	Trip Characteristics		inverse time and instantaneous
24	Universal Accessory Fitting		Yes
25	External Accessory		Rotary Operating Handle (Extended for >200A) Suitable Extended Terminals Phase Barriers Mounting Screws

10.15 Steel Tubular Pole

10.15.1 Scope

This Specification covers the design, fabrication, testing and supply of swaged type galvanized steel tubular poles to be used to support overhead electric lines and equipment.

10.15.2 Description

10.15.2.1 The steel tubular pole shall be manufactured and tested in accordance with IS:2713. The poles shall be fabricated of seamless tubes of suitable lengths as specified in **Table 1** made out of welded tubes, swaged and joined together. The diameters of various sections of the fabricated pole shall be as specified therein. A bid not conforming to the requirements of **Table 1** shall be rejected as being non responsive.

10.15.2.2 There are some numbers of poles which shall be of folding type. The folding type poles shall be fabricated in such a way that the bottom section and middle section of the poles could be securely fixed by two sets of galvanized nuts/bolts of suitable size and length at 90^0 each other. All other design requirements and parameters for folding type poles shall be as per section above and IS:2713.
10.15.2.3 The separate galvanized steel pole cap shall be provided with top section of the pole. The bottom section of the pole shall be provided with a base plate. The base plate shall be square of size 300x300 mm and 10 mm thick and it shall be welded at the bottom of the pole. The base plate shall have a hole of dia. approx. 50 mm in the center, for draining out of water.
10.15.2.4 The total supply quantity of steel tubular poles (total of non-folding type and folding type) are given in the Price Schedule. Supply quantity of folding type poles shall be finalized after pre- construction survey.

10.15.3 Material

3.1 The poles shall be fabricated from steel having tensile strength not less than 410 N/mm^2. The pole shall be composed of three sections in diminishing diameters and minimum diameter and thickness and lengths of poles shall be as shown in **Table below.**

3.2 The steel tubes shall confirm to the requirements of IS:2713, or latest revision thereof or other recognized international standards that ensures at least a substantially equal quality to the standard mentioned above.

4. **Manufacture**
4.1 All tubes forming the part of the pole shall be made from hot finished seamless or continuously welded steel in accordance with IS 2713, or equivalent international standards. Following tolerances shall be maintained.
a) Tolerance on outside diameter: +/- 1%
b) Tolerance on length: +/- 40mm on any section
+/-25mm on overall length c) Tolerance on weight: No negative tolerance
d) Tolerance on thickness: No negative tolerance
e) The out-of-straightness of the finished pole shall not exceed 1/600 of its length.
4.2 All welding of the poles shall be carried out at the manufacturers' plant.
4.3 Each section of the pole shall have only one longitudinal weld. No circumferential joints/welds of the tubes are permitted. All welds shall be capable of withstanding, without failure or cracking the stresses in a pole when subjected to its ultimate design loads.
4.4 The pole shall have hole configurations and sizes as shown in the drawings attached to this specification. The hole sizes and the locations of the hole must however be confirmed with the Project prior to manufacture.

5. **Corrosion Protection**
5.1 All sections of the pole shall be galvanized both internally and externally. Galvanizing shall be applied by the hot dip process, and shall be done in single bath (single dip) to result in a uniform thickness both internally and externally. Galvanizing of the poles shall be done after completion of fabrication process. Drilling, punching, cutting, bending and removal of burrs shall be completed before galvanizing. The preparation for galvanizing and the galvanizing process shall not adversely affect the mechanical properties of the material being coated. All galvanizing shall be in accordance with ISO 1461 or IS:4736 or an equivalent international
standard, and shall result in uniform thickness galvanization and be free from defects. The pole cap and the base plate shall also be galvanized.
5.2 The minimum thickness of the zinc coating shall not be less than 500 g/m^2 (equivalent to 70 microns) of zinc for all surfaces of steel including the base plate and the pole cover.

6. **Marking of Pole**
6.1 The pole shall have an identification marked with indelible paint on the pole at a position approximately 3.5 m. from the butt end, which is clearly and indelibly marked with:
a) Date of manufacture and identification mark of manufacture.
b) Length of pole in meters and its design working loads as defined in this specification. c) Name of the Employer
d) Contract Number.
6.2 The pole shall be marked with a permanent horizontal line at a point 1/6th of the pole height from the butt end of the assembled pole.

7. Earthing Lug, Base Plate and Pole Cap
Each pole shall be provided with earthing lug at 300 mm above the ground level. Separate pole cap shall be provided for each pole. The plate for pole cap shall be of 3 mm. minimum thickness.

8. Tests
8.1 The following test(s) shall be performed on finished poles. All testing shall be fully documented and certified test reports shall be provided to the Project.
- Test for dimensional and structural properties, and for the physical requirements of the finished poles
- Test for galvanization
- Tensile test and chemical analysis test
- Deflection test
- Permanent set test, and

- Drop test.

8.2 Poles selected for tests shall be a representative sample from each lot. The number of poles selected for conducting deflection, permanent set and drop tests shall be as follows.

S.N.	Lot size	No. of poles
1.	Up to 500	5
2.	501-1000	8
3.	1001-2000	13
4.	2001-3000	18
5.	3001 and above	20

8.3 The number of poles selected for conducting tensile test and chemical analysis tests shall be as follows:

S.N.	Lot size	No. of poles
1.	Up to 500	1
2.	501-1000	2
3.	1001-2000	3
4.	2001-3000	4
5.	3001 and above	5

8.4 The above test shall be performed as per IS:2713 or other recognized international standards. The following particulars shall be recorded:

a) Manufacturer's name and plant location;
b) Batch No. of steel plate or tubing;
c) Test date;
d) Pole type;
e) Dimensions of pole;
f) Increments of load and the deflections at each increment of load;
g) Permanent deflection;
h) Load of failure;

For deflection test, each pole shall be rigidly supported for a distance from the butt end equal to the length the depth to which it to be planted in the ground. It shall then be loaded as cantilever and the appropriate deflection load applied at right angle of the axis of pole 300 mm from the top of the poles for poles up to 9m length and 600 mm for poles over 9m length. The temporary deflection at the point of application of the applied load shall not exceed 157.5 mm

8.6 The permanent set test shall be carried out immediately after the deflection test, on the same test sample. After application of the proper load, the permanent set measured from the zero position at the point of application of load after the release of the applied load shall not exceed 13 mm.

8.7 To perform the drop test, the pole shall be dropped vertically with the bud end downward, three times in succession from a height of 2 m onto a hardwood block 150 mm thick laid on a concrete foundation. The pole shall not show any signs of telescoping or loosening of joints.

8.8 Should any of the poles first selected fail to pass any of the tests specified above, two further poles shall be selected for testing from the same batch i.e. same pole length manufactured on the same day from the same steel plate or tubing in respect of each failure. Should one or
both these additional poles fail, the test material represented by the test samples shall be
deemed as not complying with this specification.

9. Quality Assurance Program

9.1 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

i. The structure of the organization;
ii. The duties and responsibilities assigned to staff ensuring quality of works;
i. The system for purchasing, taking delivery and verification of materials;
ii. The system for ensuring quality of workmanship;
iii. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
iv. List of manufacturing facilities available;
v. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
vi. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

9.2 The manufacturer shall perform, among others, the following inspections/test on each consignment of raw steel, prior to fabrication. A certificate shall be provided to the Employer showing the test results:

i. Visual, dimensional and mechanical tests, to identify the steel meets the required strength/grade ensure compliance with the relevant Standards, and to ensure the absence of rust and surface imperfections. If the steel does

meet the strength or grade required, the batch shall be rejected.

ii. Dimensional tests to ensure that the material is within the production tolerances of IS 2713 or BS 4360 and BS 6323 or equivalent Standards. One sample shall be taken from each batch for which a certificate is provided. If the first sample fails the test, a second sample shall be taken. If the second sample fails the test, the batch shall be rejected.

10. Packing

Poles shall be stacked together and banded securely to ensure that each individual bundle does not break or the shifting of individual poles does not take place during transportation and handling. Any loose items shall be suitably banded together or packed to avoid loss during transportation and storage.

11. Bid Documentation

11.1 The Bidder shall provide with the Bid copies of the governing standards for selection of tubing, fabrication and testing of Steel Tubular Poles and copies of all other relevant standards referenced therein.

11.2 The Bidder shall provide a complete design, description and certified dimensional drawings of each type of pole.

11.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

11.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

Table 1: Pole Attributes

S.N.	Description	Unit	Value	
			For 11m Pole	For 9m Pole
1	Overall Length	m	11	9
2	Pole Designation		410 SP-52	410 SP-31
3	Section Length			
3.1	Top (h1)	m	2.7	2.0
3.2	Middle (h2)	m	2.7	2.0
3.3	Bottom (h3)	m	5.6	5.0
4	Outside Diameter			
4.1	Top (h1)	mm	114.3	114.3
4.2	Middle (h2)	mm	139.7	139.7
4.3	Bottom (h3)	mm	165.1	165.1
5	Thickness			
5.1	Top (h1)	mm	3.65	3.65
5.2	Middle (h2)	mm	4.50	4.50
5.3	Bottom (h3)	mm	4.50	4.50
6	Crippling Load	kgf	307	367
7	Approximate Weight (excluding the weight of galvanization, base plate and pole cap)	kg	175	147
8	Application of load from top of pole	m	0.6	0.3
9	Planting Depth	m	1.8	1.5

10.16 Pre-Stressed Concrete (PSC) Pole

10.16.1 Scope

These specifications apply to design, manufacture, and testing of rectangular pre-stressed concrete poles for use in electrical distribution.

10.16.2 Description

The pre-stressed concrete pole shall be designed and fabricated in full compliance with IS:1678-1978, or latest revision thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

10.16.3 Load

The working loads of various pole categories are as per the design parameters. The design ultimate strength shall be calculated using a safety factor of 2.5. Pole Attributes are listed in the design parameters.

10.16.4 Materials

10.16.4.1 **Cement**

Cement to be used in the manufacture of pre-stressed concrete poles shall be ordinary for rapid hardening Portland cement confirming to IS: 269-1976 (Specification for ordinary and low heat Portland cement) or IS: 8041 E-1978 (Specification for rapid hardening Portland cement).

10.16.4.2 **Aggregates**

Aggregates to be used for the manufacture of pre-stressed concrete poles shall confirm to IS:383 (Specification for coarse and fine aggregates from natural sources for concrete) The nominal maximum sizes of aggregates shall in no case exceed 12 mm.

10.16.4.3 **Water**

Water should be free from chlorides, sulphates, other salts and organic matter. Potable water will be generally suitable.

10.16.4.4 **Admixture**

Admixture should not contain Calcium Chloride or other chlorides and salts which are likely to promote corrosion of pre-stressing steel. The admixture shall conform to IS: 9103.

10.16.4.5 **Pre-stressing Steel**

The pre-stressing steel wires should confirm to the IS 1785 OR IS 6003. The plain wire should be of 4 mm in diameter with a guaranteed ultimate strength of 175 kg/mm^2. The strands shall be made from cold-drawn non-alloy steel (high carbon content) wires. The seven-wire strand consists of a group of wires arranged in stranded formation and shall have the following properties. The seven-wire strands shall confirm to IS:6006-1983, or latest revision thereof or any other equivalent national or international standards.

Geometrical Properties:

Type of material:	Seven-wire strand
Nominal diameter of strand	7.9 mm (7/2.6mm)
Nominal cross-sectional area of strands	37.4 mm^2

Mechanical Properties:

Nominal mass of strand:	64.50kN
Minimum breaking load:	294 g/m
0.2% proof load	54.70 kN

Long Term Behavior:

Maximum relaxation after 1000 h of operation at initial load equivalent to 60%, 70% and 80% of breaking load shall not be higher than 1.0%, 2.5% and 4.5% respectively.

10.16.4.6 **Concrete Mix**

Concrete mix shall be designed to the requirements laid down for controlled concrete (also called design mix concrete) in IS: 1343-1980 (Code of practice for pre-stressed concrete) and IS: 456 – 1978 (Code of practice for plain and reinforced concrete).

10.16.5 Design

10.16.5.1 The poles shall be as per following design parameters and the dimensions shall be shown in Drawing.

Design Parameters:

Concrete mix:	M40
Minimum diameter of pre-stressing wire:	Refer Table 2
Working Load:	Refer Table 1
Depth of Plantation:	Refer Table 2
Point of Application of Load	Refer Table 2

10.16.5.2 The minimum strength of concrete in the pole shall meet the requirements laid down in IS:1343-1960 and IS:456-1964 or in any other equivalent national or international standards.

10.16.5.3 The pre-stressing strands shall be accurately positioned and satisfactorily protected against the formation of rust or other corrosion prior to the placement of the concrete. All pre-stressing strands shall be free from loose rust, dirt, grease, oil and other lubricants or substance that might impair their bond with the concrete.

10.16.5.4 The cement employed shall be the Ordinary Portland Cement (OPC), which shall conform to the chemical and physical requirements as set forth in IS 269, or any other equivalent national or international standards.

10.16.5.5 The amount of concrete cover on the outside of the pre-stressed reinforcement shall be not less than 20 mm.

10.16.5.6 Concrete shall be compacted by spinning, vibrating, shocking or other suitable mechanical means. Hand compacting shall not be permitted.

10.16.5.7 The concrete shall be covered with a layer of sacking, canvass, Hessian or similar absorbent material and kept constantly wet up to the time when the strength of concrete is at least equal to the minimum strength of concrete at transfer of pre-stress. Thereafter, the pole may be removed from the mould and watered at intervals

to prevent surface cracking of the unit the interval should depend on the atmospheric humidity and temperature. The pre-stressing wires shall be detentioned only after the concrete has attained the specified strength at transfer (i.e. 200 or 210 kg/cm² as applicable). The cubes cast for the purpose of determining the strength at transfer should be coursed, a sear as possible, under condition similar to those under which the poles are cured. The transfer stage shall be determined based on the daily tests carried out on concrete cubes till the specified strength indicated above is reached. Thereafter the test on concrete shall be carried out as detailed in IS: 1343(code of practice for pre-stressed concrete). The manufacture shall supply, when required by the owner or his representative, result of compressive test conducted in accordance with IS: 456 (Code of practice for plain and reinforced concrete) on concrete cubes made from the concrete used for the poles. If the manufacture so desired, the manufacture shall supply cubes for test purpose and such cubes shall be tested in accordance with IS: 456 (Code of practice for plain and reinforced concrete).

10.16.5.8 The pole shall include cast-in holes. Typical hole patterns are shown in the drawings. Hole patterns must be confirmed with the NEA prior to manufacture.

10.16.5.9 All poles shall be unpolished but free of roughness, chips, excess cements, and other surface irregularities. All poles shall present a straight and symmetrical appearance after erection. The corners of all the poles shall be rounded so that they do not present a dangerously sharp edge, which could cause tearing or excessive wearing of safety belts.

10.16.5.10 All poles shall be provided with lifting hooks at two points for loading and unloading of poles.

Table 1

Working Load

S.N.	Pole Length (m)	Design Load (kgf)
1	11	350
2	9	200

Table 2

Pole Attributes

S.N.	Description	Unit	9m PSC Pole	11m PSC Pole
1	Standard		IS 1678	IS 1678
2	Length of PSC Pole	m	9	11
3	Size	mm	300*150*140	400*180*150
4	Approximate Weight	kg	680	1150
5	Working Load	kgf	200	350
6	Ultimate Load	kgf	500	875
7	Concrete Grade		M40	M40
8	Pre-stressing Wire			
8.1	Diameter	mm	7.9 mm (7/2.6mm)	7.9 mm (7/2.6mm)
8.2	Standard		IS 1785	IS 1785
9	Factor of Safety		2.5	2.5
10	No of tensioned wire		6	8
11	No of stirrups (6mm MS)		12	12
12	Depth of Plantation	m	1.5	1.8
13	Point of Application of load from pole top	m	0.6	0.6

10.16.6 Tests

Definition of various types of loads:

Working load = Expected Load

Design Working Load = Expected Load x Factor of Safety (FOS)

Ultimate Transverse Load (UTL) = Load when applied at specified point of the pole, the failure occurs.

Minimum Ultimate Transverse Load (MUTL) = Load when applied at specified point of the pole, the first crack appears.

Design Transverse Load (DTL) = Design Working Load

Design Ultimate Transverse Load (DUTL) = Design load at the transverse direction at which the first crack expected to appear (given by the Designer after calculation)

The **Design Ultimate Transverse Load (DUTL)** is less or equal to Ultimate Transverse Load

10.16.6.1 Transverse Strength Test

The pole shall be rigidly supported at the butt end for a distance equal to the specified planting depth. The load shall be applied at a point specified in Table 2 from the top of the pole and shall be steadily and gradually increased to the design transverse load until the occurrence of the first crack. The deflection is then measured. Prior to the application of the design transverse load there shall be no crack.

The load shall then be reduced to zero and increased gradually to a load equal to the first crack load plus 10% of the minimum ultimate transverse load, and held for 2 minutes. This procedure shall be repeated until the load reaches the value of 80% of the minimum ultimate transverse load and thereafter increased by 5% of the minimum ultimate transverse load until failure. Each time the load is applied, it shall be held for 2 minutes. The ultimate transverse load shall not be less than the design ultimate transverse load.

10.16.6.2 Measurement of Cover

The cover shall be measured at 3 points, one within 1.8m from the butt end of the pole, second within 0.6m from the top and the third at the intermediate point. The mean value of the measured cover should not differ by more than +/-1mm from the specified value, and the individual value should not differ by more than+/-3mm from the specified value.

10.16.6.3 The number of poles selected for testing and their conformity criteria shall be as follows:

Lot Size	**Sample Size**	**Permissible No. of Defective Samples**	**No. of Poles for Transverse Strength Test**
Up to 100	10	1	2
101 to 200	15	1	3
201 to 300	20	2	4
301 to 500	25	3	5

10.16.6.4 All the poles selected in 5.3 shall be tested for overall length, cross-section and up-rightness. The tolerance shall be +/-15mm on overall length, +/-3mm on cross-sectional dimensions, and 0.5% on uprightness.

10.16.6.5 The number of poles which do not satisfy the requirements of overall strength, cross-section and uprightness shall not exceed the number given in 5.3. If the number of such poles exceeds the corresponding number, all poles in the lot shall be tested for requirements, and those not satisfying the requirements shall be rejected.

10.16.6.6 All the poles tested for transverse strength test shall satisfy the requirements of the test. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected and subjected to test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of the test.

10.16.7 Marking

The poles shall be cleanly and indelibly marked with the following:

a) Month and year of manufacture, at approximately 3m from the butt end;
b) Specified working load in kg, at approximately 3m from the butt end; and
c) The design lifting point.
d) The pole should be marked with the Identification of the Project/Contract at approximately 5m from the butt end.

10.16.8 Bid Documentation

10.16.8.1 The Bidder shall furnish following documents together with Bid;

a. Two (2) clear copies of the standards, governing fabrication and testing of pre-stressed concrete poles and two (2) clear copies of other standards indicated in the specifications.
b. Two (2) clear copies of detailed design and drawings of each type of pole.
c. Two (2) clear certified copies of all tests performed on similar poles of same sizes and similar working loads.
d. A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

10.16.8.2 The Bidder shall provide the following details:

a) Pole dimensions in cross-section and pole taper;
b) Location and size of pre-stressing strands;
c) Hole locations;
d) Design ground line;
e) Marking of the lifting point;
g) Minimum ultimate transverse load;
h) Transverse load at first crack
i) Concrete design mix and cement specification
j) Specifications of the pre-stressing strands, their tensile strength and sizes

10.17 Porcelain Insulators and Fittings

10.17.1 Scope

This Specification covers the Type Test, fabrication and supply of pin insulators, disc insulators stay insulators, disc insulator fittings and insulator pins as herein specified for use on overhead power line construction.

10.17.2 General

10.17.2.1 General Requirements of Insulators

Insulators shall be fabricated and tested in accordance with the Standards referenced for each type of insulator or equivalent standards.
The Type Test shall be conducted in the recognized laboratory.
Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The glaze shall be brown in color. The glaze shall cover all exposed parts of the insulators.
The design of insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. The porcelain shall not engage directly with hard metal.
The cement used in construction of insulators shall not give rise to chemical reaction with metal fittings and its thickness shall be as uniform as possible.
The insulators should be manufactured in automatic temperature-controlled kilns to obtain uniform baking and better electrical and mechanical properties.
The preferred make of disc, pin and stay insulators and fittings are Allied Ceramics Pvt. Ltd., BHEL, Aditya Birla Insulators Ltd., Hindustan Chemicals Ltd. or equivalent reputed.

10.17.2.2 General Requirements of Disc Insulators fittings

The disc insulator fittings shall be designed, manufactured and tested in accordance with IS:
2486 or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

The disc insulator fittings shall be supplied with ball and socket couplings and twisted straps. The insulator fittings shall conform to the shape and dimension as per the governing standards

Disc insulator fittings like ball and socket, nuts and bolts shall be made of hot rolled steel and the twisted cross arm strap shall be made of MS sheet metal. Cotter bolts and U-bolts shall be of galvanized steel. Cotter pins shall be of stainless steel.

All forgings and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as the ball socket and holes, shall be rounded. The nominal dimensions of the ball and socket, ball eye and twisted cross arm straps, shall be as per the governing standards.

All ferrous fittings and the parts other than those of stainless steel, shall be hot dip galvanized as per IS: 2629 or equivalent

international standards.

10.17.2.3 General Requirements of Insulator Pins

The insulator pins specified herein shall be fabricated from hot rolled steel. The pin shall be a single piece obtained preferably by the process of forging. It shall not be made by jointing, welding, shrink fitting or any other processes from more than one piece of material. It shall be of good finish free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided.

All ferrous pins, nuts and washers except those made of stainless steel shall be hot dip galvanized. The threads of nuts shall be cut after galvanizing and shall be well oiled and greased. The galvanizing shall conform to IS 2629-1985 or equivalent national or international standard.

All insulator pins shall be reasonably smooth on all surfaces and free of sharp projections.

10.17.3 Specific Requirements

10.17.3.1. Pin Insulator

The pin insulator shall be manufactured and tested in accordance with IS: 731 and IS:3188 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable. The lead thread shall be compatible with the insulator pin specified in these documents.

The pin insulator shall have following ratings and features:

S.N.	Description	Unit	11 kV pin insulator
1	Highest system voltage	kV	12
2	Rated voltage	kV	11
3	Creepage distance (minimum)	mm	265
4	Wet power frequency withstand voltage	kV	35
5	Impulse withstand voltage	kV	75
6	Puncture power frequency voltage (minimum)	kV	105
7	Visible discharge voltage (Effective)	kV	9
8	Cantilever strength	kN	5
9	GI pin head		Small

10.17.3.2 Disc Insulator

The disc insulator shall be manufactured and tested in accordance with IS: 731 or latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

The disc insulator shall be ball and socket fitting type. The disc insulator shall have the following ratings and features:

S.N.	Description	Unit	Value
1	Highest system Voltage	kV	12
2	Rated Voltage	kV	11
3	Porcelain Diameter (minimum)	mm	255
4	Spacing	mm	145
5	Creepage Distance (minimum)	mm	320
6	Power Frequency Puncture withstand Voltage		1.3 x Actual dry flashover voltage
7	Wet Power Frequency Withstand Voltage	kV	35
8	Impulse Withstand Voltage	kV	75
9	Puncture Power Frequency Voltage (minimum)	kV	105
10	Visible Discharge Voltage	kV	9
11	Mechanical Strength	kN	45
12	Ball and Socket Size		16 mm B
13	Applicable Standard for Special Characteristics		IS: 3188

10.17.3.3 Stay Insulator

The stay insulator shall be manufactured and tested in accordance with IS: 5300 or latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

The stay insulator shall have the following ratings and features:

S.N.	Description	Unit	Stay Insulator for 11 kV and 400V Line
1	IS Designation		A
2	Length	mm	90
3	Diameter	Mm	65
4	Cable Hole Diameter	mm	16
5	Creepage Distance (minimum)	mm	41
6	Minimum failing load	kN	44
7	Power Frequency Withstand Voltage		
7.1	Dry	kV	18
7.2	Wet	kV	8

10.17.3.4 Insulator Pins

The insulator pins to be supplied shall conform to IS: 2486 or equivalent international standards and to the shape and dimensions shown in the drawings contained in this specification. The insulator pin shall be furnished with a spring steel split lock washer and nut assembled on the insulator pin. The ratings and features of the insulator pins shall be as follows:

S.N.	Description	Unit	Required ratings/features for 11 kV
1	Head type		Small S165P
2	Total length	mm	315
3	Stalk length	mm	165
4	Shank length	mm	150
5	Minimum failing load	kN	5
6	Applicable standard		IS: 2486 or equivalent international standard.

The insulator pins shall be compatible with the insulators specified above.

10.17.3.5 Disc Insulator Fittings

Disc insulator fittings like Ball and socket, nuts, bolts shall be made of hot rolled steel and the twisted cross arm strap shall be made of MS sheet metal. Cotter bolts and U-bolts shall be of galvanized steel. Cotter pins shall be of stainless steel.

All forgings and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as the ball socket and holes, shall be rounded. The nominal dimensions of the ball and socket, ball eye and twisted cross arm straps, are given in Drawings. The ultimate strength of the fittings shall not be less than 41 KN.

All ferrous fittings and the parts other than those of stainless steel, shall be hot dip galvanized as per IS: 2629-1985 or equal internationally recognized standards.

10.17.4 Marking

Each insulator shall be legibly and indelibly marked to show the following:

a) Name or trademark of manufacturer.
b) Year of manufacture.
c) Minimum failing load in Newton
d) Name of Employer

Markings on porcelain shall be printed and shall be applied before firing.

10.17.5 Tests

The insulators and fittings shall comply with the type tests and routine tests as per relevant governing standards.

10.17.6 Bid Documentation

The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of pin insulator and insulator pin and two (2) clear copies of all other relevant standards referenced therein.

The Bidder shall provide certified type test results of pin insulator and insulators pin as required by governing standards.

The Bidder shall provide standard catalogue and certified dimensional drawings of pin insulator and insulator pins.
A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

10.18 Stay Sets

10.18.1 Scope
This Specification covers the fabrication and supply of adjustable threaded, galvanized, ferrous, stay sets and nuts for use in overhead line construction.

10.18.2 Description
10.18.2.1 The stay set shall consist of mild steel; galvanized stay rod; stay tightener or adjustable head complete with stay plate a thimble of suitable dimensions
10.18.2.2 The stay rod shall be fabricated of mild steel of minimum tensile strength of 4200 kg/sq.cm. The other technical features and dimensions are given in table attached herewith.
10.18.2.3 The stay tightener shall be made of mild steel of minimum ultimate tensile strength of 42,000kg/sq.cm. The thimbles shall be made of 1.219mm (18 SWG) GI sheet, and shall be suitable for terminating steel stay wire with a preformed grip.
10.18.2.4 The stay plate shall be square type MS plate of dimensions as mentioned in Table herewith. The plate shall have a matching hole at the center to fit the end of the stay rod.

10.18.3 Fabrication
10.18.3.1 The stay rod and nut shall be fabricated to the shape and dimensions shown in table attached herewith.
10.13.3.2 The thread form at the threaded end of the rod, and that of the accompanying nut, shall be optional with the supplier. However, it shall be the responsibility of the Supplier to supply the stay rod with a thread form that shall sustain the rated loads specified in table without creep or stripping over the full life of the rod material at specified diameter.
10.13.3.3 After fabrication, the stay rod and nut shall be hot-dip zinc galvanized in accordance with IS 2629-1985, latest edition, or to an equivalent hot-dip galvanizing standard which produces equal or superior result.
10.13.3.4 After galvanizing, the nut and rod threading shall be such that the nut may be run the full length of the thread without the use of tools.

10.18.4 Tests
10.18.4.1 Apart from the tests indicated in the relevant referenced standard of steel, the stay set shall undergo following tests:
-Visual Inspection.
-Verification of dimensioned.
–Tensile strength: The stay set assemblies shall withstand a minimum tensile load specified in Table 1.
-Bend test: The stay rod shall be bend-tested over a mandrel of 19 mm millimeter through an angle of 90 degrees at any point in the un-threaded section of the rod without fracture of the steel. Temperature of the test shall be 68 degrees Fahrenheit (22.5 deg Celsius).

10.18.5 Bid Documentation
10.18.5.1 The Bidder shall furnish with the Bid a complete description of the stay sets proposed to be supplied including, but not limited to, steel classification of base metal, detailed drawings showing shape, dimensions, and threading certified type test results as required by paragraph 4 herein, the identity of the proposed manufacturer, and manufacturers catalogue number, plus catalogue cuts. The technical data furnished shall be bound separately from the Bid Document.

Table 1: Ratings and Features of Stay Sets

S.N.	Description	Unit	Stay Sets for 11 kV and 0.4 kV line
1	Length of stay rod	m	1.8
2	Diameter of stay rod	mm	16
3	Ultimate tensile strength of stay rod and turn-buckle	kg/cm^2	4200
4	Minimum breaking load	kg	6,433
5	Length of threaded portion	mm	300
6	Thimble shape		Suitable for 7/12 mm stay wire
7	Thimble section		18 SWG min.
8	Stay plate section	mmxmmxmm	300x300x6
9	Eyebolt length	mm	300
10	Eyebolt diameter	mm	16

10.19 Stay Wire

10.19.1 Scope
This Specification covers the fabrication and supply of zinc-coated steel wire for use in overhead power line as stay wire

ropes for line supports (poles).

10.19.2 Description of Strands

The steel strand shall be fabricated in accordance with IS 2141 or an equivalent international standard. The steel wire strand shall have a left-hand lay. The steel wires shall have no joint throughout the whole length. Strands shall be uniform and shall have no defects such as cracks, dust encapsulation or crevices. Further details are given in Table herein.

10.19.3 Packing

The steel wire strand shall be furnished in reels holding minimum of 100 kg. Each reel shall have a weather-resistant tag securely attached showing the length, nominal diameter, number of individual wires, grade of the strand, and the class of zinc coating.

10.19.4 Bid Documentation

10.19.4.1 The Bidder shall furnish the following technical data with the Bid:

a) If the material to be offered is to be manufactured in accordance with the specified B.S. standard, full technical data for the material and the identification of the manufacturer.

b) If the material offered to be manufactured in accordance with an equivalent standard, two (2) clear copies of that standard shall be furnished in addition to the data required in
(a) above.

All technical data furnished shall be bound separately from the Bids.

10.19.5 Tests

The testing of individual wires and complete conductor shall be in accordance with the nominated standards.

Table: Ratings and Features of stay wire

S.N.	Description	Unit	Stay Wire for 11 kV and 0.4 kV Line
1	Steel Wire Size	(Nos of wire/SWG)	7/12
2	No. of Wire	Nos	7
3	Diameter of Each wire	mm	2.64
4	Strand Diameter (Overall)	mm	7.8
5	Overall Cross-Sectional Area	mm^2	44.19
6	Steel Quality		Gr.700
7	Minimum Tensile Strength of Steel	N/mm^2	700
8	Min. Breaking load of single wire	kN	3.71
9	Min. Breaking load of strand	kN	26
10	Approximate Weight	kg/km	300
11	Minimum weight of Wire in each reel	kg	100
12	Left hand Lay	Yes/No	Yes
13	Minimum Thickness of Zinc Coating	g/m^2	230

10.20 11 kV Air Break Switch

10.20.1 Scope

This specification provides for manufacture, testing at works and delivery for supply of 11 kV AB switches. The 11 kV AB switches shall conform to IS: 9920 (Part-I to IV)

10.20.2 AB Switches

The 11KV Air Break Switches are required with two poles in each phase. The AB Switches shall be supplied complete with phase coupling shaft, operating rod and operating handle. It shall be manually gang operated and vertically break and horizontal mounting type.

The AB Switch shall be designed for a normal current rating of 400 Amps and for continuous service at the system voltage specified as under: 11 KV AB Switch: 11KV + 10% continuous 50 C/s solidly grounded earthed neutral system. The length of break in the air shall not be less than
400 mm for 11KV AB Switches.

The 11KV AB Switches are required with post insulators. The AB switches should be suitable for mounting on the structure. The mounting structure will be arranged by the purchaser separately. However, the AB Switches shall be supplied with base channel for mounting on the structure which will be provided by the purchaser. The phase to phase spacing shall be 750mm in case of 11KV AB Switches.

10.20.3 Post Insulators

The post insulators should conform to the latest applicable Indian standards IS: 2544. Creepage distance should be adequate for highly polluted outdoor atmosphere in open atmosphere. The porcelain used for manufacture of AB Switches should be homogeneous and free from flaws or imperfections that might affect the mechanical dielectric quality.

They shall be thoroughly vitrified, tough and impervious to moisture. The glazing of the porcelain shall be of uniform brown in color, free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable. The porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts through the range of temperature variation shall not loose the parts or create undue internal stresses which may affect the electrical or mechanical strength. Cap and base of the insulators shall be interchangeable with each other. The cap and base shall be properly cemented with insulators to give perfect grip. Excess cementing must be avoided.

The bidder shall in variably enclose with the offer, the type test certificate and other relevant technical guaranteed particulars of insulators offered by them. Please note that AB Switches without type test certificates will not be accepted.

Each 11kV Post Insulators should have technical particulars as detailed below:

S.N.	Particular	Value
1	Nominal system voltage KV (rms)	11
2	Highest system voltage KV (rms.)	12
3	Dry Power Frequency one minute withstand voltage (rms) in kV	35
4	Wet Power frequency one minute withstand voltage (rms) in kV	35
5	Power Frequency puncture KV (rms) voltage	1.3 times the actual dry flashover voltage
6	Impulse withstand voltage KV (Peak)	75
7	Visible discharge voltage KV (rms)	9
8	Creepage distance in mm (minimum)	320

The rated insulation level of the AB Switches shall not be lower than the values specified below:

S.N.	Standard declared Voltage	Rated voltage of the AB switch	Standard impulse withstand voltage (positive & negative polarity Isolating distance		One Minute power frequency withstand voltage KV (rms)	
			Across the Isolating distance	To earth & between poles	Across the Isolating distance	To earth & between poles
1	11KV	12kV	85kV	75kV	32kV	28 kV

10.20.4 Temperature Rise

The maximum temperature attained by any part of the equipment when in service at site under continuous full load conditions and exposed to the direct rays of Sun shall not exceed 45 degrees above ambient.

10.20.5 Main Contacts

AB Switches shall have heavy duty self-aligning type contacts made of hard drawn electrolytic copper/brass. The various parts should be accordingly finished to ensure inter changeability of similar components. The moving contacts of the switch shall be made from hard drawn electrolytic copper brass. This contact shall have dimensions as per drawing attached so as to withstand safely the highest short-circuit currents and over voltage that may be encountered during service. The surface of the contact shall be rounded smooth and silver-plated. In nut shell the male and female contact assemblies shall ensure.

a. Electro-dynamic withstands ability during short circuits without any risk of repulsion of contacts.

b. Thermal withstands ability during short circuits.

c. Constant contact pressure even when the lower parts of the insulator stacks are subjected to tensile stresses due to linear expansion of connected bus bar of flexible conductors either because of temperature variations or strong winds. Wiping action during closing and opening.

d. Fault alignment assuring closing of the switch without minute adjustments

10.20.6 Connectors

The connectors shall be made of hard drawn electrolytic copper or brass suitable for DOG/RABBIT ACSR conductor for both 11KV AB Switches. The connector should be 4 -bolt type.

10.20.7 Operating Mechanism

All AB Switches shall have separate independent manual operation. They should be provided with ON/OFF indicators and padlocking arrangements for locking in both the end positions to avoid unintentional operation. The isolating distances should also be visible for the AB Switches.

The AB Switch will be supplied with following accessories:

S.N.	Item	Size of 11 kV AB Switch
1	Operating Rod (GI dia)	Length 5.50 meter, dia 25 mm
2	Phase coupling square rod (GI)	Length 1800 mm, Size 25x25 mm
3	Hot dip galvanized Operating handle (GI)	1 No.

The AB Switches shall be capable to resist any chance of opening out when in closed position. The operating mechanism should be of robust constructions, easy to operate by single person and to be located conveniently for local operation in the switchyard. The GI pipe shall conform to ISS: 1239-68 and the vertical down rod should be provided with adequate joint in the mid-section to avoid bending or buckling. Additional leverage should be provided to maintain mechanical force with minimum efforts. All iron parts should be hot dip galvanized. All brass parts should be silver Plated and all nuts and bolts should be hot dip galvanized

10.20.8 Arcing Horns

It shall be simple and replaceable type. They should be capable of interrupting line charging current. They shall be of first make and after break type.

10.20.9 Bush

The design and construction of bush shall embody all the features required to withstand climatic conditions specified so as to ensure dependable and effective operations specified even after long periods of inaction of these Air Break Switches. They shall be made from highly polished bronze metal with adequate provision for periodic lubrication through nipples and vent.

10.20.10 Design, Materials And Workmanship

The successful tenderers shall assume full responsibility for co-ordination and adequate design. All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and material. All similar parts should be accurately finished and interchangeable.

Special attention shall be paid to tropical treatment to all the equipment, as it will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be of non- ferrous metal or alloys and shall be designed to limit sharp points/edges and similar sharp faces. The firm should submit the following type test certificate along with the certified copy of the drawing. The type test should not be older than 5 years from the date of opening of tender.

1. Test to prove capability of rated peak short circuit current and the rated short time current.

The rated short time current should correspond to minimum of 10kA and the peak short circuit current should correspond to minimum of 25kA.

2. Lightning impulse voltage test with positive & negative polarity.
3. Power Frequency voltage dry test and wet test.
4. Temperature rise test.
5. Mill volt drop tests.

10.20.11 Dimension of 11 kV AB Switches in (Max.) Tolerance 5%

S.N.	Particular	11KV AB Switch
1	MS Channel	450x75x40
2	Creepage distance of Post Insulator	320mm (Min)
3	Highest of Port shell	254 mm
4	Fixed contact assembly	
	i) Base	165x36x8
	ii) Contact	70x30x6
	iii) GI cover	110X44
5	Spring	6nos
6	Moving contract assemble	
a	Base Assembly	135x25x8
b	Moving	180x25x9
c	Bush	Bronze Metal

d	Thickness of Grooves	7

10.20.12 Terminal Connectors

The bidder should provide AB Switches with terminal connectors, set of insulators, mechanical inter works and arcing horns sets. The base channel for the mounting of AB Switches shall also be included in the scope of AB Switches. The operating mechanisms together with down pipe operating handle etc. are also included in the scope of supply.

10.20.13 Routine Test Certificate

The Routine test certificate should invariably be submitted in duplicate of each lot offered for inspection as per IS: 9920 (part-I to IV). The offers received without Routine test certificate shall not be entertained.

10.20.14 Acceptance Test

At the time of inspection following test shall be carried out:

a. Physical verification and measurement of dimension.

b. Power frequency high voltage test.

c. Temperature rise test.

d. Mechanical endurance test / operation test.

e. Milli volt drop test.

f. Galvanising test

10.20.15 Name Plate

The name plate in the following design shall be fixed on each AB Switch.

a. Name of supplier:

b. Name of purchaser:

c. Rating:

d. Serial number of units:

The size of name plate shall be 2" x 1" for 11 KV AB Switch.

10.21 LT Power Cable (PVC)

10.21.1 Scope

This Specification covers the design, manufacture, factory test and supply of 1.1 kV grade PVC insulated multicore power cables. The cables will be used for the purpose of 400V use of Nepal Electricity Authority.

10.21.2 Rated Voltage

The rated voltage of the cables shall be 1100V.

10.21.3 Service Condition

a)	Ambient temperature	-5 to 55 deg. C
b)	Annual average ambient temperature	30 deg. C
c)	Maximum relative humidity	99%
d)	Environmental condition	Humid Tropical climate
e)	Operational altitude	Up to 1000m above msl
f)	Isokeraunic (Thunder Day) level	90 days
g)	Solar Radiation	1.6kW/m2
h)	Wind Zone	Zone 4

10.21.4 Applicable Standards

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof or any international equivalent standards and the NEA Specifications specified hereafter.

a)	IS 1554	Specification for PVC Insulated heavy duty Electric cables for working voltages upto & including 1100 V
b)	IS 8130	Specification for conductors for insulated electric cables and flexible cords

The Bidder may propose alternative standards, provided it is demonstrated that they give a degree of quality and performance equivalent to or better than the referenced standards. The purchaser shall adjudge whether to accept or reject any standards.

The Bidder shall furnish a copy of the alternative standard proposed along with his bid. If the alternative standard is in a language other than English, an English translation shall be submitted with the standard. In case of conflict the order of the precedence shall be (1) IEC standards, (2) ISO standards, (3) European or British Standards, (4) Indian Standards, (5) Other alternative standards.

This list is not to be considered exhaustive and reference to a particular standard or recommendation in this specification does not relieve the Contractor or the necessity of providing the goods complying with other relevant standards or recommendation.

10.21.5 Technical Parameters

10.21.5.1 Minimum Technical Requirements

S.N.	Description	Unit	Requirements
1	Rated Voltage	kV	
2	Maximum System Voltage	kV	
3	Rated Voltage between two conductors	kV	
4	Power Frequency withstand voltage	kV	
5	Number of Cores		4
6	Phase Conductor		3
7	Insulation Material		PVC
8	Conductor		EC Grade Al.
9	Minimum Number of Strand		
10	Nominal Thickness of Insulation		
11	Minimum Thickness of inner sheath		
12	Type and dimensions of armor		
13	Minimum thickness of outer sheath		
14	Conductor Temperature Rise during Normal Operation	deg. C	70
15	Conductor Temperature Rise during Short Circuit	deg. C	160
16	Direction of Lay		Right Hand
17	Standard Length of Cable Per drum	m	Min. 500

10.21.5.2 Requirements of size

The required size of PVC insulated, aluminum Conductor, armored cable shall be:
4x400 mm^2, 4x300 and 4x150mm^2

10.21.6 Basic Features

10.21.6.1 Design

The power cable shall conform in all respects to highest standards of engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or material, which, in his judgment is not in full accordance therewith.

10.21.6.2 Conductors

The conductor shall be of multi-strand round aluminum of compacted circular cross-section conforming to IEC or equivalent international standards. The conductor shall be clean and reasonably uniform in size and shape and its surface shall be free from sharp edges.

10.21.6.3 Insulation

The conductor shall be provided with PVC insulation applied by extrusion. Type of insulation shall be A for general purpose PVC.

10.21.6.4 Laying up of Cores

In twin, three & multi core cables, the cores shall be laid up together with a suitable lay, the outermost layer shall have right hand lay and the successive layer shall be laid with opposite lay.

10.21.6.5 Inner Sheath

The laid up cores shall be provided with Inner Sheath applied by extrusion. It shall be ensured that the shape of Cable is as circular as possible. Inner sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to

remove it without damaging the insulation.

10.21.6.6 Armour

The armour wires/strips shall be applied as closely as practicable. A binder tape may be provided on the armour.

10.21.6.7 Outer Sheath

The outer sheath shall be applied by extrusion over the armouring. The colour of outer sheath is black unless otherwise specified. Thickness of outer sheath should be as per IS: 1554.

10.21.7 Cable Identification and Marking

The following shall be embossed on the outer sheath of the cable throughout the length of cable at 1.0 meter spacing. The embossing should be very clear and easily visible to naked eye. The height of the printed lettering shall be not less than 20% of the overall diameter of the conductor. Sequential length shall be marked on the outer sheath of the cable throughout the length by Printing in each meter length interval.

- Applicable Standards
- Name/Identification of the manufacturer,
- Name of the Purchaser 'Nepal Electricity Authority'
- Voltage Grade of Cable
- Type of Insulation, material of conductor
- Number of Cores and nominal cross-sectional area of conductor
- Cable Code
- Year and Month of Manufacture

Each phase of the core shall be identified with the color Red, Yellow, Blue and Black on the inner sheath.

10.21.8 Packaging

All conductors shall be furnished on non-returnable steel drums capable of withstanding all normal transportation and handling. Protective external lagging of sufficient thickness shall be provided and fitted closely on the drums. Binder consisting of steel straps shall be provided over the external laggings. The drums shall be new and sufficiently sturdy in construction to withstand ocean shipping, road transport, several loading and unloading, storage in tropics, hauling and field erection of conductor without distortion or disintegration.

Each reel of the conductors furnished shall contain only one (1) length of conductor. The minimum length of each drum shall be minimum of 500m. All drums shall be legibly marked in paint with the following information:

(i) Manufacturer's Name and Trademark (if any)
(ii) Drum Number or identification number
(iii) Type of conductor
(iv) Size of conductor
(v) Voltage Grade
(vi) Length in meters
(vii) Gross Weight
(viii) Net weight of conductor
(ix) Direction of rolling

10.21.9 Inspection And Testing

10.21.9.1 Acceptance Test

The successful Bidder shall make necessary arrangements for pre-shipment inspection and tests by the nominated NEA Inspectors to carry out in his presence the necessary Sample/Acceptance tests conforming to the relevant governing standards on the completed cables offered.

10.21.9.2 Routine Test

The Routine Tests shall be carried out on the completed cables at the manufacturer's plant in accordance with the governing standards. The test reports shall be made available for the observation of the NEA Inspector at the time of inspection.

10.21.10 Bid Documentation

10.21.10.1 The following shall be furnished with the offer:

(a) Complete description, catalogue, drawings showing general construction and size of the cables including dimensional drawing of cable drum for each type of cable.
(b) Completed Schedule of Guaranteed Technical Particulars
(c) A copy of the Manufacturer's ISO 9001 Certificate conforming to design and manufacture
(d) Type Test Certificates: The Type Test Certificates shall be from an Accredited Independent Testing Authority acceptable to the Purchaser.
(e) Copy of the Governing Standards
(f) Technical Literature in English Language on installation, operation and maintenance with necessary diagrams and drawings.

10.21.10.2 Type Test Certificates
The material offered shall be fully type tested by an independent accredited testing laboratory acceptable to the Employer. The bidder shall submit the type test reports along with the offer. The tests shall comply with relevant Standards. The Employer also reserves the right to have tests carried out by an independent agency, whenever there is a dispute regarding the quality of supply.

11 OTHER ELECTRICAL INSTALLATIONS

11.1 Water Level Indicator

11.1.1 Float less Type Level Switch In Water Tanks

The Contractor shall supply and install float less type switch probes in all water tanks as indicated below and shown on the drawings.

- High level alarm (over-flow);
- Low level alarm;
- Low level cut-out for raw water pumps;
- Earthing probe.

Each probe shall be of the correct length for the particular application and tank location. Electrodes shall be of polished stainless steel 20 mm OD. Electrode holders shall be weatherproof in all respect. The earthing probes shall be connected and wired to the building earth systems of the building.

Each set of electrodes shall be installed inside a 230 mm diameter PVC pipe acting as a wave barrier. The level switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided for each set of control probes and shall be installed inside centralized control cubicles inside pump room. Mechanical steel stuffing boxes shall be used.

11.1.2 Control of Duty / Standby Pumps

Operation of the duty and standby pumps shall be carried out by the following methods:

- Automatically by means of LEVEL sensor (i.e. magnetic switches);
- Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop switch.

Automatic controls shall be operated by electronic, float less type level switches.

11.1.3 Pump Indicator

Automatic controls shall be operated by electronic, float less type level switches. The following audible and visible indication shall be provided at the pump local control panels as applicable:

- Red "overflow level" indicator with buzzer for the associated water tanks;
- Amber "extra high water level" indicator for the associated water tank;
- Amber "high water level" indicator;
- Amber "low water level" indicator;
- Red "pump trip" indicator for each pump;
- Green "pump on" indicator for each pump;
- "Pump electrical supply healthy" indicator for each pump;
- Amber "remote/local" status indicator.

11.2 LT Voltage Stabilizer

Voltage stabilizer shall correct the voltage automatically as per required specification and variation limit without any distortion in the output voltage waveform.

Voltage stabilizer up to 100 kVA shall be air cooled whereas stabilizer above 100 kVA shall be oil cooled. Stabilizer shall consist of following units:

- Regulator unit
- Buck boost unit
- Automatic control unit
- Enclosure

Automatic regulator unit shall be oil cooled above 100 kVA, naturally cooled on load, stepless rolling contact type. Fittings

and accessories for regulator shall be as follows:

- Radiator cooling system when oil cooled
- Lifting lugs
- Earthing terminals
- Diagram and rating plate.
- Drain valve and oil filling hole when oil
- Silica gel breather when oil cooled
- Thermometer pockets

11.2.1 Core

The magnetic circuit shall be built of transformer grade cold rolled grain oriented low loss steel stampings having high permeability and conforming to adopted standards. Stamping shall be insulated from each other with material having high inter-lamination insulation resistance and rust inhibiting property and also capable of withstanding pressure, mechanical vibration and action of heat and oil, thus reducing the possibility of sludge formation to a minimum.

The framework clamping arrangement and general structure of the cores shall be of robust construction and shall be capable of with sustained any shock to which they may be subject during transport, installation and service. The assembled core shall be securely clamped on the limbs and the yoke, to build up a rigid structure. The clamping pressure shall be uniform the whole of the core and so adjusted as to minimize noise and vibration in the core when the transformer is in service. The framework and the core bolts shall be efficiently insulated from the core so as to reduce the circulating currents to a minimum.

The core clamping frame shall be provided with lifting eyes for the purpose of tanking and untanking the core with winding mounted thereon and shall have ample strength to take the full weight of the core and winding assembly.

11.2.2 Winding

The coils used for winding shall be circular in shape made of paper insulated continuous and smooth tinned or enameled electrolytic copper conductors of high conductivity.

Liberal ducts shall be provided to prevent any hot spot temperature in the winging that may adversely affect the life of the equipment. Adequate supports wedges and spacers of hard insulating material shall be so fitted that they will neither move nor permit relative movement of any part of winding during transit of normal service or under terminal short- circuit, nor damage the winding insulation in any way. All leads and connections shall be robust, adequately insulated, protected and clamped. The winding assembly shall be dried in vacuum with tested insulating oil of approved standard. The windings shall be subjected to a through shrinking and seasoning process so that no further shrinking of windings occur during service at site. However, adjustable devices shall be provided for taking up any possible shrinkage of coils in service. The assembly shall be held in position under adequate axial compression to withstand the axial thrust likely to occur under terminal short-circuit.

11.2.3 Auto Control Unit

Auto control unit shall be mounted along with the regulator tank and shall consists of

- PCB relay/ electronic relay
- Step syn. Geared motor
- Auto/ manual switch

Set of push buttons

- Lower raise switch/ push buttons
- Indicating lights
- Input & output voltmeters
- Ammeter with selector switch

11.2.4 Technical Parameters

	KVA Rating	As per schedule of quantities
	Rated Voltage	415 VAC
	Input Volts	330 V to 460 V AC
	Output Volts	415 V ± 1%
	Rated Frequency	50 Hz.
	No. of phases for bypass system	3 Phase 4 wires system
	Load	Unbalanced
	Type of cooling	Air cooled upto 100 kVA and ONAN above 100KVA
	Maximum temperature rise	
	of oil by thermometer	44 Deg C
	of winding by resistance	55 Deg C
	of hot spot temperature indicator	65 Deg C
	Limit of hot spot temperature for which	110 Deg C

	the transformer is designed to be	
	Service	Indoor/ Outdoor
	Automatic control gear	Consisting of one electronic relay, reversing geared motor under limit switches in order to avoid over - running highest and lowest positions, chain drive, control devices and all electrical connections. Alternatively, variac consisting of carbon brushes can be provided for Automatic regulation.
	Efficiency	Better than 94%
	Distortion at output	Not exceed 5%
	Rate of correction	Not more than 8 volts per second
	Schedule of Equipment	415 V Automatic voltage stabilizer as per technical requirements shall comprise of:
		• Rolling contact type on load voltage regulator/ variac carbon brush type. • Buck-Boost transformer. • Automatic control gear.
	Tanks and Fittings	The equipment shall be housed in a sheet steel tank fitted with radiators and mounted on bidirectional/ Unidirectional rollers. The following shall be with the equipment
		• Lifting lugs • Earthing terminals. • Rating plate. • Drain valves. • Oil filling hole. • Thermometer pocket. • Oil Level Gauge. • Silica gel breather • Filter Valve.

Note: 0-500 digital voltmeter with selector switch shall be provided for incoming and outgoing side of stabilizer.

12 ALUMINIUM DOORS, WINDOWS AND VENTILATORS

12.1 Material and sections

The aluminum work shall be carried out as per detailed specifications and conditions for the work.

All aluminum work shall be free from defect in impairing, strength durability appearance and shall be of the best commercial quality for purposes specified made with structural properties to withstand safely strains / stresses to which they shall be normally subjected. All sections shall be of approved extruded tubular anodized aluminum sections from the approved manufacturers, as per architectural drawings and as per relevant IS Specifications or equivalent. Any equivalent extrusion will be got approved from the Engineer.

The contractor shall provide all items, articles, materials, operations, mentioned or scheduled, on the drawings, including all labour, materials fixing devices, equipment and incidentals necessary as required for their completion.

The contractor shall submit shop drawings and samples of each type of doors, windows, railing and other items of aluminum work to the Project Manager for approval. The shop drawings shall show full size sections of doors and windows etc. thickness of aluminium sections, details of construction hardware as well as connections of doors, windows and other aluminium work to adjacent work. Shop drawings shall be based on actual dimensions available on site. The variation in openings and shop drawings shall not be more than + 1.5 mm.

Aluminium doors and shutters shall be manufactured by an approved manufacturer and shall be of sections, sizes, combination and details shown on the architectural drawings. The frame member shall be of one piece and glazing bars shall be threaded or interlocked as approved by the Engineer.

Glazing for doors and windows shall be of specified thickness and approved quality and shall conform to specification of glazing. Fixing of glazing shall be done with aluminum 'Snap-On' beading as per detailed drawings and instructions. Necessary rubber gaskets of approved make shall be provided.

Upon delivery of doors and windows to site, they shall be handled with care, stored on edge on level bearers and supported evenly.

The manufacturer, immediately prior to the commencement of glazing, shall adjust and set all doors and accept responsibility for the satisfactory working of the opening frames. All doors shall open or slide as indicated in drawings and schedules.

The contractor shall be responsible for the doors & window shutters being set straight, plumb and level and for their satisfactory operation after the fixing its complete.

Fittings shall retain the casements rigidly in both open & closed positions. All fittings shall be got approved from the Project Manager. The fittings and aluminium work shall be complete and shall be wrapped and protected until the complete aluminum work is washed with mild solution of non-alkali soap and water and left in complete finished conditions.

12.2 Fabrication

All fabrications shall be got done with workmen who are skilled in the trade and fully equipped to carry out phases of fabrication in accordance with the best accepted practice and as shown on the drawing. All work shall be shop fabricated and finished and then brought on site for installations. The details of the equipment possessed by the contractor shall be provided, which should conclusively prove that all facilities required to execute the work as per specifications, are available.

All aluminium works shall be deemed to include in various items, complete work including fittings, fixtures, stays, locks, handles, special hinges, floor springs, neoprene/rubber linings, gaskets, bushes, rollers, sealant etc. as directed and approved by the Engineer.

The rates quoted for aluminium works shall be inclusive of all fixtures/fittings also anodized as per main member like handles, stays, sliding gears, tower bolts, cleats, hinges etc., and their weight shall not be considered in the finished product. The payment shall be given only for the members used measured centre to centre of the sections.

All windows, glazing etc shall be made completely water proof to the satisfaction of the Engineer and necessary Silicon / Polysuphide sealants etc. shall be provided. No payment shall be made for providing necessary Silicon / Polysuphide sealant etc. to items under this sub-head.

In the items of aluminum glazing in doors and windows etc. work shall include the provision of mullions, coupling bars as required to join various units of glazing in windows and doors etc. to form larger glazing in doors or door-cum-windows as required and as per drawings.

Taking into consideration varying profiles of aluminum sections being extruded by approved manufacturers and their availability in time as required the contractor shall prepare detailed shop drawings using suitable sections based on architectural design/drawings and adequate to meet the performance and other specifications parameters laid down for the work.

The section profile weight and suitability to meet the requirement/specifications as proposed by the manufacturer and detailed shop drawings shall be subject to approval of the Engineer who should be satisfied that if fully meets the design. In case it is proposed to provide substitute for any aluminium sections, which is specified for any aluminium glazing, this would be subjected to approval of the Engineer who is to be satisfied regarding the suitability of the alternative section and it having no financial variation.

Aluminium sections used for doors and openable windows including sliding windows, fixed glazing, curtain walls, glazing

frame work, extruded wall paneling of certain hand rails etc. shall be suitable for use to meet architectural designs of relevant works and shall be subject to approval of Project Manager who would require to be satisfied about their being appropriate on technical, functional and aesthetic considerations.

All joints shall be accurately fabricated and be hairline in appearance. The finished surface shall be free from visible defects.

All aluminium shall be anodized/powder coated as specified. Anodizing powder coating shall be of approved colour and conform to IS 1868-1968 and shall be of AC 15 grade with minimum thickness of 15 microns, when measured as per IS: 6012- 1970, and density shall be at least 32 least 32 mg/sq cm. All sections are to be matt anodized/powder coated in colour as per sample approved by the Architects.

The anodized coating shall be properly sealed by steam or boiling in de-ionised water as per IS 1868-1968 and of IS 6057. Sealing quality shall be tested in accordance with DIN 50949 or similar standards.

Colour anodizing would be done only by electro colour process.

Colour fastners shall be as per 1868-1968 grading-B.

No visual variation in shade shall be permitted. The fabricator shall clearly indicate the shade variation tolerance as measured by standard equipment.

Each glazing shall be tailor made as per opening at site. No cutting and making good of concrete surface shall be permitted.

Doors, windows or fixed glazing frames shall be fixed to concrete or brick work with approved metal fasteners. Method of fixing shall be approved by the Project Manager before mass fabrication.

Samples of typical glazing shall be made and got approved from the Project Manager before fabrication.

All hardware used shall conform to the relevant IS specifications. Design, quality, type number and fixing of the hardware shall be got approved from the Engineer.

A thick layer of the clear transparent lacquer based on Methacrylates or cellulose Butyrate shall be applied on the anodized glazing before they are brought on the site. The lacquer shall be removed on completion of erection.

All screws shall be stainless steel screws threads of machine screws used shall conform to IS: 4218 or otherwise approved by the Project Manager. Gaskets for retaining glass shall be of heavy extruded neoprene.

The corners of the frame being fabricated to a true right angle. Both the fixed and opening frames shall be fabricated out of sections which have been cut to length mitered and mechanically jointed. All members shall be accurately machine milled and fitted to form headline joints. The joining accessories such as cleats, brackets, etc shall be such material as not to cause any bimetallic corrosive action.

All the frame members shall be in plumb and level and jointed in such a way that maximum expansion and contraction will not cause distortion or leakage. The contractor shall be responsible for their satisfactory performance/operation after fixing is complete.

All aluminium work shall be washed with a suitable thinner and left in a finished condition in approved uniform appearance and free from all marks and blemishes. The glass panes shall be thoroughly washed and cleaned before the work is handed over.

The requirements provisions for all anodized aluminium work shall conform to requirements specifications and parameters given in this tender, drawings, instructions and shall at least provide for or conform to IS codes relating to materials workmanship, fabrication, finishing, erection, installation etc. In this connection relevant IS codes including Nos. 1868-1973, 6012-1970, 1285-1975,7400-1974 as deemed applicable by the Project Manager shall be considered.

Suitable sections with lighter/heavier weights as may be required and approved by architect shall be provided by the contractor. No variation in quoted rates shall be made for change in section or weights given as a guide.

12.3 Glass

12.3.1 Clear Glass

The glass shall be float glass of Modi Float or equivalent. Glass used in glazing, openable and fixed doors, windows etc shall provide clear, completely undistorted vision and reflection. It shall be free from any bubbles, waves or blemishes. Glass used shall be of required size as per drawings. No extra payment shall be made for use of glasses of any size having an area up to 32 sq.ft (in one piece) for 5mm thick glass.

12.3.2 Tinted Glass

Tinted glass shall have same quality and specifications as indicated above for clear glass. It shall however be transparent glass to Bronze/Blue/Green/Smoke gray shade as required and would be expected to absorb to absorb a greater proportion of sun's radiant heat and reduce transmission than clear glass.

12.4 Drawings/ Documents

Prior to fabrication, Contractor shall submit 1 copies of shop drawing indicating details of all members, sections and hardware for Engineer's approval. All certificates against tests for anodising and other physical properties of material shall be produced to the Engineer for acceptance.

12.5 Notes

1. All the fittings shall be anodised aluminium (finish compatible with original frame) type unless otherwise specified.
2. Single leaf door shutters and ventilator shutters of more than 0.80 m width shall be provided with one extra hinge.
3. Where height of window shutter and door leaf exceeds 1.2 m and 2.15 m respectively one extra hinge shall be provided for every additional height of 0.5 m or part thereof and length of top bolt shall be increased by the height of the shutter/leaf above 2.15 m from floor level.
4. In double leaf shutters of doors, two tower bolts shall be fixed to the first shutter at top and bottom and one to the closing shutter at the top.
5. All hardware shall conform to the applicable Indian Standards.

12.6 Measurement for Payment

Generally, the items shall be measured in-situ. The method of measurement shall be based on the following:

No payment shall be released till the thickness of the anodic coating is found to be minimum 15 microns and sealing quality appropriate everywhere. The testing shall be done by Eddy Current method as per IS: 6012-1970, for thickness and relevant DIN for sealing. Likewise, colour variation measurements shall also be carried out. If any material is found sub-standard this shall be totally rejected. Requisite tests shall be done at the site. 100% checking, as instructed by the Engineer may be resorted to.

Unless stated otherwise in the BOQ, payment for windows and doors shall be made by frame area for each type with same specific section. If items scheduled call for measurement by area, architraves linings, sills etc. shall not be measured separately but shall be considered as being included in the area of the opening closed by the window, door, shuttering or any other specified closure.

Unit area openings shall be considered only if standard weights of specified aluminium section shall be within the permissible limit of variation of the section. The permissible limit of variation for aluminum works shall be + 5% over the standard weight.

All costs for hardware and fittings shall be included in the unit rate of the relevant bill items.

13 FRENCH SPIRIT POLISHING

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 litre of spirit. Suitable pigment shall be added to get the required shade. Readymade polish conforming to IS 348 can also be used.

13.1 Polishing New Surface

13.1.1 Preparation of Surface

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 size laid on while hot. Holes and indentations on the surface shall be stopped with glazier's putty. 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 litre of spirit. The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.

13.1.2 Application

The number of coats of polish to be applied shall be as described in the item. A pad of woolen cloth covered by a fine cloth shall be used to apply the polish. The pad shall be moistened 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 oil on the face of the pad facilitates 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.

13.1.3 Measurements

The length and breadth shall be measured correct to a cm. The area shall be calculated in sqm (correct to two places of decimal), except otherwise stated.

Small articles not exceeding 0.1 sqm of painted surfaces where not in conjunction with similar painted work shall be enumerated.

Area of painting on hand rail shall be calculated by multiplying single running meter to gross height of hand rail (no deduction shall be made to any kind of post.

14 MISCELLANEOUS

Unless specifically otherwise mentioned in case of repair and maintenance work, all the applicable codes & standards published by the Indian standard Institution & all other standard which may be published by them before the date of receipt of Bids, shall govern in all respects of dosing workmanship quality & propitious of materials & methods of testing, method of measurements etc. Wherever any reference to any Indian Standard specifications occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued to or revisions thereof, if any, up to the date of receipt of Bids.

In case there is no Indian Code of Standard specification for the particular work (for repair and Maintenance), such work shall be carried out in accordance with the instructions in all respects, & requirements of the Engineer. Wherever any reference to any Indian standard specification occurs in the documents relating to this contract, the same shall be inclusive of all amendment issued there to or revisions thereof, if any, up to the date of receipt of Bids.

14.1 Surface Discharge Plate

Unless otherwise mentioned in Schedule of Requirements, surface discharge plates are to be made of at least 16 – 25 mm thick M.S. plate having sufficient strength to support entire weight of the pump set and the hydraulic pressure on it. The surface plate consists of a pipe bend of size sufficient to discharge the rated flow of water. The discharge bend has welded or casted flanges in both ends. The size of the surface discharge depends on the outer diameter of the tube-well and the shape may be either rounded or rectangular.

14.2 Turfing

Turfs shall be interpreted as grass that is seasonally dormant during cold or dry seasons and is capable of renewing growth after the dormant period. The turfs shall be brought by the Contractor from areas where the top soil is reasonably fertile and contain a high percentage of loamy topsoil. Turfs shall be cut or stripped from living, thickly matted turf relatively free from weeds or other undesirable foreign plants, large stones, roots or other materials which might be detrimental to the development of the turf or to future maintenance. Turf including the soil containing the roots shall be planted in a neat and systematic way.

The top soil on which Turfing is to be done shall be free of admixture of sub-soil, stone, gravel, clay lumps, plants or their roots, sticks or other extraneous material exceeding 50 mm. diameter. It shall be clay loam. The top soil shall be approved by the Engineer before being placed.

The strips of turf shall be in uniform widths not less than 230mm and length not more than 460 mm. Such lengths should be readily lifted without breaking, tearing or loss of soil. The turfs shall be transplanted within 24 hours from the time it is stripped unless storing is necessary. If stored, turfs shall be stacked, kept moist and protected from exposure to sun.

Turfs shall be cut and moved only when the soil mixture conditions are such that favorable results can be expected. Turfing shall be performed only during the seasons when satisfactory results can be expected. Turfing may be transplanted during drought free periods with the approval of the Engineer provided the turf bed is watered to moisten the soil to a depth of at least 100 mm immediately prior to laying the turf.

The turf shall be carefully placed by hand, edge to edge with staggered joints, in rows at right angle to the slopes, commencing at the base of the area to be turfed and working upward. The turf shall immediately be pressed firmly into contact with bed by tamping to provide a true and even surface. Screened soil of good quality shall be used to fill all cracks between turfs. The quality of fill soil shall not cause smothering of the grass.

The Contractor shall provide general care for the turfed area, protect against traffic and shall continue care until final inspection and acceptance of the work. If the surface become gullied or otherwise damaged during the period the affected area shall be repaved to established grade and condition as directed.

It shall be measured in square meter on the ground surface including 150 mm. thick materials and labour.

14.3 Sand Filling

Sand filling in floor or other place as mentioned or directed by engineer shall be in specified thickness as per drawing or BOQ. The sand layer shall be 75mm layers after sprinkling with water and ramming to full consolidation. Sand filling shall be done with sand confirming Clause 2.3.3.4 in layers not exceeding 75mm. Each layer shall be well watered and rammed to full consolidation with iron rammers. Other procedures shall be for earth filling described in Clause 2.2.

Rates for sand filling shall cover the cost of the provision of suitable material for any lead, placing in layers, watering and compacting as specified will measured as the volume between ground levels before and after the filling and the rate will include forming embankments, terraces, etc.

14.4 Brick bat filling

The brickbats shall be from brick of first class well burnt or slightly over burnt bricks. The bricks bats shall be laid in flat and sand shall be spread over the bricks bats and compacted to the required depth after sprinkling water. Unless and otherwise mentioned in drawing, each layer of the brick bat shall be so laid that the final compacted depth after sand blinding and watering shall not exceed 150mm. The compaction shall be carried out either manually or mechanically to

the satisfaction of the Engineer. The sand and water used in brick bat filling works shall confirm Clause 2.3.3.4 and 2.3.3.3.

Rate for Brick bat filling shall cover the cost of the provision of suitable material, placing in layers, watering and compacting as specified will measured as the volume between ground levels before and after the filling and the rate will include forming embankments, terraces, etc.

14.5 Transportation of Surplus Materials

Excavated materials surplus after backfilling shall be disposed off immediately after the completion of backfilling works at a location as directed by the engineer as per Clause 2.2.8.

14.6 Geotextile

Geotextile shall be made of polyethylene or polyster or similar fibres, either woven or nonwoven. Unless otherwise shown on the drawing, the geotextile shall:

14.6.1 sustain a load of not less than 10kN/m at break and have minimum failure strain of 10 percent when determined in accordance with BS:6906 or shall have a grab tensile strength more than 0.4 kN/m and grab elongation corresponding to this limit in accordance with ASTM D4632.

14.6.2 have apparent opening size as shown on the Drawing. If no size is shown on the Drawing, then the apparent size shall be 0.1 mm.

14.6.3 allow water to flow through it at right angles to its principal plane, in either direction at a rate of not less than 50 litres/sq.m./sec. under a constant head of 100 mm, determined in accordance with BS:6906 (part 3) or ATSM D4491, unless otherwise shown on the Drawing. The flow rate determined in the test shall be corrected to that applicable to a temperature of 150C using data on variation in viscosity of water with temperature.

14.6.4 have a minimum puncture resistance of 200N when determined in accordance with ASTM D 4833.

14.6.5 have a minimum tear resistance of 350 N determined in accordance with ASTM D 4533.

14.7 Gas Vents

When specified, gas vent flaps or vent pipes shall be installed in accordance with the drawings or as instructed by the Engineer to provide adequate venting for the liner system. The venting pipe should be fitted with required fittings and cowling.

14.8 Electro-fusion Welding Machine

Type - Automatic with Bar Code Reader, Automatic Operations & Data Logging:

S. No.	Parameters Description	Specification Range
Input		
1	Operating Temperature	-10 to + 50 deg C (Ref. Manual)
2	Mains Voltage	230V (-15% to + 10%)
3	Supply Current	15 Amp AC (Peak -26 Amp)
4	Frequency	50±10 Hzs.
5	Supply Power	Min. - 5KW
Output		
1	Controlled Welding Voltage	8 - 48 V AC
2	Welding Power	8 to 3120 VA
3	Welding Current	1 to 65 Amp AC (100 Amp short term)
General Features		
1	Manual Operations	Should be Possible
2	Barcode Reader	Pen or Scanner
3	Automatic Temp Compensation	Must be achieved in Automatic mode
4	Environmental Protection Type	IP65
5	Electrical Protection	Class 1 Earthed
6	Overload protection	Thermal 16 A (for 230 V versions)
7	Length of connector cable - Output Cable	3 Meters

8	Length of mains cable- Input Cable	4 Meters
9	Connectors Diameter	4mm F
10	Adapters Diameter	4.7mm F / 4mm M
11	Ambient Thermometer Precision	± 1º C
12	Standard	ISO 12176 - 2:2008
13	Data Logging - In & Out	USB Port - With 1GB Pen drive to download & Data memory - 2000 Welds
14	Cooling Time display	Activated
15	Maximum Welding time	3600 Seconds
16	Dimension (W/D/H/)	Not to exceed 30 Cm x 30 Cm x 40 Cm
17	Weight with cables	Not to exceed 20 Kg
18	Display	4 Line with Backlight & High contrast. It shall be possible to view on display, any kind of information regarding malfunctions that could occur before or during welding
19	Carrying Case	Metallic Box (Transport Case). Strong Aluminium case with SS fittings
20	Warranty	12 Months from the date of purchase
21	Service Centre & Calibration Services	Shall be available locally
	TPI certification	Should have any third party independent agency certification

14.9 Manual scraper

1) Blade in hardened steel, with sharp scraping edge.
2) Blade must have interchangeable 4 scraping edges.
3) The blade must have been fixed on a plastic handle inclined at an angle of 450 with the plane of the blade.
4) The minimum width of the blade should be 50 mm.
5) Weight should not exceed 0.50 kg.

14.10 Pillar Type Saddle Clamp (Top Loading) – For Pipe Size 63 to 315 MM.

1) Manufactured from Zinc plated steel. Strong welded construction & Zinc plated steel to avoid bending, damage & rusting.
2) Suitable to work with tapping saddles (Tapping Tees), branch saddles.
3) Designed to hold saddles onto pipe with top load of 1000 to 1500 Newtons, before and during the Electro-fusion process.
4) Designed to hold saddles on 63 to 315mm diameter PE pipe.
5) The Pillar Clamps shall be supplied in two size range: 63-125mm and 63-250 mm.
6) Simple operation, Load cell with Calibrated long life spring shall be used. Encapsulated load cell to avoid malfunctioning of Spring due to mud, grit & muck. Lubrication inside the load cell to ensure smooth clamping & less wear / tear of rotating & rubbing surfaces during heavy load conditions of 1500 Newton.
7) Load spring and indicator to show correct load has been applied.
8) The loading arm must slide easily up and down the pillar, allowing quick assembly of the joint.
9) The V block / foot of the clamp to allow the tool to swivel and negotiate the pipe orientation in pit / allowing access in a confined space.
10) The Size must be less than 60 cm x 20 cm x 10 cm
11) Weight must be less than 10kg.
12) Tool must be complied with the requirements of the National Grid Transco specification GIS/PL2-5: 2006. Specification for Polyethylene pipes and fittings for natural gas and suitable manufactured gas. Part 5: Electrofusion ancillary tooling

14.11 Strap Type Saddle Clamp (Top Loading) – For Pipe Size 63 to 630 MM.

1) Manufactured from Zinc plated steel. Strong welded construction & Zinc plated steel to avoid bending, damage & rusting.
2) Suitable to work with tapping saddles (Tapping Tees), branch saddles.

3) Designed to hold saddles onto pipe with flexi-strap with top load of 1000 to 1500 Newtons, before and during the Electro-fusion process.

4) Designed to hold saddles on 63 to 630mm diameter PE pipe with the flexi-strap locked with quick-fix / quick-release buckles.

5) Simple operation, Load cell with Calibrated long life spring shall be used. Encapsulated load cell to avoid malfunctioning of Spring due to mud, grit & muck. Lubrication inside the load cell to ensure smooth clamping & less wear / tear of rotating & rubbing surfaces during heavy load conditions of 1500 Newton.

6) Load spring and indicator to show correct load has been applied.

7) The stirrup at the top of the clamp to allow the tool to swivel and negotiate the pipe orientation in pit / allowing access in a confined space.

8) The Size must be less than 20 cm x 20 cm x 20 cm

9) Weight must be less than 3kg.

10) Tool must be comply with the requirements of the National Grid Transco specification GIS/PL2-5: 2006. Specification for Polyethylene pipes and fittings for natural gas and suitable manufactured gas. Part 5: Electrofusion ancillary tooling

14.12 Pipe Restraining, Alignment and Re-rounding Clamps

1) Shall be suitable for pipes of diameter d 63,60 ,75, 90,110,125,140 160 & 180 in one clamp, with interchangeable plastic insert sleeves for each size.

2) Shall be suitable for Straight, Elbow and Angular joints.

3) In one clamp pipe restraining, alignment and re-rounding features shall be available.

4) Design must be light weight (in aluminium material)

5) Design must be flexible for ease clamping of fittings.

14.13 Pipe Cutter- Wedge type

1) Suitable for Cutting PE pipes of diameter d20 to 63 mm.

2) Manufactured from steel with Zinc plating or powder-coating. Strong construction to avoid bending, damage & rusting.

3) Sharp cutting edges in hardened steel.

4) Amplified leverage for reducing cutting efforts.

5) Positive locking for accidental release of pipe during cutting.

14.14 Apparatus and Equipment for Water Quality Laboratory

14.14.1 pH Meter

Analytical Method	Electrometric Method; APHA 4500-H+ B
Type	Bench top
Range	-2 to 16 PH : -200 to 1200C
Resolution	0.01 ppm, 0.10C
Accuracy	± 0.1PH ± 0.01 PH , ±0.2 mv, ,± 1mv , ± 0.20C
Calibration	Automatic up to 5 point calibration with 7 standard buffer solutions
Temperature Compensation	Manual or Automatic from -20.0 to 120.00C
Electrode	pH electrode: glass, interchangeable, min. 1 m cable (included); Temperature electrode: min. 1 m cable (included)
Operating environment	minimum 0 – 50 °C; RH 95%
Other features	USB interface Plastic moulded rust proof, water-proof body Data logging up to 200 records Plastic electrode holder Ready indicator GLP features

14.14.2 Lab Nephelometer (Turbid meter)

Principle of operation	Nephelometric
Analytical method	Compliance with ISO 7027 or USEPA Method 180.1 or APHA 2130 B
Range	0.0 to 9.99, 10.0 to 99.9, 100 to 4000 NTU
Range selection	Automatic
Resolution	0.01 on lowest range
Light source / Life	Tungsten filament lamp / greater than 1 00 000 readings
Accuracy	±2 % of reading plus 0.02 NTU
Calibration	Automatic 3-points calibration with memorized buffers; calibration solutions included
Repeatability	±1% of reading
Turbidity standards	< 0.1, 15, 100 and 2000 NTU
Operating environment	0 – 50 °C; RH 95%
Other features	USB PC interface minimum 10ml or 20 ml sample volume minimum 4 empty sample vials Log memory 200 records

14.14.3 Electrical Conductivity Meter

Analytical method	Laboratory Method; APHA 2510 B.
Range	to 29.99 µS /cm ,30.0 to 299.9 µS /cm, 300 to 2999 µS /cm 30 to 200 ms/cm up to 500.0 mS/cm
Resolution	0.01 µS/cm; 0.01 mS/cm
Accuracy	± 1% of reading ± (0.5 µS or 1 digit, which greater)
Electrode	conductivity probe with temperature sensor and min. 1 m cable (included)
Temperature	-5.0 ... +105.0 °C
Salinity	to 400.0% NaCl
Calibration	1 Point offset calibration (0.00 µS/cm in air):1 point slope calibration In EC standard 84 µS/cm
Operating environment	minimum 0 – 50 °C; RH 95%
Temperature Compensation	Automatic temperature compensation
Other features	Simultaneous display of temperature / 200 data memory Rechargeable battery that can last at least 6 hours

14.14.4 Handheld Pocket Residual Chlorine Analyser

Analytical Method	DPD Colorimetric, Method APHA 4500-Cl G
Range	0.01 – 5 ppm
Optics	Dual LED light source optical system with narrow band wavelength filters and photo detectors
Accuracy	Dual wavelength, 530 nm
Wavelength Tolerance	±2 nm
Data point memory	min. 1000
Filter bandwidth	10 nm
Operating environment	minimum 0 – 50 °C; RH 95%
Reagent	Supplied with reagent pack for free and total chlorine – 200 tests
Operating Temperature	0°C – 50°C
Power supply	2×1.5V AA Batteries. Auto switch off setting

Other features	Stability indicator feature that prompts when to take the reading " Hold" feature that freezes the display for easy and accurate recording 25 nm diameter test tube

14.14.5 Thermometer

The lab thermometer shall be equipped with non-mercury red alcohol and white back permanently fused markings. Length of the thermometer shall be minimum 300mm. The range of the capacity is from -10^0C to 150^0C with a division of 1^0C.

14.15 Resilient Bearing Strip

When specified, gas vent flaps or vent pipes shall be installed in accordance with the drawings or as instructed by the Engineer to provide adequate venting for the liner system. The venting pipe should be fitted with required fittings and cowling.

Resilient Bearing Strip is a bearing pad shall be manufactured by all new (unused) materials and composed of multiple layers of prestressed 50/50 cotton-polyester blend duck, 8.1 ounce per net square yard, duck warp count 50 ± 1 threads per inch and filling count 40 ± 2 threads per inch, impregnated and bound with a high quality, oil-impervious nitrile rubber compound, containing rot and mildew inhibitors and anti-oxidants, compounded into resilient pads of uniform thickness.

Pads can withstand compressive loads perpendicular to the plane of laminations of not less than 12,000 psi before breakdown.

Pads meet AASHTO standard specification for fabric-reinforced bearing pads. Low coefficient of friction via PTFE

surface

PTFE pad shall be minimum nominal thicknesses of 6.3 mm.

14.16 Stainless Steel Strip

Stainless Steel Strip used in saddle posts, anchor blocks, thrust blocks and other structure shall be as per IS 6911-1992 and dimension shall be as per the drawing. The weight of steel sheet and strips shall be taken from relevant Indian Standards based on 7.85 kg/m2 for every millimeter sheet thickness. For rolled sections, steel rods and steel strips, weight given in relevant Indian Standards shall be used.

14.17 Technical Specification of Pressure Filter

The general specification of the equipment proposed for the water treatment process is given below.

14.7.1 Chemica Doser

The chemical doser should be electro-metering type and shall be capable of applying the specified chemical dose. The dose of the chemical shall be fixed by trial at first according to the inflow water quality and discharge. A proper pumping system with all necessary accessories for chemical dosing shall be provided. The pump head should be suitable for the chemicals to be dosed. The capacity of the chemical dosing should be sufficient for 24 hours of normal operation. The contractor shall specify the type of model, capacity of dosing and pressure of dosing. The dosing tank shall be FRP. The electronic metering pump shall be fitted on the top of FRP chemical tank. The dosing pump system shall be equipped with mechanical mixer driven by electric motor. The chemical tank shall be equipped with one low level control which will automatically cut off the metering pump in case the solution level goes below the warning level.

14.7.2 Aeration Tower

The aeration tower shall be vertical type and shall be pressure operated type packed with pall rings. The tower shall furnish a filtration rate of 45 cubic meter per hour per square meter of surface area or more. The vessel shall be fabricated out of mild steel (MS) plate as per Indian Standards (IS)-226 or equivalent. The filter shall have standard dished ends at both the ends. Each filter tank shall be tested under hydrostatic pressure of 50% in excess of the working pressure of 3.5 kg/cm^2. The filter shall be equipped with the necessary flanges and connections for the exterior and interior piping. The manhole shall have an exterior bolt on cover with exterior gaskets easily removable.

All the pipes including inlet and outlet pipe shall be of diameter as specified. All the tank connections shall be of heavy steel and they shall be drilled and bolted in position. Filter exterior pipe shall not be welded but joined with the help of flanges. Filter exterior shall be provided with all necessary pipes, valves and fittings to make a complete unit. All the interconnecting pipe fittings and valves shall be best quality and confirm with ISI or equivalent. The tank support leg shall be of specified diameter heavy pipe welded to the bottom reinforced pad in tank bottom.

Aeration tower will be packed with pall rings for a depth specified. The pall ring shall be of metallic type having dimensions of 16 mm x 16 mm with thickness of 0.3 to 0.4 mm. The specific surface area pall ring shall be not less than 316 m^2/m^3 and its free space shall be 93%. The specific weight of the pall ring shall be 400 to 535 kg/m^3.

The air blower/compressor shall able to supply air with air/water ratio of 10. It shall be able to supply air in sufficient quantity as specified at a pressure sufficient to move the air in the upward direction. The air blower/compressor shall conform with ISI or equivalent.

14.7.3 Pressure Filter

The pressure filter shall be vertical type and shall be pressure operated type, sand and gravel layers packed in the steel vertical tank. Each filter shall furnish a filtration rate of 9 cubic meter per hour per square meter of filter area or more. The vessel shall be fabricated out of mild steel (MS) plate as per Indian Standards (IS)-226. The filter shall have standard dished ends at both the ends. Each filter tank shall be tested under hydrostatic pressure of 50% in excess of the working pressure of 3.5 kg/cm^2. The filter shall be equipped with the necessary flanges and connections for the exterior and interior piping. The manhole shall have an exterior bolt on cover with exterior gaskets easily removable.

All the pipes including inlet and outlet pipe shall be of diameter as specified. All the tank connections shall be of heavy steel and they shall be drilled and bolted in position. Filter exterior pipe shall not be welded but joined with the help of flanges. Filter exterior shall be provided with all necessary pipes, valves and fittings to make a complete unit. The filter shall be provided with air release valve and pressure gauge. Gauge shall be mounted for easy reading. All the interconnecting pipe fittings and valves shall be best quality and confirm with ISI or equivalent. The tank support leg shall be of specified diameter heavy pipe welded to the bottom reinforced pad in tank bottom.

The filter medium should have a size and be of such material that it will provide satisfactory effluent, retain a maximum quantity of solids, and be readily cleaned with minimum of wash water.

The sand to be used for filters should satisfy the following norms:

1. It should be of hard and resistant quartz or quartzite and free of clay, fine particles, soft grains and dirt.
2. Ignition loss should not exceed 0.7% by weight.
3. It specific gravity should be in the range of 2.55 to 2.65.
4. Its silica content should be not less than 90%.
5. Its soluble fraction in hydrochloric acid should not exceed 5% by weight in 24 hours.
6. Wearing loss should not exceed 3%.
7. Effective size (D_{10}) shall be between 0.45mm and 0.70 mm for pressure filters.
8. The uniformity coefficient (D_{60}/D_{10}) should be between 1.3 and 1.7 in pressure filters.

The sand bed is supported on the gravel bed. It supports the sand and allows filtered water to move freely towards the underdrains. It also allows the wash water to move upward uniformly on the sand. The gravel is placed in layers having finest size on the top. The gravel in the filters should be clean, hard, durable and rounded. It should be free from clay, loam, shells and other foreign matters. It should not contain flat, thin or long pieces. It should have density of about 1600 kg/m^3.

14.7.4 Accessories

The electric control panel shall be designed in such a way that the treatment shall be operated automatically. It shall be designed to operate manually also. The control panel shall control all the chemical dozers, air blowers, pumps, etc. The panel shall be wall mounted type.

14.18 BORE-HOLE DRILLING

14.18.1 General

14.18.1.1 Description of the Works

As described in Supplementary Specifications.

14.18.1.1.1Requirements, Specification, Standards and Brand Names

The contractor shall fulfill all requirements and obligations under all Clauses of the specification applicable to the construction work involved in the contract. Neither the following Clauses of this specification the detailed description therein nor the quantities shall limit the obligations of the contractor under the accompanying conditions of contract.

Where items are not included in Bill of Quantities for any such requirements or obligations, the cost of such requirements or obligations shall be deemed to be spread over all the items of the Bill of Quantities.

All the standards mentioned herein shall be deemed to from part of this specification. All references to such standards shall be to the latest edition or revision thereof unless otherwise stated. Where a specific standard is referred to in this specification another standard will be acceptable, provided that it ensures an equal or higher quality of materials and workmanship than the standards referred to. If the contractor intends to use such alternative standard, he shall notify the Engineer thereof, submitting with his notice of the proposed standard, and shall not order any material or perform any work unless and until he has obtained the Engineer's approval of such standard. Brands name where used in the specification is only intended to define a standard of quantity and performance and the contractor may use other equivalent products approved by the Engineer.

14.18.1.1.2 Contractor's Work Program

Work program for the drilling and installation of deep tubewell, purchase of casing and well screens, development and pumping test etc. showing all the stages proposed by the contractor must be submitted at the time of agreement.

After approval by the Engineer, the works program shall be binding to the contractor. Changes in the program may be made by the contractor only after prior approval of the Engineer.

The Project shall be entitled at any time to demand change in the work program as he deems necessary for the proper and expedient performance of the works.

14.18.1.13 Other Works

The contractor shall note that during the continuance of the contract other works, not covered by this contract, will be executed by the Engineer or by other contractors. The contractor shall cooperate with the Engineer or other contractors, to ensure the satisfactory completion of the project as a whole.

14.18.2 Materials

14.18.2.1 General

The contractor shall provide all the required material for the construction of tubewell completely. Materials provided and used in the works shall be new and conforming to the qualities and kinds specified herein and or equal to approve samples. In respect of all materials used in the works currently practiced relevant standard specifications such as British standard specification (or other equivalent standard specification) shall be generally applicable.

If the contract document conflict in any way with any of the above standards, the contract documents shall have precedence and shall govern.

14.18.2.2 Inspection and Testing

All materials used in the works shall be subject to inspection and tests as the Engineer may direct from time to time as the work proceeds. Only materials which are considered satisfactory by the Engineer shall be used and materials condemned or not approved by the Engineer shall be removed from the works at the contractor's cost.

14.18.2.3 Standard Specifications

Where in this specifications any material or work is required to be supplied or done in accordance with a certain standard specification, the contractor will be permitted to supply such material or to do such work in accordance with an alternative standard of his choice, provided that he has informed the Engineer and obtained the approval from the Engineer. The contractor shall not order any material or perform any work unless and until he has obtained the Engineer's approval of such standard.

14.18.3 Housing, Casing and Slotted Pipes

Unless and otherwise mentioned in BOQ, the size of housing pipe shall be of mild steel (heavy class) of min. thickness 7.0 mm with pipe lengths of 6 m. the Pipe shall be plain/ beveled ends or mild steel socketed end suitable for welding. The housing pipe shall project a distance of 400 - 600 mm above the ground level during installation. The top of the housing pipe shall have a flange welded on to which a blank flange shall bolted on at all time when the well is not attended by the Contractor.

The size of casing pipe shall be as specified in the bill of quantities and of mild steel (heavy class) of minimum thickness 7.0 mm with pipe length 3 or 6 m. having plain/ beveled ends or mild steel socketed end suitable for welding.

The housing pipe and casing pipe shall be joined by electric arc welding with MS collar/reducer of one size bigger size pipe
The housing pipe shall be 250mm diameter and 7 mm thick and 200 mm dia and 7.0 mm thick for casing pipe. Mild steel pipe with mild steel socketted ends suitable for welding. The housing pipe shall project a distance of 500 mm above the ground level. The top of the housing pipe shall have a flange welded on to which a blank flange shall be bolted.

The well screen shall be of the continuous slot wedge wire design, Johnson type, fabricated of special–shaped, manufactured in the all welded to support rod construction with electronically controlled welding system, ensuring greater fusion strength between the profile wire and support rod maintaining accurate slot opening tolerance. The wire and rods shall be of the identical material. The material shall be of SS 304 stainless steel conforming to the requirements of AISI.

The well screen shall have adequate strength to resist the external forces to which it will be subjected during and after installation. Screen openings shall be V-shaped, widening inwardly to avoid clogging during the development of the well.

The well screen shall be of heavy construction strength to set in the 200m depth. The screen shall be pipe size. Overall length shall be 3 m, end fitting shall be weld/rings, inside diameter of screen shall be 205mm, outside dia.219 mm, slot opening aperture shall be 1.3mm to 1.5mm continuous slots SS 304 stainless steel material, the percentage of slot opening shall be minimum 25 percent, wrap wire size 2.3mm x 3.5mm, supports rod size 3.8mm/42nos.

There must be a minimum length of 2 m to 6 m of 200 mm dia. casing pipe below the lowest screen pipe as a sand trap and this must be fitted with welded on conical steel plug with a solid point.

All pipes and screens shall be of the best quality and the contractor shall submit full detail concerning the specifications and sources of supply of these for approval before bringing the materials on site,

All housing and casing pipes shall be thoroughly cleaned or descaled before assembly lowering and shall be painted internally and externally with one priming coat and one top coat of an approved non toxic corrosion inhibiting paint.

All welds shall be allowed to cool before applying the necessary paint to the joints. The paint must dry before lowering the well assembly down the bore hole.

14.18.4 Tubewell Construction

14.18.4.1 General

The contractor shall drill and install the required numbers of tubewell at the site defined by the Engineer. The drilling point will be assigned by the Engineer. The contractor shall be familiar with the environment of the working place and make the necessary arrangements to complete the work in time.

The contractor shall make his own camping arrangement and find necessary access to the site and drilling site. After completion of work, the area shall be cleared by the contractor of all unnecessary materials used during construction period.

The contractor shall necessarily mobilize suitable drilling rig and accessory machineries and equipment to ensure timely completion of the said work.

The tubewell shall be drilled to the depth specified by the Engineer and shall be electrically logged, cased, screened, gravel packed, sealed, developed, tested and completed as production well.

14.18.4.2 Drilling

Drilling can be done by any of the following methods:

- Direct rotary drilling method
- Reverse rotary drilling method, and
- Percussion drilling method

It is upto the contractor to choose the suitable drilling method to drilled in the formation of the area according to their machineries and equipment bearing in mind that the works mentioned in this contract shall be completed within the stipulated time.

At first pilot hole drilling shall be carried out upto the required depth using an appropriate size drill bit.

The record of the strata encountered during the course of pilot hole drilling shall necessarily be maintained by the contractor. The lithologic samples each of 0.5 kg at an interval of 1.5 m or at the change of strata shall be collected in plastic bags. These samples should be submitted to the Engineer at the earliest possible along with lithologic log records.

After completion of drilling the pilot bore hole, the contractor, in presence of the Engineer shall carry out down the hole electrical logging (resistivity & self potential) for the verification of visual lithologic samples. Based on the lithologic samples and electrical logging data and interpretation results, the contractor shall submit the proposed well assembly (well design). Approval of this proposed design from the Engineer, must be received in written by the contractor before installation of the tubewell.

The pilot bore hole shall be enlarged (reamed) by using the appropriate diameter drill bits upto the designed depth approved by the Engineer.

The final bore hole shall be reconditioned so that all the drill cuttings shall be removed completely from the bore hole.

Verticality of the bore hole must be checked after the drilling of pilot hole and then while lowering the approved well assembly using centralizers at a maximum of 12 m spacing. The number of centralizers in each set should be three. In no case the axis of the well assembly should deviate more than 30 mm from an imaginary plumb line.

A successful tubewell should be able to yield in the range of discharge of 20-30 liters/sec to be accepted by the Engineer.

14.18.4.3 Tubewell Assembly

Immediately after drilling and reaming the bore hole to the specified diameter and depth, the contractor shall make necessary arrangement for lowering the well assembly in accordance with the design approved by the Engineer.

The Contractor shall provide all necessary materials required for the complete well assembly including housing pipe, casing pipe, well screen, collar, plug, centralizes etc. All the materials of well assembly shall be as specified and as per the prevalent practice, if not specified. Well assembly shall be approved by the Engineer before installation.

The well assembly shall be installed in the bore hole in the presence of the Engineer. After installation a verticality test shall be carried out and the permissible limit shall be 1 cm. in 40m.

14.18.4.4 Gravel Packing

The gravel pack material to be used in gravel packing, shall be composed of hard, non-calcarious, durable, well rounded particles containing no clays, silt, organic or any foreign materials. The size of gravel shall be in between 3 to 8 mm in diameter.

Immediately after lowering the well assembly into final position, the contractor shall fill the annular space between the well assembly and the wall of the bore hole with pea gravel approved by the Engineer using the continuous backwashing method to prevent bridging and reduce the possibility of damage to the tubewell assembly by sudden collapse of bridged gravel.

The gravel packing process should be continuous until the entire annular space is filled with the gravel, and then clean water should be pumped in through the casing to remove drilling mud.

Tubewell sounding must be carried out to ensure well clearance upto bottom and also the verticality of well assembly.

14.18.4.5 Well Development

After the well assembly installation and gravel packing, the well shall be developed by the contractor using the combination of the following four methods. Well development shall be carried out for a minimum of 72 hrs or as directed by the Engineer using suitable equipment of sufficient capacity.

- Backwashing (inner and outer washing)
- Hydraulic Jetting (water jetting)
- Air lift pumping (air compressor development)
- Over pumping by submersible pump

The completion of the well development shall be certified by the Engineer only when the water becomes clear and contains less than 5 (five) PPM of silt or sand particles.

14.18.4.6 Pumping Test

Following the satisfactory completion of well development, the contractor shall carry out the drawdown and recovery tests by using a suitable pump of not less than 6” dia bowl assembly. The pumping test should be carried out for a minimum of 72 hrs or as directed by the Engineer.

The contractor shall perform (a) Step drawdown test, (b) Constant drawdown test and (c) Recovery test.

a) The contractor shall perform the Step drawdown test by pumping water at four different constant discharge rates of approximately 30%, 60%, 90% and 120% of the anticipated yield of well after development at the instruction of the Engineer. For each step, the contractor shall carefully and accurately record simultaneous readings of water level, time since commencement of pumping and discharge (flow) at the intervals of 10 minutes for the period of 4 hours for each step.
b) The contractor shall perform the Constant drawdown test by pumping water at a constant discharge rate of the tubewell as guided by step drawdown test. The constant pump discharges shall be measured and recorded by the contractor using a standard v notch weir or discharge meter at the

interval of 1/2, 1, 1 1/2 , 2, 3, 4, 5, 7, 9, 10, 15, 20, 25, 30, 35, 45, 60, 90, and 120 minutes till the water level stabilizes itself.

c) On completion of test, the contractor shall cease pumping and accurately record the simultaneous readings of water levels in the well and the time since cessation of pumping, at the same time intervals of the pumping test, until the static water level has attained its pre-pumping level.

All test results with interpretation and graph plotted shall be handed over to the Engineer and the whole pumping test should necessarily be conducted in presence and close coordination with Engineer.

14.18.5 Measurement and Payment

If provided in the Contract, the measurement of the work under this Clause shall be measured and paid in units and contract rates as specified in the Bill of Quantities for completed works as directed and accepted by the Engineer. The cost and payment shall be deemed to have full and final compensation for all labour, equipment, tools and incidentals necessary to complete the work**.**

14.19 Injection Grouting (For OHT)

HYDROPHOBIC POLYURETHANE 1510, 1570, AND/OR 1572

14.19.1 General

Furnish all labor, equipment, and materials necessary and incidental thereto to perform all required operations to eliminate the flow of water by pressure injection to fill cracks, voids, and joints in concrete substrates.

14.19.2 Definition of Terms

Refusal	when a crack or void area will accept no more grout under the prevailing pumping conditions (for reasons other than the pumpability of the grout)
Return time	the time taken for a grout, under certain application conditions to completely penetrate a crack, void, or network of cracks.
Gel time	the time required for the grout to cure following the reaction with the accelerator. Gel time or cure time can be affected by temperature and amount (percentage) of accelerator mixed in the component A.

14.19.3 INJECTION PROCESS:

Fully examine the existing site conditions to ensure that all associated work can be performed without removing or relocating existing utilities, structures or structural members.

1) Remove all standing water.

2) Drill at a 45˚ degree angle where possible to intersect the wall/floor joint interface halfway through the thickness of the substrate (e.g. 4" deep for 8" thick slab)

3) Drilling depth should be half the thickness of the concrete member.

4) Install mechanical injection ports and secure in place at a spacing of 6- 12" inches apart (6" for hairline and 12" for wider cracks). Alternate positioning from left side to right side as you move along the crack where possible.

Extremely wide cracks (if any exist) should be covered with a surface seal prior to injection in order to contain the injection resin until cured. Under proper pumping conditions in active leak injection, the following signs should be observed in the order listed:

INJECTION PROCESS (Continued)

(a) Water displaced from crack/joint by the resin

(b) Water and resin mix (foamy) appearing at the crack/joint area

(c) Pure resin from crack/join

If the joint surface exhibits immediate free flow of resin while working the first packer, pause for a few minutes. In most cases the resin will react fast enough with the water and expand rapidly. The resulting resin

product will heal the joint and provide a surface seal to contain the material to follow.

The contractor is responsible for estimating what duration time is adequate for grouting the voids and is responsible to prove that the void is full by attempting to inject each port to refusal.

Once the contractor is assured that the resin has reached the next injection packer or has sufficiently stopped the water as evidenced by the grout oozing out of the joint area, he should shut off the resin flow and disconnect pump pressure line and proceed to the next packer.

Follow the injection process for one to three packers, the contractor shall return to the first packer and attempt to re-inject it again. Some of the packers will take more grout, filling up more of the crack/joint area and creating a higher density void filler and water stop.

The contractor shall continue this procedure until refusal. MATERIALS

A. **Injection Ports**

Provide suitable injection ports (stainless steel/brass/zinc/plastic), buttonhead or zerk fittings, shaft and rubberized expandable grommet.

B. **Grout Injection Material**

Hydrophobic water cut-off grout based on MDI (methylene-diphenyl- isocyanate) polyurethane. (e.g. SealBoss 1510, 1570, 1572)

Grout material is to be 100% solvent free and 100% solids.
Gel time of the product is adjustable by adding a certain percentage of accelerator per the manufacturer's recommendations. Grout material shall not shrink or swell.

Grout material shall cure to a semi-flexible foam structure which is not affected by water or dryness.

Grout material shall have the capacity to expand upon contact with water to a volume of 30 to 40 times. The composition of the material is one that water is not a component of the cured foam structure

SealBoss 1510

	1510	15X (Accelerator)	
Appearance	Dark Brown	Clear	
Solids	100%	100%	ASTM D 1010
Density, g/ml	1.12	0.93	ASTM D 3800-79
Flash Point, C / F	180/356	170/388	ASTM D 93-85
Viscosity, cps	160-200	20	ASTM D 2196
Mixing Ratio by Volume (1%-20% accelerator)	50-10 parts	1 part	
Solubility in Water	not		
Packaging	1 Gal	0.1 Gal	
	5 Gal	0.5 Gal	
	55 Gal		
Storage	Good storage stability for unopened containers at 15 - 30 C 58 - 85 F in dry, sun free indoors environment 3 years shelf life.		
Reaction			
Induction Time, 20C/68F	30 sec (10%)		
Gel time, 20C/68F	70 sec (10%)		
Induction Time, 20C/68F	15 sec (>15%)		
Gel time, 20C/68F	50 sec (>15%)		
Properties for Cured Product mixed with 10% Accelerator			
Expansion, %	2000-4000		
Elongation, %	10-20 ASTM D638		
Tensile Strength	65 psi ASTM D 638		
Shear Strength	>15 psi ASTM C 273		
Unconfined Compressive Strength (Sand filled)	1550 psi		
Corrosiveness	Non-Corrosive		
Appearance	Gold-Yellow Polyurethane Foam		
Toxicity	Essentially Non-Toxic in Cured Form MDI Based		

Resistance to Chemicals	Resistant to Most Organic Solvents, Mild Acids, Alkali and Micro Organisms

SealBoss 1570

Appearance	Light Yellow	Clear	
Solids	100%	100%	ASTM D 1010
Density, g/ml	1.08	0.93	ASTM D 3800-79
Boiling Point, C / F	205/400	170/340	
Flash Point, C / F	95/200	70/160	ASTM D 93-85
Viscosity, cps	180-250	20	ASTM D 2196
Mixing Ratio by Volume (2%-10% accelerator)	50-10 parts	1 part	
Solubility in Water	not		
Packaging	1 Gal 5 Gal 55 Gal	0.1 Gal 0.5 Gal	
Storage	Good storage stability for unopened containers at 15 - 30 C 58 - 85 F in dry, sun free indoors environment 2 years shelf life.		

Reaction	
Induction Time, 20C/68F	35 sec (10% 15X added) Gel
time, 20C/68F	140 sec (10% 15xs added)
Properties for Cured	
Product mixed with 10% Accelerator	
Expansion, %	1500-2500 (15-25 Times)
Elongation, %	250 ASTM D 638
Tensile Strength	70 psi ASTM D 638
Shear Strength	>15 psi ASTM C 273
Corrosiveness	Non-Corrosive
Appearance	Yellowish-White Polyurethane Foam
Toxicity	Essentially Non-Toxic in Cured Form, MDI Based Resistance
to Chemicals	Resistant to Most Organic Solvents, Mild Acids, Alkali and Micro Organism

C. Pump Equipment

All chemical grouting equipment shall be of a type, capacity, and mechanical condition suitable for doing the work. The equipment shall be compatible with the chemicals to be handled and shall be maintained in proper operating conditions at all times.

D. SUBMITTALS

1) Submit all technical literature covering the chemical grout material including complete manufacturer's specifications, recommendations and test data.

2) Provide Material Safety Data Sheets on any chemical products utilized during the work of this section.

3) Injection port pattern and/or grouting method statement to Architect for approval prior to starting grouting operations.

4) Samples
   (a) Stainless steel, brass, zinc, or plastic button/zerk injection packers.

F. Quality Assurance

1) Qualifications: Company specializing in structural repairs, crack injection and waterproofing of cracks shall be trained by the waterproofing material's manufacturer and certified in the application of the materials.

G. Delivery, Storage and Handling

1) Deliver all materials in the manufacturer's sealed original containers bearing the manufacturer's name and product identification in a manner to prevent damage, breakage, water or moisture intrusion.

2) Store and handle all products of this section in strict accordance with the manufacturer's instructions and product safety regulations.

3) All equipment shall meet or exceed OSHA safety requirements and be of a size and nature which does not conflict with safe accessibility to the site.

H. Project Conditions

1) Do not execute the Work of this section unless the Site Engineer or Authorized Representative is present and has authorized the work to commence.
2) Do not remove any utility equipment or piping in the area while executing the work.

I. Environmental Requirements

1) Do not apply if the temperature is below 32°F or above 90°F unless the material manufacturer is consulted for recommendations.

J. Owner's Requirements

1) Execute all work in accordance with all safety requirements, approved written procedures and with the least amount of interference with the work of other trades as possible.

2) Equipment should be confined to the delivery area and all components shall be in good working order as approved manufacturer for use with the specified materials.

3) Immediately notify the Site Engineer/Owner's representative in the event of any process interruption or environmental concerns which could affect the service or application conditions relative to this work.

14.19.4 Protection, Cleaning and Safety

1) Following a complete injection of all mechanical packers to refusal and where the visible leakage has been completely eradicated, remove all injection packers. Remove cured material where applicable and fill injection hole with rapid cement.

2) Clean all adjacent areas of excess material, powder, cement and/or droppings. Chemicals used for cleaning shall be non hazardous and non flammable such as the SealBoss R70 pump flush

3) Process grout materials using appropriate protective gear including gloves, masks, or goggles, and appropriate clothing as described and in accordance with the manufacturer's MSDS sheets.

Note:-

1. Contractor must conduct the joint survey with office and should provide detail report of survey with pipeline design and analysis & other's as per requirement of Engineer within 1 month of

Section - VIII
Bill of Quantities

Notes for Unit Rate Contracts:

Objectives

The objectives of the Bill of Quantities are

(a) To provide sufficient information on the quantities of Works to be performed to enable Bids to be prepared efficiently and accurately; and

(b) When a Contract has been entered into, to provide a priced Bill of Quantities for use in the periodic valuation of Works executed.

In order to attain these objectives, Works should be itemized in the Bill of Quantities in sufficient detail to distinguish between the different classes of Works, or between Works of the same nature carried out in different locations or in other circumstances which may give rise to different considerations of cost. Consistent with these requirements, the layout and content of the Bill of Quantities should be as simple and brief as possible.

Content

The Bill of Quantities should be divided generally into the following sections:

(a) Preamble;

(b) Work Items (grouped into parts);

(c) Day works Schedule;

d) Provisional Sums; and

(d) Summary.

Preamble

The Preamble should indicate the inclusiveness of the unit prices, and should state the methods of measurement which have been adopted in the preparation of the Bill of Quantities and which are to be used for the measurement of any part of the works.

Work Items

The items in the Bill of Quantities should be grouped into sections to distinguish between those parts of the Works which by nature, location, access, timing, or any other special characteristics may give rise to different methods of construction, or phasing of the Works, or considerations of cost. General items common to all parts of the works may be grouped as a separate section in the Bill of Quantities.

Day work Schedule

A Day work Schedule should be included only if the probability of unforeseen work, outside the items included in the Bill of Quantities, is high. To facilitate checking by the Employer of the realism of rates quoted by the Bidders, the Day work Schedule should normally comprise the following:

(a) A list of the various classes of labour, materials, and Constructional Plant for which basic day work rates or prices are to be inserted by the Bidder, together with a statement of the conditions under which the Contractor will be paid for work executed on a day work basis.

(b) Nominal quantities for each item of Day work, to be priced by each Bidder at Day work rates as bid. The rate to be entered by the Bidder against each basic Day work item should include the Contractor's profit, overheads, supervision, and other charges.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the Contract Data should state the manner in which they will be used, and under whose authority (usually the Project Manager's).

Summary

The Summary should contain a tabulation of the separate parts of the Bill of Quantities carried forward, with provisional sums for Day work, for physical (quantity) contingencies, and for price contingencies (upward price adjustment) where applicable.

These Notes for Preparing Specifications are intended only as information for the Employer or the person drafting the Bidding documents. They should not be included in the final documents.

Preamble of Bill of Quantities

A. General

1. The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, General and Special Conditions of Contract, Technical Specifications, and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Project Manager and valued at the rates and prices bid in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Project Manager may fix within the terms of the Contract.

3. For any item for which measurement is based on records made before or during construction the records shall be prepared and agreed between the Engineer and the Contractor. Should the Contractor carry out such work without the prior agreement of the Engineer, the Engineer may request the Contractor to carry out investigations to confirm the extent of the work and the quantity of work certified for payment shall be solely at the Engineer's discretion. The cost of any such investigation shall be borne by the Contractor.

4. The rates and prices bid in the priced Bill of Quantities shall, except as otherwise provided under the Contract, include all construction equipment, labour, supervision, materials, erection, maintenance, insurance, profit, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

5. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

6. The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

7. General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities. The Specification Clause references where given in the item description of the Bills of Quantities are for the convenience of bidders and generally refer to the principal relevant-specification clause but do not necessarily represent the whole of the specification requirements for the work required within the item. The presence of a Specification clause reference shall not in any way reduce the Bidders obligation to complete work in accordance with all the requirements of the Specification.

8. Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Project Manager in accordance with the Conditions of Contract.

9. The method of measurement of completed work for payment shall be in accordance with the Specifications.

10. The abbreviations and symbols used in this Bill of Quantities are:
[Insert as applicable]

B. Day work Schedule

a) General

1. Work shall not be executed on a day work basis except by written order of the Project Manager. Bidders shall enter basic rates for day work items in the Schedules. These rates shall apply to any quantity of day work ordered by the Project Manager. Nominal quantities have been indicated against each item of day work, and the extended total for day work shall, be carried forward as a Provisional Sum to the Summary Total Bid Amount. Unless otherwise adjusted, payments for day work shall be subject to price adjustment in accordance with the provisions in the Conditions of Contract.

b) Day work Labour

1. In calculating payments due to the Contractor for the execution of day works, the hours for labour will be reckoned from the time of arrival of the labour at the job site to execute the particular item of day work to the time of departure from the job site, but excluding meal breaks and rest periods. Only the time of classes of labour directly doing work ordered by the Project Manager and are competent to perform such work will be measured. The time of gangers (charge hands) actually doing work with the gangs will also be measured but not the time of foremen or other supervisory personnel.
2. The Contractor shall be entitled to payment in respect of the total time that labour is employed on day work, calculated at the basis rates entered by it in the " SCHEDULE OF DAY WORK RATES: 1. LABOUR ". The rates for labour shall be deemed to cover all costs to the Contractor including (but not limited to) i) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances, ii) any sums paid to or on behalf of such labour for social benefits in accordance with Nepal law, iii) Contractor's profit, overheads, superintendence, liabilities and insurance and iv) charges incidental to the foregoing.

c) Day work Equipment

1. The Contractor shall be entitled to payments in respect of Constructional Plant already on site and employed on day work at the basis rental rates entered by him in the “SCHEDULE OF DAY WORK RATES:2 EQUIPMENT ”. The said rates shall be deemed to include due and complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricant, and other consumables and all overhead, profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants also shall be included in the rate of the equipment and no separately payment shall be made for it.
2. In calculating the payment due to the Contractor for Constructional Plant employed on day work, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Project Manager, the travelling time from the part of the Site where the Construction Plant was located when ordered by the Project Manager to be employed on day work and the time for return journey there to shall be included for payment.

d) Day work Materials

1. The Contractor shall be entitled to payment in respect of materials used for day work (except for materials for which the cost is included in the percentage addition to labour costs as detailed heretofore), at the rates entered by him in the "SCHEDULE OF DAY WORK RATES: 3 MATERIALS" and shall be deemed to include overhead charges and profit as follows;
   (i) the rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc. and shall provide for delivery to store for stockpiling at the Site.
   (ii) the cost of hauling materials for use on work ordered to be carried out as day work, from the store or stockpile on the Site to the place where it is to be used also shall be include in the same rate.

Provisional Sums

A general provision for physical contingencies (quantity overruns) may be made by including a provisional sum in the Summary Bill of Quantities. Similarly, a contingency allowance for possible price increases should be provided as a provisional sum in the Summary Bill of Quantities. The inclusion of such provisional sums often facilitates budgetary approval by avoiding the need to request periodic

supplementary approvals as the future need arises. Where such provisional sums or contingency allowances are used, the SCC should state the manner in which they will be used, and under whose authority (usually the Project Manager's).

The estimated cost of specialized work to be carried out, or of special goods to be supplied, by other contractors should be indicated in the relevant part of the Bill of Quantities as a particular provisional sum with an appropriate brief description. A separate procurement procedure is normally carried out by the Employer to select such specialized contractors. To provide an element of competition among the Bidders in respect of any facilities, amenities, attendance, etc., to be provided by the successful Bidder as prime Contractor for the use and convenience of the specialist contractors, each related provisional sum should be followed by an item in the Bill of Quantities inviting the Bidder to quote a sum for such amenities, facilities, attendance, etc.

Bill of Quantities

1 Provisional Sum

Procument Item Details

Sl. No.	Item Description	Unit	Quantity	Unit Rate (NPR)	Amount (NPR)
1	Items not Covered by BOQ	PS	1.0	20000.0	20,000.00

2 Construction work

2.1 Water Supply System

2.1.1 Pumping System

2.1.1.1 Submersible Casing Well Construction and Plateform work

Procument Item Details

Sl. No.	Item Description	Unit	Quantity	Bidder's Rate (NPR)	Bidder's Rate (in words)	Total Amount (NPR)
1	Site preparation for drilling works	Well	1.00			
2	Layer Testing (Pilot Hole)	m	20.00			
3	To depth beyond 20m, for every additional 20 m depth, add to quantities of item 2.1.1	m	15.00			
4	Reaming of Pilot hole of standard bit (hole size, up to 6.5")	m	20.00			
5	Reaming to depth beyond 20 m, for every additional 20 m depth, add to quantities of itme 2.2.1	m	15.00			
6	Lowering of Pipes for Initial Depth of 20 m	m	20.00			
7	Lowering of Pipes to depth beyond of 20 m, for every additional 20 m depth add to quantities of item 2.3.1	m	15.00			
8	Development and Testing by Pumps	Hrs.	4.00			
9	Supply and installation of PVC Casing Pipe of 4" Diameter	m	25.00			
10	Supply and installation of PVC Ribbed Screen Pipe of 4" Diameter	m	6.00			
11	Supply and installation of PVC Column Pipe of 1 1/2" Diameter	m	21.00			
12	Supply and installation of GI Pipe Middle Class of 4" Diameter	m	1.50			
13	Miscellaneous (well cap, cross bar, centralizer, bottom plug, clamps,etc.)	set	1.00			
14	Supply and Installation of 100 mm Dia.(4") UPVC Column pipe Heavy as per drawing and specification	Mtr	25.91			
15	Supply and Installation of 100 mm Dia.(4") PVC Screen pipe as per drawing and specification	Mtr	6.10			
16	Supply and Installation of 100 mm Dia.(4") GI pipe as per drawing and specification	Mtr	1.52			
17	Supply and Installation of 40 mm Dia.(1½") UPVC pipe (6kg/cm2) as per drawing and specification	Mtr	21.34			

Procument Item Details						
Sl. No.	**Item Description**	**Unit**	**Quantity**	**Bidder's Rate (NPR)**	**Bidder's Rate (in words)**	**Total Amount (NPR)**
18	Supply and Installation of Summersible Pump 1½" as per drawing and specification	set	1.00			
19	Supply and Installation of Summersible Flat Cable 2.5mm² as per drawing and specification	Mtr	50.00			
20	Supply and Installation of Surface Plate 5" as per drawing and specification	Pic	1.00			
21	Supply and Installation of Clamp 1½" as per drawing and specification	set	1.00			
22	Supply and Installation of Connector as per drawing and specification	set	1.00			
23	Supply and Installation of Star Delta Pannel Board(1-2HP) as per drawing and specification	set	1.00			
24	Supply and Installation of GI Elbow 1½" as per drawing and specification	Pic	1.00			
25	Supply and Installation of GI Nipple 1½"(6" Long) as per drawing and specification	Pic	1.00			
26	Supply and Installation of HDPE Polyethine Tank 1000 liter (Extra Heavy) as per drawing and specification	lit.	1,000.00			
27	Supply and Installation of CPVC Pipe SDR 11 (28.1kg/cm2) 1½" as per drawing and specification	Mtr	27.00			
28	Supply and Installation of CPVC Pipe SDR 11 (28.1kg/cm2) 1" as per drawing and specification	Mtr	21.00			
29	Supply and Installation of CPVC Pipe SDR 11 (28.1kg/cm2) ¾" as per drawing and specification	Mtr	36.00			
30	Supply and Installation of CPVC Unequal tee 1½"x1" as per drawing and specification	Pic	1.00			
31	Supply and Installation of CPVC Ball Valve 1½" as per drawing and specification	Pic	3.00			
32	Supply and Installation of CPVC Ball Valve 1" as per drawing and specification	Pic	5.00			
33	Supply and Installation of CPVC Tank Nipple 1" as per drawing and specification	Pic	2.00			
34	Supply and Installation of CPVC Tank Nipple 1½" as per drawing and specification	Pic	2.00			
35	Supply and Installation of CPVC Elbow 1½" as per drawing and specification	Pic	9.00			
36	Supply and Installation of CPVC Elbow 1" as per drawing and specification	Pic	10.00			
37	Supply and Installation of CPVC Elbow ¾"	Pic	8.00			
38	Supply and Installation of CPVC Solvent as per drawing and specification	No	1.00			
39	Supply and Installation of CPVC Solvent 118 as per drawing and specification	No	1.00			

Procument Item Details						
Sl. No.	**Item Description**	**Unit**	**Quantity**	**Bidder's Rate (NPR)**	**Bidder's Rate (in words)**	**Total Amount (NPR)**
40	Supply and Installation of CPVC End Cap 1" as per drawing and specification	Pic	2.00			
41	Supply and Installation of CPVC Female Socket 1½" as per drawing and specification	Pic	1.00			
42	Supply and Installation of CPVC Female Socket 1" as per drawing and specification	Pic	1.00			
43	Supply and Installation of CPVC Union 1½" as per drawing and specification	Pic	3.00			
44	Supply and Installation of CPVC Union 1" as per drawing and specification	Pic	3.00			
45	Supply and Installation of CPVC Union ¾" as per drawing and specification	Pic	1.00			
46	Supply and Installation of CPVC Female Socket 3/4"x1/2" as per drawing and specification	Pic	8.00			
47	Supply and Installation of CPVC Reducer Socket 1½"x1" as per drawing and specification	Pic	4.00			
48	Supply and Installation of CPVC Reducer Socket 1"x3/4"	Pic	2.00			
49	Supply and Installation of CPVC Socket ¾" as per drawing and specification	Pic	5.00			
50	Supply and Installation of CPVC Socket 1" as per drawing and specification	Pic	5.00			
51	Supply and Installation of CPVC Socket 1½" as per drawing and specification	Pic	8.00			
52	Supply and Installation of CPVC Tee ¾" as per drawing and specification	Pic	5.00			
53	Supply and Installation of CPVC Tee 1" as per drawing and specification	Pic	3.00			
54	Supply and Installation ofCPVC Female Tee 3/4"x1/2" as per drawing and specification	Pic	5.00			
55	Supply and Installation of CPVC Female Elbow 3/4"x1/2" as per drawing and specification	Pic	8.00			
56	Supply and Installation of CPVC Plug ½" as per drawing and specification	Pic	10.00			
57	Supply and Installation of Long Body Tap as per drawing and specification	Pic	6.00			
58	Supply and Installation of CPVC Cap 1" as per drawing and specification	Pic	5.00			
59	Supply and Installation ofCPVC Cap 1½" as per drawing and specification	Pic	1.00			
60	Supply and Installation of Wash Basine pedastel as per drawing and specification	Pic	1.00			
61	Supply and Installation of Ancer Bat Hanger as per drawing and specification	Pic	1.00			
62	Supply of Raw Water Feed Pump 1 hp	set	1.00			

Procument Item Details						
Sl. No.	**Item Description**	**Unit**	**Quantity**	**Bidder's Rate (NPR)**	**Bidder's Rate (in words)**	**Total Amount (NPR)**
63	Supply of water treatment plant FRP vessel of 18" dia and 65 " Height	set	2.00			
64	Filter Media Coarse sand Filter Media in FRP vessel of 18" dia and 65 " Height (Vessel 1)	Bag	2.00			
65	Filter media Fine sand Filter Media in FRP vessel of 18" dia and 65 " Height (Vessel 1)	Bag	4.00			
66	Filter Media Katalox Light Filter Media in FRP vessel of 18" dia and 65 " Height (Vessel 1)	bag	2.00			
67	Filter mdia Coarse sand Filter Media in FRP vessel of 18" dia and 65 " Height (Vessel 2)	Bag	2.00			
68	Filter mdia Fine sand Filter Media in FRP vessel of 18" dia and 65 " Height (Vessel 2)	Bag	4.00			
69	Filter media MNO2	Kg	200.00			
70	Supply of 25NB side port filter multiport valve(MPV)	set	2.00			
71	Vessel Strainer and Distribution system Top and bottom 5m3/hr	Set	2.00			
72	Supply of Air Vent Valve of size 15mm.	set	2.00			
73	Supply of Pressure Gauge	set	2.00			
74	Supply of 25mm and 40mm Interconnection pipe and fittings from raw water feed pump to both filter upto treated water tank inlcuding CPVC pipes, valves, bend, tees, sockets, Union and other associate items	Set	1.00			
75	Installation, Transportation Testing and logistic work for the whole water treatment plant	job	1.00			
76	Supply and delivery of 4" dia BORE WELL Submersible Motor Pump with 50 Hz, 3 phase, 400 (±5%) Volt motor star delta connection. Pumping Discharge (Q)-720 LPM @ Delivery of Total Head (H=±10%) -63 m with 3 mtr suitable size Submersible Flat cable as per specification and Instruction of Engineer	set	2.00			
77	Supply and Delivery of 100 Ampire Outdoor Terminal Bus bar Board Fabricated out of 16swg m/s sheet metal, Suitable Space for Connection of Incoming & Outgoing Cable, Lockable Double Door Front Openable, Floor Mounted Type. With TPNE Copper Bus bar and Internal wiring, Angle Stand with followings for 20 HP ±10% for above Pump with 75A, 4 pole CONECTOR & wiring materials, 1 set of Enclosure with wiring and cable shoe.	set	2.00			
78	Modular 40 HP LT PANEL with CONTROLER or for above pump motor 2W at Pumping Station 100 A	set	2.00			

Procument Item Details						
Sl. No.	**Item Description**	**Unit**	**Quantity**	**Bidder's Rate (NPR)**	**Bidder's Rate (in words)**	**Total Amount (NPR)**
	MCCB with Box, Star Delta Starter -20 HP - 2					

Total of Procument Items	
Total Item Price	
VAT	
Grand Total	

Section - IV
General Conditions of Contract

Section VII. General Conditions of Contract (GCC)

1. General Provisions	
1.1 Definitions	In the Contract as defined below, the words and expressions defined shall have the following meanings assigned to them, except where the context requires otherwise:
The Contract	1.1.1 "**Contract**" means the Agreement signed between the Employer and the contractor and the other documents listed in the Special Conditions of Contract (SCC). 1.1.2 "**Specification**" means the document as listed in the SCC, and any variation to such document. 1.1.3 "**Drawings**" means the Employer's drawings of the Works as listed in the SCC, and any variation to such drawings. 1.1.4 "**Bill of Quantities**" means the priced and completed bill of quantities forming part of the Tender. 1.1.5 "**Bid or Quotation**" means the contractor's priced offer to the Employer for the execution and completion of the Works and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance. 1.1.6 "**Letter of Acceptance**" means the formal acceptance by the Employer of the **bid** or Tender.
Persons	1.1.7 "**Employer**" means the person named in the Agreement and the legal successors in title to this person, but not (except with the consent of the contractor) any assignee. 1.1.8 "**Contractor**" means the person named in the Agreement and the legal successors in title to this person, but not (except with the consent of the Employer) any assignee. 1.1.9 "**Party**" means either Employer or the contractor.
Date, Times and Periods	1.1.10 "**Commencement Date**" means the date stated in the SCC after the date the Agreement comes into effect or any other date agreed between the Parties. 1.1.11 "**Day**" means a calendar day.

	1.1.12 "**Time for Completion**" means the time for completing the Works as stated in the SCC (or as extended under Sub-Clause 6.3), calculated from the Commencement Date.
Money and Payments	1.1.13 "**Cost**" means all expenditure properly incurred (or to be incurred) by the contractor, whether on or off the Site, including overheads and similar charges, but does not include profit. 1.1.14 "**Contract Price**" means the sum stated in the Letter of Acceptance as payable to the contractor and adjusted with any Variation Orders and Other Adjustments upon completion of the works and the remedying of any defects therein in accordance with the provisions of the Contract. 1.1.15 "**Retention Money**" means the aggregate of all monies retained by the Employer pursuant to Sub-Clause 10.3
Other Definitions	1.1.16 "**Contractor's Equipment**" means all apparatus, machinery, vehicles, facilities and other things required for the execution of the Works but does not include Materials or Plant. 1.1.17 "**Country**" means Nepal. 1.1.18 "**Employer's Liabilities**" means those matters listed in Sub-Clause 5.1. 1.1.19 "**Materials**" means things of all kinds (other than Plant) intended to form or forming part of the permanent work. 1.1.20 "**Plant**" means the machinery and apparatus intended to form or forming part of the Permanent Works. 1.1.21 "**Site**" means the places provided by the Employer where the Works are to be executed, and any other places specified in the Contract as forming part of the Site. 1.1.22 "**Variation**" means any change which is a result of unforeseen circumstances that arise as a result of instruction by the Employer/ Engineer under Sub-Clause 9.1. 1.1.23 "**Works**" means all the work and design (if any) to be performed by the contractor including temporary work and any Variation. 1.1.24 "**Permanent Works**" means the permanent works to be executed (Including Plant) in accordance with the Contract. 1.1.25 "**Temporary Works**" means all temporary works of every kind (other than contractor's Equipment) required in or about the execution and completion of the Works and the remedying of any defects therein.
1.2 Interpretation	Words importing persons or parties shall include firms and organisations. Words importing singular or one gender shall include plural or the other gender where the context requires.
1.3 Priority of Documents	The documents forming the Contract shall to be taken as mutually explanatory of one another. If an ambiguity or discrepancy is found in the documents, the Employer shall issue any necessary instructions to the contractor, and the priority of the documents shall be in accordance with the order as **listed in the SCC**.
1.4 Law	The law of the Contract is stated in the Law of Nepal.

1.5Communications	Where provision is made for the giving or issue of any notice, instruction, or other communication by any person, unless otherwise specified such communication shall be written in the language stated in the SCC as shall not be unreasonably withheld or delayed. If a notice given pursuant to Sub Clause 1.5 fails to be delivered due to failure to trace the address of the party then the notice shall be published as public notice in a National daily newspaper and when the notice is so published then the notice shall be considered to be delivered to the concerned party.
1.6 Statutory Obligations	The contractor shall comply with the laws of Nepal where activities are performed. The contractor shall give all notices and pay all fees and other charges in respect of the Works.
2. The Employer	
2.1 Provision of Site	The Employer shall provide the Site and right of access thereto at the times stated in the SCC.
2.2 Permits and Licenses	The Employer shall, if requested by the contractor, assist him in applying for permits, licences or approvals which are required for the Works.
2.3 Employer's Instructions	The contractor shall comply with all instructions given by the Employer in respect of the Works including the suspension of all or part of the Works.
2.4 Approvals	No approval or consent or absence of comment by the Employer or the Employer's representative shall affect the contractor's obligations.
3. Employer's Representatives	
3.1 Authorised Person	One of the Employer's personnel shall have authority to act for him. This authorised person shall be as stated in the SCC, or as otherwise notified by the Employer to the contractor.
3.2 Employer's Representative	The Employer may also appoint a firm or individual to carry out certain duties. The appointee may be named in the SCC, or notified by the Employer to the contractor from time to time. The Employer shall notify the contractor of the delegated duties and authority of this Employer's representative.
4. The Contractor	
4.1 General Obligations	The contractor shall carry out the Works properly and in accordance with the Contract. The contractor shall provide all supervision, labour, Materials, Plant and contractor's Equipment which may be required. All Materials and Plant on Site shall be deemed to be the property of the Employer. During continuance of the of the contract, the contractor and his sub-contractors shall abide at all times by all labour laws, including child labour related enactments, and rules made there under. A child who has not attained the age of fourteen years shall not be employed in any work as a labourer.

4.2	**Contractor's Representative**	The contractor shall submit to the Employer for consent the name and particulars of the person authorised to receive instructions on behalf of the contractor.
4.3	**Subcontracting**	The contractor shall not subcontract the Works.
4.4	**Performance Security**	As **stated in the SCC**, the Contractor shall deliver to the Employer no later than the date specified in the Letter of Acceptance.
5.	**Employer's Liabilities**	
5.1	**Employer's Liabilities**	In this Contract, Employer's Liabilities mean: a. war, hostilities (whether war be declared or not), invasion, act of foreign enemies, within the Country, b. rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war, within the Country, c. riot, commotion or disorder by persons other than the contractor's personnel and other employees, affecting the Site and/or the Works. d. use or occupation by the Employer of any part of the Works, except as may be specified in the Contract, e. design of any part of the Works by the Employer's personnel or by others for whom the Employer is responsible, f. any operation of the forces of nature affecting the Site and/or the Works, which was unforeseeable or against which an experienced contractor could not reasonably have been expected to take precautions g. a suspension under Sub-Clause 2.3 unless it is attributable to the contractor's failure, h. any failure of the Employer, i. physical obstructions or physical conditions, other than climatic conditions, encountered on the Site during the performance of the Works, which obstructions or conditions were not reasonably foreseeable by an experienced contractor and which the contractor immediately notified to the Employer, j. any delay or disruption caused by any Variation, k. any change to the law of the Contract after the date of the contractor's offer as stated in the Agreement, l. losses arising out of the Employer's right to have the permanent work executed on, over, under, in or through any land, and to occupy this land for the permanent work, and m. damage which is an unavoidable result of the contractor's obligations to execute the Works and to remedy any defects.
6.	**Time for Completion**	
6.1	**Execution of the Works**	The contractor shall commence the Works on the Commencement Date and shall proceed expeditiously and without delay and shall complete the Works within the Time for Completion.
6.2	**Programme**	The contractor shall submit to the Employer a programme for the Works within the time stated in the SCC

6.3	**Extension of Time**	The contractor shall be entitled to an extension to the Time for Completion if he is or shall be delayed by any of the Employer's Liabilities. The contractor shall submit an application to the Employer for extension of time, stating the causes for delay, 21 days before the expiry of the Contract completion date. On receipt of an application from the contractor, within 21 days , the Employer shall consider all supporting details provided by the contractor and shall decide extend the Time for Completion as appropriate.
6.4	**Liquidated Damages for Delay**	If the contractor fails to complete the Works within the Time for Completion, the contractor's liability to the Employer for such failure shall be to pay the amount stated in the SCC for each day for which he fails to complete the Works.
7.	**Taking-Over**	
7.1	**Completion**	The contractor may notify the Employer when he considers that the Works are complete. In addition to the other provisions, before acceptance of the completed works, Employer shall verify and assure that such works are within the set objective, quality and appropriate to operate and use.
7.2	**Taking-Over Notice**	The Employer shall notify the Contractor when he considers that the Contractor has completed the Works stating the date accordingly. Alternatively, the Employer may notify the Contractor that the Works, although not fully complete, are ready for taking over, stating the date accordingly. The Employer shall take over the Works upon the issue of this notice. The Contractor shall promptly complete any outstanding work and, subject to Clause 8, clear the Site.
8.	**Remedying Defects**	
8.1	**Remedying Defects**	The Employer may at any time prior to the expiry of the period stated in the SCC, notify the Contractor of any defects or outstanding work. The Contractor shall remedy at no cost to the Employer any defects due to the Contractor's design, materials, plant or workmanship not being in accordance with the Contract. Failure to remedy any defects or complete outstanding work within a reasonable time of the Employer's notice shall entitle the Employer to carry out all necessary work at the Contractor's cost.
8.2	**Uncovering and Testing**	The Employer may give instruction as to the uncovering and/or testing of any work. Unless as a result of any uncovering and/or testing it is established that the contractor's design, materials, plant or workmanship are not in accordance with the Contract, the Contractor shall be paid for such uncovering and/or testing as a Variation in accordance with Sub-Clause 9.2.
9.	**Variations and Claims**	
9.1	**Right to Vary**	The Employer may instruct Variations.

9.2 Valuation of Variations	Variations shall be valued as follows: a. where appropriate, at rates in the Contract, or b. in the absence of appropriate rates, the rates in the Contract shall be used as the basis for valuation or c. at appropriate new rates, as may be agreed or which the Employer considers appropriate.
9.4 Right to Claim	If the contractor incurs cost as a result of any of the Employer's Liabilities, the contractor shall be entitled to the amount of such cost. If as a result of any of the Employer's Liabilities, it is necessary to change the Works, this shall be dealt with as a Variation.
9.5 Variation and Claim Procedure	The contractor shall submit the Employer an itemised make-up of the value of Variations and claims within 7 days of the instruction or of the event giving rise to the claim. The Employer shall check and if possible agree the value. In the absence of agreement, the Employer shall determine the value.
10. Contract Price and Payment	
10.1 Valuation of the Works	The Contract Bill of Quantities and the approved Variation quantities shall be used to calculate the valuation of the works completed .The Contractor shall be paid for the quantity of work done at the rate in the Bill of Quantities or rate agreed pursuant to clause 9.2 for varied works.
10.2 Payments Certificates	The Contractor shall submit to the Employer monthly statements of the estimated value of the works completed less the cumulative amount certified previously. The Employer shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor
10.3 Payments	The Employer shall pay to the contractor the amount certified less retention at the rate stated in the SCC within 30 days of the date of each certificate.
10.4 Payment of Retention	One half of the retention shall be repaid by the Employer to the contractor within 30 days upon expiry of Defects Liability Period and the Employer has certified that the notified defects have been corrected. The remainder of the retention shall be paid by the Employer to the contractor within 7 days after submission of evidence document from the concerned Internal Revenue Office that the contractor has submitted his Income Returns
10.5 Advance Payment	10.5.1 The Employer shall make advance payment to the Contractor of the amounts stated in the SCC in two equal installments by the date stated in the SCC, against provision by the Contractor of an unconditional bank guarantee from Commercial Bank or Financial Institution eligible to issue Bank Guarantee as per prevailing Law in Nepal in a form acceptable to the Employer in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

	10.5.2 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 payment has been used in this way by supplying copies of invoices or other documents to the Project Manager. 10.5.3 The advance payment shall be repaid by deducting proportionate amounts, as stated in SCC, from payments otherwise due Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.
10.6 Local Taxation & Value Added Tax	a. The prices quoted by the Contractor shall include all taxes that may be levied in accordance to the laws and regulations in being in Nepal. b. The Contractor shall pay VAT in the concerned VAT office within time frame specified in VAT regulation.
11. Termination of Contract and Payment	11.1 The Employer may terminate the Contract at any time if the contractor; a. does not commence the work as per the Contract, b. abandons the work without completing, c. fails to achieve progress as per the Contract. 11.2 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract. 11.3 Fundamental breaches of Contract shall include, but shall not be limited to, the following : (a) The Contractor uses the advance payment for matters other than the contractual obligations, (b) the Contractor stops work for 30 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager; (c) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 30 days; (d) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation. (e) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 90 days of the date of the Project Manager's certificate; (f) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager; (g) The Contractor fails to update the Program as per the contract and demonstrate acceleration of the works within a reasonable period of time determined by the Project Manager; (h) the Contractor does not maintain a Security, which is required; (i) the Contractor has delayed the completion of the Works by the number of

	days for which the maximum amount of liquidated damages can be paid, **as defined in the SCC 6.4** ; and (j) If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract. 11.5 Notwithstanding the above, the Employer may terminate the Contract for convenience. 11.6 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.
	11.7 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer. 11.8 If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager 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 and securing the Works, and less advance payments received up to the date of the certificate. 11.9 If the Contract is terminated because of fundamental breach of Contract or for any other fault by the Contractor, the performance security shall be forfeited by the Employer. In such case, amount to complete the remaining works as per the Contract shall be recovered from the Contractor as Government dues.
12. Risk and Responsibility	
12.1 Contractor's Care of the Works	The contractor shall take full responsibility for the care of the Works from the Commencement Date until the date of the Employer's notice under Sub-Clause 7.2. Responsibility shall then pass to the Employer. If any loss or damage occurs to the Works during the above period, the contractor shall rectify such loss or damage so that the Works conform to the Contract.
12.2 Force Majeure	If a Party is or shall be prevented from performing any of its obligations by Force Majeure, the Party affected shall notify the other Party immediately. If necessary, the contractor shall suspend the execution of the Works and, to the extent agreed with the Employer, demobilise the contractor's Equipment. If the event continues for a period of 90 days, either Party may then give notice of termination which shall take effect 30 days after the giving of the notice. After termination, the contractor shall be entitled to payment of the unpaid balance of the value of the Works executed and of the Materials and Plant reasonably delivered to the Site, adjusted by the following: a. any sums to which the contractor is entitled under Sub-Clause 9.4,

	b. the Cost of his suspension and demobilisation, c. any sums to which the Employer is entitled. The net balance due shall be paid or repaid within 30 days of the notice of termination.
13. Resolution of Disputes	
13.2 Amicable Settlement	The Employer and the Contractor shall attempt to settle amicably by direct negotiation any disagreement or dispute arising between them under or in connection with the Contract.
14.Conduct of Bidders	14.1 The Bidder shall be responsible to fulfill his obligations as per the requirement of the Contract Agreement, Bidding documents, GoN's Procurement Act and Regulations. 14.2 The Bidder shall not carry out or cause to carry out the following acts with an intention to influence the implementation of the procurement process or the procurement agreement : a) give or propose improper inducement directly or indirectly, b) distortion or misrepresentation of facts c) engaging or being involved in corrupt or fraudulent practice d) interference in participation of other prospective bidders. e) coercion or threatening directly or indirectly to cause harm to the person or the property of any person to be involved in the procurement proceedings, f) collusive practice among bidders before or after submission of bids for distribution of works among bidders or fixing artificial/uncompetitive bid price with an intention to deprive the Employer the benefit of open competitive bid price.. g) contacting the Employer with an intention to influence the Employer with regards to the bid or interference of any kind in examination and evaluation of the bids during the period after opening of bids up to the notification of award of contract
15. Blacklisting Bidder	15.1 Without prejudice to any other right of the Employer under this Contract, GoN, Public Procurement Monitoring Office may blacklist a bidder for his conduct up to three years on the following grounds and seriousness of the act committed by the bidder: a) if it is proved that the bidder committed acts pursuant to the Sub - Clause 14.2, b) if it is proved later that the bidder/contractor had committed substantial defect in implementation of the contract or had not substantially fulfilled his obligations under the contract or the completed work is not of the specified quality as per the contract , c) if convicted by a court of law in a criminal offence which disqualifies the bidder from participating in the contract. d) if it is proved that the contract agreement signed by the bidder was

	based on false or misrepresentation of bidder's qualification information, **e) other acts mentioned in the Bidding Data** 15.2 A firm declared blacklisted and ineligible by the GON shall be ineligible to bid for a contract during the period of time determined by the PPMO.
16. Provision of PPA and PPR	If any provision of this document are inconsistent with Public Procurement Act (PPA), 2063 or Public Procurement Regulations (PPR), 2064, the provision of this documents shall be void to the extent of such inconsistency and the provision of PPA and PPR shall prevail.

Section - V
Special Conditions of Contract

Section VIII - Special Conditions of Contract (SCC)

This SCC forms part of the Agreement
[Note: with the exception of the items for which the Purchaser's requirements have been inserted, the Bidder shall complete the following information before submitting his Sealed Quotation.]

1.1.1	Documents forming the Contract listed in the order of priority: 1. The Agreement 2. Special Conditions of Contract 3. General Conditions of Contract 4. The Technical Specifications 5. The Drawings 6. The Bill of Quantities
1.1.12	The indented completion date for the works shall be within 7 days from agreement .
1.5	The language of the contract is ENGLISH/NEPALI.
2.1	The Site Possession Date(s) shall be: on the day of Agreement
3.1	The Authorised person is : Surat lal Chaudhary
3.2	Name and Address of Employer's representative is : Surat lal Chaudhary, Biratnagar Morang Koshi Pradesh
4.4	The Performance Security amount is: : 5% i) If bid price of the bidder selected for acceptance is up to 15 (fifteen) percent below the approved cost estimate, the performance security amount shall be 5 (five) percent of the bid price. ii) For the bid price of the bidder selected for acceptance is more than 15 (fifteen) percent below of the cost estimate, the performance security amount shall be determined as follows: Performance Security Amount = [(0.85 x Cost Estimate –Bid Price) x 0.5] + 5% of Bid Price. The Bid Price and Cost Estimate shall be inclusive of Value Added Tax
6.2	Time for the submission of programme : 15 days.
6.4	Liquidated Damages for Delay is 0.05% of the Contract Price per day up to a maximum of 10% of sum stated in the Agreement.
8.1	Period for notifying defects is 365 days calculated from the date stated in the notice under Sub-Clause 7.2.
10.5.1	The Advance Payments shall NOT be applicable
10.5.3	Deductions from Payment Certificates will commence in the first certificate in which the Value of works executed exceeds 30% of the Contract Price. Deduction will be at the rate of 0% of the respective Monthly Interim Payment Certificate until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the end of 80 % of the approved contract price.

Section - IX
Contract Forms

Contract Forms

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

Letter of Acceptance

[on letterhead paper of the Employer]

Date: ……..

To: ……. name and address of the Contractor ……..

Subject: ……. Notification of Award

This is to notify that your Quotation dated ……..date ……..for execution of the……..name of the contract and identification number, as given in the SCC …….. for the Contract price of Nepalese Rupees [insert amount in figures and words in Nepalese Rupees], as corrected in accordance with the Instructions to Bidders is hereby accepted in accordance with the Instruction to Bidders.

You are hereby instructed to contact this office to sign the formal contract agreement within 7 days with Performance Security of ……..[specify the performance security amount computed as per ITB 22.2 and 25.1] consisting of a Bank Guarantee in the format included in Section IX (Contract Forms) of this Bidding Document.

The Employer shall forfeit the bid security, in case you fail to furnish the Performance Security and to sign the contract within specified period.

Authorized Signature: ……..

Name and Title of Signatory: ……

Contract Agreement

THIS AGREEMENT made the .....day of …….. between…….. name of the Employer …….. (hereinafter "the Employer"), of the one part, and ……name of the Contractor ……(hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as …….. name of the Contract .....should be executed by the Contractor, and has accepted a Quotation by the Contractor for the execution and completion of these Works and the remedying of any defects in the sum of NRs ……..[insert amount of contract price in words and figures including taxes] (hereinafter "the Contract Price").

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement.
   (a) the Letter of Acceptance;
   (b) the Letter of Bid;
   (c) the Addenda Nos ..... insert addenda numbers if any ……
   (d) the Special Conditions of Contract;
   (e) the General Conditions of Contract;
   (f) Bills of Quantities (BOQ);
   (g) the Specification;
   (h) the Drawings;
   (i) the Activity Schedules; and
   (j).....[***Specify if there are any other document***]
3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of Nepal on the day, month and year indicated above.

Signed by …….
for and on behalf the Contractor in the presence of

Witness, Name Signature, Address, Date

Signed by……..
for and on behalf of the Employer in the presence of

Witness, Name, Signature, Address, Date

Performance Security

Bank's Name, and Address of Issuing Branch or Office
(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

…… ***Bank's Name, and Address of Issuing Branch or Office*** ……Beneficiary: …… Name and Address of Employer ……
Date: ……

Performance Guarantee No.:……

We have been informed that … … ***[insert name of the Contractor]*** (hereinafter called "the Contractor") has been notified by you to sign the Contract No. …… ***[insert reference number of the Contract]*** for the execution of ……. ***[insert name of contract and brief description of Works]*** (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we… …… . ***[insert name of the Bank]*** hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of ……***[insert name of the currency and amount in figures*] (… ……. insert amount in words)*** such sum being payable in Nepalese Rupees, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the……..Day of …… **, and any demand for payment under it must be received by us at this office on or before that date.

……
Seal of Bank and Signature(s)

Note:
All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

* The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract in Nepalese Rupees.

** Insert the date thirty days after the date specified for the Defect Liability Period. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".

Advance Payment Security

Bank's Name, and Address of Issuing Branch or Office

(On Letter head of the Commercial bank or any Financial Institution eligible to issue Bank Guarantee as per prevailing Law)

…… Bank's Name, and Address of Issuing Branch or Office……

Beneficiary: ……***Name and address of employer***

Date : ……

Advance Payment Guarantee No……..

We have been informed that ……has entered into Contract No. ….. ***Name and Address of Employer***……***name of the Contractor***……(hereinafter called "the Contractor")..reference number of the Contract……dated …… with you, for the execution of ...contract and brief description of Works ……. (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum…… name of the currency and amount in figures****…(…. amount in words …..)*** is to be made against an advance payment guarantee.

At the request of the Contractor, we... ..... . ***name of the Bank*** …… hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of……name of the currency and amount in figures****……(…… amount in words … ….. .)***upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty (80) percent of the Contract Price has been certified for payment, or on the ..... day of .....**, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

……

Seal of Bank and Signature(s)

Note:

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

*The Guarantor shall insert an amount representing the amount of the advance payment in Nepalese Rupees of the advance payment as specified in the Contract.

** Insert the date Thirty days after the expected completion date. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee".